Interventions for the spreading of misinformation on social network sites

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**INTERVENTIONS FOR THE SPREADING OF MISINFORMATION
ON SOCIAL NETWORK SITES**

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2018

**INTERVENTIONS FOR THE SPREADING OF MISINFORMATION
ON SOCIAL NETWORK SITES**

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A thesis submitted to the Nanyang Technological University
in partial fulfilment of the requirement for the degree of
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2018

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A graduating senior once told me that the four years of PhD were the best four years of her life. During the past four years, I occasionally thought about what she said and even doubted about it when I struggled. But now as I look back at this challenging but fruitful journey, I would have to agree.

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ABSTRACT

The popularity of social network sites (SNSs) has demonstrated their important role in the digital world, but they have also led to the serious issue of widespread misinformation (defined in this study as inaccurate information in general, be it spread intentionally or not). The widespread misinformation on SNSs can cause misunderstanding, unnecessary anxiety, and even physical damage on users. Moreover, it is a big obstacle that prevents social media from growing into powerful information sources. Research addressing the issue of misinformation can be roughly categorised into three main approaches, namely diffusion analysis, correction and labelling, and user education. However, a gap still exists, since most studies focused primarily on the inaccurate content and the misinformed users.

The present study suggests addressing the issue of misinformation from an angle that does not start from the credibility or judgment of the content of misinformation. In this way, a wider population can be targeted: both the intentional and unintentional spreading by the informed and the misinformed. Specifically, the study proposed interventions to address users' spreading of health-related misinformation on Facebook. The study suggests seeing individual users' spreading of misinformation on SNS as an information behaviour with underlying motivations weighted heavier than the informational value of the content. Employing social cognitive theory (SCT) as the theoretical framework, three interventions were developed based on the three types of outcome expectation from SCT, namely physical, social, and self-evaluative outcome expectation.

Through experiments, the effects of the interventions on user' negative outcome expectation toward misinformation spreading as well as their spreading of misinformation were investigated. Results showed that the interventions, particularly the one developed based on self-evaluative outcome expectation, were effective in reducing participants' misinformation spreading. The promising findings yield important knowledge that can direct and encourage further research on the new strategy proposed in this thesis. This study differs from and complements existing studies that focused primarily on the quality of content in SNS messages, together a more comprehensive solution for the spreading of misinformation on SNS may be gained.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	i
ABSTRACT	iii
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES.....	ix
CHAPTER ONE INTRODUCTION.....	1
1.1 Background	1
1.2 Problem Statement.....	3
1.3 Proposing Interventions	6
1.4 Research Objectives and Research Questions.....	9
1.5 Significance.....	11
CHAPTER TWO LITERATURE REVIEW	13
2.1 Overview of Chapter.....	13
2.2 The Spread of Misinformation and Social Network Sites.....	13
2.2.1 The Growth of Social Network Sites	14
2.2.2 The Spread of Misinformation	17
2.2.2.1 Rumour diffusion	20
2.2.3 Conceptualisation of Misinformation	21
2.2.3.1 Intentionally or unintentionally misleading.....	22
2.2.3.2 Unintentionally misleading only	23
2.2.3.3 Intentionally misleading only.....	23
2.2.3.4 Unspecified intentionality	24
2.2.3.5 Summary of definitions on misinformation	25
2.3 Approaches to Address the Spread of Misinformation on Social Network Sites	29
2.3.1 Diffusion Analysis of Misinformation	30
2.3.2 Correction and Labelling.....	32
2.3.2.1 Correction	32
2.3.2.2 Labelling.....	35
2.3.3 User Education	37
2.3.4 The Need for Another Strategy.....	40
2.4 The Spreading of Misinformation as an Information Behaviour.....	43
2.4.1 The More-than-Informational Purposes of Information Sharing.....	44
2.4.1.1 Online health information seeking.....	49
2.4.2 The Spreading of Misinformation as An Information Behaviour.....	50
2.4.2.1 Scope of the study	52
2.5 Interventions for the Spreading of Misinformation on Social Network Sites	54
2.5.1 Theoretical Framework for the Intervention	54
2.5.2 Overview of Social Cognitive Theory	57
2.5.2.1 Outcome expectation	59
2.5.2.2 Self-efficacy.....	64
2.5.2.3 Other determinants of social cognitive theory.....	65
2.5.2.4 Social cognitive theory and social media use.....	67

2.5.3	Gender Differences in Addressing the Spreading of Misinformation on Social Network Sites	69
2.6	Summary	71
CHAPTER THREE METHODS		74
3.1	Overview of Chapter.....	74
3.2	Summary of A Preliminary Experimental Study.....	74
3.2.1	Research questions and main variables.....	75
3.2.2	Experimental design.....	76
3.2.3	Study population and sample size.....	77
3.2.4	Data analysis method	77
3.2.5	Key findings	78
3.3	Research Design	80
3.3.1	Random assignment of participants	83
3.3.2	Pretest.....	83
3.3.3	Interventions	86
3.3.4	Posttests.....	88
3.3.5	Post experiment questionnaire.....	89
3.3.6	Cover story	89
3.4	Development of the Interventions	91
3.4.1	Item collection and grouping.....	92
3.4.2	Survey study	94
3.4.2.1	Research objectives	94
3.4.2.2	Method.....	94
3.4.2.3	Results	97
3.4.3	Selection of Items for Interventions.....	99
3.5	Measurements.....	99
3.5.1	The spreading of health-related misinformation on Facebook	100
3.5.2	Negative outcome expectation toward health-related misinformation spreading	102
3.5.3	Self-efficacy for not spreading health-related misinformation.....	103
3.5.4	Perceived accuracy of health-related misinformation.....	104
3.5.5	Gender.....	105
3.6	Sampling and Data Collection.....	105
3.7	Internal and External Validity	106
3.7.1	Internal validity.....	106
3.7.2	External validity	107
3.7.3	Limitations	108
3.8	Data Analysis	110
CHAPTER FOUR RESULTS		114
4.1	Characteristics of Participants.....	114
4.2	Overview of Variables Related to the Spreading of Health-related Misinformation	116
4.2.1	Negative outcome expectation toward misinformation spreading.....	116
4.2.2	The spreading of misinformation.....	118
4.2.3	Self-efficacy for not spreading of misinformation.....	119
4.2.4	Perceived accuracy of misinformation.....	119
4.3	Qualitative Analysis of Content Related to Health-related Misinformation	

Spreading.....	119
4.4 Descriptive Data (Time 1 to Time 2).....	121
4.5 RQ1: What are the Effects of the Interventions, Developed Based on Outcome Expectation from SCT, on Changing the Negative Outcome Expectation Toward Spreading Health-Related Misinformation on Facebook?	124
4.5.1 Model 1: Effects of the interventions on negative outcome expectation solely	125
4.5.2 Model 2: Effects of the interventions on negative outcome expectation with regards to the influences of self-efficacy and gender.....	125
4.6 RQ2: What are the Effects of the Interventions, Developed Based on Outcome Expectation from SCT, on Reducing the Spreading of Health-Related Misinformation on Facebook?.....	127
4.6.1 Model 3: Effects of the interventions on the spreading of misinformation solely	128
4.6.2 Model 4: Effects of the interventions on the spreading of misinformation with regards to the influences of self-efficacy and gender	129
4.6.3 Model 5: Effects of the interventions on the spreading of misinformation with regards to influences of self-efficacy, gender, and negative outcome expectation...	132
4.7 Summary of Results for Research Questions	137
CHAPTER FIVE DISCUSSION AND CONCLUSION	140
5.1 Discussion of Main Findings.....	140
5.1.1 Effects of the interventions on changing participants' negative outcome expectation toward misinformation spreading.....	140
5.1.2 Effects of the interventions on reducing participants' spreading of misinformation.....	141
5.1.3 Overall effects of the interventions on addressing the spreading of misinformation.....	145
5.2 Implications.....	148
5.3 Limitations and Future Directions	154
5.4 Conclusion	157
REFERENCES	159
APPENDICES	174
Appendix A. IRB approval and instrument of the experimental study	174
Appendix B. IRB approval and instrument of the survey study	231
Appendix C. List of articles used in the development of the intervention items	241
Appendix D. Supplement tables.....	245
Appendix E. List of publications	248

LIST OF TABLES

Table 2.1 Definitions of Misinformation in Literature	26
Table 3.1 Top 20 Important Outcomes of Not Spreading Misinformation.....	98
Table 4.1 Demographics Information	115
Table 4.2 Negative Outcome Expectation and the Spreading of Misinformation.....	117
Table 4.3 Description of Variables Related to Misinformation Spreading	122
Table 4.4 The Correlation Matrix for Main Variables in the Study ($N = 262$)	124
Table 4.5 Results of Logistic Regression Analysis (Model 2A)	126
Table 4.6 ANCOVA Results of the Spreading of Misinformation (Model 4A)	130
Table 4.7 ANCOVA Results of the Spreading of Misinformation (Model 4B).....	131
Table 4.8 ANCOVA Results of the Spreading of Misinformation (Model 5A)	133
Table 4.9 ANCOVA Results of the Spreading of Misinformation (Model 5B).....	135
Table 4.10 Results summary for RQ1: Negative outcome expectation toward spreading health-related misinformation.....	137
Table 4.11 Results summary for RQ2: Spreading of health-related misinformation	138

LIST OF FIGURES

Figure 1.1 Conceptual Model of the Study	11
Figure 2.1 The SCT Model for Promoting Health Behaviour (Bandura, 2004).....	59
Figure 3.1 Procedure of the Experimental Study.....	82
Figure 3.2 Examples of Misinformation Posts Used in the Study.....	84
Figure 3.3 Presentation of the Example Facebook Posts on Qualtrics	85
Figure 3.4 Intervention Messages Used in the Study.....	87
Figure 3.5 Conceptual map of the relationships between the research questions and data analysis models	113
Figure 4.1 Estimated Means of Percentage of Misinformation Spread (Model 4A)	130
Figure 4.2 Estimated Means of Percentage of Misinformation Spread (Model 4B)	132
Figure 4.3 Estimated Means of Percentage of Misinformation Spread (Model 5A)	134
Figure 4.4 Estimated Means of Percentage of Misinformation Spread (Model 5B)	136

CHAPTER ONE INTRODUCTION

1.1 Background

Social network sites (SNSs) have become a global phenomenon. In 2016, 68% of all adults in the United States were using Facebook, among whom about three-quarters (76%) visited the site on a daily basis (Greenwood, Perrin, & Duggan, 2016). Likewise, in early 2017, 77% of the population in Singapore visited social media platforms on a monthly basis, which was ranked third highest usage globally (behind the United Arab Emirates and South Korea) (Kemp, 2017a). Singapore users reported spending about two hours on social media platforms daily, and Facebook is the top SNS in the country with 4.4 million monthly active users (Kemp, 2017b). As SNSs are attaining global popularity, they are increasingly being examined and used as an important information source. For example, some researchers have investigated how SNSs can function as instant information exchange platforms during crises (e.g. O. Oh, Agrawal, & Rao, 2013; Starbird, Maddock, Orand, Achterman, & Mason, 2014; Tanaka, Sakamoto, & Matsuka, 2013). Others have investigated ways to make use of the rich information pool available on SNSs, such as knowledge creation through collaborative tagging (H. L. Kim, Decker, & Breslin, 2009).

In the meantime, misinformation – defined in this study as inaccurate information in general, be it spread intentionally or not – has become a significant issue on SNS. The World Economic Forum has listed the rapid spread of misinformation online as one of the top ten threats to which our society needs to pay attention (World Economic Forum, 2014). A survey study conducted in Singapore found that more than two-thirds of the respondents (67.8%) admitted to having shared misinformation on social media platforms

(Chen & Sin, 2013). Likewise, a recent survey found that nearly a quarter of Americans reported having shared political misinformation online (Barthel, Mitchell, & Holcomb, 2016). Not only is misinformation prevalent on SNS, but it is also being spread rapidly. For instance, after the Boston Marathon bombing in 2013, a number of related misinformation pieces were spread instantly via Twitter, one of which was related to an online discussion that misidentified a missing university student as the bomber. Although this piece of misinformation was corrected within hours, it took only ten minutes for it to peak from 40 tweets to more than 4,000 (Starbird et al., 2014).

Misinformation has existed on the Internet since before the age of social media (Fitzgerald, 1997; Floridi, 1996). Yet, the spread of misinformation is reaching new and unprecedented heights on SNS. While user-generated content allows every user to participate, it lacks quality control and fact-checking mechanisms. In addition, the well-developed interaction features largely simplify the sender's sharing process and increase the number of receivers while keeping nearly all the behaviour traces (e.g. posts that a user "Liked" or "Shared") on the sites for further interaction (e.g. a user's Facebook friends can "Like" or "Comment" on a post that the user "Shared"). For example, when a Facebook user clicks "Like" on a public post, not only his/her friends on the site can see this activity instantly on their news feeds, but the activity is also logged on the site and is searchable anytime by his/her friends. And currently, over 800 millions users use the "Like" function daily (Nowak & Spiller, 2017). These characteristics of SNSs largely lower the costs of and barriers to information exchange on social networks (Ellison & boyd, 2013), which unsurprisingly includes the spread of misinformation.

The spread of misinformation on SNS can cause direct consequences on individual users by creating misunderstanding, confusion, and unnecessary anxiety (Budak, Agrawal, & Abbadi, 2011; Tanaka et al., 2013). Moreover, in the long term, it

can cause misinformation effect in memory (Appan & Browne, 2012) - that is, although users might not believe in the misinformation at first, they might start accepting it after being repeatedly exposed to the piece due to its widespread dissemination and persistence on SNS. Misinformation has become a big obstacle that prevents SNS from realising its full potential as a powerful information source; to address the spread of misinformation on SNS is in urgent need.

1.2 Problem Statement

In recent years, the topic of widespread misinformation on SNS is gaining increasing attention in academia. Through disparate strains of research, attempts are being made to address the spread of misinformation. Extant research can be roughly classified into three main approaches: diffusion analysis, correction and labelling, and user education. While each approach to some extent addressed the spread of misinformation on SNS, a gap exists.

Diffusion analysis, which focuses on the diffusion and transmission patterns of misinformation on SNS, is the main research focus in the field of computer science and information systems. Researchers in this field aim to predict and detect the spread by the systems. From the patterns of transmission (Zubiaga, Liakata, Procter, Bontcheva, & Tolmie, 2015) and the roles of individuals in the networks (Bakshy, Rosenn, Marlow, & Adamic, 2012; Doerr, Fouz, & Friedrich, 2012) to the descriptive analysis of real data (Castillo, Mendoza, & Poblete, 2011) and the theoretical modelling of automatic detection (Kumar & Geethakumari, 2013; S. Li, Zhu, Li, Kim, & Huang, 2013), all these studies have aimed to understand the spread of misinformation on a macroscopic level.

Whereas algorithmic-driven solutions can be effective, personal factors are left out of the picture.

Another strain of research focuses on the correction and labelling of misinformation. For example, some researchers have drawn attention to the power of “self-correcting crowd” on SNS through investigating the use of correction information to overcome the diffusion of misinformation (Mendoza, Poblete, & Castillo, 2010). Other researchers have developed systems and tools to help users seek clarification of misinformation (Ennals, Trushkowsky, & Agosta, 2010; Yamamoto & Tanaka, 2011). Yet others have focused on classifying and labelling online misinformation for users’ references (Fitzgerald, 1997; Zhou & Zhang, 2007). In fact, the Poynter Institute has launched a forum called the *International Fact-checking Network* (IFCN) to work with fact-checkers worldwide (The Poynter Institute, 2017). And Facebook has been making use of fact checking organizations that are signatories of the IFCN (e.g. AP Fact Check and Snopes) to label misinformation (Mosseri, 2016). Still, the correction information is often observed to be much less widespread than the original misinformation (Jong & Dückers, 2016; Starbird et al., 2014). Moreover, correction and labelling can backfire, as it was found that for people who were interested in conspiracy stories, the more debunking information these users were exposed to, the more their bias reinforced (Bessi, Caldarelli, Del Vicario, Scala, & Quattrociocchi, 2014). This has partly led to the Washington Post discontinuing a weekly column on debunking misinformation after one year and a half (Dewey, 2015). After all, such tools of correction and labelling would probably not be effective if used in isolation without regard to users’ psycho-behavioural factors. For all such tools to fully function, their users need to take the appropriate initiatives and actions.

Thirdly, there is the user education approach, which is recommended in the field of information literacy (IL) (Calvert, 2001; Floridi, 1996). Some researchers have suggested expanding the scope of IL to accommodate the online environment, coining terms like “cyberliteracy” (Gurak, 2001) and “metaliteracy” (Mackey & Jacobson, 2010). Others have identified a number of skill sets which, once acquired through training, can help users evaluate online information and identify misinformation (Fitzgerald, 1997; Walsh, 2010). In contrast to the two abovementioned approaches, user education means to address the spread of misinformation at the prevention stage by working at the level of individual users. When misinformation is unavoidable on today’s SNS, users themselves need to be able to critically contribute and use information in the first place (Cooke, 2017). However, it has become evident that users sometimes choose to spread misinformation even when they are aware of its inaccuracy, because of its amusement and socialising values (Barthel et al., 2016; Chen, 2016; Karlova & Fisher, 2013; H. Li & Sakamoto, 2014). When information evaluation is not users’ top priority and perceived accuracy is not the primary factor that influences users’ spreading of misinformation on SNS, IL education is no longer sufficient to address the matter.

In summary, the above approaches have attempted to solve the spread of misinformation on SNS from different angles, but few have considered the meaning of the spreading act by individual users as more than mere noise that is caused by misbeliefs (e.g. H. Li & Sakamoto, 2014; Zhou & Zhang, 2007). It should be noted that the spreading of misinformation is part and parcel of the routine use of SNSs and that SNSs are not only information dissemination platforms but also the place for social network building and maintenance, as well as leisure activities. It has been documented in the literature that information sharing and exchange can function for more than informational purposes in communities and on social networks (boyd, Golder, & Lotan, 2010; Burnett,

2000; Talja, 2002). Even for knowledge sharing, which is particularly about accurate and useful information, noninformational motivations are often identified among informational ones (Bock, Zmud, Kim, & Lee, 2005; Chiu, Hsu, & Wang, 2006; Wasko & Faraj, 2005). The current study argues that this can also be the case for spreading misinformation on SNS. That is, individual users' spreading of misinformation on SNS should be seen as a kind of information behaviour with underlying motivations (e.g. social, personal, etc.) that are weighted heavier than the informational value of the content. While much attention has been paid to the diffusion, content, and identification of misinformation, the individual behaviour of spreading it deserves no less, if not more, attention.

1.3 Proposing Interventions

While previous user-centred attempts focused primarily on correcting users' misbeliefs so as to decrease the spreading of misinformation by the misinformed, this study suggests addressing the issue from an angle that does not start from the credibility or judgment of the content of misinformation, in order to target a wider population. That is, this study proposes a new strategy that aims to address intentional and unintentional spreading by both the informed and the misinformed. In particular, this study proposes interventions that focus on users' beliefs about the act of spreading, that is, their outcome expectation (e.g., their beliefs about the consequences of spreading misinformation, such as undermining one's health, misleading others, or being irresponsible for one's action) rather than on their beliefs about the content of misinformation. The interventions were developed to target users' motivations and expectations underlying their spreading of misinformation – in other words, their beliefs about how the behaviour of spreading can satisfy their various needs for SNS use.

In particular, this study focuses on health-related misinformation in everyday life. Among different types of misinformation, health-related misinformation is one of the most prevalent. For instance, on Snopes.com, a well-known misinformation debunking website, the category of medical-related misinformation is one of the largest on the site, and there is another category for food safety-related misinformation (Snopes.com, 2017). Moreover, health-related misinformation tends to be action-related (e.g. suggests readers to follow home remedies for health benefits), which can hinder one from getting effective treatment on time and lead to serious damage on one's well-being. Hence, it is especially crucial to address health-related misinformation on SNS.

To guide the design of the interventions, social cognitive theory (SCT) (Bandura, 1977a, 1986) is employed as the theoretical framework of this study. SCT subscribes to a system of triadic reciprocal causation. That is, one's behaviour both influences and is influenced by personal factors (e.g. outcome expectation and self-efficacy) and the environment (Bandura, 1986). SCT is commonly used in the field of information behaviour. Early in the 80s, Wilson's model of information seeking behaviour (Wilson, 1981) has incorporated social learning theory (SLT) (Bandura, 1977b) with an emphasis on self-efficacy. SLT was also developed by Bandura and can be seen as an earlier incarnation of SCT (LaRose & Eastin, 2004). Likewise, in social media research, it has been suggested that the perspective of SCT could be employed in the uses and gratifications theory (UGT) to better understand social media use. Notably, the concept of gratification in UGT could be operationalised as outcome expectation categories (LaRose, Mastro, & Eastin, 2001). Moreover, SCT has been successfully and commonly applied in other fields with regards to behavioural change, such as health behaviours (e.g. Ashford, Edmunds, & French, 2010; Williams & French, 2011).

Specifically, the interventions proposed in this study are developed based on outcome expectation, a primary construct in SCT. Outcome expectation refers to one's belief of the likely consequences that one's behaviour will produce (Bandura, 1997). Central to SCT is the assumption that one's behaviour is influenced by one's outcome expectation. That is, people behave in ways that they believe will lead to positive consequences and avoid behaving in ways that they expect negative consequences. Therefore, applying this concept to the spreading of misinformation on SNS, this study proposes that providing positive consequences of not spreading misinformation and negative consequences of spreading misinformation can change individual users' outcome expectations toward spreading misinformation and reduce their spreading behaviour on SNS. There are three main types of outcome expectations, namely physical outcome expectation, social outcome expectation, and self-evaluative outcome expectation; accordingly, three interventions are developed.

In addition, to find out how best to tailor the interventions to individual users, this study also investigates the moderating effects of two factors of individual differences on the effects of the interventions in addressing the spreading of misinformation on SNS. First, there is self-efficacy, another main determinant from SCT. Self-efficacy refers to one's belief in his/her capabilities to perform certain behaviour (Bandura, 1997). Since SCT is the theoretical framework of the interventions, it is reasonable to explore the effects of self-efficacy for not spreading misinformation, given the theoretical link between self-efficacy and outcome expectation. Second, gender is included in this study as a primary factor of individual differences. Gender has been investigated in some applications of SCT (e.g. Lent, Brown, & Hackett, 1994; Tokar, Thompson, Plaufcan, & Williams, 2007). Moreover, gender differences are often found in social media use (e.g. Greenwood et al., 2016; Lu, Lin, Hsiao, & Cheng, 2010; Muscanell & Guadagno, 2012).

Therefore, it is also interesting to examine the influences of gender on the effects of the interventions.

In this way, guided by SCT with outcome expectation in particular, the study proposes and tests a set of three interventions that are tailored to the context of misinformation spreading on SNS, while incorporating influences of individual differences factors, namely self-efficacy and gender.

1.4 Research Objectives and Research Questions

This study aims to address the spreading of health-related misinformation on SNS by developing interventions to target users' outcome expectations. Specifically, there are three research objectives (RO):

- RO1: To develop interventions based on outcome expectation from SCT to address the spreading of health-related misinformation on SNS.
- RO2: To investigate the effects of these interventions in changing individual users' outcome expectations toward the spreading of health-related misinformation on SNS.
- RO3: To investigate the effects of these interventions in reducing individual users' spreading of health-related misinformation on SNS.

Based on the research objectives, two main research questions (RQs) have been developed for the study:

- RQ1: What are the effects of the interventions, developed based on outcome expectation from SCT – (1a) physical outcome expectation; (1b) social outcome

expectation; and (1c) self-evaluative outcome expectation – on changing the *negative outcome expectation toward spreading health-related misinformation on Facebook?*

- Does (1d) self-efficacy for not spreading misinformation on Facebook and (1e) gender moderate the above effects of the interventions?
- RQ2: What are the effects of the interventions, developed based on outcome expectation from SCT – (2a) physical outcome expectation; (2b) social outcome expectation; and (2c) self-evaluative outcome expectation – on reducing the *spreading of health-related misinformation on Facebook?*
 - Does (2d) self-efficacy for not spreading misinformation on Facebook and (2e) gender moderate the above effects of the interventions?

Therefore, Figure 1.1 below illustrates the conceptual model of the study. In addition, the baseline values (i.e. prior to intervention) of negative outcome expectation as well as spreading of misinformation are included to control for their influences in the investigations of RQ1 and RQ2 respectively. It is a common approach in intervention studies to include baseline level values for a more accurate estimate of the treatment effects. Also, perceived accuracy of misinformation is included as a control variable in the investigation of RQ2. While this study acknowledges the notion in user education approach that individual users are prepared to evaluate information on SNS, this study is interested in testing the effects of the interventions on the spreading of misinformation when the influence of perceived accuracy of misinformation has been accounted for. In this way, a more precise investigation on the effects of the interventions may be gained.

Figure 1.1 Conceptual Model of the Study

1.5 Significance

The present research work contributes to both knowledge and practice in several ways. First, this study proposes and tests an original set of interventions to address the spreading of health-related misinformation on SNS by drawing from SCT and targeting outcome expectation. Findings of this study may yield important knowledge that can help to direct and encourage further research on this new strategy. Moreover, the study suggests seeing the spreading of misinformation as an information behaviour, which provides a new niche, where SCT, as a behaviour change theoretical framework, can be applied. While previous studies have primarily focused on the inaccurate content being spread, this study draws from SCT to address the spreading by centring on users' beliefs about their act of spreading. Thus, the proposed interventions are able to work on an angle that targets a wide scope, encompassing intentional and unintentional spreading by both the informed and the misinformed. This strategy differs from and complements existing research with broader theoretical perspectives. In this way, a more

comprehensive understanding of the spreading of misinformation can be sought. The knowledge of SCT in the field of behaviour change can also be furthered to a new area of widespread misinformation.

Besides theoretical contributions, findings of the study can provide specific and effective intervention recommendations for SNS to address the misinformation issue on their sites. For instance, the study not only tests the effects of different interventions, but also explores the factors of individual differences. The findings can shed light on whether specific types of intervention are more effective for users with different level of self-efficacy and of different genders. Furthermore, the interventions are designed in the form of web-based short messages that can be relatively economically delivered to a large group of users, which provides a workable solution that can be reproduced and applied to various SNSs. As a further step, the interventions may be used in combination with other tools; for example, the intervention messages can be delivered to particular users when they interact with debunked misinformation or when the platform detects an active spread of misinformation. Thereby, this study can help to reduce the negative consequences that misinformation brings to individuals as well as contributing to the development of SNS and social media.

CHAPTER TWO LITERATURE REVIEW

2.1 Overview of Chapter

This chapter presents the literature review for the study and consists of four parts. Section 2.2 includes a review on the phenomenon of widespread misinformation on social network sites (SNSs), as well as a conceptualization of misinformation. Section 2.3 reviews previous research addressing the spreading of misinformation, including three main approaches (diffusion analysis, correction and labelling, and user education), and identified the research gap. Section 2.4 presents a discussion of seeing the spreading of misinformation as an information behaviour. Lastly, the theoretical framework of the study, social cognitive theory (SCT) is presented in Section 2.5. The main factors of SCT, outcome expectation and self-efficacy in particular, are discussed. Section 2.5 ends with a discussion of including gender as a primary factor of individual differences in the study.

2.2 The Spread of Misinformation and Social Network Sites

This section first discusses the characteristics of SNSs, which have contributed to the rapid spreading of misinformation. This is followed by an overview of the spreading of misinformation, from the early forms of misinformation on the Internet to the negative consequences which are emerging. Finally, it provides a conceptualisation of the term “misinformation”, where misinformation-related definitions from previous studies are reviewed and classified.

2.2.1 The Growth of Social Network Sites

Kaplan and Haenlein (2010, p. 61) defined social media as “a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user generated content”. Kaplan and Haenlein (2010) also classified six types of social media, namely collaborative projects, blogs, content communities, SNSs, virtual game worlds and virtual social worlds. The popularity of social media in recent years is undeniable. It was reported that a new stage of the Internet is developing, namely the “social Web”, where social media are not only about applications, but have rather become an essential platform for users to share information, communicate and collaborate (Anttiroiko & Savolainen, 2011).

Under the rapid growth of social computing technologies, the SNS represents one of the most significant developments (Ellison & boyd, 2013). Earlier in the 2000s, boyd and Ellison (2007) proposed three main characteristics of SNSs, namely the profile, connection lists and the ability to traverse connections between users. During its development, the focus of the SNS and the border between it and other social media has been in flux. On the one hand, in recent years, more and more other types of social media, such as media sharing websites and gaming sites, have employed SNS functions to enable individuals to set up profiles and list their contacts on the sites. On the other, the focus of the SNS itself has also shifted. SNSs used to be more profile-centric, as their initial functions had to do with online dating and networking; as they have gained popularity, however, they have become common platforms for all kinds of activities, and the role of user-generated content has become increasingly significant.

In terms of the evolution of SNSs over time, Ellison and boyd (2013) suggested a new definition for the term: an SNS is “a networked communication platform in which participants 1) have uniquely identifiable profiles that consist of user-supplied content,

content provided by other users and (or) system-provided data; 2) can publicly articulate connections that can be viewed and traversed by others; and 3) can consume, produce and (or) interact with streams of user-generated content provided by their connections on the site”. They employed the term “social network site” instead of “social networking site” or “online social network”, with the objectives of highlighting the focus of SNSs on the networks themselves rather than networking and SNS users’ ability to both present their social networks and to view others’ networks. In fact, by employing this definition, nearly all of the most common and popular social media platforms can currently be considered SNSs, including Facebook, Instagram, LinkedIn, Pinterest, Tumblr, Twitter, YouTube and so on. This definition of SNS is used in the current study.

The definition above considered the SNS as a communication platform which highlights the importance of content sharing, thereby pointing to the foundational aims of SNSs – to communicate and share content (Ellison & boyd, 2013). SNSs’ ability to lower the costs of and barriers to communication and information sharing has reshaped the networks on current SNSs, as it largely eases the costs of building and maintenance of weak tie relationships articulated on them. It has also simplified and accelerated information dissemination, as any individuals can build up a broadcasting network. Moreover, with the increasing popularity of mobile devices, people are connecting to social media at any time, from anywhere (The Nielsen Company, 2012), which is further speeding up the circulation of information.

The first SNS, Sixdegree.com, was created less than two decades ago in 1997, and the use of SNS grew into a phenomenon only after 2003 when Friendster, MySpace and Facebook subsequently went mainstream (boyd & Ellison, 2007). Nonetheless, the SNS has attained global popularity across a diverse mix of demographic groups over such short amount of time. The social media reports conducted with national U.S. samples by

the Pew Research Centre showed that in a mere span of ten years (2005 to 2015), the proportion of adults who use SNS went up from 7% to 65%, while the percentages of Internet users from 2005 to 2015 rose from 10% to 76% (Perrin, 2015).

When SNSs expand, so does the volume of information produced through user interactions. For instance, currently every day over 800 millions users use the “Like” function on Facebook (Nowak & Spiller, 2017). The role of social media as an information source is attracting attention, and researchers are focusing on the functionalities of the information on social media and SNSs. For example, regarding the unique characteristics of social media and user-generated content, collaborative tagging functions were investigated and suggested to be beneficial for creating new knowledge from the information pool in social media (H. L. Kim et al., 2009).

Beyond entertainment and everyday life use, people are increasingly accessing SNSs for online news. In 2016, 62% of adults in the U.S. gets news on SNSs, with two-thirds of Facebook users (which is 44% of the U.S. adult population) get news from the site (Gottfried & Shearer, 2016). Likewise, people are increasing their use of SNSs for real-time news updates during crises. SNSs are playing an increasingly important role during crisis situations. The use and diffusion of information on SNSs during crises have been studied, including in the cases of the Japan earthquake in 2011 (Tanaka et al., 2013) and Boston bombing in 2013 (Starbird et al., 2014). It was suggested that it has become a new norm where crisis-related information is first posted and spread on SNSs by local individuals, and mainstream media involvement follows the initial real-time reports (O. Oh et al., 2013). SNS is turning into the foundational platform of the new Web age; it is no longer only a playground for sociable teenagers, but a complex world involving people and services of all kinds.

In particular, Facebook has been the most-widely used SNS in recent years; in 2016, Pew Research Centre found that 68% of all US adults use Facebook, more than twice the share that uses the rest four major SNSs: Instagram (28%), Pinterest (26%), LinkedIn (25%), and Twitter (21%) (Greenwood et al., 2016). Facebook also has a user base that is most broadly representative of the whole population; there are more than 60% Internet users who use Facebook in all age groups, with young adults (18 to 29 years old) being the highest usage population and the elderly population (aged 65 and above) continuing to increase (Greenwood et al., 2016). Facebook users also exhibit high levels of engagement – by March 2017, there were 1.28 billions of users who visited Facebook daily, and 1.94 billion monthly active users (Facebook, 2017).

Given the popularity and large user population of Facebook, this study focuses on the spreading of misinformation on Facebook. However, one should note that the results obtained in the context of Facebook should not be simply generalised to other SNSs, since other platforms have their own characteristics, interfaces and user groups that might or might not be addressed by the interventions.

2.2.2 The Spread of Misinformation

The rise of Web 2.0 tools has already revealed some dark sides of information, for example, information overload and anxiety (Bawden & Robinson, 2009); with the growth of information flows on SNSs, the spread of misinformation is also becoming a significant issue. When the UK riots happened in 2011, a number of related false rumours diffused on Twitter. Two examples of such rumours were “rioters released animals in the London Zoo” and “rioters attacked a children hospital in Birmingham”; in both cases, more than five hundred related tweets appeared on Twitter just an hour after the rumour

came out (Guardian Interactive team, Procter, Vis, & Voss, 2011). While five hundred per hour was not a small number, misinformation was spread even more rapidly in relation to the recent Boston Marathon bombing in 2013, only two years after the UK riots. Starbird et al. (2014) analysed the diffusion of misinformation and corrections on Twitter after the bombings occurred. In this case, it was found that one of the false rumours peaked from 40 tweets to more than 4,000 within 10 minutes. Moreover, for another false rumour which described the bombings as a “false flag” attack staged by the U.S. Government, although the overall amount of misinformation was relatively less, the researchers found that it persisted at low levels and even gained steam for days after corrections came out (Starbird et al., 2014).

Some false information can take the form of “factoids”, which is more likely to be related to everyday life. As such misinformation is less likely to be event-specific, it can persistently circulate on SNSs and emerge repeatedly whenever the conditions are right, thereby continuously creating misunderstandings (Friggeri, Adamic, Eckles, & Cheng, 2014; Frost, 2002). This kind of misinformation was already prevalent during the earlier stages of the Internet in the form of chain letters. For example, there was an unsubstantiated claim spread by email for many years stating that dialling particular numbers on mobile phones could result in being deceived by fraud companies (Frost, 2000). In the age of social media, a similar example is the false claim that Facebook will start charging a fee (Friggeri et al., 2014).

These examples provide a glance at the spread of misinformation which commonly occurs on SNSs. Misinformation acts to hinder the information-sharing process, as well as the credibility of social media. Instead of providing current and useful information, such misinformation could rapidly reach a large number of people, causing confusion and unnecessary anxiety amongst users (Budak et al., 2011; Tanaka et al.,

2013). Furthermore, in addition to the direct consequences that misinformation might create by misleading people, in the long term, it can also cause misinformation effect in memory, which refers to people's tendency to recall false information learned following an event instead of original material from the time the event occurred (Appan & Browne, 2012). It is known that repeated exposure to a statement will increase its acceptance as true, as long studied in rumour research (Allport & Postman, 1947; Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012). Thus, even though some individuals might not believe in the misinformation at the moment they read it, the misinformation could have a greater impact due to its widespread dissemination and persistence on SNSs.

Misinformation is not new on social media. During the early stages of the Internet, philosopher Luciano Floridi (1996) noticed the potential problem of defective information and discussed whether the Internet would become a powerful means for disinformation (Floridi's term "disinformation" is similar to the meaning of "misinformation"; the two concepts are discussed in the next section). He pointed out that the development of interactivity of a new medium would give rise to disinformation. Following the questions raised by Floridi, Calvert (2001) conducted a focus group study with information professionals to discuss the potential for misinformation on the Internet caused by scholarly misconduct. Likewise, Hernon (1995) expressed concerns about the potential impact of inaccurate information on the Internet on information quality in the case of government information. Fitzgerald (1997) contended that despite the positive aspects of the Internet, how misinformation arises online needs to be explored, and the types of Internet misinformation need to be classified.

The spread of misinformation is reaching new and unprecedented heights as a result of the popularity of SNSs. As discussed above, the ability of SNS to lower the costs of and barriers to communication and content sharing, as well as the increasingly

important role of user-generated content on SNSs, have not only made their dynamics different from other social networks (Kumar & Geethakumari, 2013), but also largely changed the manner in which information is exchanged through them (Ellison & boyd, 2013). On the one hand, user-generated content allows everyone to participate; on the other, such content lacks quality control and fact-checking mechanisms. Furthermore, the well-developed interaction features on SNSs simplify the sender's sharing process and increase the number of receivers, while retaining traces of nearly all the behaviour on the sites for further interaction. Although SNS is being considered an information source for more and more people, it has become less reliable due to the extensive spread of misinformation (Budak et al., 2011). In 2016, Pew Research found that nearly two thirds (64%) of U.S. adults considered that fake news stories had caused a great deal of confusion about the basic facts of current issues (Barthel et al., 2016). Scholars have observed that catchiness and repeatability, rather than truthfulness, are driving the information diffusion on SNS (Ratkiewicz et al., 2011).

2.2.2.1 Rumour diffusion

Misinformation is often discussed with rumour. The concept of misinformation in this study can be differentiated from rumour in that rumour is unverified information that can be true or false, while only false rumour is misinformation (details in Section 2.2.3). In the early stage of rumour research, Allport and Postman (1947) suggested that people spread rumour to find meaning, so as to reduce ambiguity of related important issues. Similarly, Shibutani (1966) proposed that spreading rumour could be seen as a form of collective problem-solving. Rosnow (1991) identified four factors for rumour transmission, including outcome-relevant, personal anxiety, uncertainty, and credulity. That is, people spread rumour because they needed explanations of the uncertain events,

and retelling and discussing rumour helped them reduce anxiety. DiFonzo and Bordia (2007) summarised three main psychological motivations for rumour transmission, which were fact finding (e.g. to ascertain veridical information), relationship enhancement (e.g. to increase teller–hearer affinity), and self-enhancement (e.g. to boost self-esteem). DiFonzo, Robinson, Suls, and Rini (2012) studied rumours about cancer and furthered the motivation categories to include propaganda, entertainment, emotional coping, and altruism; they also summarised items for fact-finding motivation, which included information gathering, clarification and verification, threat assessment, and decision making. While rumour research tended to focus on rumours that were considered true or useful, rumour shares some elements with misinformation, and hence, above studies on reasons for rumour spreading were expected to enhance the understanding of the consequences of spreading misinformation on SNS.

2.2.3 Conceptualisation of Misinformation

In this study, misinformation is defined following the core definition of misinformation, which is: false (Fitzgerald, 1997) or inaccurate information (Karlova & Fisher, 2013). However, despite the growing research attention on the topic of misinformation, most studies have not devoted much discussion to formally defining what misinformation is (Zhou & Zhang, 2007). When discussing misinformation, some studies have simply followed the definition used in dictionary (e.g. Stahl, 2006), while some have treated misinformation as the opposite of ‘good’ information (e.g. Nguyen, Yan, & Thai, 2013; Srinivasan, 2014). Among those who did describe what misinformation was, the discussions were rather scattered. Before investigating solutions for the spread of misinformation, it is essential to take a step back and conceptualise the term. Currently, there are several veins of research related to misinformation, including

computer science, information science, communication, philosophy, psychology and so on, and definitions with different scopes have been employed respectively. While definitions vary, most of them can be classified based on two characteristics, that is, the accuracy of the content and its intention (Zhou & Zhang, 2007).

First, the term misinformation is defined in the *Oxford English Dictionary* as “false or inaccurate information, especially that which is deliberately intended to deceive” (“Misinformation,” 2017). Applying the two aforementioned characteristics to this definition, misinformation would be inaccurate content that is created or used either intentionally or unintentionally. This is also one of the most common definitions of misinformation in use. Nevertheless, definitions of misinformation still differ in existing studies, especially on the intentionality of its user (i.e., whether one intend to spread the misinformation to mislead others). The intentionality can be grouped into four categories: (1) can be intentional or unintentional misleading; (2) unintentionally misleading only; (3) intentionally misleading only; and (4) unspecified.

2.2.3.1 Intentionally or unintentionally misleading

Some researchers defined misinformation as a broader concept that includes both intentionally and unintentionally misleading false content. For instance, Starbird et al. (2014), who studied misinformation on Twitter, suggested that there are two types of misinformation – purposeful (introduced by someone who knew that it was false) and accidental misinformation (caused by lost context). Moreover, misinformation is often discussed along with a similar concept, namely that of disinformation. Floridi (2005) referred to misinformation as false content; misinformation would become disinformation when the source is aware of its false nature. Likewise, in Qazvinian, Rosengren, Radev,

and Mei's (2011) Twitter study, misinformation was considered to be false information, whilst deliberately false information was disinformation. Therefore, in this category, disinformation is seen as a special kind of misinformation – it is “misinformation with attitude” (Fetzer, 2004).

2.2.3.2 Unintentionally misleading only

Some researchers considered misinformation and disinformation to be mutually exclusive categories (e.g. Fallis, 2009). In such a case, misinformation is described as false content created or used unintentionally. That is, misinformation can be viewed as an “honest mistake” (Hernon, 1995; Walsh, 2010) or “accidental falsehood” (Stahl, 2006). In contrast, disinformation is false information which is deliberately deceptive. In this definition, although both misinformation and disinformation relate to information which is inaccurate, there is distinguishing difference between misinformation and disinformation in terms of the intentionality (Kumar & Geethakumari, 2013).

2.2.3.3 Intentionally misleading only

In contrast to the definition above, some other studies have used the term “misinformation” to describe false information which is intentional. For instance, in Mintz (2002) discussion of misinformation on the Internet, she defined it as “always [involving] the intent to misinform”. Zhou and Zhang (2007) extended the definition of misinformation from information which does not match the true state of the world (false facts) to include information which did not reflect the state of the communicator's mind, that is, false intent. To further confuse the matter, Floridi (1996) used the term

disinformation for defective information that needs not be intentional, a definition which many others have used for misinformation instead.

2.2.3.4 Unspecified intentionality

Similar to the definition of misinformation in the Oxford dictionary ("Misinformation," 2017), some researchers have not specified the state of intentionality in their use of the term. For instance, Chew and Eysenbach's (2010) content analysis study classified tweets as misinformation when it was unsubstantiated by their standard references (e.g. credible news sources like CNN) and could not be categorised as a joke. Likewise, scholars in experimental psychology have studied the "misinformation effect" on memory and cognition (Ecker, Lewandowsky, & Tang, 2010; Lewandowsky et al., 2012). In these studies, misinformation referred to information which is initially stated as true and is subsequently proven wrong. In this type of definition, there is a status change from truth to falsity in terms of the content of information, but the intention is unspecified.

Moreover, when the concept of misinformation is discussed together with rumour, the intentionality is often not specified. Rumour has been a serious research area in psychology since the 1940s (Allport & Postman, 1947). DiFonzo and Bordia (2007) defined rumour as "unverified and instrumentally relevant information statements in circulation that arise in contexts of ambiguity, danger or potential threat, and that function to help people make sense and manage risk". Some scholars have used the terms "misinformation" and "rumour" interchangeably (S. Li et al., 2013; Tanaka, Sakamoto, & Honda, 2014), whereas others have tended to follow DiFonzo and Bordia's (2007) definition and considered rumour to be a broader term. In addition, while rumour shares

some elements with misinformation, the rumour research in psychology has tended to focus on the usefulness of rumour transmission in sense making related to particular events (DiFonzo & Bordia, 2007). Therefore, amongst unverified rumours, it was the ones which were considered true and useful which were more studied and valued, while false rumour – misinformation – is less relevant in rumour research in psychology.

2.2.3.5 Summary of definitions on misinformation

In summary, there are four main ways to define misinformation regarding its content and intention of its spreader, as follows: (1) Inaccurate content that is unintentionally or intentionally misleading; (2) Inaccurate content that is unintentionally misleading; (3) Inaccurate content that is intentionally misleading; (4) Inaccurate content without specifying the intentionality. Table 2.1 summarises the various definitions of misinformation that have been discussed.

In this study, misinformation is defined in line with the first concept (Section 2.2.3.1); that is, misinformation is inaccurate information in general, be it spread intentionally or not. Both the unintentional and intentional spreading of misinformation by the misinformed and the informed are targeted by the proposed interventions, which focus on users' beliefs about their act of spreading rather than users' beliefs about the content of the misinformation. Specifically, following the concept of outcome expectation in SCT, the study proposes an intervention to make users more aware about the possible consequences of spreading misinformation. The idea is to make all users think more carefully before interacting with information on SNS (e.g., share or like), and hence, potentially reduce their spreading of inaccurate information (details in Section 2.5 below).

Moreover, considering that users may not accurately report their intentionality of spreading misinformation due to potential social desirability bias (i.e., participants are more likely to give answers that are socially appropriate instead of real response, when users are directly asked whether they intentionally spread inaccurate information), perceived accuracy of misinformation is included in the study design as a proxy to control for the influence of users' intentionality (details of measurement in Section 3.5.4 below). One may infer that users who tend to perceive the examples of misinformation accurate may be more likely to be spreading misinformation unintentionally, as they are not aware of what they spread is inaccurate; while those who perceive what they spread is inaccurate are more likely to be the intentional spreaders.

In terms of its relationship to related concepts, misinformation in this study is considered to overlap with rumour: False rumour is misinformation; but not all misinformation is rumour, as misinformation does not only raise in contexts of ambiguity, danger or potential threat. Disinformation is considered inaccurate information with a misleading intention, and hence as a subset of misinformation.

Table 2.1 Definitions of Misinformation in Literature

Article	Quotes of discussion on the definition of misinformation
Bode & Vraga, 2015	"Misinformation, or factual misperception, refers to the presence of or belief in objectively incorrect information."
Cooke, 2017	"Misinformation is simply defined as information that is incomplete, but it can also be categorized as information that is uncertain, vague, or ambiguous."
Chew & Eysenbach, 2010	"Tweets were categorized as misinformation if the tweet was not categorized as a joke and was unsubstantiated by our reference standard."

Table 2.1 Definitions of Misinformation in Literature (Continued)

Dang et al., 2016	“As people have a tendency to believe misinformation, which are false rumours, and misinformation is more likely to be spread.”
Ecker et al., 2010	“We use the label misinformation for a piece of information that is corrected after its initial dissemination, without meaning to imply that it was initially introduced in order to intentionally mislead the receiver.”
Fallis, 2014	“Inaccurate information (or misinformation) can mislead people whether it results from an honest mistake, negligence, unconscious bias, or (as in the case of disinformation) intentional deception.”
Fetzer, 2004	“While “misinformation” can be simply defined as false, mistaken, or misleading information, “disinformation” entails the distribution, assertion, or dissemination of false, mistaken, or misleading information in an intentional, deliberate, or purposeful effort to mislead, deceive, or confuse.”
Floridi, 1996	“Disinformation arises whenever the process of information is defective. This can happen because of a lack of objectivity, completeness, and pluralism. Each form of disinformation need not necessarily be intentional.”
Floridi, 2005	“When semantic content is false, this is a case of misinformation ... And if the source of misinformation is aware of its nature, one may speak of disinformation.”
Hernon, 1995	“Inaccurate information might result from either a deliberate attempt to deceive or mislead (disinformation), or an honest mistake (misinformation).”
Karlova & Fisher, 2013	“Misinformation (inaccurate information) ... disinformation (deceptive information) ... information (accurate information).”
Kumar & Geethakumari, 2013	“Disinformation is the deliberate spreading of false or inaccurate information. It is considered as an act of deception. Misinformation is the unintentional spread of false or inaccurate information. The difference lies in the intentions.”
Lewandowsky et al., 2012	“We use the term “misinformation” here to refer to any piece of information that is initially processed as valid but that is subsequently retracted or corrected.”
Loftus, 2005	“The misinformation effect refers to the impairment in memory for the past that arises after exposure to misleading information.”
Mintz, 2002	“How many ways can people find to use new technologies to support lies, deception, misdirection, fraud, spin control, propaganda, and all other forms of misinformation? ... we define it [misinformation] as always with intent to misinform.”

Table 2.1 Definitions of Misinformation in Literature (Continued)

Qazvinian et al., 2011	“A rumor is commonly defined as a statement whose true value is unverifiable. Rumors may spread misinformation (false information) or disinformation (deliberately false information) on a network of people.”
Stahl, 2006	“In this paper I will continue to distinguish between misinformation as accidental falsehood and disinformation as deliberate falsehood.”
Starbird et al., 2014	“... many of these rumors contained misinformation ... In recent crises, both purposeful misinformation, introduced by someone who knew it to be false, and accidental misinformation, often caused by lost context.”
Walsh, 2010	“Misinformation has no element of intention, it is inaccurate information produced by honest mistakes. Disinformation is inaccurate information created intentionally to mislead a user. “
Zhou & Zhang, 2007	“Misinformation often refers to information that does not directly reflect the “true” state of the world (e.g., distorted information or falsehoods) ... We extend the definitions of misinformation by including information that does not reflect the “true” state of mind of an information sender, such as a lie or something deviating from the true belief of the sender.”

Lastly, when defining misinformation as inaccurate or false, there is a question which remains unanswered: What is truth or falsity? This brings the discussion to a philosophical level. When defining misinformation, Fitzgerald (1997) pointed out that no definition can satisfy everyone, since different individuals might see truth differently. Likewise, discussing misinformation from the perspective of critical research, Stahl (2006) suggested that since there is no universally accepted theory of truth, there cannot be a clear line between information and misinformation. Furthermore, Karlova and Fisher (2013) pointed out that misinformation and disinformation have generally been ignored as “noise” in traditional models of information behaviour; they highlighted the social context and conversations amongst people through which information, misinformation or disinformation has been created and used, and argued for the informativeness of misinformation and disinformation. In line with the abovementioned viewpoints, the study suggests that misinformation should not be treated as complete noise and the

reasons behind its spreading are worth investigating. The inherently ambiguous division between information and misinformation does not prevent us from studying the spreading of misinformation as a kind of information behaviour. Still, this study does not focus on justifying the informative values of misinformation, and it is not the intention of this study to discuss the philosophical definition of misinformation. Further details on the spread of misinformation as an information behaviour are given in Section 2.4.

2.3 Approaches to Address the Spread of Misinformation on Social Network Sites

Recently, the topic of widespread misinformation on SNSs has been gaining increasing attention in academia, especially from researchers in computer science and information science. In this section, previous attempts to characterise the spread of misinformation are reviewed, of which three main focuses could be identified, namely (1) diffusion analysis, (2) correction and labelling, and (3) user education. The diffusion of misinformation is being studied, with an aim to detect the spread by analysing and predicting data transmission patterns. The correction and labelling approach works by empowering users with correction and clarification tools. While these two approaches are useful, they focused on the stage after misinformation has been spread; on the other hand, user education addresses the issue at prevention by preparing users with skills to evaluate and use online information. However, users might still spread misinformation when they are aware of its inaccuracy (more discussion below). Therefore, a new strategy is needed. Similar to the user education approach, the current study also focuses on preventing the users from spreading misinformation. However, the proposed strategy is able to target a wider population (intentional and unintentional spreading by both the informed and the misinformed) by seeing the spreading of misinformation as a kind of information behaviour (details in Section 2.4).

2.3.1 Diffusion Analysis of Misinformation

In the fields of computer science and information systems, scholars have investigated the diffusion of misinformation on SNSs, from the patterns of transmission to the roles of individuals in the networks, and from descriptive analysis of real data to theoretical modelling of automatic detection. All such research has the objective of understanding the spread of misinformation on a macroscopic level.

Some studies have been situated in the broader context of rumour research. For instance, Qazvinian et al. (2011) developed a model for retrieving a complete set of tweets which discuss a specific rumour. The study resulted in the first large-scale, publicly available rumour dataset; this provided many new materials for studying the issue of widespread misinformation on SNSs. Castillo et al. (2011) examined social media's credibility issue and analysed the trending topics on Twitter to look for automatic methods to assess the credibility of a given set of tweets. They subsequently built and tested auto-classifiers to locate credible information on Twitter (Castillo, Mendoza, & Poblete, 2013). S. Li et al. (2013) proposed algorithms for locating a set of users who could broadcast correct information to compete with rumours in social networks. Doerr et al. (2012) simulated a natural rumour-spreading process to determine why rumours spread so quickly on online social networks which were not designed for the spread of misinformation. The researchers discovered that the propellers for the spreading process were not only influential individuals with many connections making the information available to a wide audience, but average users with limited numbers of online friends also quickly conveyed the information from one person to another. Similarly, Bakshy et al. (2012) Facebook study found that although the strong ties (close friends and family) were more influential individually, it was the abundant weak ties that were responsible for the propagation of novel information. These findings on social ties and information

diffusion pointed back to the characteristics of social media discussed previously (Section 2.2.1); that is, the low cost of disseminating information on SNSs had fostered diffusion dynamics which were different from those of offline situations (Bakshy et al., 2012).

Recently, more studies have been conducted focusing on misinformation. Jain, Sharma, and Kaushal (2016) proposed an approach for automatic real-time detection of misinformation on Twitter, which suggested steps to distinguish and analyse authoritative and general tweets in trending topics, so as to use the former to detect misinformation in the latter. Likewise, Zhang, Alim, Li, Thai, and Nguyen (2016) proposed and tested an algorithm to timely detect misinformation on SNS, which efficiently minimised the number of monitor placements. Nabeshima, Mizuno, Okazaki, and Inui (2014) applied linguistic techniques to develop a method to extract and aggregate false information from Twitter. Moreover, Del Vicario et al. (2016) analysed the spreading of scientific and conspiracy news on Facebook and found that the two had similar consumption patterns in terms of the period of the piece being spread (lifetime) but differed in cascade sizes. While the lifetime of scientific news does not correspond to its cascade size, the longer a piece of conspiracy news stays on SNS, the more users it would be exposed to and thus, a larger impact it would have. Indeed, Facebook itself has become aware of the misinformation issues and taken steps to stop its spread on the sites, such as using machine learning to detect fraud and spam accounts, and improving news feed ranking to reduce false news content (Mosseri, 2017).

The diffusion of misinformation in crisis has also been investigated. For instance, Tanaka et al. (2014) conducted an experiment on the spread of rumours related to the 2011 Japan earthquake and found that adding URL-like text in disaster-related tweets increased rumour-spreading behaviour, even though the URLs did not provide any cues about credibility. Zubiaga et al. (2015) developed an annotation tool based on rumour

tweets collected during the 2014 Ferguson unrest, and demonstrated that it is effective for collecting rumours on SNSs and identifying multiple rumours associated with a range of stories without manually inputting rumour-specific keywords.

The area of political campaigns represents another focus in the literature. Ratkiewicz et al. (2011) investigated how misinformation was spread to create the appearance of widespread support for political purposes and tried to detect the early patterns of this kind of spreading of misinformation. Moreover, Budak et al. (2011) proposed algorithms to locate influential individuals in a social network in order to minimise the impact of a misinformation campaign. Kumar and Geethakumari (2013) proposed an information diffusion model for the spread of misinformation using evolutionary game theory and evolutionary graph theory. In addition, Ratkiewicz et al. (2011) found that even if the misinformation is intentionally created and spread, many of the users involved in a “successful spread” might in fact be legitimate users who unwittingly become complicit in the deception. Kumar and Geethakumari (2013) explained such “bad” campaigns as semantic attacks; these were usually launched as disinformation campaigns, but then were carried forward through ordinary users’ spreading of misinformation who were influenced by them. This phenomenon is addressed in the next section, which focuses on the spread of misinformation by promoting correction and regulation amongst users.

2.3.2 Correction and Labelling

2.3.2.1 Correction

Studies focusing on the relationships between flows and corrections of misinformation have shed light to the notion of the “self-correcting crowd” on SNSs. In

Mendoza, Poblete, and Castillo's (2010) study on the propagation of true and false rumours on Twitter during the 2011 earthquake in Chile, they found that users did question rumours, and false rumours tended to be questioned much more than confirmed truths. Moreover, in the Guardian Interactive team's analysis of rumours related to the UK riots which occurred in 2011, the significant takeover of correction information in the diffusion of these rumours was also evidenced. The findings suggested the possibility of building tools to leverage crowd activities in order to identify misinformation. Facebook has inbuilt function to encourage users to flag posts of false information whenever they see one (Mosseri, 2017). Twitter, in contrast, has not launched products particularly addressing the misinformation issue; the company claims to believe in the self-correcting abilities of its users (Crowell, 2017).

Starbird et al. (2014) further explored the potential of the crowd to self-correct by analysing misinformation on Twitter related to the 2013 Boston Marathon bombing. Although it was found that crowd-sourced corrections emerged soon after the misinformation was spread, however, the corrections were muted compared with the much larger scale of propagation of the misinformation. While Starbird et al. (2014) followed the method outlined by Mendoza et al. (2010), it should be noted that Starbird et al. (2014) study was conducted three years later, which is a long time in the world of social media; it is possible that the spreading of misinformation on SNSs had expanded to too great a scale to be corrected easily. Likewise, Jong and Dücker (2016) who analysed tweets related to a crisis of an armed man entered the national news broadcasting station in the Netherlands in 2015 also recognised the self-correcting mechanism of Twitter users. It was found that minutes after a major false rumour (that the same situation was also taking place in Belgium) appeared, individual users started to fact-check and dispel it. However, it was also observed that tweets denying the rumour only accounted for

about 10% of the total tweets related to the rumour, and that the initial misinformation continued to be retweeted regardless of the availability of new facts.

Additionally, Friggeri et al. (2014) made use of Facebook data to study the relationship between the cascades of rumour reposting and added clarification comments. They found that if a “Share” of a rumour was commented on with clarification, it was more likely to be deleted. On the other hand, it was also observed that a majority of “Shares” of false and mixed rumours actually occurred even after clarification had been added to the particular rumour post. The reason for this phenomenon was proposed to be either that users were likely not noticing the correction, or were intentionally ignoring it. This highlighted the limitations of the correction approach: First, the speed and scale of the spreading of correction might not match with that of the misinformation; second, even when users’ attention is specifically drawn to the correction, it can still be ignored.

However, in another vein, researchers in psychology have studied the impact of the misinformation effect on memory. Although a slightly different definition of misinformation is used in this field, results from these studies could contribute to the design of correction techniques. For example, it is known that warning people about the fact that they might in the future be exposed to misinformation could help them to resist it (Loftus, 2005). While post-misinformation warnings tend to be less effective, Ecker et al. (2010) found that the continued influence of misinformation could be reduced by explicitly warning people at the outset that they might be misled, especially when warnings are specific to the event.

2.3.2.2 Labelling

Beyond studying misinformation correction patterns, other researchers have developed systems to help users who want clarifications of online misinformation. Safieddine, Masri, and Pourghomi (2016) suggested adding a “right-click authenticate” function to SNS, which integrated existing technologies to verify misinformation that has appeared online (e.g. use Google Image search to detect modification of an original image). Bode and Vraga (2015) proposed and tested a function of related links on Facebook and found that providing correction links when users clicked on a link with misinformation significantly reduced the misperceptions. Likewise, Tanaka et al. (2013) suggested that it would be more efficient if individuals could benefit from others’ criticisms of false information, and thus designed a social-technological system in which critical thinking concerning misinformation could be crowd-sourced by the indirect collaboration among users. Taking the user’s judgment into account, Yamamoto and Tanaka (2011) proposed an information retrieval system for judging the credibility of Web search results, which was not only able to present the score of search results based on a combination of credibility factors, but could also develop specialised credibility judgment models for users based on their feedback and re-rank the search result list according to the models. Ennals et al. (2010) made use of trusted information on the Internet to build a database of disputed claims, based on which a browser extension was created to alert users of potential misinformation by examining the text on the webpage which the user is browsing.

Fitzgerald (1997) also proposed “quality certification” as a solution, which is similar to the labelling of misinformation (Walsh, 2010). H. Li and Sakamoto (2014) also called for the development of functions on social media which could collect and display truthfulness judgments. Recently, Facebook is testing a similar function which displays

warnings to users who click on a misinformation piece that has been disputed by third-party fact checking organisations, with the objective of preventing people from being misled (Mosseri, 2017).

The notion of misinformation classification and organisation has also been mentioned (Walsh, 2010). Early in 1997, Fitzgerald (1997) classified different types of Internet misinformation, including hardware and software problems, Internet architecture problems and traditional problems which may be transferred from print into electronic publishing. Zhou and Zhang (2007) proposed an ontology-supported misinformation model to lay a foundation for building a digital misinformation library which they considered beneficial for future research. In fact, several websites have been devoted to evaluating the truth or falsity of information, such as Snopes.com (Snopes.com, 2017). While these websites contain a big pool of misinformation pieces, their coverage tends to follow the trending misinformation online and is loosely organised based on the topics of content. Hence, the classification websites often lack comprehensiveness. Furthermore, labelling has not been an efficient and effective method: not only do the rules of evaluation tend to be temporary (Walsh, 2010), but checking material on the Internet is also an endless task (Calvert, 2001).

Despite all of the active research efforts on correction and labelling techniques, the discussion by Lewandowsky et al. (2012) about misinformation and debiasing has suggested that individuals' worldview plays a major role in their resistance to corrections of misinformation. If the initial false statement matches peoples' pre-existing beliefs, not only is it harder for them to accept corrections that are contrary to their worldviews, but their misinformed beliefs might even be strengthened when they feel their worldviews are threatened. Thus, they may counter-argue against any correction information. In line with this argument, Ennals et al. (2010) noted that their claim disputing tool was only catered

to people who were either sceptical about information they read online or cared strongly about the issues discussed, since other users were “unlikely to be interested in” the tool. This notion could also be applied to other clarification tools and techniques prepared for users. If users do not feel the need to understand the online information well, they may not make use of such tools. For instance, it was evidenced that some users keep forwarding misinformation posts on Facebook, regardless of the clarification comment attached right under the post (Friggeri et al., 2014). Therefore, in order to make the most of all the correction and labelling tools, it is essential for users themselves to have the initiatives and take the actions. However, these important preconditions are often not met.

2.3.3 User Education

Educating users on the skills and importance of information evaluation on SNSs is one possible approach making them aware of their spreading of misinformation. The need to focus on this area has been documented. For example, Flanagin and Metzger (2000) found that Internet users who knew they should verify online information actually failed to do so when being observed in the study. They hence suggested that future research should focus on this attitude–behaviour gap. In addition, while H. Li and Sakamoto (2014) hypothesised in their study that users would make use of the collective opinion when they were uncertain about health-related information on SNSs, it was instead found that people simply followed the collective opinion even if it comprised debatable or false information. Similarly, recent research suggested that people could be affected by the “truthiness effect” when rapidly evaluating a claim. That is, one relies on truthiness (refers to subjective and intuitive feelings of truth, coined by the comedian Stephen Colbert) instead of the actual truth to evaluate information (Cooke, 2017; Newman, Garry, Bernstein, Kantner, & Lindsay, 2012). For examples, people were found more

likely to believe in a statement when there was a related but nonprobative photo (Newman et al., 2012) or when the statement involved a person with an easy-to-pronounce name (Newman et al., 2014). Furthermore, such “truthiness effect” might persist over time and continue to bias one’s judgment (Fenn, Newman, Pezdek, & Garry, 2013). The rise of the “truthiness effect” shows that majority of users might not have the right set of skills to evaluate and use information on SNS. When users rely on intuitive feelings in judgement, they might not be able to correctly identify misinformation and therefore unintentionally contribute to its widespread.

Although Tanaka et al. (2013) proposed a crowd-sourced correction system for misinformation, they acknowledged the importance of critical thinking in the age of social media and considered the system a substitute to be used when people are unable or unavailable to evaluate each piece of misinformation. Moreover, the education approach could be built on other approaches. For example, Zhou and Zhang (2007) suggested that information literacy education could make use of the misinformation library and databases for training, such databases can be developed from research on the correction and labelling approach.

The user education approach complements the other approaches discussed above on at least two levels. First, it tackles the problem of social media misinformation from the point of view of the individual users as opposed to the diffusion analysis or correction and labelling approaches outlined above. Second, it works at the prevention stage in the spreading of misinformation, as opposed to the aforementioned approaches, which tend to focus on the post-outbreak stage. In fact, information literacy is suggested by information professionals to be one of the best solutions to the spread of misinformation on SNSs and the Internet. Floridi (1996) discussed individual education as a solution to Internet misinformation. He pointed out that although technology sharpens the problem of

misinformation, the “fundamental questions remain human and social” (Floridi, 1996, p. 513). Fitzgerald (1997) developed a skill set of information evaluation strategies for Internet users based on the types of misinformation evident at a given time. The skills comprise the following: adopting critical consciousness for all Internet interactions; establishing prior knowledge through wide browsing, searching and reading; distinguishing between fact and opinion; evaluating arguments; comparing and contrasting related pieces of information from different sites, sources and search engines; evaluating the reliability of online sources; identifying and detecting bias; learning to interpret the conventions of the Internet; and examining assumptions. Similarly, all of the information professionals in Calvert’s (2001) focus group study agreed that improving information literacy is the most effective means to help users identify misinformation.

In recent years, Walsh (2010) proposed a framework of multi-literacy instruction for librarians to control the problem of false information and protect Internet users. The accuracy of information, which tended to be one of the criteria in general information literacy standards, became the major focus in Walsh’s proposed instruction. He divided the concept of accuracy into five sub-categories which were tailored for online false information, including source accuracy, currency accuracy, copyright accuracy, inlink (the number of websites which link to a website) accuracy and Google PageRank (which evaluates the importance of a webpage by using the number of inlinks and other criteria in an algorithm). While a number of information literacy instructions already existed, Walsh (2010) argued that a new method was needed in the online context of misinformation and disinformation, where evaluation required a more sceptical learning paradigm, that is, more critical reflection about the information given.

In fact, the element of scepticism in Walsh (2010) study has been highlighted elsewhere. Gurak (2001) coined the term “cyberliteracy” in relation to the Internet

environment, defining this a “set of concepts and critical views with which to understand today’s Internet”. Likewise, Mackey and Jacobson (2010) expanded the scope of information literacy to “metaliteracy”, with the objective of promoting critical thinking and collaboration in the digital age for effective participation and communication in social media. Following this concept, Cooke (2017) suggested that, as misinformation is not new and not going away, individual users should be educated to be metaliterate learners, who can both critically contribute to discourse online and successfully navigate the pool of online information mixed with misinformation. Furthermore, it has also been considered that the appropriate role for information professionals in terms of the problem of misinformation should be to instruct users on how to evaluate and use online information, instead of to determining and promoting the truth which they should acquire (Walsh, 2010).

2.3.4 The Need for Another Strategy

Overall, different techniques and methods with various focuses are being used to address the spread of misinformation on SNSs. Three main categories of attempts have been identified above. Diffusion analysis focuses on characterising the spread of misinformation by analysing and predicting its patterns systematically; correction and labelling tools empower individuals to discount misinformation and avoid misbeliefs; and user education approach educates and prepares users for dealing with misinformation on SNSs. This study shares a position with information literacy research in the sense that changing the individual users is considered the primary way to address the spread of misinformation. However, the study looks at aspects other than information literacy.

Information literacy is undoubtedly an important area when it comes to addressing the problem of misinformation, but it might not be sufficient or efficient enough for this rapidly growing issue. It has been demonstrated that some users who share misinformation on SNSs are aware that the information is false. That is, they are able to evaluate and recognise the false nature of the misinformation, but still choose to share it. Li and Sakamoto's (2014) experiment indicated that although people are more likely to share information they perceive to be true, the sharing likelihood of perceived false information is not nil. In the experimental conditions, when participants were exposed to manipulated collective opinions which were contrary to real ones, the results showed similar sharing likelihoods for both true and false information.

Moreover, not only do people share misinformation despite being aware of its false nature, they might even enjoy reading and sharing information they do not believe (Karlova & Fisher, 2013). In Ennals et al.'s (2010) interview, there were participants who reported regularly obtaining information from sources they regarded as untrustworthy simply because it was interesting, entertaining or coming from a friend. In Chen's (2014) qualitative content analysis on the sharing of a piece of entertaining misinformation, there were users who forwarded the misinformation and specifically indicated that they did not care about it being false, because the scenario described was too adorable and cheery to not share with others. A 2016 survey by Pew Research Centre showed that 14% respondents admitted having shared fake news online knowingly, and one of the reasons of sharing was for the amusement value (Barthel et al., 2016). Chen (2016) examined four main motivation categories related to the spreading of misinformation by social media users, namely entertainment, socialising, self-expression and status seeking. Only the category of information seeking was not found to be associated with users' intention to repost misinformation. Likewise, Dang, Smit, Moh'd, Minghim, and Milios (2016) used a

mixed approach to analyse content related to a misinformation piece on Reddit and found that the users who were joking about the piece – not those who support or debunk the piece – were most active and interacted the most with others. That is, a larger group of users who contributed to the popularity of the misinformation might be looking at the entertainment values of misinformation, rather than the informational ones.

In fact, Guerin and Miyazaki (2006) suggested that the primary function of spreading rumours, gossip, urban legends and so on – which are the opposite of “serious knowledge” – is to entertain or keep the listener's attention, thereby enhancing social relationships; they are all merely different ways of telling a good story in conversation. Moreover, such information need not be credible to be passed on, as long as it is capable of grabbing attention, being novel, or having titillating content that is horrifying, humorous, or scandalous, it can be passed on (Guerin & Miyazaki, 2006). When the relationship between perceived accuracy of the information and users' likelihood of sharing it is not proportional, methods other than that of information literacy are needed to address the spread of misinformation. Apparently, perceived accuracy is not the only factor influencing users' spreading of misinformation on SNSs; as discussed, factors such as enjoyment and social impact are also greatly involved.

When highlighting the importance of critical thinking, we might over-rationalise the users, which points to information professionals' tendency to see people primarily as thinking beings (Case, 2012). This is not to say that individual users cannot think critically, but human beings might not be able to or willing to do so all the time. For example, Lewandowsky, Stritzke, Oberauer, and Morales (2009) suggested that only when people were sceptical or suspicious in the first place would they make use of the corrections to discount the misinformation; otherwise, the original misinformation persisted in their memory. Also, Case (2012) discussed the “artificial distinction”

between information and entertainment, arguing that many people might prefer the most entertaining material over the “most authoritative” when seeking information.

Furthermore, Wilson (1981) suggested that information users should be seen as “living and working in social settings which create their own motivations to seek information to help satisfy largely affective needs”, instead of being driven to seek information for cognitive ends alone. This viewpoint is now widely accepted in the field. Sharing Wilson’s position, Talja (2002) suggested that the social aspects of information seeking can only be captured in a framework which adheres to social and cultural norms. Burnett and Buerkle (2004) also warned that focusing on posts in an online community on an individual basis would miss the give-and-take of a community's interactions, which continuously redefine the meanings of posts. Moreover, Karlova and Fisher (2013) held that it was important to emphasise social context and conversations amongst people in determining what information is and what can be informative when discussing misinformation and disinformation.

The spread of misinformation on SNSs can thus be better understood by taking the social context into account. It happens during the routine use of social media, and social media is not only an information dissemination platform, but also a place for social network building and maintenance, as well as leisure activities.

2.4 The Spreading of Misinformation as an Information Behaviour

In this section, the potential for understanding the spreading of misinformation as more than an unintentional action by the misinformed is further discussed. Literature about the non-informational-purpose aspects of information sharing and information exchange is reviewed, and their connection to the spread of misinformation is

demonstrated. This study suggests that the spread of misinformation on SNSs should be seen as a kind of information behaviour with underlying motivations which have greater weight than the informational value of the content. Therefore, the study proposes to develop interventions to address the spread of misinformation on SNSs by focusing on the act of spreading rather than the content of the misinformation.

2.4.1 The More-than-Informational Purposes of Information Sharing

Looking at the spread of misinformation in terms of aspects other than, and more than, the inaccurate content is not only useful but also essential. In fact, the more-than-informational functions of information have been documented in information sharing literature. In the early 2000s, Talja (2002) identified four types of information sharing in academic communities, namely strategic sharing (as a conscious strategy of maximising efficiency), paradigmatic sharing (as a means of establishing a novel and distinguishable research approach or area), directive sharing (between teachers and students) and social sharing (as a relationship- and community-building activity). Beyond the other three informationally purposeful types of sharing, social sharing is not necessarily related to optimising efficiency or to satisfying individual information needs. Rather, its essence lies in building and maintaining social relationships. It is also the only type of sharing activity that occurred during scholars' collaboration in document retrieval across all disciplines studied (Talja, 2002). Through the sharing of information within the scholar's community, scholars could gain a sense of belonging to a group, as well as recognition of their works, raising the possibility that the act of sharing is more important than what specific content is being shared. Similarly, Marshall and Bly (2004) identified four types of social values in people's sharing of information encountered in everyday reading, as follows: (a) establishing mutual awareness, (b) educating and raising givers' concerns, (c)

developing a rapport and (d) reflecting the known interests of the receiver. It was suggested that in the third and fourth categories, the content of information was less important or useful compared to the act of sharing it, since the sender was sharing the information to demonstrate a shared interest or to recognise the recipient's interests, which may or may not require the recipients to even actually read the information (Marshall & Bly, 2004).

Furthermore, even for studies that focused on motivations of knowledge sharing, which is about accurate and useful information, noninformational motivations are often identified among informational ones. For example, Chiu et al. (2006) applied the social cognitive approach to knowledge sharing in virtual community and identified two main types of outcome expectations, which were personal outcome expectation (e.g. sharing my knowledge will give me a feeling of happiness) and community-related outcome expectation (e.g. sharing my knowledge would help the community grow). Bock et al. (2005) examined motivational drivers that influenced employees' willingness to sharing knowledge in the company and developed three broad categories of motivations, including 1) extrinsic reward, 2) relationship and self-worth, and 3) affiliation, innovativeness, and fairness. Kankanhalli, Tan, and Wei (2005) studied benefit factors for electronic knowledge repositories usage and identified three types of extrinsic benefits (organisational reward, self-image, and reciprocity) and two types of intrinsic benefits (knowledge self-efficacy and enjoyment in helping others). Wasko and Faraj (2005) studied the question why individuals shared knowledge in electronic networks of practice and found reputation and enjoyment in helping to be the two main motivations. Hsu and Lin (2008) investigated blog usage and developed a scale to measure knowledge sharing motivations, including expected reciprocal benefit, reputation, expected relationships, trust, and altruism.

The social significance of information sharing and exchange is especially prominent in the online environment, in which communication and information exchange takes place primarily in the ongoing text-based discursive activity between users (Burnett, 2000). Hersberger, Murray, and Rioux (2007) proposed a framework of information sharing in online social networks, emphasising that information sharing behaviour is critical in building critical relationships in online communities. Burnett (2000) argued that in an online community, “information sharing itself is a fundamentally social act”. He developed a typology of information exchange in online communities in which three main types of information-oriented behaviours were classified, namely announcements, queries or specific requests for information and directed group projects. Three types of non-information-oriented behaviours were also described, as follows: neutral behaviours (pleasantries and gossip), humorous behaviours (language games and other types of play) and empathic behaviours (emotional support). Thus, in this typology, the non-informational aspects were highlighted in addition to the variety of functions which information performed online. Applying this typology in the context of misinformation on SNS, it is possible to be seen as all three types non-information-oriented behaviours. For examples, as gossip for those feel uncertain about the content, as humour for those unbelieved, and emotional support for those misinformed.

Burnett (2000)’s typology included the category of announcement, through which participants present information that is of potential interest to others within the community. While announcement was considered one of the most common information-oriented behaviours, whether it could be informational was still subject to the community’s responses. What researchers defined as “announcement” are often treated by users as “spam”, which referred to information unrelated to the nominal subject interests of the community (Burnett & Buerkle, 2004). The ambiguous relationship

between announcement and spam arose because different community members might have different perceptions of the meaning of the same piece of information. In this way, the social meaning of any post in an online community is often subjected to interpretation by that community, that is, the readers and respondents, rather than being inherent in its text, and thus reflecting the author's intention (Burnett & Buerkle, 2004). This phenomenon also corresponds to previous discussions on information and misinformation. Similar to classifying a post as announcement or spam, defining misinformation per se is a difficult task, where most problematic is the fact that no definition is universally accepted. In addition, when Burnett and Buerkle (2004) divided the category of announcement into two subcategories—pointers to outside information and personal updates—they found that the former kind of announcements were similar to the reposting activities which later occurred on SNSs, in the sense that both acts were about passing on impersonal information to a group of users.

In fact, the term “sharing” has gained another layer of meaning in the social media environment, where reposting of information has become a common feature provided on the platforms, such as the “Share” on Facebook and “Retweet” (or “RT”) on Twitter. In fact, the Oxford dictionary has created a separate entry under the word “share” to refer sharing on social media, defined as “an instance of posting or reposting something on a social media website or application” (“Share,” 2017). With such convenient designs embedded in rapid information dissemination platforms like social media, the effort and cost of action are largely reduced, and sharing is highly encouraged for online social networks.

The difference between an online community (e.g. online forum) and SNS lies in their different focuses. The former is relatively more interest-driven, while the latter is more friendship-driven (Ellison & boyd, 2013). That is, people engage publicly with

individuals they already know to some extent on SNSs, while they go to an online community to meet others who are interested in a particular topic or hobby. The roles of information on SNSs are thus less information-oriented, which may have led to the growth and acceptance of non-information behaviours on SNSs. boyd et al. (2010) argued that “retweeting” (the act of copying and reposting Tweets originally posted by others) on Twitter could be understood not only as a form of information diffusion to get information out to others, but also, more importantly, as a mean of participating in conversations and engaging with others. They identified ten diverse motivations for users’ retweeting behaviours. While the list was not exhaustive, it appeared that no more than half of the ten were information-oriented. The information-oriented ones are listed as follows: to amplify or spread tweets to new audiences; to entertain or inform a specific audience; to comment on someone’s tweet by retweeting and adding new content, often to begin a conversation; to validate others’ thoughts; and to save tweets for future personal access (boyd et al., 2010). Meanwhile, the other five motivations were more related to the act of retweeting: to make one’s presence as a listener visible; to publicly agree with someone; as an act of friendship, loyalty, or homage by drawing attention; to recognise or refer to less popular people or less visible content; and for self-gain, either to gain followers or reciprocity from more visible participants (boyd et al., 2010).

Likewise, Yan and Huang (2014) study on microblog reposting found that perceived enjoyment (i.e., noninformational motivation), representing internal motivation, had a greater influence on users’ reposting intention than perceived usefulness (i.e., informational motivation) as an external motivation. In addition, social presence (the warmth, sensitivity, personalness and sociability features perceived by users of a medium) was found to mediate the impact of information quality on perceived enjoyment and perceived usefulness, reflecting the social aspects of microblogging. They

thus suggested that microblogging is a kind of “dual-purpose information system”, which not only help users to realise instrumental values, such as information seeking, reputation building and relationship development, but could also satisfy users’ need for enjoyment and relaxation (Yan & Huang, 2014). Moreover, Lee and Ma (2012) found two motivation factors that were related to users’ news sharing intention on social media other than the motivation of information seeking, namely socialising and status seeking. In addition to satisfying information needs, sharing news on social media – as an activity that required less time and effort than other social media uses (e.g. content contribution) – could make individual users feel connected to the community, creating opportunities to meet people with similar interests and to help others to access relevant content in order to interact with them and attain status in the communities.

2.4.1.1 Online health information seeking

Additionally, as the particular type of misinformation focused in this study is health-related misinformation, studies related to online health information seeking were also briefly reviewed here. For instances, Yoo and Robbins (2008) employed the uses and gratifications approach to study middle-aged women’s online health information seeking and summarised a list of gratification items, including to get general health information, to keep up with current health issues, to get second opinion, to get social support, and so forth. Ybarra and Suman (2006) studied sex and age differences in online health information use and summarised seven reasons to use the Internet to seek for health information, such as information is easy to find and needed information quickly. Abrahamson, Fisher, Turner, Durrance, and Turner (2008) explored how nonprofessionals seek health information online and identified seven reasons, including to find information on a specific condition or medicine, to search for health service, to keep

up with breaking health news, and so forth. S. Oh (2012) studied individuals who answer health-related questions online and proposed ten main motivational factors for health answerers, including enjoyment, efficacy, learning, personal gain, altruism, community interest, social engagement, empathy, reputation, and reciprocity.

Overall, informational motivations and benefits had a salient role in individuals' online health information seeking, which might be less relevant to the case of health-related misinformation spreading, since the quality of content is often less valued in the latter. Nonetheless, for comprehensiveness, studies in this area were taken into account in understanding the outcome expectations toward spreading health-related misinformation on SNS.

2.4.2 The Spreading of Misinformation as An Information Behaviour

The literature has shown that information sharing and exchange could serve for more than informational purposes in communities and social networks, but prior research seems to assume that the information being shared is accurate, useful or relevant, without fully discussing what it is. For instance, the term “information sharing” was found to be often used interchangeably with “knowledge sharing” (Wilson, 2010), or to refer to information one owns which others may need or desire (Jansen, Sobel, & Cook, 2011).

The present study argues that the above discussions from research on information sharing (Section 2.4.1) are relevant to the spread of misinformation, reasons as follows. First, accurate information is not the only type of material which could be informative and useful. As mentioned in the definitions of misinformation (Section 2.2.3.5), researchers have pointed out the potential informativeness of misinformation and its ambiguous relation to accurate information (i.e., there is no universal truth). Moreover,

the specific content being shared or spread could become relatively less important when considering the social aspects of the act of information sharing. Although the findings from research on information sharing might not be fully applicable to the spread of misinformation due to the fundamental differences in truthfulness, it is reasonable to assume that since accurate information could already be multifunctional (both informational and non-informational) when it is being shared in social networks, so could misinformation. In fact, it has been suggested that misinformation shares much in common with news in terms of both materials' reasons for being transmitted, and that the only distinguishing difference is whether it is true (Frost, 2002).

The perspective of looking at the sharing and spreading of information, both in terms of the content and the act, is relevant and important for understanding users' spreading of misinformation on SNSs. It is especially relevant and useful in the case of "everyday misinformation", i.e. misinformation which is not related to specific situations like crises. Misinformation during a crisis shares some elements with rumour in terms of the ambiguity and anxiety of the situation. Rumour research has been considered similar to crisis research, as both focus on unpredictable, unfamiliar and unplanned "non-routine" situations (O. Oh et al., 2013). Everyday misinformation, on the other hand, tends to appear during the ordinary use of SNS, and could cover various topics and both positive and negative sentiments. Spreading of such misinformation is relatively more similar to general SNS activities, and hence, more applicability of the multifunctional viewpoint of information on SNS. In addition, it is less timely, and might persist on SNSs for a long time to continue create damage.

As discussed above, the present study suggests that the spread of misinformation on SNSs should be seen as a kind of information behaviour with underlying motivations (e.g. social, personal, etc.) that are weighted heavier by the users than the informational

value of the content, instead of merely caused by misbeliefs (about the content). While much attention has been paid to the diffusion, content and identification of misinformation, the individual act of spreading it deserves no less, if not more, attention. To address the problem of misinformation from this point of view, the present study proposes and tests interventions that focus on users' beliefs about the act of spreading apart from their beliefs concerning the content of misinformation. That is, while previous attempts mostly wanted to correct users' misbeliefs about the *content* so as to decrease the spreading of material by the misinformed, the main focus of this study relates to users' motivations and expectations underlying misinformation spreading, that is, their beliefs about how the *act* of spreading could satisfy their various needs related to social media use.

2.4.2.1 Scope of the study

Specifically, caution is taken to distinguish *spreading* of misinformation, which is the focus of the study, from sharing (reposting) of misinformation. This distinction is drawn due to the unique nature of SNS. One primary type of response on SNS is to "Like" a post, which simply involves clicking a button. "Liking" a post would result in behaviour traces on the site and lead to increased visibility of the content on the social networks. In the case of "Liking" a piece of misinformation, the action speaks for itself as some kind of approval or appreciation of the post, as no correction message can be attached to the action. Moreover, most SNSs have features that allow easy reposting of others' posts to one's social network, such as Facebook's "Share", Twitter's "RT", and Tumblr's "Reblog". Such reposting is similar to the general sense of sharing, and users are able to add comments to the posts when reposting them. Sharing through reposting features allows the information to be directly disseminated.

Therefore, with the objective of addressing the misinformation problem in a more effective way, this study employs the term *spreading* of misinformation (encompassing reposting and “Liking”), which is conceptually wider than sharing (reposting).

The study does not focus on justifying the informative values of misinformation. Instead, this study proposes that given the problems with defining information and misinformation, it is possible and desirable to address the spread of misinformation from an angle which does not start from the clarifications of the content or users’ judgments of accuracy of information. Hence, the study proposes interventions that can target a wider population and cover more situations – both the unintentional and intentional spread by the misinformed and informed. Moreover, as discussed in Section 2.2.3.5, *perceived accuracy of misinformation* is included in the conceptual model (Figure 1.1) as a proxy to control for the influence of users’ intentionality for investigation of RQ2, with an aim to better isolate the effects of the interventions on the spreading of misinformation. Taking into account the influences of users’ intentionality was also in line with the notion in the user education approach (Section 2.3.3), which suggested that users spread misinformation because they are unable to identify its falsity (i.e., more likely to be unintentional spreading).

The strategy taken in this study could target the subgroup of the population who would deliberately spread misinformation they do not believe in, and at the same time, it is not limited to this subgroup. Since this strategy also targets the informed, it could work well with the existing approaches that focused on the misinformed. Combined with the existing approaches, this provides a more comprehensive solution for the issue of widespread misinformation. Details of the proposed interventions are discussed in the upcoming section (Section 2.5).

In addition, the present study focused on health-related misinformation in everyday life. Among different types of misinformation, addressing health-related misinformation is especially crucial as this kind of misinformation tends to be action-related (e.g. suggests readers start doing something or stop doing something for health benefits), which can hinder readers from getting effective treatment on time and even lead to irreversible damage before the misinformation is corrected. Moreover, most of the information in the health domain is scientifically verifiable and open to the public. Therefore, this provides relatively authoritative and consistent standards for us to evaluate the accuracy of a piece of information, and thus reduce the complexity in terms of the question “what is accurate and what is not?” when designing the study instrument.

2.5 Interventions for the Spreading of Misinformation on Social Network Sites

In this section, the theoretical framework for the interventions, namely social cognitive theory (SCT), is introduced. The appropriateness of SCT in guiding the design of interventions for the spreading of misinformation is discussed in Section 2.5.1. Major components of SCT with outcome expectation highlighted in particular, and sources of outcome expectation in related fields, are presented in Section 2.5.2. This section ends with a discussion on including gender as a primary factor of individual differences in Section 2.5.3.

2.5.1 Theoretical Framework for the Intervention

A theoretical basis is essential for the effective design of a behaviour change intervention; identifying the components of the theory that predict behaviour change and targeting the components with behaviour change techniques allow the intervention to be

better applied to other situations. Theories could provide explanations of how the intervention works, besides the question of “Does it work?”. If planned without a theoretical framework, intervention design might omit psychological processes that are central to behaviour change, and therefore fail to optimise effectiveness (Michie & Abraham, 2004). Hence, it is important to develop interventions that are theory-based (Lippke & Ziegelmann, 2008; Michie & Abraham, 2004). Moreover, the amount of theory necessary for intervention design depends on its objectives. Lippke and Ziegelmann (2008) suggested that when the goal is to advance theoretical knowledge, intervention should be developed strictly based on one theory. In contrast, if the focus is on the effectiveness of interventions, strategies do not necessarily need to originate from one theory or from the theory as a whole. The current study fits with the latter approach; that is, while theory is employed to provide a stronger basis for the intervention design, it is not the main goal of the study to test the theory.

A number of behaviour change theories and models have been applied for intervention design in the health domain, such as SCT (Bandura, 1986), the theory of reasoned action (TRA; Fishbein, 1979), the theory of planned behaviour (TPB; Ajzen, 1991), the health belief model (Rosenstock, 1974), protection motivation theory (Rogers, 1975) and the trans-theoretical model (TTM; Prochaska & Velicer, 1997). With the exception of the TTM, which is a stage model that identified different temporary determinants for behaviour change during different stages, most of these theories focused on social cognition and included overlapping determinants under different terminologies (Bandura, 2004). Among these theories, SCT is commonly used in research of information behaviours. In fact, when Wilson expanded his 1981 model of information seeking behaviour (Wilson, 1981) by drawing research from a variety of other fields, one of the theories that he incorporated into the model was social learning theory (SLT). SLT

was also developed by Bandura and can be seen as an earlier incarnation of SCT (LaRose & Eastin, 2004), which is closely related to SCT in that it also emphasised the concept of self-efficacy (Wilson, 1999). Bandura (2004) argued that many of the factors in the different models are in essence different types of “outcome expectations”—the preferred term in SCT to represent a person’s beliefs of the likely consequences that will occur as a result of the person performing (or not) a particular behaviour (Bandura, 1986). For example, the construct of attitude in TPB is measured by perceived outcomes and the value placed on them. This in fact concords with the concept of outcome expectation in SCT. Similarly, the concept of perceived severity and susceptibility to disease in the health belief model could also be seen as expected negative physical outcomes (Bandura, 2004). Furthermore, most of the behaviour change theories are concerned primarily with explaining and predicting behaviour without specifying how to change it. SCT is a notable exception to this (Michie, Johnston, Francis, Hardeman, & Eccles, 2008), as it offers not only predictors, but also principles and sources for behaviour change (Bandura, 2004).

The effectiveness of SCT in behaviour change has been widely documented in various areas, from health behaviours (e.g. Young, Plotnikoff, Collins, Callister, & Morgan, 2014) to career development (e.g. Lent et al., 1994), but not on the spreading of misinformation on SNS. As it is a popularly and empirically supported theory for behaviour change interventions in other informational or health-related behaviours, the current study proposed that SCT also serves as a suitable and valuable theoretical framework guiding the intervention to addressing individual’s spreading of misinformation on SNSs.

2.5.2 Overview of Social Cognitive Theory

SCT uses a model of emergent interactive agency (Bandura, 1986), in which behaviour, cognition and other personal factors, as well as environmental influences, all operate as interacting determinants which influence each other bidirectionally. That is, people are neither autonomous agents driven by inner forces nor simply mechanical conveyers shaped by the environment. Rather, they make a causal contribution to their own motivation, behaviour and development within a system of triadic reciprocal causation (i.e., the three determinants are influenced by and influencing on each other) (Bandura, 1986). SCT recognises the influence of personal factors, such as expectations, beliefs, self-perceptions, goals and intentions, when it comes to shaping the behaviours. This suggests that while one's behaviours can accommodate environmental influences, one can also choose to behave otherwise through the exercise of self-influence. This supports the feasibility of developing an intervention to reduce users' spreading of misinformation. In other words, intervention can be developed to change one's behaviour (in this case, reduce users' spreading of misinformation) through altering their personal factors (e.g. expectations). Therefore, among SCT's reciprocal relationships (i.e., the influences of personal factors on behaviour and the influence of behaviour on personal factors), a predominant amount of research that applies SCT for behaviour change focused on the former (i.e., influences of personal factors on behaviour). For instance, in how personal factors influence health behaviour (Bandura, 2004) (discussed in the upcoming paragraph on page 58) and training for computer skills (Compeau & Higgins, 1995). Additionally, the influences of behaviour and environment on personal factors are also acknowledged in SCT, which points to the feasibility and desirability of modifying individual's expectations, beliefs and other cognitive competencies (i.e., personal factors) through modelling, instruction, social persuasion and so on. This, in return, offers

directions for the design of interventions (e.g. provide information related to one's expectation toward misinformation spreading).

SCT does not have a standardised model or a defined set of determinants. This can be seen as its strength, since this makes the theoretical perspective of SCT more robust when being interpreted and applied to various fields of research, from education to health behaviour and the workplace. However, this also represents a weakness, because without a standard, empirical studies of SCT tended to be conducted with slightly different measures, which creates difficulties for knowledge accumulation and has slowed down the theoretical development of SCT. As a result, variations of the model have been developed with differently focused variables. Intervention research has tended to draw on particular constructs of SCT to guide the design and evaluation of behaviour change techniques, amongst which those of self-efficacy and outcome expectation are especially prevalent. SCT research in other areas (e.g. social media use), on the other hand, has focused more on testing SCT and applying it to different situations. For example, Lent et al. (1994) included the construct of interest to develop their social cognitive career theory. Meanwhile, LaRose, Lin, and Eastin (2003) emphasised on self-regulation and habit strength to understand unregulated Internet usage.

While models vary, one well-known model is Bandura (2004)'s model. In this model, Bandura illustrated the main determinants of SCT for promoting health behaviour (Figure 2.1), including outcome expectations, self-efficacy, goals and socio-structural factors (these are discussed in more detail in the following sections). This model of SCT has been widely used in intervention research in the health domain; hence, it is also expected to be suitable and useful in informing intervention design related to the spread of misinformation on SNSs. Moreover, in this study, emphasis is placed on outcome expectation. Following SCT, this study considers outcome expectation to be most

relevant for addressing the spreading of misinformation on SNS (details discussed in Section 2.5.2.1 below). As previously mentioned, the theoretical development of a full SCT model is not the main focus of the study. Hence, although the SCT model provides guidance for the development of the intervention, it is not part of the research objectives to apply and test it fully, nor to develop a more comprehensive version of SCT in the case of the spread of misinformation on SNS.

Figure 2.1 The SCT Model for Promoting Health Behaviour (Bandura, 2004)

2.5.2.1 Outcome expectation

Outcome expectation is a primary construct of SCT. It is the main focus of this study's intervention design. Outcome expectation refers to one's belief of the likely consequences that one's performance will produce (Bandura, 1997). Central to SCT is the assumption that people will act in ways which they believe will lead to positive outcomes, while avoiding behaviours which they expect to result in negative outcomes. That is,

people spread misinformation on SNS could be because they expect positive consequences from their spreading, or because they expect negative consequences if not to do so. As such, changing their outcome expectations could contribute to the decrease of spreading. Indeed, Abraham and Michie (2008)'s taxonomy of behaviour change techniques identified "provide information on consequences" as one of the commonly used techniques linked to SCT. Defined as providing "information about the benefits and costs of action or inaction, focusing on what will happen if the person does or does not perform the behaviour" (Abraham & Michie, 2008, p. 382), this technique was used in the majority of interventions for physical activity and healthy eating reviewed in their study.

Specifically, Bandura (1997, pp. 21-22) classified three major types of outcome expectations, namely physical, social and self-evaluative. Physical outcome expectation refers to the physical effects that one expects to accompany the behaviour. Pleasant sensory experiences and physical pleasure are positive physical outcome expectations, whereas negative physical effects can be aversive sensory experiences, involving pain and physical discomfort. For example, people who believe in the misinformation they spread could be influenced by the positive physical outcome expectations they hold. The misinformation may be about tips on improving one's health, and they spread it as a conscious effort to stay healthy. Hence, the approach to correct such misbeliefs seek to change people's beliefs about the physical consequences (i.e., physical outcome expectation); that is, spreading health-related misinformation will not contribute to physical health improvement, but is more likely to have the opposite result.

Social outcome expectation refers to the social reactions one expects to be evoked from the behaviour. As discussed above (Section 2.4.2), the spreading of misinformation could serve a social function in the network. That is, people could be spreading the

misinformation as a socialising move to interact with others. Positive social outcomes related to spreading misinformation could be expressions of interest, approval and recognition by others in the online social network, which are commonly achieved through the SNS features of “Likes” and further “Sharing” of the post by other users. Correspondingly, the negative outcomes would be disinterest, disapproval, rejection or censure by others, expressed by ignoring the post or leaving critical comments by other users.

The third form is self-evaluative outcome expectation, which refers to the self-evaluative reactions one expects from the behaviour. Self-evaluative outcome expectation corresponds to the SCT proposition that humans are not completely shaped by external factors. People adopt personal standards and regulate their behaviour by self-sanctions. They will do things which give them self-satisfaction, a sense of pride and self-worth, while refraining from behaviours that which self-dissatisfaction, self-devaluation or self-censure. Hence, even when people foresee that spreading misinformation could bring a pleasant experience and approval by others, they could still choose not to spread it by excising self-influence if they regard it as a poor behaviour.

Notably, although self-efficacy has a direct influence on outcome expectation in the SCT model in Figure 2.1, the relationship between self-efficacy and outcome expectation is not fixed (Bandura, 1997). For activities where the quality of performance ties closely to the outcomes, the types of outcomes people anticipate depend largely on their beliefs about how well they will be able to perform in given situations (i.e., their self-efficacy), which fits the situation for most health behaviours promotion. On the other hand, outcome expectation could contribute independently to the behaviour when outcomes are not completely controlled by the quality of performance, such as when a minimum level of performance is needed and variations in performance quality do not

make a difference. The spreading of misinformation falls in the latter category, because to spread out one piece of misinformation only involves clicking a few buttons on SNSs. In this case, this study anticipates outcome expectation to have a major influence on the spreading of misinformation. Moreover, the effect of outcome expectation could be independent of the belief that one is capable of refraining from the spreading misinformation (i.e., self-efficacy).

Additionally, to design an intervention with a clearly targeted behaviour, it is important to distinguish a behaviour from a consequence, as the latter is what follows the former. In the context of the spreading of misinformation, the act of spreading out a piece of misinformation is the behaviour. Whereas the inaccurate content misleading people and causing harm, or the post getting no appreciation from others, are kinds of consequences that might (or might not) occur due to the spreading. Expecting either of these consequences could prevent one from spreading the particular misinformation. In short, it is the behaviour that needs to be addressed, and this can be done by modifying different types of related outcome expectations.

Based on the discussion above, the study suggests that designing interventions targeting users' outcome expectations could be an effective strategy to address the spreading of misinformation on SNS. The study investigates the effects of the interventions on changing (i.e., reducing) the behaviour (i.e., users' spreading of misinformation on SNS). As the interventions are developed based on outcome expectation, the study is also interested in the effects of the interventions on changing users' outcome expectations toward misinformation spreading. In sum, the study investigated two different dependent variables, one on users' outcome expectations toward misinformation spreading (RQ1), the other on users' misinformation spreading behaviour (RQ2). Furthermore, since there are different types of outcome expectations, it

would be interesting to see whether interventions targeting these different types would have different effects, and if so, which one works better. Specifically, three interventions have been developed, aiming respectively at physical (RQ1a, RQ2a), social (RQ1b, RQ2b) or self-evaluative outcome expectations (RQ1c, RQ2c). Therefore, two main research questions (RQ) have been developed as follows:

- RQ1: What are the effects of the interventions, developed based on outcome expectation from SCT – specifically, (1a) physical outcome expectation; (1b) social outcome expectation; and (1c) self-evaluative outcome expectation – on changing the *negative outcome expectation toward spreading health-related misinformation on Facebook*?
- RQ2: What are the effects of the interventions, developed based on outcome expectation from SCT – specifically, (2a) physical outcome expectation; (2b) social outcome expectation; and (2c) self-evaluative outcome expectation – on reducing the *spreading of health-related misinformation on Facebook*?

Additionally, while the interventions are developed based on outcome expectation to address the misinformation spreading issue, it is not the main goal of this study to test the relationship between belief (outcome expectation) and behaviour (spreading of misinformation). Rather, the study is interested in the effects of the interventions on both users' belief and behaviour. Nonetheless, the study includes an initial exploration of the influences of the negative outcome expectation and interventions strategies together on the spreading of information.

2.5.2.2 Self-efficacy

Self-efficacy refers to “beliefs in one’s capabilities to organise and execute the courses of action required to produce given attainments” (Bandura, 1997, p. 3). In this study, SNS users’ beliefs in their abilities to refrain from spreading misinformation. For intervention research in the health behaviour domain, self-efficacy is considered the most salient contribution of SCT (Ashford et al., 2010). However, it has also been commented that self-efficacy has received too much attention in intervention research in comparison to the other components of SCT (Young et al., 2014). In a review of intervention related to physical activity, it was found that many studies which claimed to have employed SCT merely applied self-efficacy (Rhodes & Nigg, 2011). It is important not to misinterpret SCT as a “one-factor theory”. Given the reciprocal nature of SCT, it has been suggested that it is important to test self-efficacy with other less-investigated SCT variables, such as outcome expectation (Bandura, 2004; Young et al., 2014).

Besides in the field of health behaviour change, there is also evidence that self-efficacy could be an influential factor in SNS adoption and continuation (Błachnio, Przepiórka, & Rudnicka, 2013; Gangadharbatla, 2008). This is consistent with its important role as previously demonstrated in computer use and Internet use research (Compeau & Higgins, 1995; LaRose & Eastin, 2004). The effects of self-efficacy have also been examined in context of various activities on SNS, such as collaborative learning on Facebook (Lampe, Wohn, Vitak, Ellison, & Wash, 2011), self-presentation on Facebook (Sun & Wu, 2011) and information evaluation on SNSs (Khang, Han, & Ki, 2014). However, results from these studies were not completely significant; for example, Khang et al. (2014) followed LaRose and Eastin’s (2004) measures, but failed to find a significant relationship between self-efficacy and SNS use. In fact, it is mentioned that

research on self-efficacy in social media use has yet to be adequately explored and operationalised (Błachnio et al., 2013; Hocevar, Flanagin, & Metzger, 2014).

While the interventions in the present study are not based on self-efficacy, it is reasonable to explore the moderating effects of self-efficacy for not spreading misinformation on the effects of the interventions. That is, to investigate whether the interventions exert different effects on people who have different levels of self-efficacy to refrain from spreading misinformation on SNS. Accordingly, two sub-questions are developed under the two main RQs:

- RQ1d: Does self-efficacy for not spreading misinformation on Facebook moderate the effects of the interventions on changing the *negative outcome expectation toward spreading health-related misinformation on Facebook*?
- RQ2d: Does self-efficacy for not spreading misinformation on Facebook moderate the effects of the interventions on reducing the *spreading of health-related misinformation on Facebook*?

2.5.2.3 Other determinants of social cognitive theory

Goal is another determinant of SCT. In SCT, there are two types of goals. A distal goal serves an orienting function, while a proximal goal mobilises self-influences and directs what one does in the here and now. Moreover, Bandura (2004) suggested that the proximal goal is essentially equivalent to the concept of intention in psychosocial theories, such as the TPB, as “I intend to” and “I aim to” both refer to what a person proposes to do. An intention is more than an expectation or prediction of future actions, but is instead refers to a proactive commitment to bringing them about (Bandura, 2001).

Similarly, the goal system is grounded in self-monitoring, internal standards and self-reaction.

How people set goals and plan actions is influenced by self-efficacy as well as outcome expectation, while the goal also has an independent contribution to performance. Goals play an important role in the self-regulation of behaviour (Bandura, 1986); by setting goals, people organise and guide their behaviour towards desired outcomes over time. This is essential for behavioural maintenance, since other factors that might serve as guides and motivators are unlikely to produce a lasting effect unless individuals develop the means to exercise control over their behaviour (Bandura, 2005).

While goal setting and self-regulation are especially relevant for behavioural maintenance (Bandura, 2005; Rothman, Baldwin, & Hertel, 2004), addressing different aspects of behaviour change (such as initiation of new behaviour, breaking established behaviour and maintaining and generalising behaviour) might require interventions with focuses other than goals (Michie & Abraham, 2004). The main focus of the study is on breaking SNS users' established spreading habits, which is the initial step to address the behaviour. That is, reducing users' spreading of misinformation falls under the category of studies that requires intervention with focusing on something other than goals, e.g. beliefs. Collectively, the construct of goal is not of focus in this study's use of SCT.

Lastly are the socio-structural factors. Environmental factors such as economic conditions, socioeconomic status and educational and family structures could be facilitators of or impediments to behaviour change, as they may act indirectly through their impact on people's sense of efficacy, personal standards and other self-regulatory influences (Bandura, 1997). Socio-structural factors were often not included in studies investigating SCT. For the purpose of this study, socio-structural factors are not included

in the intervention, but are considered background demographic information of the study population to be controlled for. That is, we hope that the impact from socio-structural factors might be reduced in a relatively homogeneous sample.

2.5.2.4 Social cognitive theory and social media use

As discussed in Section 2.4, the study suggests seeing individuals' spreading of misinformation on SNS as an information behaviour on SNS with underlying motivations that are weighted heavier than the informational value of the content by the users. A number of research studies have been done on the motivations of social media use. To mention a few, Joinson (2008) conducted a content analysis on users' description of their use of Facebook and identified a list of use and gratification categories, including social connection, shared identities, photograph usage, content usage, and so forth. Sheldon (2008) applied gratification items from Internet use studies to understand students' use of Facebook and named six categories of reasons: relationship maintenance, passing time, virtual community, entertainment, coolness, and companionship. Park, Kee, and Valenzuela (2009) studied reasons for using the Group function in Facebook and identified four categories: socialising, entertainment, self-status seeking, and information seeking. Y. Kim, Sohn, and Choi (2011) compared the motivations for using SNS between American and Korean college students and came up with a scale of five motivation categories, including seeking friends, seeking convenience, seeking social support, seeking information, and seeking entertainment. Smock, Ellison, Lampe, and Wohn (2011) emphasised on seeing Facebook as a group of features and developed eight motivations for Facebook use, including relaxing entertainment, expressive information sharing, companionship, professional advancement, and so forth. Lee and Ma (2012) investigated new sharing activities on social media and identified four categories of

motivation: information seeking, socializing, entertainment, and status seeking. The motivation approach is widely used to investigate the use of social media, and a significant amount of motivation research has been based on the uses and gratifications theory (UGT) (e.g. Lee & Ma, 2012; Park et al., 2009; Shao, 2009; Smock et al., 2011). UGT has been recognised as one of the most effective approaches to understanding individuals' needs in relation to media use (Park et al., 2009; Shao, 2009). It was suggested that the current functional features are able to provide users with greater gratifications by allowing them to control both interaction and content, and to do so even with little input (Shao, 2009).

In fact, being a special kind of social media use, the spreading of misinformation on SNS has been found to be related to the major motivation categories of UGT. For example, Chen (2016)'s study found that three main gratification categories (entertainment, socialising, and self-expression and status seeking) were significantly related to respondents' misinformation sharing on social media. However, a common criticism of UGT is its ambiguous conceptualisations of gratification sought and obtained. Hence, it has been proposed that individuals' use of media should be studied through a continual comparison of gratifications sought and obtained (LaRose et al., 2001; Ruggiero, 2000). Initial gratifications sought influence people's choice of media, and will subsequently be modified by the actual gratifications obtained. Such a mechanism basically has to do with the bidirectional effects that are central to SCT's reciprocal causation system (Bandura, 1986). Consequently, it has also been suggested that the perspective of SCT could be employed in UGT research (LaRose et al., 2001). In particular, the concept of gratification could be seen as the outcome expectation of SCT, and should be operationalised based on outcome expectation categories (LaRose et al., 2001). While UGT is useful in understanding the reasons and motivations of users'

behaviour on social media, it does not focus on providing guidelines on how to change users' behaviour. SCT, on the other hand, not only proposed a set of determinants that have direct influences on the behaviour, but also suggested how the determinants can be used to change the behaviour. Thus, the close conceptual connection between UGT and SCT further supports the study's proposal of designing interventions which focus on SNS users' outcome expectations toward misinformation spreading.

2.5.3 Gender Differences in Addressing the Spreading of Misinformation on Social Network Sites

SCT recognises the influences of individual differences variables (Lent et al., 1994). In fact, the personal determinants emphasised within SCT's triadic causal system of persons and their behaviours and environments (Bandura, 1986) are sub-types of individual difference variables. Moreover, some applications of SCT have taken more factors of individual differences into account. Lent et al. (1994)'s social cognitive career theory (SCCT), for example, added a set of individual differences factors (e.g. gender, ethnicity, predispositions, etc.) based on major theories of career development. Similarly, Tokar et al. (2007) expanded the SCCT by examining the influences of gender, personality traits and conformity to gender role norms on learning experiences, which further influences on self-efficacy and outcome expectation.

Considering the statistical power of the experimental design, the study did not focus on surveying and testing the influences of various individual characteristics on the effects of the interventions. In particular, gender, a primary factor of individual differences, was included in this study. The study suggested that gender could be a prominent individual characteristic to the topic studied. When SCT was being developed,

Bandura recognised the influences of gender and its relationship with SCT determinants (Bussey & Bandura, 1999). SCT proposed that gender differences are socially constructed. People behave as their gender roles because they are influenced by the society, while themselves are also part of the social influences (Bussey & Bandura, 1999). This explanation suggests possible relationships between gender and the SCT determinants (outcome expectation and self-efficacy, in this study) that could be investigated.

Moreover, in social media use research, gender differences are often reported in terms of usage and motivations. It was found that bloggers' outcome expectations had influences on their motivations to blog, and the relationship was moderated by gender (Lu & Hsiao, 2009). Specifically, women were more likely to blog so as to discuss information about themselves with others, while men tended to blog for rewards, such as reputations. Both women and men were likely to blog when they considered that the people who are important to them expect them to do so (Lu et al., 2010). Likewise, women tend to spend more time on social media and are more likely to use Facebook compared with men (Duggan et al., 2015). Women are also more likely to use Facebook for relationship maintenance, as they are more likely to post status updates, upload photos and post to others' walls and comment on others' posts (Hampton, Goulet, Rainie, & Purcell, 2011; Muscanell & Guadagno, 2012). Men, on the other hand, tend to be task-focused and use SNSs to create new relationships and find job leads (Muscanell & Guadagno, 2012). They are also much more likely to have never "Liked" any of their friends' content (Hampton et al., 2011).

Gender difference is also frequently investigated in online health information behaviour research. Whereas men tended to be more active Internet users, women were found more engaged in health-related online information behaviour (Bidmon & Terlutter,

2015; Hallyburton & Evarts, 2014). Women users were reported more likely to engage in health-related blogging and SNS use (Prestin, Vieux, & Chou, 2015). In fact, women were more likely to employ more type of sources when seeking for health-related information (Rowley, Johnson, & Sbaffi, 2017), which likely includes SNS. Still, a considerable amount of studies included gender only as part of the background demographic information, leaving the role of gender difference understudied. Researchers have hence called for further research to test possible gender differences (Sbaffi & Rowley, 2017).

Accordingly, the study proposed to examine how gender differences might moderate the effects of the intervention on addressing the spreading of misinformation on SNS. Two last sub-questions are developed as follows:

- RQ1e: Does gender moderate the effects of the interventions on changing the *negative outcome expectation toward spreading health-related misinformation on Facebook?*
- RQ2e: Does gender moderate the effects of the interventions on reducing the *spreading of health-related misinformation on Facebook?*

2.6 Summary

Applying the SCT model (Figure 2.1), the design of this study centred on outcome expectation and self-efficacy, as they are core factors in SCT that are posited to directly influence people's behaviour. Regarding other factors from SCT such as users' prior experience and environmental factors that indirectly impact behaviours, while they are not a focus of the study due to their indirect role in SCT, this study also sought to account for potential relevant factors among them. Specifically, as shown in the conceptual model

of the study (Figure 1.1), the influences of baseline measures are included. That is, users' misinformation spreading and negative outcome expectation toward the behaviour prior to the experiment are taken into account.

Besides the original set of SCT factors, gender is included in the study as a primary factor of individual differences. This inclusion is due to the relevance of gender in applications of SCT, social media use, and health information seeking (as discussed in Section 2.5.3 above). The study selected a relatively homogeneous sample as a mean to reduce the influences of potential confounding factors such as age (further discussed in Section 3.6 below). In addition, perceived accuracy of misinformation is employed as a proxy to control for the influence of users' intention (as discussed in Section 2.2.3.5). Participants' judgments on the accuracy of misinformation also indicate their ability to evaluate misinformation, which to some extent reflect their information literacy level. This allows the study to test the interventions while acknowledging the notion of the user education approach that preparing individuals with information evaluation skills is important in addressing their unintentional spreading of misinformation.

In sum, this study proposed two main RQs, each with five sub-questions:

- RQ1: What are the effects of the interventions, developed based on outcome expectation from SCT – (1a) physical outcome expectation; (1b) social outcome expectation; and (1c) self-evaluative outcome expectation – on changing the *negative outcome expectation toward spreading health-related misinformation on Facebook*?
 - Does (1d) self-efficacy for not spreading misinformation on Facebook and (1e) gender moderate the above effects of the interventions?

- RQ2: What are the effects of the interventions, developed based on outcome expectation from SCT – (2a) physical outcome expectation; (2b) social outcome expectation; and (2c) self-evaluative outcome expectation – on reducing the *spreading of health-related misinformation on Facebook*?
 - Does (2d) self-efficacy for not spreading misinformation on Facebook and (2e) gender moderate the above effects of the interventions?

CHAPTER THREE METHODS

3.1 Overview of Chapter

This chapter discusses the methods of the experimental study and consists of seven parts. First, a summary of a preliminary experimental study is presented in Section 3.2. Second, the experimental design of the current study and its major components are discussed in Section 3.3. Third, the development of the interventions is presented in Section 3.4, which involved a survey study. Fourth, the operationalisation and measurement of main variables being studied are given in Section 3.5. The sampling method and data collection (Section 3.6), as well as discussion on the internal and external validity of the study (Section 3.7) are also presented. The chapter ends with a discussion on the focus of the data analysis (Section 3.8).

3.2 Summary of A Preliminary Experimental Study

A preliminary experimental study has been conducted in 2014 as part of the PhD confirmation process. Part of the results has been published (Chen, Sin, Theng, & Lee, 2015). The preliminary study investigated the effects of one intervention message, developed to target the concept of outcome expectation in general, in changing undergraduates' spreading of misinformation and outcome expectation toward misinformation spreading on Facebook. As an initial step to explore the effects of social cognitive theory (SCT)-guided intervention, the significant findings of the preliminary study suggested the possibility and usefulness of developing SCT-guided interventions to address the misinformation issue. Moreover, the results built an important basis for the intervention development and research design of the current main study. Expanding from

the preliminary study, three specific interventions, each based on one type of outcome expectations, are proposed and tested in the main study. Also, the development of interventions in the main study employs a more rigorous process of multiple stages. Below is a summary of the study.

3.2.1 Research questions and main variables

The preliminary study proposed an intervention message designed to decrease users' spreading of misinformation and modify their expectations about the consequences of spreading misinformation. The design of the intervention message was guided by social cognitive theory (SCT), and especially the concept of outcome expectation. With the objective of testing the effects of the proposed intervention, two research questions (RQ) were proposed: *Can exposure to the SCT-guided intervention message change undergraduate students' (1) spreading of misinformation on Facebook; and (2) outcome expectation about misinformation spreading on Facebook?*

The spreading of misinformation was operationalized as both the frequency and percentage of misinformation spreading. *Frequency of misinformation spreading* refers to the absolute number of times that participants "Liked" or "Shared" posts containing misinformation. *Percentage of misinformation spreading* refers to the number of times that participants "Liked" or "Shared" posts containing misinformation among the total number of times that participants "Liked" or "Shared" all posts (including both misinformation and accurate information). Additionally, "Likes" and "Shares" that accompanied self-explanatory texts that clarified the inaccurate content were excluded.

Outcome expectation of misinformation spreading refers to users' beliefs that certain outcomes would be produced from spreading misinformation. It was measured

using a ten-item seven-point scale (1 = *strongly disagree* and 7 = *strongly agree*). The scale items were developed based on previous research on outcome expectation of Internet use (LaRose et al., 2001) and misinformation sharing (Chen & Sin, 2013). Most of the items described positive outcomes.

3.2.2 *Experimental design*

The preliminary study used a classical experimental design. Participants were randomly assigned to a control group or an experimental group. A cover story was used to mask the study's focus and to avoid the priming effects and social desirability effects. The study was introduced as an evaluation of a particular Facebook-post recommendation system. It was delivered through an online survey platform and took 30 minutes to finish.

All participants went through a pretest where they viewed 10 posts that were designed to look like Facebook posts (five contained misinformation and five were accurate). After viewing each post, participants were given response options that mirrored actual Facebook settings ("Like," "Share," "Comment," or no response at all).

The next stage involved the intervention. While the experimental group read the intervention passage, the control group read a passage that contained irrelevant information. The intervention passage was written in the form of a magazine article (about 700 words) that focused on negative outcomes of misinformation spreading in general, such as physical harm.

During the posttest, each participant used the response options listed above on an additional set of 10 posts (five with misinformation and five without). The pretest and posttest misinformation posts were pilot tested and designed to parallel one another. For example, the study contained two fake advertisements for cell phone software upgrades,

where one claimed that the software upgrade could make a phone completely waterproof, and the other said that it could allow a phone to recharge inside of a microwave oven.

After the posttest, participants answered questions about their demographics, social media use, and outcome expectation towards misinformation spreading. Participants were debriefed immediately after the experiment, as required by human subject protection guidelines.

3.2.3 Study population and sample size

The study population was undergraduate students in a public university in Singapore, who were between 18 to 25 years old and visited Facebook at least weekly. The sample was drawn using stratified systematic sampling. Invitations for the online survey were emailed to the students. Since participation was voluntary, not everyone who was invited took part in the study.

Data collection was conducted in October 2014 after obtained approval from the university's IRB. A total of 131 responses were received and analysed. There were more female ($n = 83$) than male ($n = 48$) participants. The average age was 21.3 years ($SD = 1.75$). All participants ($N = 131$) visited Facebook weekly, and over 60% ($n = 81$) visited more than once a day.

3.2.4 Data analysis method

To answer RQ1, two 2×2 (time [pretest, posttest] $\times$ condition [experiment, control]) mixed ANOVA tests were conducted to determine the effects of the intervention on the frequency and percentage of misinformation spreading. To answer RQ2,

independent t-tests were conducted to test the influences of the intervention on participants' outcome expectations by comparing the differences between the experimental group and the control group.

3.2.5 Key findings

First, results of the ANOVA for the frequency of misinformation spreading showed that there was a significant *Time* $\times$ *Condition* interaction effect. This indicates that after receiving the intervention, participants in the experimental group spread significantly fewer misinformation posts than the control group. Specifically, out of the five misinformation posts, the experimental group spread nearly one post less ($M = 0.91$) after intervention, and the decrease in the control group was marginal ($M = 0.27$).

Similarly, results of the ANOVA for the percentage of misinformation spreading showed that there was a significant *Time* $\times$ *Condition* interaction effect. This indicates that after receiving the intervention, the percentage (proportion) of Facebook posts containing misinformation among all posts spread by participants in the experimental group decreased significantly compared with the control group. Participants in the experimental group had a 14.1% absolute reduction in the proportion of misinformation among all posts spread, whereas in the control group the percentages of misinformation spread barely changed (0.3%).

The above results together answered RQ1 by illustrating that the intervention was effective in decreasing the spreading of misinformation on Facebook, both in terms of the frequency of misinformation spreading as well as in the percentage of misinformation-containing posts among all posts spread.

Second, results of the independent samples t-tests conducted on the outcome expectation scale (1 = *strongly disagree* and 7 = *strongly agree*) showed that participants in the experiment condition rated significantly lower scores for three positive social outcomes than the control group. The three significant differed outcome expectations were: “*stay in touch with people I know*”; “*feel like I belong to a community*”; and “*be welcomed by people who are important to me*”. This indicates that after receiving the intervention, participants in the experimental condition expected significantly less positive social outcomes from spreading misinformation on Facebook compared to the control condition. Hence, answering RQ2, the intervention was to some extent effective in decreasing participants’ positive social outcome expectations of the spreading of misinformation.

In summary, the preliminary study explored the effects of an intervention message, guided by the concept of outcome expectation in general, in changing undergraduate students’ spreading of misinformation and outcome expectation toward misinformation spreading on Facebook. The study shed light on the possibility of developing interventions to address the misinformation issue. The significant findings enriched and strengthened the design of the current main study. Expanding from the preliminary study, the current main study proposes and tests the effects of three specific interventions based on three main types of outcome expectations in SCT. Also, the current study employs a more rigorous process of multiple stages to develop the set of interventions.

3.3 Research Design

To achieve the proposed research objectives, the current study adopted an experimental research design to investigate the effects of the interventions in changing users' outcome expectations toward the spreading of health-related misinformation (RO2) and reducing their spreading of health-related misinformation on SNS (RO3). The development of the interventions (RO1) is discussed in Section 3.4 below. Experimental research is powerful for investigating causal relationships, as it allows precise control of variables and enables experimenters to isolate and target the causal variables (Neuman, 2011). Moreover, experimental research is suitable for topics with a focused scope and defined theoretical concerns. These characteristics of experimental research make it a suitable and popular approach to investigate the effects of interventions, as can be seen in some intervention review studies (Ashford et al., 2010; Williams & French, 2011). Therefore, an experiment was employed in the current study to examine the effect of the interventions, hence addressing RO2 and RO3. The following paragraphs give an overview of the study design, details of the experiment are presented in Section 3.3.1 to 3.3.6.

Specifically, the current study had a randomised crossover design with a control group (Shadish, Cook, & Campbell, 2002). Participants were randomly assigned to either the experimental group or the control group; participants in the experimental group received all three interventions (treatment) in a randomised sequence, while the control group received no treatment.

Figure 3.1 illustrated the procedure of the experiment. All participants went through a pretest (first measure time point), where they were invited to view a set of ten health-related Facebook posts (Set 1) and given the options of responding to the individual posts using "Like", "Reaction", "Share", "Comment", or not at all; they also

rated their negative outcome expectations toward health-related misinformation spreading on a seven-point scale (1 = *strongly disagree* to 7 = *strongly agree*).

Participants then listened to two minutes of relaxing music as a break to refresh their minds. Following that was the first treatment section, in which individuals in the experimental group were showed an intervention-embedded post as the first posts, while those in the control group were showed an irrelevant post. All participants continued to view and respond to another ten health-related example posts (Set 2) and rated their negative outcome expectation, which served as the posttest for the first treatment (second measure time point).

The same procedures were conducted for the second and third treatment sessions (third and fourth measure time points). To avoid confounding order effects, the delivery sequence of the three treatments were randomised (Shadish et al., 2002), that is, participants were randomly assigned to receive the interventions in one of the six possible orders.

Figure 3.1 Procedure of the Experimental Study

After the experiment, participants were asked to fill out basic demographic information, including gender, age, nationality, and school of study. Participants were also asked to rate their self-efficacy for not spreading health-related misinformation on a seven-point scale (1 = *not confident at all* to 7 = *highly confident*) as well as the perceived accuracy of each health-related misinformation example on a five-point scale (1 = *false* to 5 = *true*). The experiment was concluded with a debriefing session.

The experiment was carried out using Qualtrics Online Survey Software; it was expected that the survey would generally take 40 to 60 minutes to complete. Before taking part in the online survey, a consent form was presented to participants, in which the purpose of the study, the participant's involvement and privacy protection issues were explained. Participants were given 15 Singapore dollars as a token for their participation.

3.3.1 Random assignment of participants

Random assignment uses random drawing to divide participants into groups and reduces potential biases that could be introduced if researchers were to decide which participant should belong to which group. This allows experimenters to treat the groups as equivalent for making comparisons (Neuman, 2011). Participants of the study were assigned to either the experimental group or the control group. Random assignment was achieved by the randomisation function provided by Qualtrics, the online survey software on which the experiment was conducted.

3.3.2 Pretest

The pretest was administered in the form of survey questions. In the online survey, participants were invited to view a total of ten Facebook posts (Set 1); eight were examples of health-related misinformation while the other two consisted of accurate information (see Figure 3.2 for two examples of posts representing misinformation, and Appendix A for the full set of examples used). As misinformation is always mixed with other information that is circulating on social network sites (SNSs) in the real world, two examples of accurate Facebook posts were also employed in the experiment to reflect a more realistic scenario.

Figure 3.2 Examples of Misinformation Posts Used in the Study

The example posts were presented to participants one at a time in a random order. They were shown in the form of Facebook post screenshots made by the author of this study. Participants were told to read the example posts as if they were browsing their own Facebook news feed as usual. They were asked to respond to each example post the way they normally do. Options of response to each post followed the actual Facebook setting; that is, participants could choose to “Like”, “React” to (including “love”, “haha”, “surprise”, “sad”, and “angry”), “Share” with or without text, “Comment” on, or pass the post without doing anything. They were also able to set whom in their networks to “Share” with as well as the visibility of their actions (i.e. to the public, to friends, to their own, or custom). Moreover, icons of real Facebook ‘buttons’ were used to represent the corresponding activity options to increase the authenticity of the experiment. Figure 3.3 shows the representations of the Facebook posts on Qualtrics.

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

[Example of Facebook misinformation post in the form of screenshot]

Like

Comment

Share

I'm not going to respond to this post

👍

❤️

😂

😱

😓

😡

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Figure 3.3 Presentation of the Example Facebook Posts on Qualtrics

Note: Reaction icons, text boxes, and visibility option appear only after participants clicked on the corresponding buttons.

The examples of misinformation were created based on existing widespread misinformation on SNSs and were modified to appropriate length and presentation. In an effort to present various forms of misinformation typically seen on Facebook, they

included a combination of news stories, interesting facts, to-do advice, and so forth. Likewise, the health-related topics of the misinformation-containing posts were related to home remedies, first aid guides, self-diagnosis tests, food safety, medical conspiracy theories. Considering that different people may have different viewpoints on what is true, the contents of these misinformation-containing posts were carefully selected so there was little chance of dispute concerning the truthfulness of the content of each post. It should be noted that the examples were used to show realistic scenarios of misinformation flowing on Facebook, rather than to develop a comprehensive set of categories and subjects of misinformation.

Examples of accurate information were created based on what was commonly seen on SNSs, including information about promoting a healthy lifestyle as well as information about risk factors of common cancers.

Lastly, all three negative outcome expectations, each matched with one of the treatment, was also measured in a seven-point scale (1 = *strongly disagree* to 7 = *strongly agree*). Details are presented in Section 3.5.2 on measurements.

3.3.3 Interventions

Three interventions (each being one treatment) were developed based on the three outcome categories in social cognitive theory (SCT): physical, social, and self-evaluative outcome (Bandura, 1997). Details of the development of interventions are presented below. The interventions were embedded in the example posts of Set 2, Set 3, and Set 4 and presented to participants in the experimental group as the first pieces of the sets (Figure 3.4). Whereas the experimental group received an intervention-embedded post,

the control group received an irrelevant post (e.g. quotes on happiness). The three treatments were delivered to participants in the experimental group in a randomised order.

Figure 3.4 Intervention Messages Used in the Study

3.3.4 Posttests

After each treatment was delivered, a posttest followed. That is, another set of ten Facebook posts were showed to the participants, eight consisting of misinformation and the other two containing accurate information. Questions of the corresponding negative outcome expectation were also asked. In total, there were three posttests for the three treatments. The setting and procedure were identical to those in the pretest, except that the content was different for each of the ten posts.

In order to test the effect of the interventions on participants' information behaviours, it may seem ideal at first to study how participants would respond differently to the same set of misinformation-containing posts after receiving each treatment. But as Shadish et al. (2002) pointed out, taking the same test again might influence the observed outcomes, since practice, familiarity, or other forms of reactivity could be mistaken for an effect of the intervention. This is also known as testing effect. Besides, there were caveats when an identical set of posts were presented four times in a single experiment. Not only is it unusual for ordinary users to repeatedly “Like”, “React” to, “Share”, or “Comment” on the same pieces of information on Facebook within a short period of time, but presenting the same set of posts to participants multiple times would probably arouse suspicion concerning the intent of the experiment, both of which would have decreased the validity of the post-test and the quality of the data.

To decrease dissimilarity of the four sets of misinformation, the total 32 posts containing misinformation were developed in eight groups of four, with all posts within the same group share similar format, topic, subject matter, and other attributes. The grouping of misinformation examples was pilot-tested for sufficient resemblance (despite different contents) by a small group, in which there were information professionals as well as Facebook users who were familiar with misinformation. Modifications of the

content were made after discussion and deliberation. To further reduce potential confounding effects from intrinsic differences in the misinformation posts that might affect participants' responses, the four pieces developed within the same group were randomly located to the four sets. That is, each set consisted of eight pieces each randomly selected from one of the eight groups.

Similarly, in every posttest, two examples of accurate health information were presented to participants, with a total of eight examples created and used.

3.3.5 *Post experiment questionnaire*

Upon finishing the last posttest, participants answered a post experiment questionnaire. Participants were first asked for their demographic information, including age, gender, school of study, and nationality. Their self-efficacy for not spreading misinformation and perceived accuracy of misinformation examples were also measured (see Section 3.5 for details on measurements). In addition, questions on the experience of the experiment were asked (e.g. to what extent they considered the experiment and their behaviour within to be similar to that in real life) and participants were given an opportunity to provide feedback.

3.3.6 *Cover story*

Emphasising the falsity of misinformation may impede participants' expression of their real opinions and thus affect the quality of the data, since it may not reflect well on them to admit having spread misinformation (Hertwig & Ortmann, 2008). Also, asking the participants to view and respond to several similar sets of example Facebook posts within one survey could raise doubts or lead them to scrutinise the latter sets to an

unusual extent, thus decreasing the authenticity of their responses. To address these potential issues, a cover story was created to mask the real purpose of the study, so as to avoid any priming effects from naming the study focus as well as to reduce demand characteristics (a phenomenon in which participants become aware of the experiment's purpose and thus change their behaviour accordingly). In fact, mild deception is commonly used to increase experimental control in psychology (with Institutional Review Board (IRB) approval, steps in place to safeguard the well-being of the participants, and timely debriefing). One of the major reasons to employ deception in a psychological experiment is that people might alter their 'natural' behaviour in order to look as good as possible to social observers when they are aware that some socially undesirable aspects of their behaviour are being observed (Hertwig & Ortmann, 2008). In this case, spreading inaccurate information might not be perceived as a socially desirable behaviour. The use of mild deception in the study was approved by the university's IRB and participants were debriefed immediately after the experiment.

The study was introduced to the participants as a research project about evaluating the effectiveness of a personalised post recommendation system for social media use that required them to take part in an online survey. Participants were told that the study investigated how users' prior activity on Facebook (i.e., whether or not they liked, reacted, shared, commented on a set of posts) could be analysed to generate new posts that were more relevant for their interests. Thus, participants were initially invited to view a set of example Facebook posts that were said to be randomly generated example posts, but were in fact the pretest. They were given the options of responding to the individual post using "Like", "Reaction", "Share", or "Comment", or not responding at all. Both groups then viewed and responded to another three sets of example Facebook posts in sequence, similar to what they have done in pretest. They were subsequently shown three

sets of 11 posts (one intervention post or irrelevant post, followed by ten health-related examples) and told that those were newly generated based on their interests. In fact, for each time, the experimental group received an intervention message embedded as the first piece in the set, while the control group was presented an irrelevant post.

Likewise, doubt might arise when questions of negative outcome expectations were asked repeatedly. Thus, all three negative outcome expectation questions, plus three irrelevant items about social media use, were presented together as a scale about attitudes toward social media in general and given to participants at all four measure periods of negative outcome expectation (at pretest and after each treatment).

Participants were debriefed right after they finished the survey and given correction on the misinformation examples shown. They also had the opportunity to signal their understanding of the real purpose of the study and that they agree or disagree to allow their data to be retained and analysed. In this way, the research design was able to present a situation relatively similar to the real world, where the fidelity of information is not immediately apparent to the receiver but is mixed with ordinary posts during normal use of Facebook.

3.4 Development of the Interventions

To achieve RO1, the interventions were developed in stages. First, statements related to outcomes of misinformation spreading were collected from existing studies. The large pool of statements was then summarised into 54 broader statements, which were further grouped under the three outcome categories in SCT model. Details of this stage is presented below in Section 3.4.1. Thereafter, a survey was carried out to investigate which are the most important outcomes that would make respondents avoid

spreading information (Section 3.4.2). Lastly, the item with the highest score in each of the three outcome categories in SCT was selected to be used in the intervention (Section 3.4.3).

3.4.1 Item collection and grouping

There have not been much direct discussions about outcome expectations of misinformation spreading on SNS in previous studies, which is part of the reason this study proposed the new interventions. Therefore, research of outcome expectations and related concepts (e.g. attitudes and motivations) in other relevant, albeit different, areas are searched to look for relevant measurements that might be employed in the context of consequences of misinformation spreading. For comprehensiveness, search areas included social media use (see details in Section 2.5.2.4), rumour diffusion (see details in Section 2.2.2), information sharing (see details in Section 2.4.1), and online health information seeking (see details in 2.4.1.1). Scale statements related to outcome expectation, motivation, and reasons were all included (e.g. Chiu et al., 2006; DiFonzo et al., 2012; S. Oh, 2012; Powell, Inglis, Ronnie, & Large, 2011; Smock et al., 2011).

A total of 733 statements were collected from 48 studies in various fields (see Appendix C for the list of references). Data cleaning was conducted to exclude statements with duplicated wordings (e.g. “*because it is enjoyable*” and “*to enjoy it*”, the latter being excluded), statements that were not about outcome (e.g. “*because it is easy to use*”, which was about characteristic of the SNS; “*members in my department cooperate well with each other*”, which was about work culture in the company; or “the medical professional recommended specific sources”, which was about reason why one seek health information online), and statements about irrelevant outcomes (e.g. “*without alerting*

others, I know relevant and updated events in my social network”, *“I will receive additional points for promotion in return for my knowledge sharing”*, or *“I want to learn about what kinds of health problems people have”*). After cleaning, a list of 280 outcome statements was generated.

Second, to narrow down the scale of the statements for more efficient investigation, the 280 outcomes were divided by the author of this study into 54 groups each with a summarised statement. The grouping was reviewed and evaluated by a small group of information professionals as well as Facebook users who were familiar with misinformation. Modifications were made after discussion and deliberation. In this way, 54 statements of outcomes related to misinformation spreading were developed. It should be noted that, at this stage, the objective was to get a more comprehensive coverage of the matter, and hence, the focus was on variety. The importance of each outcome on this list was investigated in the section below.

These 54 statements were further divided according to the three outcome categories in SCT (i.e. physical, social, and self-evaluative, as discussed in Section 2.5.2.1) to facilitate subsequent analysis. Six information professionals (e.g. doctoral students in information studies) were employed for the classification. They were given the definitions of the three outcome expectations and were asked to assign each of the 54 statements to one of the three SCT outcome categories. At least five out of the six professionals must agree before a statement can be conclusively assigned to one of the three categories; those statements whose categories the panel could not reach consensus on would be omitted from the final analysis (details presented in Section 3.4.3 below).

3.4.2 *Survey study*

3.4.2.1 Research objectives

The survey study investigated what were the most important outcomes that college students considered when they avoid spreading misinformation on Facebook. The findings were intended for developing the interventions used in the experimental study, hence achieving RO1.

3.4.2.2 Method

An online questionnaire survey was conducted for the study. Survey research is useful for collecting self-reported characteristics (Neuman, 2011), which was suitable for the study investigating individuals' expectations and attitudes toward outcomes of misinformation spreading.

The online survey was carried out using Qualtrics online survey software and took 15 to 20 minutes to complete. The length is believed to be proper for respondents to stay focused. A consent form was presented to respondents before they took part in the study. It contained a brief introduction of the study purposes, participant involvements, and privacy protection measures.

Respondents were first presented several concrete examples of misinformation (e.g. a short article about how “*pineapple juice is 500% more effective than cough syrup*”) to get a better sense of what were the health-related misinformation being studied. Following that, the 54 outcome statements were presented to respondents in a random order. To avoid framing effects (occurs when different descriptions of one issue, e.g. lost or gain, lead to different responses on the issue) (Chong & Druckman, 2007), all statements were rephrased to include both positive framing (about what would be gained

from not spreading misinformation) and negative framing (about what would be lost from spreading misinformation). On a 7-point scale (1 = *not at all important* to 7 = *extremely important*), respondents were asked to indicate how important for them each outcome is in terms of making them avoid spreading health-related misinformation on Facebook.

Afterwards, respondents were also asked for their demographic information, including age, gender, school of study, nationality, and so forth. Upon finishing the survey, respondents received five Singapore dollars as a token of appreciation.

The study population of the study was undergraduate students who were Facebook users in Nanyang Technological University (NTU), a public university in Singapore. Students in the National Institute of Education (NIE) were outside of the scope of this study, as it is an autonomous institute and its students are on a separate mailing list from those pursuing undergraduate programmes administered directly by NTU. College students were chosen since they generally are familiar with social media and the phenomenon of misinformation. The participants' age range was set to 18 to 30 years old (young adults) (Perrin, 2015), which was consistent with other social media studies and information behaviour research with college-aged samples (e.g. Baumgartner & Hartmann, 2011; Gangadharbatla, 2008).

Stratified systematic sampling, a probability sampling method, was employed in this study to generate a list of undergraduate students in NTU to whom participation invitations were sent out. Probability sampling technique is the basis for the representativeness of a sample and the ability to generalise a study's findings; using a probability sampling technique can ensure every individual has a known probability of being selected (Neuman, 2011). In particular, the sampling process made use of the public mailing list of the university and consisted of two stages: firstly, proportionate

stratified sampling was applied and the target population was divided into 50 sub-populations based on the enrolment programmes indicated in their email profiles. Enrolment programme is a basic characteristic of undergraduate students. The expertise taught in different programmes may impact on students' interaction with health-related information (e.g. arts vs science). Hence, it was used as the basis of the strata for higher representativeness of the study population. Systematic sampling was subsequently used to select cases from each program. According to the university's official information (Nanyang Technological University, 2016), at the time of the study (academic year 2015) the size of the undergraduate population was 23,452. With the desired final response number of around 200, and an estimated response rate of about 10% (Epstein, 2012), the number of invitations to be sent was set at around 2,000. Hence, the systematic sampling interval was calculated as 11; that is, every 11th email account in the program mailing list (alphabetically ordered) was selected.

Data collection was conducted in February 2016 after approval by the university's institutional review board (IRB). While the mailing list was supposed to be consistent with the reported population of 23,452, it turned out to be slightly larger. A total of 2,231 participation invitation letters with a link to the survey were sent out via email. Of these, 339 questionnaires were started, of which 252 responses were completed. It should be noted that, even though invitations were sent using a probability sampling technique, the representativeness of the final sample could not be fully ensured, since participation in the current research was voluntary and not everyone being invited took part in the study.

3.4.2.3 Results

Of the 252 responses, 16 of them were finished within five minutes, which was considered unreasonable for a survey that required 15 minutes in average; these responses were excluded, resulted in 236 responses for analysis.

There were 68.6% ($n = 162$) female respondents and 31.4% ($n = 74$) male respondents. Respondents came from all 13 schools that offered undergraduate programs in the university, with more coming from schools of basic and applied sciences ($n = 126$) than schools of arts and social sciences ($n = 110$). The majority of respondents were Singaporean ($n = 183$) while the rest ($n = 53$) were comprised of six different nationalities, including Chinese, Indian, Indonesian, Malaysian, Thai, and Vietnamese. As required in the entry criteria of the survey, respondents' age ranged from 18 to 30 years old; the average age was 21.9 years, $SD = 1.92$.

On a seven-point scale (1 = *not at all important* to 7 = *extremely important*), 25 of the 54 items had a mean score greater than 4. For reference, Table 3.1 shows the means and standard deviations of these top 20 important outcomes for not spreading misinformation. They were listed in descending order as rated by the respondents (see Appendix B for the full list of items).

Table 3.1 Top 20 Important Outcomes of Not Spreading Misinformation

Outcome statement	M	SD	Rank
to avoid misleading or confusing others / to instruct others	5.59	1.47	1
to avoid getting misleading online medical consultation / to get reliable online medical consultation	5.41	1.57	2
to avoid finding inaccurate information / to find accurate information	5.36	1.57	3
to avoid causing harm to others / to help others	5.30	1.58	4
to avoid obtaining poor quality information / to obtain good quality information	5.28	1.46	5
to avoid finding inaccurate health-related information / to find accurate health-related information	5.22	1.53	6
to avoid undermining others' health / to improve others' health	5.03	1.70	7
to avoid being irresponsible for my actions / to be more responsible for my actions	4.99	1.64	8
to avoid misunderstanding issues relevant to me / to make sense of issues relevant to me	4.98	1.62	9
to avoid suggesting ineffective course of action / to suggest effective course of action	4.97	1.67	10
to avoid hindering public education / to facilitate public education	4.96	1.65	11
to avoid being regarded as untrustworthy / to be regarded as trustworthy	4.90	1.71	12
to avoid harming the development of online community / to benefit the development of online community	4.72	1.62	13
to avoid becoming more confused with my health conditions / to get a better understanding of my health conditions	4.63	1.78	14
to avoid damaging my image or reputation / to improve my image or reputation	4.62	1.69	15
to avoid impeding learning / to facilitate learning	4.54	1.66	16
to avoid undermining my health / to improve my health	4.45	1.81	17
to avoid being hindered from verifying the information I found / to verify the information I found	4.44	1.64	18
to avoid complicating information seeking / to help me find information	4.44	1.68	19
to avoid hindering information exchange and discussion / to improve information exchange and discussion	4.40	1.72	20

3.4.3 Selection of Items for Interventions

Finally, the statements with their scores from the survey were examined within each of the three SCT categories (physical, social, and self-evaluative), and the item with the top score in each category was selected. In conclusion, the three outcome statements used as the interventions for the experiment were:

- “*to avoid undermining my health / to improve my health*” (physical outcome expectation; $M = 4.45$, $SD = 1.81$; ranked 17th)
- “*to avoid misleading or confusing others / to instruct others*” (social outcome expectation; $M = 5.59$, $SD = 1.47$; ranked 1st)
- “*to avoid being irresponsible for my actions / to be more responsible for my actions*” (self-evaluative outcome expectation; $M = 4.99$, $SD = 1.64$; ranked 8th)

The statements were formatted into sample Facebook posts. To avoid framing effects, they were rephrased to cover the corresponding positive and negative consequences of spreading or not spreading misinformation on Facebook (Figure 3.4).

3.5 Measurements

This section presents the measurements of major variables used in the main experimental study (not to be confused with the survey study presented above), including (1) The spreading of health-related misinformation on Facebook; (2) Negative outcome expectation toward health-related misinformation spreading; (3) Self-efficacy for not spreading misinformation; (4) Perceived accuracy of health-related misinformation; and (5) Gender.

3.5.1 The spreading of health-related misinformation on Facebook

The spreading activities on Facebook were operationalised as the combination of “Liking”, “Reacting” and “Sharing”. Comments were excluded, so were “Likes”, “Reactions”, or “Shares” with text that showed self-explanatory clarification. Reasons for these operationalisations are discussed below.

According to the current Facebook settings, users can respond to a post in four ways: By clicking “Like”; By clicking one of the “Reactions” (including “love”, “haha”, “surprise”, “sad” and “angry”); by “Sharing” it with others (with or without text); and by “Commenting” on a post. “Comment” was excluded from “spreading activities” based on two reasons: first, the attitude of a user who selects “Comment” under a post varies and is largely dependent on the specific content written; second, “Comments” always stay under the post and are not forwarded to other users.

In contrast, using “Share” is the major and most direct way of spreading out a post, because with one or two clicks a user can forward the post to their entire social network on Facebook. “Like” and other “Reactions” can also be seen as indirect ways of spreading information. The action of “Like” not only could be interpreted as an approval of the post, but would also be seen by the user’s social network in the Facebook newsfeed; moreover, no text could be added to the “Like” to explain the act. This is also the case for “Reactions”. Especially, due to the positive sentiments of “love”, “haha”, and “surprise”, reacting in such ways could also be seen as approving the misinformation and would make it more visible to the users’ social network. While the reactions of “sad” and “angry” themselves could express negative sentiments, without accompanying explanatory text it would be hard to interpret if a user clicks “angry” because s/he believes in the negative content in the misinformation or because s/he disapproves the credibility/accuracy of the posts; meanwhile, such reactions contribute to the spread by

making the misinformation more visible. As discussed earlier, it is the convenience and low cost of interaction on SNSs that contributed to the large-scale spreading of misinformation on it. In order to capture the spreading activities in a more comprehensive fashion, “Likes”, “Reactions” and “Shares” were thus all included.

Additionally, since users could choose to add text or not to their “Shares” on Facebook, users might, in some cases, “Share” the misinformation while adding texts of opposite views with the objectives of clarifying it. This kind of “Sharing” could arguably be seen as a different act from spreading misinformation if the texts add clarification to the topic. The same goes for an act of “Like”, “React”, or “Share” with different or opposing content created via “Comment” under the original misinformation. That is, for any “Like”, “Reaction”, or “Share” with critical comments, irrespective of whether the critiques were written within “Share” or “Comment”, would not be reasonably counted as spreading misinformation. Nonetheless, due to the lack of context in the online environment, a few clarifying words might not be enough to articulate the sharers’ actual attitudes and opinions, e.g. whether one is being serious or satirising. Based on these considerations, “Likes”, “Reactions”, or “Shares” with text that showed self-explanatory clarification, and only self-explanatory clarification (e.g. with an explanation or correct information of the misinformation, instead of sarcasm or yes-no question), were excluded from the definition of misinformation spreading used this study. Nonetheless, the texts in the “Shares” and “Comments” were analysed qualitatively to enrich the understanding on participants’ spreading of misinformation.

As discussed earlier, misinformation in this study was defined as inaccurate information in general, be it spread intentionally or not. In the experiment, misinformation was operationalised as a total of 32 examples of misinformation on Facebook that were created to be shown to participants in the experiment; details of the

examples were discussed in Section 3.3.2 above. The extent of misinformation spreading was measured by the percentage of posts spread that contained misinformation in the study. To be specific, percentage of misinformation spreading = (number of “Likes”, “Reactions”, and “Shares” on posts that contained misinformation / total number of “Likes”, “Reactions”, and “Shares” on all posts) $\times$ 100%. In this way, the study was able to measure the misinformation spreading with reference to the spreading of all information (misinformation and accurate information combined); change in this percentage before and after intervention would reflect an effect of the intervention on the spreading of misinformation among all information spread. A decrease would be expected for a successful intervention.

3.5.2 Negative outcome expectation toward health-related misinformation spreading

Negative outcome expectation toward health-related misinformation spreading refers to one’s belief of the likelihood that certain negative consequences will be produced from her/his spreading of health-related misinformation (Section 2.5.2.1). As mentioned in Section 3.4 above, the interventions were developed based on the three types of outcome expectations in SCT. To measure whether participants’ outcome expectation changed after receiving the intervention, three negative outcome expectation statements were created, corresponding to the negative outcomes described in the three interventions. Specifically, the three statements measured the three outcome expectations were:

- Negative physical outcome expectation: *“I believe ‘Sharing’, ‘Liking’, or ‘Reacting to’ inaccurate health-related information on Facebook will not improve my health; it will undermine it.”*;

- Negative social outcome expectation: “*I believe ‘Sharing’, ‘Liking’, or ‘Reacting to’ inaccurate health-related information on Facebook will not instruct others; it will mislead or confuse them.*”; and
- Self-evaluative outcome expectation: “*I believe ‘Sharing’, ‘Liking’, or ‘Reacting to’ inaccurate health-related information on Facebook is not being more responsible for my actions; it will be irresponsible.*”

On a seven-point scale (1 = *disagree strongly* to 7 = *agree strongly*), participants were asked to indicate to what extent they agree on each statement.

All three questions of negative outcome expectation were asked in pretest, and again after the corresponding treatment session (i.e. posttests). Although all three questions of negative outcome expectation were presented to participants in every posttest to avoid demand characteristics (as discussed above in Section 3.3.6 on the cover story), only the score from the statement corresponding to the treatment was analysed. For control condition, negative outcome expectation at pretest and posttests were measured using the average scores of all three statements.

3.5.3 Self-efficacy for not spreading health-related misinformation

Self-efficacy for not spreading health-related misinformation (self-efficacy) refers to one’s beliefs in her/his ability to avoid spreading health-related misinformation on Facebook (Section 2.5.2.2). Self-efficacy is domain specific (people have different self-efficacy for different behaviour) and there is no existing self-efficacy measurement for not spreading misinformation. Thus, in the study, an 18-item scale was developed to measure self-efficacy. Moreover, Bandura, the author of SCT, suggested that measurement of self-efficacy should be constructed as a composite of measurements in

different functioning sub-aspects and with different situational demands (Bandura, 2006). For the case of not spreading misinformation, to produce the behaviour is relatively simple – by not clicking ‘buttons’ on Facebook (compared to the self-efficacy for teaching, for example). However, the behaviour, as a kind of SNS use with multiple purposes, may have different levels of difficulties in various situations (e.g. one may find it more difficult to refrain from spreading misinformation when one wants to connect with one’s friends who are spreading it, or when one wants to use misinformation spreading to gain attention). Thus, the 18 statements developed depicted various situations that could make one more likely to spread inaccurate health-related information on Facebook, e.g. “*when I want to escape from reality*” and “*when I want to get attention*” (see Appendix A for all the items). On a seven-point scale (1 = *not confident at all* to 7 = *highly confident*), participants rated how confident they were that they could stick to not spreading health-related misinformation on Facebook under each of the 18 situations.

3.5.4 Perceived accuracy of health-related misinformation

In the post-experiment questionnaire, the 32 misinformation examples were once again showed to the participants, and participants were asked to indicate to what extent they considered each example true or false on a five-point scale (1 = *false* to 5 = *true*). The perceived accuracy of the 32 misinformation examples were measured by averaging the scale of all 32 items. As indicated in the conceptual model (Figure 1.1) and Section 2.2.3.5, *perceived accuracy of misinformation* was included as a proxy to control for the influence of users’ intentionality so as to have a more focused investigation on the effects of interventions on the spreading of misinformation (RQ2). Users’ intentionality was not directly measured and tested in the study due to the concerns that social desirability bias

might occur. That is, if users are directly asked whether they intentionally spread inaccurate information, they might be more likely to answer in the ways that are socially appropriate rather than accurately reporting their real intentionality.

3.5.5 Gender

As mentioned in Section 3.3.5, participants were asked to indicate their gender, together with other demographic information in the post-experiment questionnaire. Gender was coded as a dichotomous variable with female = 0 and male = 1.

3.6 Sampling and Data Collection

The theoretical population of the study was undergraduate students who were Facebook users. The study population was narrowed down to undergraduate students, who were users of Facebook, in Nanyang Technological University (NTU), a public university in Singapore. Undergraduate students were chosen since they generally are familiar with social media and the phenomenon of misinformation. The participants' age range was set to 18 to 30 years old (young adults) (Perrin, 2015), which was consistent with other social media studies and information behaviour research with college-aged samples (e.g. Baumgartner & Hartmann, 2011; Gangadharbatla, 2008). Furthermore, since this was an exploratory experimental study, having a relatively homogeneous population group could help narrow the study focus and reduce the potential impact of confounding factors (e.g., educational level or age group difference).

Convenience sampling was used in this study; recruitment ads in print were put up around campus to invite eligible students to participate. Data collection was conducted during December 2016 to January 2017 after approval from the university's institutional

review board (IRB). A total of 491 questionnaires were started, of which 304 were completed.

3.7 Internal and External Validity

3.7.1 *Internal validity*

The experiment was designed to alleviate potential threats to internal validity. Internal validity occurs when the dependent variable is influenced by nothing other than the independent variables (Neuman, 2011).

First of all, the study used a classical laboratory experimental design that allowed greater control. Since the experiment from pretest to posttest was conducted via a continuous process within a 60-minute survey, it avoided some potential influence from time (e.g., maturation effect), which results from the natural changes that take place in participants over time (such as a participant becoming more experienced over time). The three treatments were delivered in a random order and music breaks were used between treatments, so as to reduce order effect in the within-subjects design (occurs when being exposed to one treatment impacts on the performance in another treatment). Also, a control group was employed to reduce single group threats, such as those from the history effect, which occurs when any unplanned events happen during the experiment that produce the observed outcome. As noted earlier, random assignment was applied to divide participants into experiment and control condition to avoid selection bias.

Second, the study developed a detailed cover story to introduce the experiment to participants, which satisfied participants' curiosity while reducing threats related to reactivity. Reactivity arises when participants are aware that they are being studied in an experiment, and was a potential issue in this study when words that may be perceived as

socially undesirable like “misinformation” and “spread” were mentioned. Moreover, since the study used an online survey, threats related to communication between the experimenter and participants were also lessened, for example from the effects of experimenter expectancy (experimenter indirectly makes participants aware of the desired results).

Last but not least, the experiment was pilot-tested before being put into actual use so that improvements of the experiment’s design regarding issues such as unclear instructions and formatting issues were made based on feedback and comments.

3.7.2 *External validity*

External validity refers to the effectiveness of generalising experimental findings, including naturalistic generalisation and population generalisation (Neuman, 2011). Experimental research is powerful for investigating causal relationships, as it allows precise control of variables and enables experimenters to isolate and target the causal variables. With strengths in the ability to control, experimental research comes with weakness in external validity in terms of naturalistic generalisation. To address the external validity issue, one possible approach is to use field experiments, which take place in the natural settings of real life. However, while field experiments tend to have higher external validity and are more generalisable, they have the shortcoming of low internal validity due to the reduced amount of control over the experimental conditions. Thus, most experiments (including this study) are still highly localised and particular, and conducted in a restricted range of settings (Shadish et al., 2002).

Additionally, with respect to the laboratory nature of the experiment, attempts were made to enhance the naturalistic generalisation of the study. A cover story was

employed to withhold the real purpose of the study when presenting the experiment to the participants. Through this mild deception, the research was able to give a more realistic scenario to participants. The real-world misinformation would not be self-labelled but rather mixed with other accurate information and would appear as it does during routine use of social media. Also, although the research design was a laboratory experiment embedded in a survey instead of a natural one in the field, efforts were put into presenting an interface similar to the real world. The survey was an online one that allowed participants to take part whenever and wherever they preferred, which avoided the artificial influence of going to a physical lab. Similarly, screenshots of Facebook posts and icons of Facebook ‘buttons’ were used in the questionnaire to increase the perception of authenticity. After the experiment, questions related to the experimental setting and manipulations related to creating the setting were asked, during which participants rated how close to real-life settings they thought the experiment and their behaviours were.

This study employed convenience sampling and hence, caution is required when generalising the findings. However, like other experimental studies, it is not the goal of this study to assume population generalisation. Rather, the study focuses on testing the effects of the proposed interventions and theoretical development. In fact, it has been noted that while random sampling is always desirable, it is also “only rarely and contingently feasible” in experimental research (Shadish et al., 2002, p. 23). Testing the effects of the interventions with different populations is recommended in future studies.

3.7.3 *Limitations*

In spite of the detailed preparation that informed the creation of this experimental study, there is space for improvement.

One potential area for improvement is that the Facebook posts in the pretest and three posttests were not identical. Although they were carefully constructed and evaluated, this design might have weakened the internal validity. The study still decided on using matching post sets because presenting identical posts multiple times could have raised more threats to internal validity, such as the testing effects as discussed in Section 3.3.4.

Another would be the naturalness of the research design, as no matter how close the lab setting was to a real-world setting it was still not actually “real” in the sense that participants were not really on Facebook and using their accounts to “Like”, “React”, “Share”, or “Comment”. Similarly, the experiment had continued showing of mostly inaccurate information and slightly sudden appearances of intervention messages (or irrelevant messages for the control condition), with which the cover story might not have been able to keep participants completely away from doubting the objectives of the study. These lab settings would make the study less generalisable. However, the weakness in naturalistic generalisation is a trade-off for stronger causal testing of controlled experimental study.

Moreover, having the whole experiment with repeated measures in a continuous process might have increased the threats of testing effect, since it is possible that normal users might learn something from the earlier sessions that affected their subsequent responses, or lose interest in carefully responding to the study questions after viewing too many examples within a short period of time. Nonetheless, the study has managed to limit the length of the whole experiment to be less than an hour on average.

Similarly, respondent fatigue might have occurred since participants were tested multiple times in the experiment, which could affect the quality of participants’ answers

in the later sessions. To reduce the potential influence of respondent fatigue, participants' spreading of misinformation was measured by the percentage of misinformation spread, as discussed in Section 3.5.1. In this way, even if participants' overall interactions with the example posts dropped in the later sessions, the calculation of a percentage score (with the denominator being total number of "Likes", "Reactions", and "Shares" given to all the Facebook posts in one session), would be able to at least partially correct for such a possible drop in interactions due to fatigue. Furthermore, the measure of misinformation spreading only required participants to behave as what they would normally do on Facebook (i.e., viewing and responding to posts). According to a 2017 report (Kemp, 2017b), Singapore users reported spending about two hours on social media daily. Thus, it is reasonable to consider that the experiment, which could be completed within an hour, is within the acceptable range in keeping the participants active. Lastly, the Likert scale measuring negative outcome expectation had a concise set of six items to keep participants engaged. The items were presented in random order each session to reduce potential boredom and fatigue.

Lastly, the study employed convenience sampling. As it is a nonprobability sampling technique that could not generate a representative sample, caution is required when generalising the findings.

3.8 Data Analysis

The focus of the current analysis was on the effectiveness of the interventions when participants received the first treatment (i.e. the change from pretest to the first posttest, as shown in Figure 3.1). At this first encounter, participants in the experimental condition had been randomly assigned one of the three treatments only. Therefore, the

experimental group could be split into three sub-groups for Treatment A, Treatment B, and Treatment C, and together with the control group there were four conditions. In this way, we have a randomised pretest and posttest control group classical experimental design for the current data analysis. With this focus on analysing the first treatment (Time 2), the results are not affected by potential testing effects that may occur in subsequent treatments (Time 3 and Time 4). While at the same time, using a crossover experimental design with four time points allowed the study to collect comparable post-experiment questionnaire data. For example, in the current study, participants in the experimental conditions experienced all three treatments and responded to the same set of 32 misinformation messages when they answered items related to *perceived accuracy of health-related misinformation* in the post-experiment questionnaire. If the study were to collect data using an experimental design that only had a pretest and one posttest (Time 2), at the point of the post-experiment questionnaire, the participants would have divergent experience (different treatment condition and different misinformation messages). Such design would introduce noise in the post-experiment questionnaire data. The current study design would avoid this issue.

To answer the first research question (RQ1), a set of logistic regression analyses were performed to determine the effectiveness of the interventions on increasing participants' negative outcome expectation toward misinformation spreading. First, the effects of the interventions were tested solely to get an overview of the relationship between treatment and negative outcome expectation (Model 1). Second, with regards to the influences of the individual differences factors, the effects of the interventions were tested together with two individual differences factors (self-efficacy and gender). The baseline outcome expectation score (i.e., before intervention) was also included (as indicated in Figure 1.1). Accounting for the influence of baseline level value is commonly

used in intervention research, which allows more precise detection of the treatment effects on the post-intervention negative outcome expectation. Both a main effects only model (Model 2A) and a main effects and interaction effects model (Model 2B) were performed.

Similarly, a set of analysis of variance (ANOVA) and analysis of covariance (ANCOVA) tests were conducted to determine the effectiveness of the interventions on reducing participants' spreading of misinformation (RQ2). ANCOVA was employed as it is a commonly used analytic tool which handles variables that are not manipulated in the experiment but have impacts on the dependent variable (i.e., covariates). This allows the effect of the experiment to be assessed more accurately (Field, 2013). First, the effects of the interventions were tested solely to get an overview of the relationship between treatment and the spreading of misinformation (Model 3). Second, with regards to the roles of the individual differences factors, the effects of the interventions were tested together with two individual differences factors (self-efficacy and gender). Also, two covariates were included (as indicated in Figure 1.1): influence of the *baseline spreading of misinformation* was controlled to allow a more accurate estimate of the treatment effects on post-intervention spreading; *perceived accuracy of misinformation* was controlled for with consideration to the notion of the user education approach (details in Section 2.4.2.1). Both a main effects only model (Model 4A) and a full model with interaction terms (Model 4B) were performed. Therefore, developing from Figure 1.1, Figure 3.5 below illustrates the relationships between the RQs of the study and the abovementioned models.

Figure 3.5 Conceptual map of the relationships between the research questions and data analysis models

Lastly, as mentioned in Section 2.5.2.1, the study further explored the influence of negative outcome expectation and interventions together on the spreading of misinformation. Thus, two more ANCOVA tests, were conducted by adding negative outcome expectation as a between-subjects factor into Model 4A and Model 4B; one was a main effects only model (Model 5A) and the other was a full model with interaction terms (Model 5B).

Data analysis of this study was conducted with SPSS Statistics. Details of the analysis and results are presented in the following section.

CHAPTER FOUR RESULTS

4.1 Characteristics of Participants

Before going into the analysis, data cleaning was conducted. Among the 304 complete responses, three of them were finished within 20 minutes, which was considered unreasonable for a survey that required 45 minutes in average; one reported being more than 30 years of age, which did not meet the criteria for entry into the study sample. Another 38 have 'not going to respond' chosen on all example posts presented in the experiment (including both inaccurate and accurate information), which were considered inattentive responding. These 42 responses were excluded and a total of 262 responses were analysed.

An overview of the demographic characteristics of participants is presented in Table 4.1. Of the total number of participants 54.58% ($n = 143$) were female and 45.42% ($n = 119$) were male. Participants came from all 15 schools that offered undergraduate programs in the university, with more coming from schools of basic and applied sciences ($n = 150$) than schools of arts and social sciences ($n = 112$). The majority of the participants ($n = 162$) were Singaporean, while the rest ($n = 100$) included seven different nationalities (e.g., Chinese, Indonesian, and Malaysian). As the study population required, participants were all between 18 to 30 years old and the average age was 21.49 years ($SD = 1.72$).

Table 4.1 Demographics Information

Characteristic	Total (<i>N</i> = 262)	Control condition (<i>n</i> = 37)	Experimental conditions (<i>n</i> = 225)		
			Treatment A (<i>n</i> = 74)	Treatment B (<i>n</i> = 68)	Treatment C (<i>n</i> = 83)
Gender					
Female	143 (54.58%)	20 (54.05%)	36 (48.65%)	40 (58.82%)	47 (56.63%)
Male	119 (45.42%)	17 (45.95%)	38 (51.35%)	28 (41.18%)	36 (43.37%)
Nationality					
Singaporean	162 (61.83%)	21 (56.76%)	48 (64.86%)	42 (61.76%)	51 (61.45%)
Others	100 (38.17%)	16 (43.24%)	26 (35.14%)	26 (38.24%)	32 (38.55%)
Academic discipline					
Basic & applied sciences	150 (57.25%)	18 (48.65%)	47 (63.51%)	43 (63.24%)	42 (50.6%)
Art & social sciences	112 (42.75%)	19 (51.35%)	27 (36.49%)	25 (36.76%)	41 (49.4%)
Age					
Mean	21.49	21.68	21.66	21.24	21.46
SD	1.72	1.80	2.09	1.43	1.52

Note. The three sub-conditions under “experimental conditions” refer to the experimental sub-conditions at Time 2. Treatment A, B, and C refer to the interventions developed based on physical, social, and self-evaluative outcome expectation, respectively.

Besides data on the total population, Table 4.1 also reports the breakdown of study participants by condition at Time 2 (details on the conditions are discussed in Section 4.4 below). The experimental design employed random assignment. Due to the limitation of the online survey software, the unequal size of the study population among the experimental conditions was resulted from the unequal dropout of participants. Chi square tests for independence were performed to verify that the four groups were not too

different from each other. The participants in the four conditions did not differ significantly in terms of gender, $X^2(3) = 1.69, p = .640$; school of study, $X^2(3) = 4.80, p = .187$; and nationality, $X^2(3) = 0.70, p = .874$. Likewise, one-way analysis of variance (ANOVA) tests were conducted, there is no significant difference in the four groups in terms of age, $F(3, 258) = 0.90, p = .441$. Hence, the data among four conditions appeared to have similar characteristics, which is desirable as this suggests the experimental and control groups were relatively comparable to begin with.

4.2 Overview of Variables Related to the Spreading of Health-related Misinformation

This section gives an overview of the main variables being studied, including negative outcome expectation toward health-related misinformation spreading, the spreading of health-related misinformation, self-efficacy for not spreading of health-related misinformation, and the perceived accuracy of misinformation. Descriptive data of the variables are presented below to provide more background information.

4.2.1 *Negative outcome expectation toward misinformation spreading*

Negative outcome expectation toward health-related misinformation spreading on Facebook (negative outcome expectation), which refers to one's belief of the likelihood that certain negative consequences will be produced from her/his spreading of health-related misinformation on Facebook, was dichotomised for further analysis. The sample was split at the median on negative outcome expectation (1 = *disagree strongly* to 7 = *agree strongly*) at Time 1 (*median* = 5), Time 2 (*median* = 5), Time 3 (*median* = 5), and Time 4 (*median* = 5), yielding high (above median; i.e. tend to believe that spreading

misinformation is likely to produce negative consequences) and low (equal to and below median; i.e., tend *not* to believe that spreading misinformation is likely to produce negative consequences) groups for each variable. Table 4.2 presents the frequencies and percentages of negative outcome expectation at each time point.

Table 4.2 Negative Outcome Expectation and the Spreading of Misinformation

Variable	Time 1	Time 2	Time 3	Time 4
Negative outcome expectation				
Total ($N = 262$)				
Low	152 (58.02%)	146 (55.73%)	140 (53.44%)	131 (50.00%)
High	110 (41.98%)	116 (44.27%)	122 (46.56%)	131 (50.00%)
Control condition ($n = 37$)				
Low	19 (51.35%)	19 (51.35%)	20 (54.05%)	17 (45.95%)
High	18 (48.65%)	18 (48.65%)	17 (45.95%)	20 (54.05%)
Experimental condition ($n = 225$)				
Low	133 (59.11%)	127 (56.44%)	120 (53.33%)	114 (50.67%)
High	92 (40.89%)	98 (43.56%)	105 (46.67%)	111 (49.33%)
Spreading of misinformation				
Total ($N = 262$)				
Mean	59.34%	48.43%	42.37%	38.56%
SD	36.05%	37.80%	38.08%	37.40%
Control condition ($n = 37$)				
Mean	61.74%	64.12%	53.91%	47.04%
SD	36.56%	36.12%	37.00%	38.28%
Experimental condition ($n = 225$)				
Mean	58.95%	45.84%	40.48%	37.17%
SD	36.03%	37.52%	38.00%	37.15%

Overall, slightly more participants had low negative outcome expectation ($n = 152$) than high negative outcome expectation ($n = 110$) at Time 1. For the experimental condition, there was a continuous growth on the number of participants of high negative

outcome expectation from Time 1 to Time 4, with a total increase of 8.4% ($n = 19$). On the other hand, the changes in control condition were inconsistent. The proportions did not change at Time 2; then the high negative outcome expectation group slightly decreased (2.7%) in at Time 3, and increased by 8.1% at Time 4.

4.2.2 The spreading of misinformation

Table 4.2 also presents the means and standard deviations of the spreading of health-related misinformation on Facebook (referred to as “spreading of misinformation”) at four time points. The spreading of misinformation was measured as the proportion of “Likes”, “Reactions”, and “Shares” on posts that contained misinformation among the total number of “Likes”, “Reactions”, and “Shares” on all posts. They were percentage scores, each calculated by dividing the total counts of “Like”, “Reactions”, and “Shares” for the eight misinformation examples by the total counts of “Like”, “Reactions”, and “Shares” for all ten examples of misinformation and accurate information combined. Overall, nearly 60% of the posts that participants spread (i.e., clicking “Like”, “Reaction”, or “Share”) in the study was misinformation. For the experimental condition, there was a continuous decrease spreading of misinformation from Time 1 ($M = 59.34\%$, $SE = 36.05\%$) to Time 4 ($M = 38.56\%$, $SE = 37.40\%$), with a total drop of 21.78%. The control condition spread slightly more misinformation at Time 2 (2.38%), but subsequently reduced the spreading, with a smaller total decrease of 14.70% from Time 1 to Time 4 than the experimental condition.

Among the spreading activities, two “Likes” and six other “Reactions” were made with self-explanatory clarification text in the “Comment” section (e.g. “*That's just... blatantly [sic] not true [link to correction information]*”), which were excluded from

further analysis (as explained in Section 3.5.1). There was no “Share” made with self-explanatory clarification text.

4.2.3 Self-efficacy for not spreading misinformation

The score of self-efficacy for not spreading misinformation on Facebook (self-efficacy) was computed from the means of the 18 seven-point scale (1 = *not confident at all* to 7 = *highly confident*) items measuring self-efficacy, which had high internal consistency with Cronbach's alpha = .95 (Cronbach, 1951). Self-efficacy is also dichotomised. The sample was then split at the median (5) to form low and high group, with almost equal proportions of low self-efficacy group ($n = 134$) and high self-efficacy group ($n = 128$).

4.2.4 Perceived accuracy of misinformation

The score of perceived accuracy of misinformation was computed from the means of perceived accuracy of all 32 misinformation examples; the 32 items showed high internal consistency, with Cronbach's alpha = .94 (Cronbach, 1951). On a five-point scale (1 = *false* to 5 = *true*), the mean of perceived accuracy of misinformation was 2.54 ($SD = 0.63$), indicating that participants doubted the accuracy of the misinformation examples.

4.3 Qualitative Analysis of Content Related to Health-related Misinformation Spreading

Texts accompanying the “Shares” or in the “Comment” were briefly analysed qualitatively to enrich the understanding of participants’ spreading of misinformation.

Among the texts created with “Shares”, the majority seemed convinced by the misinformation examples, e.g. *‘Good to know!’*, *‘Useful tips to take note!’*. The participants assessed their health based on the posts (e.g. *‘I have an unhealthy heart :(’*), wanted to do what the posts advised (e.g. *‘Seems not bad, can try’*), and commented agreeably on the topic (e.g. *‘Ultimately, all things in moderation’*, *‘We’re all being controlled’*). Likewise, many recommended the posts to their friends (e.g. *‘This is important guys!’*, *‘A way to have a healthier life!’*), and tagging friends’ names. Positive feelings toward the content were expressed, such as amusement (e.g. *‘haha funny’*), and surprise (e.g. *‘Wow!’*). No “Shares” were undertaken to clarify the falsity of the misinformation. Though there were a number of “Shares” that stated doubts (e.g. *‘Not sure if it’s real’*, *‘really? any doctors able to confirm this?’*) and a few mentioned the falseness (e.g. *‘I think this is fake!’*, *‘Sounds dumb’*), none of them added self-explanatory clarification to the content (e.g. explaining why it is inaccurate with evidence).

On the other hand, the content of “Comments” was quite different from that of ‘Shares’. Though there were also some affirmations expressed in the “Comments”, the majority focused on the falsity of the misinformation. Participants expressed doubts and requested for clarification (e.g. *‘Is this accurate? Where’s the proof?’*, *‘please state the source of this news’*), discussed about the falseness (e.g. *‘Geez it’s ridiculous! If it works then what do we need hospitals and doctors for?’*), and provided corrections (*‘That may not be true [link to correction information]’*). Interestingly, for “Comments” of the accurate information, some doubts were also raised (e.g. *‘Really?’*, *‘The preventive looks credible but the data? Is it real? Without proper credits and sources, I am still sceptical [sic]’*). As mentioned, “Comment” alone is excluded from misinformation spreading activities.

4.4 Descriptive Data (Time 1 to Time 2)

As mentioned in the method section, while negative outcome expectation and the spreading of misinformation were measured four times (baseline and after each treatment) in the experiment; the current study focuses on investigating the changes from baseline to after the delivery of first treatment (Time 1 to Time 2). Hence, in the analysis and in the following report, “conditions” refer to the control condition and three experimental conditions (Treatment A [based on physical outcome expectation], Treatment B [based on social outcome expectation], or Treatment C [based on self-evaluative outcome expectation]), based on the treatment participants received at Time 2 (Table 4.3). The scores of “negative outcome expectation” and “the spreading of misinformation” refer to their scores at Time 2.

Table 4.3 Description of Variables Related to Misinformation Spreading

Variable	Total (<i>N</i> = 262)	Control condition (<i>n</i> = 37)	Experimental conditions (<i>n</i> = 225)		
			Treatment A (<i>n</i> = 74)	Treatment B (<i>n</i> = 68)	Treatment C (<i>n</i> = 83)
Baseline negative outcome expectation					
Low	152 (58.02%)	19 (51.35%)	37 (50.00%)	51 (75.00%)	45 (54.22%)
High	110 (41.98%)	18 (48.65%)	37 (50.00%)	17 (25.00%)	38 (45.78%)
Negative outcome expectation					
Low	146 (55.73%)	19 (51.35%)	42 (56.76%)	46 (67.65%)	39 (46.99%)
High	116 (44.27%)	18 (48.65%)	32 (43.24%)	22 (32.35%)	44 (53.01%)
Baseline spreading of misinformation					
Mean	59.34%	61.74%	64.93%	57.26%	55.01%
SD	36.05%	36.56%	34.09%	36.21%	37.28%
Spreading of misinformation					
Mean	48.43%	64.12%	49.32%	49.35%	39.87%
SD	37.80%	36.12%	37.99%	36.87%	37.30%
Self-efficacy for not spreading misinformation					
Low	134 (51.15%)	24 (64.86%)	32 (43.24%)	35 (51.47%)	43 (51.81%)
High	128 (48.85%)	13 (35.14%)	42 (56.76%)	33 (48.53%)	40 (48.19%)
Perceived accuracy of misinformation					
Mean	2.54	2.75	2.52	2.41	2.56
SD	0.63	0.59	0.58	0.63	0.68

Note. The three sub-conditions under “experimental conditions” refer to the experimental sub-conditions at Time 2. “Baseline negative outcome expectation” and “negative outcome expectation” refer to negative outcome expectation measured at Time 1 and Time 2, respectively. “Baseline spreading of misinformation” and “spreading of misinformation” refer to the spreading of misinformation measured at Time 1 and Time 2, respectively.

Before further analysis, a chi square test for independence was performed, the participants in the two groups (experimental and control) did not differ significantly in terms of self-efficacy, $X^2(1) = 3.25, p = .072$. ANOVA test was also conducted, there was no significant difference in the four conditions (three treatment conditions and one control condition at Time 2) in terms of baseline spreading of misinformation, $F(3, 258) = 1.12, p = .340$. However, results of independent t-test showed a significant difference in

participants' perceived accuracy of misinformation between the experimental group ($M_{Experimental} = 2.50, SD = 0.63$) and the control group ($M_{Control} = 2.75, SD = 0.59$), $t(260) = 2.25, p = .025$. When further ANOVA analysis was performed among the four conditions (the three treatment conditions and one control condition), this significance disappeared: $F(3, 258) = 2.45, p = .064$. Significant group difference was also found in baseline negative outcome expectation, $X^2(3) = 11.17, p = .011$. Specifically, the crosstab table (see Appendix D) shows that the standardised adjusted residuals of two cells had absolute values greater than 1.96, which indicated significant difference (Field, 2013). The two cells were Treatment B $\times$ low negative outcome expectation (3.3) and Treatment B $\times$ high negative outcome expectation (-3.3). This shows that participants in Treatment B condition were more likely to have low negative outcome expectation at baseline than the rest three conditions (Table 4.3). This is unexpected but possible for a between-subject design. However, random assignment has been employed in the study to distribute participants to each condition, so as to produce relatively comparable groups to begin with and eliminate alternative causes that might confound with the treatment effects. Also, the control condition did not significantly differ from the three experimental conditions, which suggested it was still feasible to investigate the effects of the interventions between those who received treatments and those who did not. Furthermore, the influence of baseline outcome expectation was considered in the subsequent analysis. It was included as one of the predictors in the logistic regression analysis presented in Section 4.5.

Lastly, the correlations amongst the study variables were examined and the correlation matrix is presented in Table 4.4. Participants who had high negative outcome expectation at baseline were more likely to have high self-efficacy ($p < .001$) and considered the examples of misinformation false ($p < .001$). Likewise, participants who

tended to spread misinformation at baseline were more likely to be women ($p = .012$) and considered the examples of misinformation true ($p < .001$).

Table 4.4 The Correlation Matrix for Main Variables in the Study ($N = 262$)

	1	2	3	4	5	6	7
1. Baseline negative outcome expectation (High)	-						
2. Baseline Spreading of Misinformation	-.107	-					
3. Negative outcome expectation (High)	.550**	-.045	-				
4. Spreading of Misinformation	-.176**	.311**	-.148*	-			
5. Self-efficacy (High)	.205**	-.084	.220**	-.157*	-		
6. Gender (Male)	.109	-.154*	.082	-.137*	.013	-	
7. Perceived accuracy of misinformation	-.277**	.270**	-.297**	.300**	-.213**	-.116	-

* $p < .05$. ** $p < .01$.

4.5 RQ1: What are the Effects of the Interventions, Developed Based on Outcome Expectation from SCT, on Changing the Negative Outcome Expectation Toward Spreading Health-Related Misinformation on Facebook?

As mentioned in the method chapter (Section 3.8), a set of binary logistic regression analyses were performed to test the effect of the interventions on changing the negative outcome expectation toward misinformation spreading. First, to give an overview, Section 4.5.1 presents the results of Model 1, a binary logistic regression analysis that tested the effects of condition solely on the likelihood that participants have high negative outcome expectation. Section 4.5.2. presents the results of Model 2A and Model 2B, which examine the effects of the interventions and two individual differences factors

(self-efficacy and gender), while controlling for the baseline outcome expectation. Model 2A is the main effects only model, while Model 2B includes both main effects and interaction terms among all predictors.

4.5.1 Model 1: Effects of the interventions on negative outcome expectation solely

Model 1, a binary logistic regression analysis, was performed to give an overview of the relationship between condition and negative outcome expectation. To meet the core assumption, tests for multicollinearity were conducted. All the variance inflation factor (VIF) values were less than 10 and none of the tolerance values were less than 0.1, which were within the recommended cut-off points for identifying multicollinearity (Field, 2013). This indicates that multicollinearity is unlikely to be a concern. The logistic regression model was not significant, $\chi^2(3) = 6.90, p = .075$. The model only explained 3.48% (Nagelkerke R^2) of the variance in participants' negative outcome expectation and correctly classified 57.63% of cases. Condition was not a significant predictor ($p = .082$). That is, without considering other factors, participants who received any intervention did not result in significantly different negative outcome expectation than those who did not receive the intervention.

4.5.2 Model 2: Effects of the interventions on negative outcome expectation with regards to the influences of self-efficacy and gender

Building on Model 1, Model 2A took into accounts other factors that may impact the negative outcome expectation. To meet the core assumption, tests for multicollinearity were conducted and reported in Table 4.5; all of the VIF values were less than 10, and none of the tolerance values were less than 0.1, which were within the recommended cut-

off points for identifying multicollinearity (Field, 2013). This indicates that multicollinearity is unlikely to be a concern and the assumption was met. The logistic regression model (Table 4.5) was significant, $\chi^2(6) = 92.21, p < .001$. The model explained 39.73% (Nagelkerke R^2) of the variance in negative outcome expectation and correctly classified 77.86% of cases. Participants who had high self-efficacy were 2.03 times more likely to have high negative outcome expectation than low self-efficacy group. Participants who had high negative outcome expectation at baseline are 11.24 times more likely to have high negative outcome expectation. However, condition was not a significant predictor; receiving intervention did not change the likelihood of participants having high negative outcome expectation.

Table 4.5 Results of Logistic Regression Analysis (Model 2A)

	B	SE	Odds Ratio	95% CI		Collinearity	
				Lower	Upper	Tolerance	VIF
Condition							
Treatment A	-	0.49	0.59	0.22	1.56	.46	2.19
Treatment B	-	0.51	0.72	0.27	1.96	.46	2.18
Treatment C	0.26	0.48	1.30	0.51	3.34	.45	2.23
Self-efficacy (High)	0.71	0.31	2.03*	1.11	3.71	.94	1.06
Gender (Male)	0.18	0.31	1.19	0.65	2.18	.98	1.02
Baseline negative outcome expectation (High)	2.42	0.32	11.24**	6.06	20.87	.91	1.10

Note. Nagelkerke $R^2 = .397$.

* $p < .05$. ** $p < .01$.

Model 2B was performed using the same set of variables of Model 2A, adding interaction terms among all predictors. Likewise, tests for multicollinearity were first conducted; however, quite a few factors had VIF values much greater than 10 (see Appendix D). This indicated that the assumption of multicollinearity was violated, hence,

the results of Model 2B should not be used or further discussed. The data are listed as follows only for reference: The logistic regression model yielded $\chi^2(31)$ of 141.87, $p < .001$. The model explained 56.00% (Nagelkerke R^2) of the variance in negative outcome expectation and correctly classified 79.77% of cases. However, none of the predictors or interactions was significant (see table in Appendix D).

4.6 RQ2: What are the Effects of the Interventions, Developed Based on Outcome Expectation from SCT, on Reducing the Spreading of Health-Related Misinformation on Facebook?

To answer the second research question (RQ2), a set of analysis of variance (ANOVA) and analysis of covariance (ANCOVA) tests were performed to test the effects of the interventions on reducing participants' spreading of misinformation, as discussed in Section 3.8.

First, to give an overview of the relationship between condition and the spreading of misinformation, Section 4.6.1. reports the results of Model 3, a one-way ANOVA that tested whether the spreading of misinformation differed among conditions. Section 4.6.2. presents the results of Model 4, which include two ANCOVA that tested the effects of interventions and individual differences factors (in this study, self-efficacy and gender) on the spreading of misinformation. Individual variations, specifically, their baseline spreading of misinformation (correlation with outcome variable, $r = .311$, $p < .001$) and perceived accuracy of misinformation ($r = .300$, $p < .001$) (Table 4.4) were accounted for in the model as covariates. This allows more precise detection of the effects of the studied factors. Model 4A is a main effects only ANCOVA and Model 4B is a full ANCOVA with interaction terms. Last but not least, results of Model 5 are presented in Section

4.6.3. Model 5 explored the effects of the interventions with consideration to the influences of negative outcome expectation. It included a main effects only ANCOVA model (Model 5A) and a full ANCOVA model with interaction terms (Model 5B) which added negative outcome expectation as a between-subjects factor into Model 4A and Model 4B, respectively.

To meet the core assumptions, Levene's tests for equality of variances were carried out for each ANOVA and ANCOVA, and tests homogeneity of regression slopes were conducted for each ANCOVA. None of the tests were significant, indicating that there were no significant unequal variances between groups or significant interaction between the covariates and factors, and hence that the assumptions were met.

4.6.1 Model 3: Effects of the interventions on the spreading of misinformation solely

To give an overview, Model 3, a one-way ANOVA, tested if the spreading of misinformation differed among conditions. The results showed that condition significantly impacted on the spreading of misinformation, $F(3,258) = 3.68, p = .013$. Tukey's HSD post-hoc analysis showed a significant difference between control condition and Treatment C (intervention based on self-evaluative outcome expectation) ($p = .006$). In this case, participants who received Treatment C spread significantly less misinformation, comparing to those who did not receive any intervention ($M_{\text{difference}} = 24.25\%, SE = 7.36\%$). However, Model 3 had a small R^2 value of .041 ($Adjusted R^2 = .030$), indicating a poor overall model fit.

4.6.2 Model 4: Effects of the interventions on the spreading of misinformation with regards to the influences of self-efficacy and gender

First, a main effects only ANCOVA [*between-subjects factor: condition (control, Treatment A, Treatment B, Treatment C), self-efficacy (low, high), gender (female, male); covariate: baseline spreading of misinformation, perceived accuracy of misinformation*] was performed (Model 4A). There was a significant effect of condition on the spreading of misinformation after controlling for the effect of the two covariates, $F(3,254) = 3.01$, $p = .031$ (Table 4.6). The estimated means of percentage of misinformation spread for control, Treatment A (based on physical outcome expectation), Treatment B (based on social outcome expectation), and Treatment C (based on self-evaluative outcome expectation) were 59.76% ($SE = 5.74\%$), 48.69% ($SE = 4.04\%$), 50.77% ($SE = 4.23\%$), and 40.12% ($SE = 3.81\%$) respectively (Figure 4.1). Bonferroni post-hoc analysis showed that Treatment C resulted in a significantly lower percentage of misinformation spread than control condition, $M_{\text{difference}} = 19.65\%$, $SE = 6.87\%$, $p = .028$. Both of the covariates, baseline spreading of misinformation, $F(1,254) = 14.42$, $p < .001$, and perceived accuracy of misinformation, $F(1,254) = 11.17$, $p < .001$, were significantly and positively related to the spreading of misinformation.

Table 4.6 ANCOVA Results of the Spreading of Misinformation (Model 4A)

Source	Sum of Squares	df	Mean Square	F	η_p^2
Baseline spreading of misinformation	17151.05	1	17151.05	14.41**	0.054
Perceived accuracy of misinformation	13293.07	1	13293.07	11.17**	0.042
Condition	10745.78	3	3581.93	3.01*	0.034
Self-efficacy (High)	2417.79	1	2417.79	2.03	0.008
Gender (Male)	2273.31	1	2273.31	1.91	0.007
Error	302214.78	254	1189.82		

Note. $R^2 = .189$; Adjusted $R^2 = .167$.

* $p < .05$. ** $p < .01$.

Figure 4.1 Estimated Means of Percentage of Misinformation Spread (Model 4A)

Likewise, a full model ANCOVA was performed using the same set of variables in Model 4A (Model 4B). There was a significant effect of condition on the spreading of misinformation after controlling for the effect of the two covariates, $F(3,244) = 3.16$, $p = .025$ (Table 4.7). The estimated means of misinformation spreading for control,

Treatment A, Treatment B, and Treatment C were 59.78% ($SE = 6.02\%$), 48.49% ($SE = 4.09\%$), 52.08% ($SE = 4.31\%$), and 39.63% ($SE = 3.86\%$) respectively (Figure 4.2).

Bonferroni post-hoc analysis showed that Treatment C resulted in a significantly lower percentage of misinformation spread than control condition, $M_{difference} = 20.15\%$, $SE = 7.15\%$, $p = .031$. Both of the covariates, baseline spreading of misinformation, $F(1,244) = 13.06$, $p < .001$, and perceived accuracy of misinformation, $F(1,244) = 9.78$, $p = .002$, were significantly and positively related to the spreading of misinformation.

Table 4.7 ANCOVA Results of the Spreading of Misinformation (Model 4B)

Source	Sum of Squares	df	Mean Square	F	η_p^2
Baseline spreading of misinformation	15747.30	1	15747.30	13.06**	0.051
Perceived accuracy of misinformation	11795.56	1	11795.56	9.78**	0.039
Condition	11427.76	3	3809.25	3.16*	0.037
Self-efficacy (High)	1790.30	1	1790.30	1.48	0.006
Gender (Male)	3089.98	1	3089.98	2.56	0.010
Condition $\times$ Self-efficacy	861.02	3	287.01	0.24	0.003
Condition $\times$ Gender	6852.96	3	2284.32	1.89	0.023
Self-efficacy $\times$ Gender	219.91	1	219.91	0.18	0.001
Condition $\times$ Self-efficacy $\times$ Gender	146.91	3	48.97	0.04	0.000
Error	294184.43	244	1205.67		

Note. $R^2 = .211$; Adjusted $R^2 = .156$.

* $p < .05$. ** $p < .01$.

Figure 4.2 Estimated Means of Percentage of Misinformation Spread (Model 4B)

The ANCOVA tests of Model 4A ($R^2 = .189$, $R^2_{adj} = .167$) and Model 4B ($R^2 = .211$, $R^2_{adj} = .156$) employed the same set of variables. Both models had similar results in terms of statistically significant variables and accounted for similar proportion of variance. Therefore, Model 4B, the full model, is used for further discussion.

4.6.3 Model 5: Effects of the interventions on the spreading of misinformation with regards to influences of self-efficacy, gender, and negative outcome expectation

Adding the factor of negative outcome expectation onto Model 4A, another ANCOVA [between-subjects factor: condition (control, Treatment A, Treatment B, Treatment C), self-efficacy (low, high), gender (male, female), negative outcome expectation (low, high); covariate: baseline spreading of misinformation, perceived accuracy of misinformation] was performed (Model 5A). Model 5A was a main effects only model. There was a significant effect of condition on the spreading of misinformation after controlling for the effect of the two covariates, $F(3,253) = 2.92$, $p =$

.035 (Table 4.8). The estimated means of percentage of misinformation spread for control, Treatment A, Treatment B, and Treatment C were 59.99% ($SE = 5.75\%$), 48.37% ($SE = 4.06\%$), and 50.06% ($SE = 4.34\%$), and 40.28% ($SE = 3.82\%$) respectively (Figure 4.3). The Bonferroni post-hoc analysis showed that Treatment C resulted in a significantly lower percentage of misinformation spread than control condition, $M_{difference} = 19.71\%$, $SE = 6.88\%$, $p = .027\%$. Both of the covariates, baseline spreading of misinformation, $F(1,253) = 14.71$, $p < .001$, and perceived accuracy of misinformation, $F(1,253) = 8.82$, $p = .003$, were significantly and positively related to the spreading of misinformation.

Table 4.8 ANCOVA Results of the Spreading of Misinformation (Model 5A)

Source	Sum of Squares	df	Mean Square	F	η_p^2
Baseline spreading of misinformation	17533.50	1	17533.50	14.71**	0.055
Perceived accuracy of misinformation	10516.10	1	10516.10	8.82**	0.034
Condition	10440.06	3	3480.02	2.92*	0.033
Self-efficacy (High)	1895.95	1	1895.95	1.59	0.006
Gender (Male)	2125.39	1	2125.39	1.78	0.007
Negative outcome expectation (High)	710.31	1	710.31	0.60	0.002
Error	301504.47	253	1191.72		

Note. $R^2 = .191$; Adjusted $R^2 = .166$.

* $p < .05$. ** $p < .01$.

Figure 4.3 Estimated Means of Percentage of Misinformation Spread (Model 5A)

Likewise, a full model ANCOVA with the same set of variables in Model 5A was also performed (Model 5B). As Table 4.9 shows, there was a significant effect of condition on the spreading of misinformation after controlling for the effect of the two covariates, $F(3,228) = 3.95$, $p = .009$. The estimated means of percentage of misinformation spread for control, Treatment A, Treatment B, and Treatment C were 59.26% ($SE = 6.27\%$), 47.85% ($SE = 4.23\%$), and 54.72% ($SE = 5.18\%$), and 36.28% ($SE = 4.47\%$) respectively (Figure 4.4). The Bonferroni post-hoc analysis showed that Treatment C resulted in a significantly lower percentage of misinformation spread than control condition, $M_{\text{difference}} = 22.98\%$, $SE = 7.69\%$, $p = .019$, and unexpectedly, Treatment B, $M_{\text{difference}} = 18.44\%$, $SE = 6.85\%$, $p = .046$. Both of the covariates, baseline spreading of misinformation, $F(1,228) = 11.68$, $p < .001$, and perceived accuracy of misinformation, $F(1,228) = 6.98$, $p = .009$, were significantly and positively related to the spreading of misinformation.

Table 4.9 ANCOVA Results of the Spreading of Misinformation (Model 5B)

Source	Sum of	df	Mean Square	F	η^2
Baseline spreading of misinformation	14321.46	1	14321.46	11.68**	0.049
Perceived accuracy of misinformation	8561.51	1	8561.51	6.98**	0.030
Condition	14506.90	3	4835.63	3.95**	0.049
SE	3007.30	1	3007.30	2.45	0.011
Gender (Male)	2448.78	1	2448.78	2.00	0.009
NOE	9.06	1	9.06	0.01	0.000
Condition × SE	954.51	3	318.17	0.26	0.003
Condition × Gender	8834.07	3	2944.69	2.40	0.031
Condition × NOE	828.68	3	276.23	0.23	0.003
SE × Gender	777.32	1	777.32	0.63	0.003
SE × NOE	7.78	1	7.78	0.01	0.000
Gender × NOE	3100.83	1	3100.83	2.53	0.011
Condition × SE × Gender	125.05	3	41.68	0.03	0.000
Condition × SE × NOE	5369.71	3	1789.90	1.46	0.019
Condition × Gender × NOE	3196.89	3	1065.63	0.87	0.011
SE × Gender × NOE	5.11	1	5.11	0.01	0.000
Condition × SE × Gender × NOE	1855.16	3	618.39	0.50	0.007
Error	279501.17	228	1225.88		

Note. SE = Self-efficacy (high); NOE = Negative outcome expectation (high).

$R^2 = .250$; *Adjusted R*² = .142.

** $p < .01$.

Figure 4.4 Estimated Means of Percentage of Misinformation Spread (Model 5B)

The ANCOVA tests of Model 5A ($R^2 = .191$, $R^2_{adj} = .166$) and Model 5B ($R^2 = .250$, $R^2_{adj} = .142$) employed the same set of variables and had similar results in terms of statistically significant variables. The two models also accounted for similar variance. Therefore, Model 5B, the full model, is used for further discussion.

In fact, the results of all four ANCOVA models (Model 4A, 4B, 5A, and 5B) showed the same set of significant variables: condition, baseline spreading of misinformation, and perceived accuracy of misinformation. In addition, Model 5B, which was a full ANCOVA developed by adding negative outcome expectation as a between-subjects factor to Model 4B, did not find negative outcome expectation significant but showed a larger estimate of effect size of condition ($\eta_p^2 = .049$) than Model 4B ($\eta_p^2 = .039$). It also reported a significant difference between Treatment B and Treatment C.

4.7 Summary of Results for Research Questions

For RQ1, results show that the effects of the three interventions, developed based on physical (RQ1a), social (RQ1b), and self-evaluative outcome expectation (RQ1c) respectively, did not significantly change participants' negative outcome expectation toward spreading health-related misinformation on Facebook. Neither did self-efficacy for not spreading misinformation on Facebook (RQ1d) nor gender (RQ1e) significantly moderate the above effects of the interventions. Table 4.10 summarised the results for RQ1.

Table 4.10 Results summary for RQ1: Negative outcome expectation toward spreading health-related misinformation

	Model 1	Model 2A
Condition		
Treatment A		
Treatment B		
Treatment C		
Self-efficacy (High)		+
Gender (Male)		
Baseline negative outcome expectation (High)		+

Note. + Statistically significant positive relationship. Not applicable cells are greyed out. Model 2B (Appendix D) not shown above given its high multicollinearity.

For RQ2, results show that the effects of the intervention developed based on self-evaluative outcome expectation (RQ2c) significantly reduced participants' spreading of health-related misinformation on Facebook. The interventions developed based on physical (RQ2a) and social outcome expectation (RQ2b) were not found significant. Self-efficacy for not spreading misinformation on Facebook (RQ2d) and gender (RQ2e) did

not significantly moderate the above effects of the interventions. Table 4.11 summarised the results for RQ2.

Table 4.11 Results summary for RQ2: Spreading of health-related misinformation

	Model 3	Model 4A	Model 4B	Model 5A	Model 5B
Baseline spreading of misinformation		+	+	+	+
Perceived accuracy of misinformation		+	+	+	+
Condition	- (Treat. C) - (Treat. C) - (Treat. C) - (Treat. C) - (Treat. C)				
Gender (Male)					
SE					
NOE					
Condition × Gender					
Condition × SE					
Condition × NOE					
Gender × SE					
Gender × NOE					
SE × NOE					
Condition × Gender × SE					
Condition × Gender × NOE					
Condition × SE × NOE					
Gender × SE × NOE					
Condition × Gender × SE × NOE					

Note. *SE* = Self-efficacy (high); *NOE* = Negative outcome expectation (high). *Treat. C* = Treatment C. Not applicable cells are greyed out.

+ Statistically significant positive relationship. - Statistically significant negative relationship.

In summary, this chapter presented the analysis and results of the experimental study, encompassing general characteristics of the sample, descriptive information of the main variables, and a number of logistic analyses and ANCOVA tests performed to

answer the proposed RQs. The main findings are interpreted and discussed in the upcoming section (Chapter Five).

CHAPTER FIVE DISCUSSION AND CONCLUSION

5.1 Discussion of Main Findings

The present study investigated the effects of three interventions (Treatment A, B, and C), developed based on the three types of outcome expectation (physical, social, and self-evaluative outcome expectation) from social cognitive theory (SCT), on changing individual users' outcome expectations and reducing their spreading of misinformation on Facebook. The major results presented in the preceding chapter are interpreted and discussed in the upcoming sections.

5.1.1 Effects of the interventions on changing participants' negative outcome expectation toward misinformation spreading

To investigate the first research question (RQ), a set of binary logistic analyses were conducted using negative outcome expectation as the dependent variable. As mentioned in Section 4.5, Model 2A was considered the most appropriate model. Results of Model 2A (Table 4.5) showed that baseline negative outcome expectation and self-efficacy for not spreading misinformation (referred to simply as “self-efficacy” hereafter), significantly influenced on negative outcome expectation toward misinformation spreading. Of all conditions, participants who at baseline held strong belief that spreading misinformation would produce negative consequences were much more likely (11 times) to continue believing so than those who had low baseline negative outcome expectation. Likewise, participants who had higher self-efficacy (i.e., stronger belief in one's ability to prevent oneself from spreading misinformation) were about two times more likely to believe that spreading misinformation would produce negative consequences than those

who had low self-efficacy. This relationship between self-efficacy and outcome expectation is consistent with SCT (Bandura 2004).

However, condition was not found to be a significant factor in Model 2A. That is, receiving the intervention or not in the experiment did not significantly change participants' expectation of how likely negative consequences will be produced from spreading misinformation. Hence, the interventions are not effective in changing users' outcome expectations in terms of statistical significance. Still, among participants who received Treatment C, a slightly larger percentage (53.01%) of people were found to have high negative outcome expectation compared to those in the control condition (48.65%) (Table 4.3). Therefore, if changing users' outcome expectations is the main goal, information literacy (IL) trainers and social media designers may consider not to focus on the proposed interventions. Rather, other factors, such as self-efficacy, may have a more major influence. Nonetheless, to address the issue of misinformation spreading, it is crucial to change not only users' attitudes but also their actual behaviour. This result will be further interpreted together with results of RQ2 in Section 5.1.3 below.

5.1.2 Effects of the interventions on reducing participants' spreading of misinformation

To investigate the second research question, a set of analysis of variance (ANOVA) and analysis of covariance (ANCOVA) tests were performed to investigate the effects of the interventions on reducing participant's spreading of misinformation in the experiment. As discussed in Section 4.6.2, Model 4B, a full model, was selected as the model for discussion. Results of Model 4B showed that the two covariates, baseline spreading of misinformation ($F(1,244) = 13.06, p < .001$) and perceived accuracy of

misinformation ($F(1,244) = 9.78, p = .002$), were both significant. For all participants, regardless of having received the intervention or not, the less misinformation they spread at baseline, the less misinformation they spread in the experiment. Besides, keeping in view the notion in user education approach that individual users are prepared to evaluate and use information on social network sites (SNSs), the study included perceived accuracy of misinformation as a covariate. Results obtained were consistent with that notion. For participants of all conditions, the less accurate they considered the misinformation pieces, the less misinformation they spread in the experiment. This finding suggested that the quality of information did matter when participant chose to “Like”, “React to”, or “Share” posts (or not) on Facebook. Educating individual users indeed helps to address, to some extent, the widespread misinformation issue on SNS.

Moreover, after accounting for the influences of the two covariates, condition was still a significant factor on participants’ spreading of misinformation ($F(3,244) = 3.16, p = .025$). In particular, participants who received Treatment C (based on self-evaluative outcome expectation) spread significantly less misinformation, measured as a percentage of misinformation spread among total information spread, than those who did not receive intervention (control condition), $M_{\text{difference}} = 20.15\%$, while participants who received Treatment B (based on physical outcome expectation) ($M_{\text{difference}} = 11.29\%$) and Treatment C ($M_{\text{difference}} = 7.7\%$) also to some extent spread less misinformation than the control group (Figure 4.2). Additionally, while Model 4B was selected for further interpretation, the significant difference between Treatment C and control group was found in all models conducted using the spreading of misinformation as the dependent variable.

Specifically, Treatment C was the intervention developed based on self-evaluative outcome expectation, which refers to the self-evaluative reactions one expects to be

produced from one's certain behaviour (see details in Section 2.5.2.1). People behave in ways that give them self-satisfaction and self-worth and avoid behaviours that bring self-dissatisfactions (Bandura, 1997). While all three types of outcome expectations are important in directly affecting on one's behaviour (Bandura, 2004), results of this study suggested that self-evaluative outcome expectation most strongly influenced on the spreading of misinformation.

Wójcicki, White, and McAuley (2009) suggested that different types of outcome expectation might have relatively more or less importance in different situations. In this case, the findings suggested that self-evaluative outcome was most valued when participants refrained themselves from spreading misinformation. Self-evaluative outcome expectation corresponds to the core proposition of SCT that humans are not completely shaped by external factors but can self-regulate one's behaviour by internal standards. In fact, when Bandura (2004) argued that the concept of outcome expectation can be found as similar constructs in other behaviour change theories, including health belief model and theory of planned behaviour, self-evaluative outcome expectation was considered a unique component of SCT. Moreover, in Dijkstra, Vries, Kok, and Rouackers (1999)'s self-evaluation motivation model for smoking cessation developed from SCT, it was suggested that self-evaluative outcome expectation was of central importance in changing the behaviour and could even mediate the influences of physical and social outcome expectations. Likewise, Suh, Weikert, Dlugonski, Sandroff, and Motl (2011)'s study examined the effects of social cognitive variables in physical activity also found self-evaluative outcome expectation being the only type of outcome expectation that had a direct effect on physical activity. In line with these studies, the finding on the effects of the intervention showed the usefulness of employing SCT as the theoretical framework and demonstrated the central role of self-evaluative outcome in SCT.

In addition, while the correlation matrix in Table 4.4 showed that participants who were male and participants who had low self-efficacy were less likely to spread misinformation in the experiment, these two factors of individual differences, self-efficacy and gender, were found not significant in the Model 4B. Also, none of the interaction was significant, indicating that moderating effects of self-efficacy and gender on the influences of interventions on participants' spreading of misinformation were not found statistically. The findings of nonsignificance are still beneficial. As discussed in the literature review, because self-efficacy as a major construct in SCT (see details in Section 2.5.2.2) and gender as a primary factor of individual differences (see details in Section 2.5.3) are often investigated in other studies, including these potential factors made the research design more comprehensive.

Furthermore, another ANCOVA (Model 5B) was conducted to explore the effects of the interventions on participant's spreading of misinformation, with the addition of negative outcome expectation as one of the factors. The results (Table 4.7) were similar with Model 4B: two covariates (baseline spreading of misinformation and perceived accuracy of misinformation) and the condition factor were found significant. Negative outcome expectation was not a significant factor in the model. However, Model 5B showed that participants who received Treatment C not only spread significantly less misinformation (expressed as percentage of misinformation spread among total information spread) than those received no treatment (control condition), but also significantly less than those who received Treatment B. The estimated means in Model 5B showed that participants who received Treatment B (54.72%) spread only slightly less than the control group (59.26%).

Treatment B was the intervention developed based on physical outcome expectation. Physical outcomes include the physical effects one expects accompanying

one's certain behaviour (Bandura, 1997) (details are presented in Section 2.5.2.1). In this study, it was operationalised as about consequences on participants' health. The significant difference between participants who received Treatment B and those who received Treatment C is a new finding, as such difference was not anticipated. A possible explanation is that, participants did not expect changes in their own health to be a major consequence from spreading health-related misinformation, thus, their spreading of misinformation after receiving Treatment B remained similar to the control group. In fact, results from the survey study on the importance of outcomes for not spreading misinformation (presented in Section 3.4.2) showed that physical outcomes were not highly rated. The item selected to be applied in Treatment B, "*to avoid undermining my health / to improve my health*", ranked 17th among the 54 outcomes of not spreading misinformation and was the only one physical outcome in the top 20 important outcomes (Table 3.1). As mentioned above, different outcome expectations could have different levels of importance (Wójcicki et al., 2009). Since spreading misinformation on SNS involves only a few clicks online, their health statuses as an offline consequence might seem distant to individual users in this context. Therefore, information literacy (IL) educators and platform designers of SNS may consider focusing the interventions on the social and self-evaluative outcome expectations, while being aware that physical ones are least effective.

5.1.3 Overall effects of the interventions on addressing the spreading of misinformation

The study found that the issue of misinformation spreading is prominent among the sample – at baseline, almost 60% of all posts that participants spread during the experiment contained misinformation (Table 4.2). This might be partly due to the large

proportion of misinformation among all posts presented to participants, but it should be noted that the study used a college-student sample, indicating that the spreading of misinformation is relatively common even in this well-educated population.

Encouragingly, the experimental results suggested that introducing interventions can bring a positive impact in terms of reducing participants' spreading of misinformation. Answering the two main research questions together, results of this study showed that even though the interventions did not make a significant change in participants' negative outcome expectation toward misinformation spreading, they significantly reduced participants' spreading of misinformation in the experiment. This significant reduction is particularly notable for the one based on self-evaluative outcome expectation from SCT. While it was not satisfactory that participants' beliefs (outcome expectation) were not changed by the interventions statistically, it is promising that participants' behaviour (the spreading) was changed. The intervention was of a single brief session, delivered in the midst of participants' Facebook browsing as one of the posts; yet it was able to induce a significant change in Facebook users' spreading of misinformation. As the current study is the first step to pursue the interventions proposed in the thesis, these affirmative findings demonstrated the feasibility and effectiveness of this new strategy and laid a path for subsequent research of the issue.

Moreover, it is possible that the change in participants' behaviour could lead to change in their beliefs, that is, the reduction in participants' spreading of misinformation observed in the experiment may lead to change in their outcome expectations toward misinformation spreading at a later time. Research in psychology has documented that, while it is common for attitudes to influence behaviour, behaviour can also influence attitudes and beliefs (Olson & Stone, 2014). Festinger (1957)'s theory of cognitive dissonance is one well-known theory that supports this perceptive. Theory of cognitive

dissonance emphasised on the notion of consistency among cognitive elements of an individual, including attitudes, beliefs, values, and behaviour. The main idea is that, when there are inconsistencies between cognitions, dissonance occurs, which would generate psychological discomfort (Festinger, 1957). People are thus motivated to change the cognitive elements to maintain consistency and reduce dissonance, for example, modify one's attitude to follow one's behaviour. Therefore, in the case of this study, it is reasonable to posit that as participants reduced their spreading of misinformation after receiving the intervention, their attitudes toward consequences of spreading misinformation might no longer match their behaviour. Hence, their outcome expectation, while not yet changed in the experiment, may subsequently be changed to follow the behaviour.

Alternatively, self-perception theory is another popular perspective that supports the influence of behaviour on attitudes. Developed by Bem (1967), self-perception theory proposed that individuals observe their own behaviour and use it as an information source to infer their internal states, such as attitudes and beliefs. Thus, unlike dissonance theory involved solving unpleasant psychological states, self-perception theory suggests that the behaviour to attitude change results from a cognitive process (Bem, 1967). Moreover, Fazio, Zanna, and Cooper (1977) suggested that self-perception theory was particularly useful for attitude-congruent behaviour, which was about behaviour moderately changes attitude to a position that is still within one's latitude of acceptance. Such self-perception processing has been documented, for examples, in research of helpfulness and intrinsic motivation (Olson & Stone, 2014). The current study can also be seen as being about attitude-congruent behaviour. The median split point for the high and low group of negative outcome expectation toward misinformation at baseline was at five out of a seven-point scale (1 = *strongly disagree*, 7 = *strongly agree*). This showed that

participants to some extent agreed that spreading misinformation would lead to negative consequences in the beginning, and the interventions were designed to further their beliefs – that is, the attitude change is relatively moderate, rather than a 180-degree change from total disbelief to belief. Hence, while a change of negative outcome expectation was not found per se, participants' behaviour which occurred in the experiment (reduced spreading of misinformation) may be observed and used by themselves to change their outcome expectations subsequently. Their change in belief (i.e., higher negative outcome expectation) would then further reinforce their behaviour (i.e. further reduction of misinformation spreading). Future studies may be designed to test this hypothesis.

5.2 Implications

First, the study proposed a new strategy of developing interventions for the spreading of misinformation on SNS. Basing on outcome expectation from SCT, the intervention messages work by providing information about consequences on spreading misinformation, without mentioning clarification or evaluation on the content of misinformation. The significant findings reinforce the proposed perspective of seeing misinformation as an information behaviour on SNS with motivations (e.g. personal and social) that are weighted heavier than the information value of the content. Consequently, the proposed interventions are able to work on both the intentional and unintentional spreading by the informed or the misinformed. This angle targets a wide range of individuals, which differs and complements previous studies that focused primarily on intentional spreading (e.g. diffusion analysis approach) or the misinformed (e.g. user education approach). Together, a more comprehensive set of solutions to address the spreading of misinformation on SNS can be sought.

Specially, in terms of contribution to research, the following steps summarised the proposed strategy of developing interventions to address the spreading of misinformation on SNS and testing the effectiveness of the interventions.

Stage I: Developing the intervention messages

1. Collect measurement items related to consequences of misinformation spreading on SNS from the literature.
2. Summarise the collected items into broader outcome statements, which are to be written in both gain and loss frames. For example, “increase others' knowledge about health or health care benefit public education”, “make people aware of the issue”, and “tell others what to do” were both summarised into “avoid misleading or confusing others / to instruct others”.
3. Conduct focus group discussions with experts in information behaviour and social media as well as active SNS users to review and revise the grouping created in Step 2. Participants will also be asked to further generate more outcome statements through discussions.
4. Employ a group of six experts in information behaviour and social media to further group the statements under the three types of outcome expectations in SCT (physical, social, and self-evaluative). At least five out of the six experts must agree before a statement can be conclusively assigned to one of the three types.
5. Carry out a survey study to investigate the importance of the outcome statements for not spreading misinformation on SNS. Respondents will be asked to rate how important each of the statements is for them to not spread misinformation on Facebook on a Likert-scale.

6. For each of the three types of SCT outcome expectation (physical, social, and self-evaluative), select from the survey results the outcome statement that obtains the highest rating in importance. The three outcome statements will serve as the three intervention messages.

Stage II: Developing experiments to test the effectiveness of the interventions

1. Select an experimental design that best fits the study focus (e.g., within-subject or between-subject, one session or multiple sessions, etc.).
2. Conceptualise and operationalise the dependent variable (i.e., the spreading of misinformation on Facebook).
3. Develop examples of health-related misinformation posts based on existing ones on SNS.
4. Develop examples of accurate health-related posts based on existing ones on SNS.
5. Format the intervention messages developed in Stage I into sample posts. The messages should be phrased in a way that includes the corresponding outcomes of spreading or not spreading misinformation on Facebook. For example, “‘Sharing’, ‘Liking’ or ‘Reacting to’ inaccurate health-related information on Facebook would NOT instruct others and would mislead or confuse others. NOT ‘Sharing’, Liking’, or ‘Reacting to’ inaccurate health-related information on Facebook would avoid misleading or confusing others and would instruct others.”
6. Conceptualise and operationalise the independent variables (e.g., self-efficacy for not spreading misinformation) and control variables (e.g.,

baseline spreading of misinformation, perceived accuracy of misinformation, etc.).

7. Develop post-test questionnaire to measure the independent variables and control variables.
8. Develop a cover story to introduce the experiment to participants that may satisfy their curiosity while reducing internal validity threats related to reactivity. Debriefing should be conducted at the end of the experiment to inform participants the real purpose of the study.

Moreover, the study applied SCT in guiding the design of interventions for the spreading of misinformation on SNS, which adds a new area of SCT applications. While SCT is commonly employed as the theoretical framework in the field of behaviour change, it has not been previously linked to the issue of misinformation spreading. The study proposed to look at the issue as an information behaviour, and hence, provided a new angle through which the application of SCT can be relevant and beneficial. Besides, while SCT has been successfully applied to various fields of behaviour change, it did face some limitations in certain fields. For examples, SCT was not found beneficial in understanding the effects of TV programming on changing audiences' outcome expectations about unsafe sexual behaviour (Nabi & Clark, 2008); mixed results were shown for the direct influence of outcome expectation in diabetes exercise (Allen, 2004) and physical activity behaviours (Young et al., 2014). Identifying and examining new areas that SCT can be applied (e.g., misinformation spreading) is an important step in furthering the knowledge of the theory.

The affirming findings on the effects of interventions demonstrated the applicability and effectiveness of SCT as a theoretical framework guiding intervention for this topic, which contributes to the knowledge of SCT in the field of behaviour change. In particular, while SCT proposed three main types of outcome expectations that influence one's behaviour, the study recognised the influence of outcome expectation and further explored the level of importance of each of the three types of outcome expectation. The findings showed that the different outcome expectations did not hold the same level of importance for all situations. In the case of addressing misinformation spreading on SNS, self-evaluative outcome expectation was found to have the strongest influence, while physical outcome expectation was the least effective. One possible reasoning for this interesting difference is that SCT was developed in the 1980s, during which time most of the behaviours being discussed relied on physical actions (e.g., to exercise and to teach). Spreading misinformation on SNS (i.e., clicking "Like", "Reaction", and "Share" buttons to respond to SNS posts), however, is one of the online behaviours that were born after the advent of the "Internet era" and do not have offline equivalences. In such online setting, consequences related to one's physical status may become less thought of or valued directly. To enhance the applicability of SCT, the study suggests that more attention should be directed to distinguish the influences of the three types of outcome expectation. For example, researchers should conduct systematic studies to test which type of outcome expectations is more influential in changing what kinds of behaviours under what contexts.

Also, in behaviour change studies that employed SCT, much emphasis had been put on the other primary construct, self-efficacy, which had led to some concerned that SCT was being used as a "one-factor theory" (Wójcicki et al., 2009; Young et al., 2014). The study highlighted the usefulness of outcome expectation in addressing the spreading

of misinformation on SNS, findings of which added to the knowledge of applying outcome expectation in intervention studies.

Furthermore, there are practical implications for addressing the widespread misinformation in the real world. Findings of this study show that providing information on consequences of misinformation spreading – self-evaluative consequences in particular – can be an effective way to refrain SNS users’ from spreading misinformation. The interventions were designed in the format of a short post, which can be relatively easy and economical to be incorporated by various SNSs. For example, brief information about consequences of spreading misinformation, especially self-evaluative ones, can be displayed from time to time as system notices or official posts embedded in users’ news feeds. Likewise, the interventions are suitable to be combined with other existing approaches to address misinformation spreading in different occasions. When a widespread of misinformation is being detected or predicted by the systems, SNSs may increase the frequency of displaying intervention messages to users. Also, SNS providers can include information on consequences of spreading misinformation as part of the clarification message presented to users when they want to interact with posts that contained misinformation.

Last but not least, information professionals need to be aware that users nowadays who spread misinformation are not always the misinformed, and consequently, information literacy training cannot focus solely on imparting knowledge to evaluate information and identify misinformation. To better educate users to take a correct attitude towards the spreading of misinformation and refrain themselves from spreading misinformation, information literacy training shall also highlight the consequences of misinformation spreading (with self-evaluative consequences emphasised) as well as non-informational motivations.

5.3 Limitations and Future Directions

This study developed and tested interventions to address individuals' spreading of health-related misinformation on Facebook. The experimental results suggest that introducing interventions based on outcome expectation from SCT can be effective. Nonetheless, the study faced several limitations and has room for improvement; further studies in several directions discussed below are of paramount importance.

First, as mentioned in Section 3.8, the current study focused on analysing the beginning part of the data (i.e., from Time 1 to Time 2). Future studies are encouraged to make use of the full data set (i.e., from Time 1 to Time 4), so as to investigate the effects of the three interventions in a within-subject design, and to compare the effects of receiving multiple interventions with that of a single intervention. Such studies would require extra caution when interpreting the findings, given the potential of testing effects discussed previously.

Second, the study developed interventions based on the concept of outcome expectation in SCT. It did not directly test the mediating role of outcome expectation in the effect of the interventions on misinformation spreading. Future studies are encouraged to test this mediating relationship to better understand the underlying mechanisms of how such interventions work.

Likewise, SCT suggests bidirectional influences between one's behaviour and personal factors. While the study followed the commonly studied direction from personal factors to behaviour, the study recognises the importance of investigating how one's behaviour may have a reverse influence on personal factors. Future studies are needed to fully elucidate this bidirectional relationship. In terms of SCT constructs, the two primary focuses were outcome expectation and self-efficacy. Future testing may include other

social cognitive variables, such as goal setting and socio-structural factors. In this way, theoretical knowledge in the full application of SCT in interventions addressing the spreading of misinformation will be advanced.

Third, the study did not directly examine the role of users' intentions of spreading misinformation in the process of interventions. It should be noted that, though not being the focus of the study, users' intention was not disregarded but controlled for. To better isolate the effects of the interventions on the spreading of misinformation, perceived accuracy of misinformation was included in the study as a proxy to control for the influences of users' intention, as discussed in Section 2.2.3.5. Looking forward, the study acknowledges that further understanding of users' spreading intention could be beneficial for interpreting how the interventions work. Future studies measuring users' spreading intention in more direct ways are encouraged. Moreover, to fully verify the utility of the intervention across both the informed and uninformed, future studies should be carried out with users divided into two categories, namely those who are aware of the false nature of the misinformation but intentionally spread it, and those who are unaware and unintentionally spread the misinformation.

Fourth, the study focused on two individual characteristics that were considered most prominent to the topic studied, namely gender and self-efficacy. The study did not include more variables in order to maintain the statistical power of the study with the current experimental design and sample size. The study acknowledges that there could be other possible factors that might be relevant in investigating the effects of the interventions. Nonetheless, the study had a relatively homogeneous population group (undergraduates in a local university) to reduce the potential impact of confounding factors (e.g., educational level or age group difference). A control group and random assignment were also employed. Future research may consider including other possible

individual characteristics, such as age, experience with the Internet and social media, knowledge of health-related information, etc. to test and interpret the effects of the interventions in a more comprehensive setting.

Fifth, the type of misinformation and SNS in the current study focused on health-related misinformation and Facebook. Future studies that test and compare the effects of the interventions on different types of misinformation (e.g. political and crisis-related) as well as different SNS environments (e.g. Twitter and Instagram) are encouraged.

Sixth, another area of interest may involve the development of longitudinal studies. The current experimental design tested only the short-term effect of the interventions, in which participants were to receive all interventions within one-time setting. Further testing with follow-up experiments are encouraged to measure if (and when) the effects of interventions wear off. Also, as discussed in Section 3.7.3, currently the whole experiment was in a continuous process, which might have increased the threats of testing effect. Future studies may consider measuring the effects of the interventions with longer breaks in between sessions.

Lastly, the lab setting of the experiment, though closely replicated, could not be able to be identical to the actual real-world (see Section 3.7.3 for further discussion on the limitations related to the research method). Complementary studies that investigate the effects of the interventions outside of experimental sessions may be developed. For example, future research may consider collaboration with computer scientists to study real-world user-generated data recorded in the systems. This will help verify the study's external validity and especially its naturalistic generalisation. Likewise, incorporating the qualitative approach (e.g. interview and focus group) is another research path that will

enable detailed exploration of the underlying reasons in users' spreading of misinformation.

With all these questions answered one by one, our understanding of and solutions for the spreading of misinformation on SNS would eventually grow its shape and help make SNS a better and sharper tool shaping the future of the Information Age.

5.4 Conclusion

The popularity of SNS has demonstrated its important role in the digital world, but it has also led to the serious issue of widespread misinformation. To address the spreading of misinformation on SNS – health-related misinformation on Facebook in particular – the present study proposed interventions, seeing individual users' spreading of misinformation on SNS as an information behaviour with underlying motivations weighted heavier than the informational value of the content. Employing social cognitive theory (SCT) as the theoretical framework, three interventions were developed based on the three types of outcome expectation from SCT, namely physical, social, and self-evaluative outcome expectation. Through experiments, the effects of the interventions on user' negative outcome expectation toward misinformation spreading as well as their spreading of misinformation were investigated. Results showed that the interventions, particularly the one developed based on self-evaluative outcome expectation, were effective in reducing participants' misinformation spreading. These promising findings yield important knowledge that can direct and encourage further research on the new strategy proposed in the thesis. This study complements other studies that focused primarily on the quality of content in social media messages, and hence lead to a more

comprehensive understanding of the solutions for the spreading of misinformation on SNS.

REFERENCES

- Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*(3), 379-387.
- Abrahamson, J. A., Fisher, K. E., Turner, A. G., Durrance, J. C., & Turner, T. C. (2008). Lay information mediary behavior uncovered: Exploring how nonprofessionals seek health information for themselves and others online. *Journal of the Medical Library Association, 96*(4), 310-323.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior & Human Decision Processes, 50*(2), 179-211.
- Allen, N. A. (2004). Social cognitive theory in diabetes exercise research: An integrative literature review. *The Diabetes Educator, 30*(5), 805-819.
- Allport, G. W., & Postman, L. (1947). *The psychology of rumor*. New York: Holt, Rinehart & Winston.
- Anttiroiko, A.-V., & Savolainen, R. (2011). Towards Library 2.0: The adoption of Web 2.0 technologies in public libraries. *Libri, 61*(2), 87-99. doi:10.1515/libr.2011.008
- Appan, R., & Browne, G. J. (2012). The impact of analyst-induced misinformation on the requirements elicitation process. *MIS Quarterly, 36*(1), 85-106.
- Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology, 15*(2), 265-288.
- Bakshy, E., Rosenn, I., Marlow, C., & Adamic, L. (2012). The role of social networks in information diffusion. *Proceedings of the 21st Conference on International World Wide Web* (pp. 519-528).
- Bandura, A. (1977a). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological review, 84*(2), 191.
- Bandura, A. (1977b). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology, 52*(1), 1-26.

- Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, 31(2), 143-164.
- Bandura, A. (2005). The primacy of self-regulation in health promotion. *Applied Psychology: An International Review*, 54(2), 245-254.
- Barthel, M., Mitchell, A., & Holcomb, J. (2016). Many Americans believe fake news is sowing confusion. Retrieved from <http://www.journalism.org/2016/12/15/many-americans-believe-fake-news-is-sowing-confusion/>
- Baumgartner, S. E., & Hartmann, T. (2011). The role of health anxiety in online health information search. *Cyberpsychology, Behavior, and Social Networking*, 14(10), 613-618.
- Bawden, D., & Robinson, L. (2009). The dark side of information: Overload, anxiety and other paradoxes and pathologies. *Journal of Information Science*, 35(2), 180-191.
- Bem, D. J. (1967). Self-perception: An alternative interpretation of cognitive dissonance phenomena. *Psychological Review*, 74(3), 183-200.
- Bessi, A., Caldarelli, G., Del Vicario, M., Scala, A., & Quattrociocchi, W. (2014). Social determinants of content selection in the age of (mis) information. *Proceedings of the International Conference on Social Informatics* (pp. 259-268).
- Bidmon, S., & Terlutter, R. (2015). Gender differences in searching for health information on the internet and the virtual patient-physician relationship in Germany: exploratory results on how men and women differ and why. *Journal of Medical Internet Research*, 17(6).
- Błachnio, A., Przepiórka, A., & Rudnicka, P. (2013). Psychological determinants of using Facebook: A research review. *International Journal of Human-Computer Interaction*, 29(11), 775-787.
- Bock, G.-W., Zmud, R. W., Kim, Y.-G., & Lee, J.-N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly*, 87-111.
- Bode, L., & Vraga, E. K. (2015). In related news, that was wrong: The correction of misinformation through related stories functionality in social media. *Journal of Communication*, 65(4), 619-638. doi:10.1111/jcom.12166
- boyd, d. m., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13(1), 210-230.

- boyd, d. m., Golder, S., & Lotan, G. (2010). Tweet, tweet, retweet: Conversational aspects of retweeting on Twitter. *Proceedings of the 46th Hawaii International Conference on System Sciences (HICSS-46)* (pp. 1-10).
- Budak, C., Agrawal, D., & Abbadi, A. E. (2011). Limiting the spread of misinformation in social networks. *Proceedings of the 20th Conference on International World Wide Web* (pp. 665-674).
- Burnett, G. (2000). Information exchange in virtual communities: A typology. *Information Research*, 5(4).
- Burnett, G., & Buerkle, H. (2004). Information exchange in virtual communities: A comparative study. *Journal of Computer-Mediated Communication*, 9(2).
- Bussey, K., & Bandura, A. (1999). Social cognitive theory of gender development and differentiation. *Psychological Review*, 106(4), 676-713.
- Calvert, P. J. (2001). Scholarly misconduct and misinformation on the World Wide Web. *Electronic Library*, 19(4), 232-240.
- Case, D. O. (2012). *Looking for Information: A survey of research on information seeking, needs and behavior* (3rd ed.). Bingley, UK: Emerald.
- Castillo, C., Mendoza, M., & Poblete, B. (2011). Information credibility on Twitter. *Proceedings of the 20th Conference on International World Wide Web*, pp. 675-684.
- Castillo, C., Mendoza, M., & Poblete, B. (2013). Predicting information credibility in time-sensitive social media. *Internet Research*, 23(5), 560-588.
- Chen, X. (2014). *What we talk about when we talk about misinformation on social media: A qualitative content analysis on the sharing of a popular piece of misinformation*. Paper presented at the 5th Honors Symposium for Asian PhD Students in Communication Research, Singapore.
- Chen, X. (2016). The influences of personality and motivation on the sharing of misinformation on social media. *ICConference 2016 Proceedings*.
- Chen, X., & Sin, S.-C. J. (2013). 'Misinformation? What of it?' Motivations and individual differences in misinformation sharing on social media. *Proceedings of the American Society for Information Science and Technology*, 50(1), 1-4.
- Chen, X., Sin, S.-C. J., Theng, Y.-L., & Lee, C. S. (2015). Deterring the spread of misinformation on social network sites: A social cognitive theory-guided intervention. *Proceedings of the Association for Information Science and Technology*, 52(1), 1-4.

- Chew, C., & Eysenbach, G. (2010). Pandemics in the age of Twitter: Content analysis of Tweets during the 2009 H1N1 outbreak. *PLoS One*, 5(11), e14118.
doi:10.1371/journal.pone.0014118
- Chiu, C.-M., Hsu, M.-H., & Wang, E. T. (2006). Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories. *Decision Support Systems*, 42(3), 1872-1888.
- Chong, D., & Druckman, J. N. (2007). Framing theory. *Annual Review of Political Science*, 10, 103-126.
- Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 189-211.
- Cooke, N. A. (2017). Posttruth, truthiness, and alternative facts: Information behavior and critical information consumption for a new age. *The Library Quarterly*, 87(3), 211-221.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.
- Crowell, C. (2017). Our approach to bots & misinformation. Retrieved from https://blog.twitter.com/official/en_us/topics/company/2017/Our-Approach-Bots-Misinformation.html
- Dang, A., Smit, M., Moh'd, A., Minghim, R., & Milios, E. (2016). Toward Understanding How Users Respond to Rumours in Social Media. *Proceedings of the 2016 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining* (pp. 777-784).
- Del Vicario, M., Bessi, A., Zollo, F., Petroni, F., Scala, A., Caldarelli, G., . . . Quattrociocchi, W. (2016). The spreading of misinformation online. *Proceedings of the National Academy of Sciences of the United States of America*, 113(3), 554-559.
doi:10.1073/pnas.1517441113
- Dewey, C. (2015). What was fake on the Internet this week: Why this is the final column. Retrieved from <https://www.washingtonpost.com/news/the-intersect/wp/2015/12/18/what-was-fake-on-the-internet-this-week-why-this-is-the-final-column>
- DiFonzo, N., & Bordia, P. (2007). *Rumor psychology: Social and organizational approaches* (1st ed.). Washington, DC: American Psychological Association.

- DiFonzo, N., Robinson, N. M., Suls, J. M., & Rini, C. (2012). Rumors about cancer: Content, sources, coping, transmission, and belief. *Journal of Health Communication, 17*(9), 1099-1115.
- Dijkstra, A., Vries, H. D., Kok, G., & Rouackers, J. (1999). Self-evaluation and motivation to change: Social cognitive constructs in smoking cessation. *Psychology & Health, 14*(4), 747-759.
- Doerr, B., Fouz, M., & Friedrich, T. (2012). Why rumors spread so quickly in social networks. *Communications of the ACM, 55*(6), 70. doi:10.1145/2184319.2184338
- Duggan, M., Ellison, N. B., Lampe, C., Lenhart, A., Madden, M., Rainie, L., & Smith, A. (2015). Social media update 2014. Retrieved from <http://www.pewinternet.org/2015/01/09/social-media-update-2014/>
- Ecker, U. K., Lewandowsky, S., & Tang, D. T. (2010). Explicit warnings reduce but do not eliminate the continued influence of misinformation. *Memory & Cognition, 38*(8), 1087-1100. doi:10.3758/MC.38.8.1087
- Ellison, N. B., & boyd, d. m. (2013). Sociality through social network sites. In W. H. Dutton (Ed.), *The Oxford Handbook of Internet Studies* (pp. 151-172). Oxford: Oxford University Press.
- Ennals, R., Trushkowsky, B., & Agosta, J. M. (2010). Highlighting disputed claims on the web. *Proceedings of the 19th International Conference on World Wide Web*, 341-350.
- Epstein, L. (2012). Singing about popsicles: How to estimate your population. Retrieved from <https://www.surveymonkey.com/blog/2012/10/02/how-to-estimate-your-population/>
- Facebook. (2017). Company Info. Retrieved from <https://newsroom.fb.com/company-info/>
- Fallis, D. (2009). A conceptual analysis of disinformation. *iConference 2009 Proceedings*.
- Fallis, D. (2014). A functional analysis of disinformation. *iConference 2014 Proceedings* (pp. 621-627). doi:10.9776/14278
- Fazio, R. H., Zanna, M. P., & Cooper, J. (1977). Dissonance and self-perception: An integrative view of each theory's proper domain of application. *Journal of Experimental Social Psychology, 13*(5), 464-479.
- Fenn, E., Newman, E. J., Pezdek, K., & Garry, M. (2013). The effect of nonprobative photographs on truthiness persists over time. *Acta psychologica, 144*(1), 207-211.

- Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.
- Fetzer, J. H. (2004). Disinformation: The use of false information. *Minds and Machines*, 14(2), 231-240.
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). London, England: Sage.
- Fishbein, M. (1979). A theory of reasoned action: Some applications and implications. In H. Howe & M. Page (Eds.), *Nebraska Symposium on Motivation*. Lincoln: University of Nebraska Press.
- Fitzgerald, M. A. (1997). Misinformation on the Internet: Applying evaluation skills to online information. *Emergency Librarian*, 24(3), 9-14.
- Flanagin, A. J., & Metzger, M. J. (2000). Perceptions of Internet information credibility. *Journalism and Mass Communication Quarterly*, 77(3), 515-540.
- Floridi, L. (1996). Brave.Net.World: The Internet as a disinformation superhighway? *Electronic Library*, 14(6), 509-514.
- Floridi, L. (2005). Is semantic information meaningful data? *Philosophy and Phenomenological Research*, 70(2), 351-370.
- Friggeri, A., Adamic, L. A., Eckles, D., & Cheng, J. (2014). Rumor cascades. *Proceedings of the 8th International AAAI Conference on Weblogs and Social Media* (pp. 101-110).
- Frost, C. (2000). Tales on the Internet: Making it up as you go along. *Aslib Proceedings*, 52(1), 5-10.
- Frost, C. (2002). Source credibility: Do we really believe everything we're told? *Aslib Proceedings*, 54(4), 222-228.
- Gangadharbatla, H. (2008). Facebook me: Collective self-esteem, need to belong, and internet self-efficacy as predictors of the iGeneration's attitudes toward social networking sites. *Journal of Interactive Advertising*, 8(2), 5-15.
- Gottfried, J., & Shearer, E. (2016). News use across social media platforms 2016. Retrieved from <http://www.journalism.org/2016/05/26/news-use-across-social-media-platforms-2016/>
- Greenwood, S., Perrin, A., & Duggan, M. (2016). Social media update 2016. Retrieved from <http://www.pewinternet.org/2016/11/11/social-media-update-2016/>

- Guardian Interactive team, Procter, R., Vis, F., & Voss, A. (2011). How riot rumours spread on Twitter. Retrieved from <http://www.guardian.co.uk/uk/interactive/2011/dec/07/london-riots-twitter>
- Guerin, B., & Miyazaki, Y. (2006). Analyzing rumors, gossip, and urban legends through their conversational properties. *Psychological Record*, 56(1), 23-33.
- Gurak, L. J. (2001). *Cyberliteracy: Navigating the Internet with awareness*. New Haven, CT: Yale University Press.
- Hallyburton, A., & Evarts, L. A. (2014). Gender and online health information seeking: A five survey meta-analysis. *Journal of Consumer Health on the Internet*, 18(2), 128-142.
- Hampton, K., Goulet, L. S., Rainie, L., & Purcell, K. (2011). Social networking sites and our lives. Retrieved from <http://pewinternet.org/~media/Files/Reports/2011/PIP%20-%20Social%20networking%20sites%20and%20our%20lives.pdf>
- Hernon, P. (1995). Disinformation and misinformation through the Internet: Findings of an exploratory study. *Government Information Quarterly*, 12(2), 133-139.
- Hersberger, J. A., Murray, A. L., & Rioux, K. S. (2007). Examining information exchange and virtual communities: An emergent framework. *Online Information Review*, 31(2), 135-147.
- Hertwig, R., & Ortmann, A. (2008). Deception in experiments: Revisiting the arguments in its defense. *Ethics & Behavior*, 18(1), 59-92.
- Hocevar, K. P., Flanagin, A. J., & Metzger, M. J. (2014). Social media self-efficacy and information evaluation online. *Computers in Human Behavior*, 39, 254-262.
- Hsu, C.-L., & Lin, J. C.-C. (2008). Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information & management*, 45(1), 65-74.
- Jain, S., Sharma, V., & Kaushal, R. (2016). Towards Automated Real-Time Detection of Misinformation on Twitter. *Proceedings of the 2016 International Conference on Advances in Computing, Communications and Informatics (ICACCI)* (pp. 2015-2020).
- Jansen, B. J., Sobel, K., & Cook, G. (2011). Classifying ecommerce information sharing behaviour by youths on social networking sites. *Journal of Information Science*, 37(2), 120-136.

- Joinson, A. N. (2008). Looking at, looking up or keeping up with people?: Motives and use of Facebook. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1027-1036).
- Jong, W., & Dückers, M. L. (2016). Self-correcting mechanisms and echo-effects in social media: An analysis of the “gunman in the newsroom” crisis. *Computers in Human Behavior*, 59, 334-341.
- Kankanhalli, A., Tan, B. C., & Wei, K.-K. (2005). Contributing knowledge to electronic knowledge repositories: An empirical investigation. *MIS Quarterly*, 113-143.
- Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of social media. *Business Horizons*, 53(1), 59-68.
- Karlova, N. A., & Fisher, K. E. (2013). A social diffusion model of misinformation and disinformation for understanding human information behaviour. *Information Research*, 18 (1).
- Kemp, S. (2017a). Digital in 2017 global overview. Retrieved from <https://wearesocial.com/special-reports/digital-in-2017-global-overview>
- Kemp, S. (2017b). Digital in Southeast Asia in 2017. Retrieved from <https://wearesocial.com/special-reports/digital-southeast-asia-2017>
- Khang, H., Han, E.-K., & Ki, E.-J. (2014). Exploring influential social cognitive determinants of social media use. *Computers in Human Behavior*, 36, 48-55.
- Kim, H. L., Decker, S., & Breslin, J. G. (2009). Representing and sharing folksonomies with semantics. *Journal of Information Science*, 36(1), 57-72.
- Kim, Y., Sohn, D., & Choi, S. M. (2011). Cultural difference in motivations for using social network sites: A comparative study of American and Korean college students. *Computers in Human Behavior*, 27(1), 365-372.
- Kumar, K., & Geethakumari, G. (2013). Information diffusion model for spread of misinformation in online social networks. *Proceedings of the 2013 International Conference on Advances in Computing, Communications and Informatics (ICACCI)* (pp. 1172-1177).
- Lampe, C., Wohn, D. Y., Vitak, J., Ellison, N. B., & Wash, R. (2011). Student use of Facebook for organizing collaborative classroom activities. *International Journal of Computer-Supported Collaborative Learning*, 6(3), 329-347.
- LaRose, R., & Eastin, M. S. (2004). A social cognitive theory of Internet uses and gratifications: Toward a new model of media attendance. *Journal of Broadcasting & Electronic Media*, 48(3), 358-377. doi:10.1207/s15506878jobem4803_2

- LaRose, R., Lin, C. A., & Eastin, M. S. (2003). Unregulated Internet usage: Addiction, habit, or deficient self-regulation? *Media Psychology*, 5(3), 225-253.
- LaRose, R., Mastro, D., & Eastin, M. S. (2001). Understanding Internet usage a social-cognitive approach to uses and gratifications. *Social Science Computer Review*, 19(4), 395-413.
- Lee, C. S., & Ma, L. (2012). News sharing in social media: The effect of gratifications and prior experience. *Computers in Human Behavior*, 28(2), 331-339.
- Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, 45(1), 79-122.
- Lewandowsky, S., Ecker, U. K. H., Seifert, C. M., Schwarz, N., & Cook, J. (2012). Misinformation and its correction: Continued influence and successful debiasing. *Psychological Science in the Public Interest*, 13(3), 106-131.
doi:10.1177/1529100612451018
- Lewandowsky, S., Stritzke, W. G., Oberauer, K., & Morales, M. (2009). Misinformation and the 'War on Terror': When memory turns fiction into fact. *Terrorism and Torture: An Interdisciplinary Perspective*, 179-203.
- Li, H., & Sakamoto, Y. (2014). Social impacts in social media: An examination of perceived truthfulness and sharing of information. *Computers in Human Behavior*, 41, 278-287. doi:10.1016/j.chb.2014.08.009
- Li, S., Zhu, Y., Li, D., Kim, D., & Huang, H. (2013). Rumor restriction in online social networks. *Proceedings of the 2013 IEEE 32nd International Performance Computing and Communications Conference (IPCCC)* (pp. 1-10).
- Lippke, S., & Ziegelmann, J. P. (2008). Theory-based health behavior change: Developing, testing, and applying theories for evidence-based interventions. *Applied Psychology: An International Review*, 57(4), 698-716.
- Loftus, E. F. (2005). Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning & Memory*, 12(4), 361-366.
doi:10.1101/lm.94705
- Lu, H.-P., & Hsiao, K.-L. (2009). Gender differences in reasons for frequent blog posting. *Online Information Review*, 33(1), 135-156.

- Lu, H.-P., Lin, J. C.-C., Hsiao, K.-L., & Cheng, L.-T. (2010). Information sharing behaviour on blogs in Taiwan: Effects of interactivities and gender differences. *Journal of Information Science*, 36(3), 401-416. doi:10.1177/0165551510363631
- Mackey, T. P., & Jacobson, T. E. (2010). Reframing information literacy as a metaliteracy. *College & Research Libraries*, 62-78.
- Marshall, C. C., & Bly, S. (2004). Sharing encountered information: Digital libraries get a social life. *Proceedings of the 4th ACM/IEEE-CS joint conference on Digital libraries* (pp. 218-227).
- Mendoza, M., Poblete, B., & Castillo, C. (2010). Twitter under crisis: Can we trust what we RT? *Proceedings of the 1st Workshop on Social Media Analytics* (pp. 71-79).
- Michie, S., & Abraham, C. (2004). Interventions to change health behaviours: Evidence-based or evidence-inspired? *Psychology & Health*, 19(1), 29-49.
- Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: Mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology: An International Review*, 57(4), 660-680. doi:10.1111/j.1464-0597.2008.00341.x
- Mintz, A. P. (2002). *Web of deception: Misinformation on the Internet*. Medford, NJ: Information Today, Inc.
- Misinformation. (2017). *Oxford English dictionary online*. Retrieved from <http://www.oxforddictionaries.com/definition/english/misinformation>
- Mosseri, A. (2016). News Feed FYI: Addressing hoaxes and fake news. Retrieved from <https://newsroom.fb.com/news/2016/12/news-feed-fyi-addressing-hoaxes-and-fake-news/>
- Mosseri, A. (2017). Working to stop misinformation and false news. Retrieved from <https://newsroom.fb.com/news/2017/04/working-to-stop-misinformation-and-false-news/>
- Muscanell, N. L., & Guadagno, R. E. (2012). Make new friends or keep the old: Gender and personality differences in social networking use. *Computers in Human Behavior*, 28(1), 107-112.
- Nabeshima, K., Mizuno, J., Okazaki, N., & Inui, K. (2014). Mining false information on Twitter for a major disaster situation. In D. Slezak, G. Schaefer, S. T. Vuong, & Y. S. Kim (Eds.), *Proceedings of the 2014 International Conference on Active Media Technology, (Warsaw, Poland, August 11-14), Lecture Notes in Computer Science 8610* (pp. 96-109). Cham: Springer.

- Nabi, R. L., & Clark, S. (2008). Exploring the limits of social cognitive theory: Why negatively reinforced behaviors on TV may be modeled anyway. *Journal of Communication*, 58(3), 407-427.
- Nanyang Technological University. (2016). Undergraduate population from AY2009-10 to AY2016-17. Retrieved from <http://www.ntu.edu.sg/AboutNTU/CorporateInfo/FactsFigures/Pages/undergraduatepopulation2009-15.aspx>
- Neuman, W. L. (2011). *Social research methods: Qualitative and quantitative approaches* (7th. ed. International ed.). Boston: Pearson Education.
- Newman, E. J., Garry, M., Bernstein, D. M., Kantner, J., & Lindsay, D. S. (2012). Nonprobative photographs (or words) inflate truthiness. *Psychonomic Bulletin & Review*, 19(5), 969-974.
- Newman, E. J., Sanson, M., Miller, E. K., Quigley-McBride, A., Foster, J. L., Bernstein, D. M., & Garry, M. (2014). People with easier to pronounce names promote truthiness of claims. *PLoS One*, 9(2), e88671.
- Nguyen, N. P., Yan, G., & Thai, M. T. (2013). Analysis of misinformation containment in online social networks. *Computer Networks*, 57(10), 2133-2146. doi:10.1016/j.comnet.2013.04.002
- Nowak, M., & Spiller, G. (2017). Two billion people coming together on Facebook. Retrieved from <https://newsroom.fb.com/news/2017/06/two-billion-people-coming-together-on-facebook/>
- Oh, O., Agrawal, M., & Rao, H. R. (2013). Community intelligence and social media services: A rumor theoretic analysis of tweets during social crises. *MIS Quarterly*, 37(2), 407-426.
- Oh, S. (2012). The characteristics and motivations of health answerers for sharing information, knowledge, and experiences in online environments. *Journal of the Association for Information Science and Technology*, 63(3), 543-557.
- Olson, J. M., & Stone, J. (2014). The influence of behavior on attitudes. In D. Albarracin, B. T. Johnson, & M. P. Zanna (Eds.), *The handbook of attitudes* (pp. 223-272). New York, NY: Psychology Press.
- Park, N., Kee, K. F., & Valenzuela, S. (2009). Being Immersed in social networking environment: Facebook groups, uses and gratifications, and social outcomes. *CyberPsychology & Behavior*, 12(6), 729-733. doi:10.1089/cpb.2009.0003

- Perrin, A. (2015). Social media usage: 2005-2015. Retrieved from <http://www.pewinternet.org/2015/10/08/social-networking-usage-2005-2015/>
- Powell, J., Inglis, N., Ronnie, J., & Large, S. (2011). The characteristics and motivations of online health information seekers: cross-sectional survey and qualitative interview study. *Journal of Medical Internet Research*, 13(1).
- Prestin, A., Vieux, S. N., & Chou, W.-y. S. (2015). Is online health activity alive and well or flatlining? Findings from 10 years of the Health Information National Trends Survey. *Journal of Health Communication*, 20(7), 790-798.
- Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion*, 12(1), 38-48.
- Qazvinian, V., Rosengren, E., Radev, D. R., & Mei, Q. (2011). Rumor has it: Identifying misinformation in microblogs. *Proceedings of the Conference on Empirical Methods in Natural Language Processing* (pp. 1589-1599).
- Ratkiewicz, J., Conover, M., Meiss, M., Gonçalves, B., Patil, S., Flammini, A., & Menczer, F. (2011). Detecting and tracking the spread of astroturf memes in microblog streams. *Proceedings of the 20th Conference on International World Wide Web* (pp. 249-252).
- Rhodes, R. E., & Nigg, C. R. (2011). Advancing physical activity theory: A review and future directions. *Exercise & Sport Sciences Reviews*, 39(3), 113-119.
- Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *The Journal of Psychology*, 91(1), 93-114.
- Rosenstock, I. M. (1974). Historical origins of the health belief model. *Health Education Monographs*, 2, 328-335.
- Rosnow, R. L. (1991). Inside rumor - A personal journey. *American Psychologist*, 46(5), 484-496. doi:10.1037//0003-066x.46.5.484
- Rothman, A. J., Baldwin, A. S., & Hertel, A. W. (2004). Self-regulation and behavior change: Disentangling behavioral initiation and behavioral maintenance. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of self-regulation: Research, theory, and applications* (pp. 130-148). New York: Guilford Press.
- Rowley, J., Johnson, F., & Sbaffi, L. (2017). Gender as an influencer of online health information-seeking and evaluation behavior. *Journal of the Association for Information Science and Technology*, 68(1), 36-47.

- Ruggiero, T. E. (2000). Uses and gratifications theory in the 21st century. *Mass Communication and Society*, 3(1), 3-37.
- Safieddine, F., Masri, W., & Pourghomi, P. (2016). Corporate responsibility in combating online misinformation. *International Journal of Advanced Computer Science and Applications*, 7(2), 126-132.
- Sbaffi, L., & Rowley, J. (2017). Trust and credibility in web-based health information: a review and agenda for future research. *Journal of Medical Internet Research*, 19(6).
- Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference* (2nd ed.). Boston: Houghton Mifflin.
- Shao, G. (2009). Understanding the appeal of user-generated media: A uses and gratification perspective. *Internet Research*, 19(1), 7-25.
- Share. (2017). *Oxford English dictionary online*. Retrieved from <http://www.oxforddictionaries.com/definition/english/share>
- Sheldon, P. (2008). Student favorite: Facebook and motives for its use. *Southwestern Mass Communication Journal*, 23(2), 39-53.
- Shibutani, T. (1966). *Improvised news: A sociological study of rumor*: Ardent Media.
- Smock, A. D., Ellison, N. B., Lampe, C., & Wohn, D. Y. (2011). Facebook as a toolkit: A uses and gratification approach to unbundling feature use. *Computers in Human Behavior*, 27(6), 2322-2329.
- Snopes.com. (2017). Snopes.com: The definitive Internet reference source for urban legends, folklore, myths, rumors, and misinformation. Retrieved from <http://www.snopes.com/>
- Srinivasan, R. (2014). What Tahrir Square has done for social media: A 2012 snapshot in the struggle for political power in Egypt. *The Information Society*, 30(1), 71-80. doi:10.1080/01972243.2013.856363
- Stahl, B. C. (2006). On the difference or equality of information, misinformation, and disinformation: A critical research perspective. *Informing Science: International Journal of an Emerging Transdiscipline*, 9, 83-96.
- Starbird, K., Maddock, J., Orand, M., Achterman, P., & Mason, R. M. (2014). Rumors, false flags, and digital vigilantes: Misinformation on Twitter after the 2013 Boston marathon bombing. *iConference 2014 Proceedings*.
- Suh, Y., Weikert, M., Dlugonski, D., Sandroff, B., & Motl, R. W. (2011). Social cognitive correlates of physical activity: Findings from a cross-sectional study of

- adults with relapsing-remitting multiple sclerosis. *Journal of Physical Activity and Health*, 8(5), 626-635.
- Sun, T., & Wu, G. (2011). Traits, predictors, and consequences of Facebook self-presentation. *Social Science Computer Review*, 30(4), 419-433.
- Talja, S. (2002). Information sharing in academic communities: Types and levels of collaboration in information seeking and use. *New Review of Information Behavior Research*, 3(1), 143-159.
- Tanaka, Y., Sakamoto, Y., & Honda, H. (2014). The impact of posting URLs in disaster-related Tweets on rumor spreading behavior. *Proceedings of the 47th Hawaii International Conference on System Science* (pp. 520-529).
doi:10.1109/hicss.2014.72
- Tanaka, Y., Sakamoto, Y., & Matsuka, T. (2013). Toward a social-technological system that inactivates false rumors through the critical thinking of crowds. *Proceedings of the 46th Hawaii International Conference on System Sciences (HICSS-46)* (pp. 649-658).
- The Nielsen Company. (2012). State of social media: The social media report. Retrieved from <http://www.nielsen.com/us/en/insights/reports/2012/state-of-the-media-the-social-media-report-2012.html>
- The Poynter Institute. (2017). About the International Fact-Checking Network — Poynter. Retrieved from <http://www.poynter.org/about-the-international-fact-checking-network/>
- Tokar, D. M., Thompson, M. N., Plaufcan, M. R., & Williams, C. M. (2007). Precursors of learning experiences in social cognitive career theory. *Journal of Vocational Behavior*, 71(3), 319-339.
- Walsh, J. (2010). Librarians and controlling disinformation: Is multi-literacy instruction the answer? *Library Review*, 59(7), 498-511. doi:10.1108/00242531011065091
- Wasko, M. M., & Faraj, S. (2005). Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly*, 35-57.
- Williams, S., & French, D. (2011). What are the most effective intervention techniques for changing physical activity self-efficacy and physical activity behaviour—and are they the same? *Health Education Research*, 26(2), 308-322.
- Wilson, T. D. (1981). On user studies and information needs. *Journal of Documentation*, 37(1), 3-15.

- Wilson, T. D. (1999). Models in information behaviour research. *Journal of Documentation*, 55(3), 249-270.
- Wilson, T. D. (2010). Information sharing: An exploration of the literature and some propositions. *Information Research*, 15(4).
- Wójcicki, T. R., White, S. M., & McAuley, E. (2009). Assessing outcome expectations in older adults: The multidimensional outcome expectations for exercise scale. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 64(1), 33-40.
- World Economic Forum. (2014). Top 10 trends of 2014: 10. The rapid spread of misinformation online. Retrieved from <http://reports.weforum.org/outlook-14/view/top-ten-trends-category-page/10-the-rapid-spread-of-misinformation-online/>
- Yamamoto, Y., & Tanaka, K. (2011). Enhancing credibility judgment of web search results. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1235-1244).
- Yan, W., & Huang, J. (2014). Microblogging reposting mechanism: An information adoption perspective. *Tsinghua Science and Technology*, 19(5), 531-542.
- Ybarra, M., & Suman, M. (2006). Reasons, assessments and actions taken: Sex and age differences in uses of Internet health information. *Health Education Research*, 23(3), 512-521.
- Yoo, E. Y., & Robbins, L. S. (2008). Understanding middle-aged women's health information seeking on the web: A theoretical approach. *Journal of the Association for Information Science and Technology*, 59(4), 577-590.
- Young, M., Plotnikoff, R., Collins, C., Callister, R., & Morgan, P. (2014). Social cognitive theory and physical activity: A systematic review and meta-analysis. *Obesity Reviews*, 15(12), 983-995.
- Zhang, H. L., Alim, M. A., Li, X., Thai, M. T., & Nguyen, H. T. (2016). Misinformation in Online Social Networks: Detect Them All with a Limited Budget. *ACM Transactions on Information Systems (TOIS)*, 34(3). doi:10.1145/2885494
- Zhou, L., & Zhang, D. (2007). An ontology-supported misinformation model: Toward a digital misinformation library. *Systems, Man and Cybernetics, Part A: Systems and Humans, IEEE Transactions on*, 37(5), 804-813.
- Zubiaga, A., Liakata, M., Procter, R., Bontcheva, K., & Tolmie, P. (2015). Towards detecting rumours in social media. *Proceedings of the AAAI Workshop on AI for Cities*.

Appendix A. IRB approval and instrument of the experimental study

NTU-IRB approval letter for the experimental study

Research Support Office

Reg. No. 200604393R

IRB-2016-06-023

31 August 2016

Associate Professor Sin Sei Ching Joanna
Wee Kim Wee School of Communication and Information

NTU INSTITUTIONAL REVIEW BOARD APPROVAL

Project Title: A social cognitive theory-guided interventional approach to the sharing of misinformation on social media

I refer to your application for ethics approval with respect to the above project.

The Board has considered your application and noted from your application that your research involves collecting behavioral data from participants using surveys and Facebook.

You have also confirmed that informed consent will be obtained from the participants and you have guaranteed the confidentiality of your participants' biodata obtained from them.

The documents reviewed are:

- a) NTU IRB application form dated **1 August 2016**
- b) Participant information sheet and consent form: version 2 dated **26 August 2016**
- c) Data collection form: version 1 dated **1 August 2016**

The Board is therefore satisfied with the bioethical consideration for the project and approves the ethics application under **Expedited** review. The approval period is from **31 August 2016 to 30 August 2017**. The NTU IRB reference number for this study is **IRB-2016-06-023**. Please use this reference number for all future correspondence.

The following protocol and compliances are to be observed upon NTU IRB approval

1. All research involving procedures greater than minimal risk on minors (individuals who are less than the legal age of 21 years old) requires IRB approved written Parental Consent and assent from the participant to be obtained before any research protocols can be administered. Minimal risk refers to an anticipated level of harm and discomfort that is no greater than that ordinarily encountered in daily life, or during the performance of routine educational, physical, or psychological examination.
2. Only the approved Participants Information Sheet and Consent Form should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject should be given a copy of the signed consent form.

Blk N2.1, B4-01, 76 Nanyang Drive, Singapore 637331 Nanyang Avenue, Singapore 639798
Tel : +65 6791 9857, Fax: 6793 2019
www.ntu.edu.sg

Research Support Office

3. Consent forms are important documents therefore they should be stored in the strictest arrangement. Loss of consent form would result in disciplinary action.
4. No deviation from, or changes of, the protocol should be initiated without prior written NTU IRB approval of an appropriate amendment.
5. The Principal Investigator should report promptly to NTU IRB regarding:
 - a. Deviation from, or changes to the protocol.
 - b. Changes increasing the risk to the subjects and/or affecting significantly the conduct of the trial
 - c. All serious adverse events (SAEs) which are both serious and unexpected.
 - d. New information that may affect adversely the safety of the subjects of the conduct of the trial.
 - e. Completion of the study.
6. Continuing Review Request/ Notice of Study completion form should be submitted to NTU IRB for the following:
 - a. Annual review: Status of the study should be reported to the NTU IRB at least annually using the Continuing Review Request/ Notice of Study completion form.
 - b. Study completion or termination: Continuing Review Request/ Notice of Study completion form is to be submitted within 4 to 6 weeks of study completion or termination.
7. All Principal Investigators should comply with existing legislation that would have an impact on the domain of their research.

A handwritten signature in black ink, appearing to read "Lionel", is positioned above the name of the signatory.

Professor Lionel Lee
Chair, NTU Institutional Review Board
encl.

cc Members, NTU Institutional Review Board

Consent form and introduction

Do you fulfill **ALL** of the following requirements?

- You are an undergraduate student in NTU
- You have an account on Facebook
- You are 18 years old or above

☐ Yes

☐ No

Respondent Consent Form

Title of Project: Effectiveness of a personalized post recommendation system for social media use

Name of Researchers: Joanna Sin, Xinran Chen

Contact Detail of Researcher: chen0872@e.ntu.edu.sg

Contact Detail of NTU-Institutional Review Board: Ms Germaine Foo
(Email: irb@ntu.edu.sg; Phone: 65922495)

Eligibility: You must be a NTU undergraduate student who is Facebook user and 18 years old or above to participate in the study.

You are invited to participate in this research study about the effectiveness of a personalized post recommendation system for social media use. We would greatly appreciate it if you could take some time to fill out a questionnaire for us. If you meet the eligibility criteria stated above and complete the survey truthfully, you will receive **15 SGD** as token for your participation. In addition, 10 participants who complete the survey will be selected and invited to a post-study interview. If you are selected and decide to partake the interview, you will receive additional incentives of 10 SGD for completing the interview. The compensation will be made in the form of gift card or PayPal transfer according to your choice.

Study purpose: The study investigates the effectiveness of a personalized post recommendation system on social media, as well as what are the relationships between social media use and individual difference factors, such as self-efficacy and

personality. Information from this study will benefit users with better experience on Facebook and social media.

Respondent involvement: If you decide to participate in this study, you will be asked to fill out an online questionnaire, during which you will be asked to view and react to some health-related Facebook postings, as well as listening to several 2-minute music intervals. The questionnaire will take about **40-50 minutes** to complete. If you are selected for and decide to participate in the follow-up interview, you will be asked about your experiences and opinions toward the study. The interview takes about 30 minutes. You will be asked to provide your contact information (e.g. email, phone number) to receive the compensation.

Risks: There are no anticipated risks associated with participating in these studies beyond those encountered in daily life.

Benefits: Participation in the research will provide you with the opportunity to acquire first-hand knowledge of the research process.

Voluntary withdrawal: Your participation in this study is completely voluntary, and you may withdraw from the study at any time without penalty. However, it is important to us that you answer as many questions as possible. You may skip over any questions or procedures, or you may withdraw by informing the research associate that you no longer wish to participate (no question will be asked). Your decision to participate, decline, or withdraw participation will have no effect on your status or relationship with the Nanyang Technological University.

Data privacy: All answers you have provided will be kept strictly confidential. Only the researchers of the pertinent project will have access to your responses. In the event of publication of this research, no personally identifying information will be disclosed. Thank you for considering partaking in this study. Your participation will provide us invaluable insights. Please let us know if you have any questions about the study.

I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.

I agree to take part in this study.

- ☐ Yes
☐ No

Note: As the information system is under evaluation and needs unbiased opinions, **please do not communicate with others about this study**. In particular, please keep confidential the posts presented to you in the study. We greatly appreciate your understanding.

Please choose one preferred way to receive the S\$15 incentive and leave your contact information. If you have not heard from us after **30 days**, please feel free to contact us at chen0872@e.ntu.edu.sg.

- ☐ Email for Amazon.com eGift Card
☐ Email for online bank transfer (via OCBC Pay Anyone™)
☐ Email for PayPal Transfer
☐ Email contact for self-collection of cash at WKWSCl

Please leave your matriculation number for verification:

Various types of health-related information are floating around on Facebook. Most of them are similar to some randomly picked sample pieces that will be presented to you later.

You will be presented 4 sets of sample pieces in total, with music breaks in between. Each set contains about 10 pieces.

Please respond as if you were browsing your own Facebook as usual, and respond ('Share', 'Like', 'React to', or 'Comment') or not respond to each post the way you normally do.

- If you have seen the post and shared, liked, reacted to, or commented on it before, **please do so again** in the survey if you do not regret sharing, liking,

reacting to, or commenting on it.

- If you don't feel like doing anything, just pass the post by pressing "I am not going to respond to this post" button.

Misinformation Example Set 1 A

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now · 🌐

Daily Tips

Food cooked in microwave ovens poses a greater risk to health. Consuming microwaved food not only changes the nutrients in the food; but also has cancerous effects on the blood that could cause deterioration in the human system. Cook your food by conventional means only.

👍 Like

💬 Comment

➦ Share

👍 Like

💬 Comment

➦ Share

I'm not going to respond to this post

☐

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Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 1 B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

Comment

Share

I'm not going to respond to this post

☐☐☐☐ ☐☐☐☐☐☐

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 1 C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

Comment

Share

I'm not going to respond to this post

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 1 D

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

Comment

Share

Like

Comment

Share

I'm not going to respond to this post

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public

Misinformation Example Set 2 A

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

Comment

Share

I'm not going to respond to this post

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public

Misinformation Example Set 2 B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

Comment

Share

I'm not going to respond to this post

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 2 C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan

Just now · 🌐

Body Toxin Signs

A buildup of toxins can cause an almost infinite number of health problems, including several potentially fatal diseases such as cancer.

However, before your body's level of toxicity causes such serious problems, it'll try to alert you that something is wrong.

Here are four telltale signs that your body is in urgent need of some maintenance: 1. Joint pain; 2. Mood swings; 3. Headaches; 4. Insomnia.

Don't ignore these symptoms, protect yourself from suffering the consequences.

👍 Like

💬 Comment

➦ Share

👍 Like

💬 Comment

➦ Share

I'm not going to respond to this post

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Write a Comment ...

➦ Share

and say something about this...

Set this visible to...

Public

Misinformation Example Set 2 D

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan

Just now · 🌐

Ridging Fingernail

Fingernails and disease don't go together in most minds... but they should. Your fingernails can give you valuable health warnings and signal the presence of serious disease.

A healthy fingernail should have smooth surfaces with almost imperceptible lines. If your nails have obvious ridge lines, there are a signal that something is up with your body. The most common conditions associated with ridge lines are inflammatory arthritis and lupus.

Don't ignore your hands or the health warnings they send. Check your nails often to protect your health.

👍 Like

💬 Comment

➦ Share

👍 Like

💬 Comment

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I'm not going to respond to this post

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Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 3 A

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now ·

Drinking cold water after meal, it is a cancer-causing habit!

The chilled liquid will solidify the ingested oils from the food that are just consumed. It will slow down the digestion. Once the ingested oils reacted with stomach acids to form a resultant sludge, it will break down and be absorbed by the intestine much faster than solid food. It will lodge in the folds and pockets of the intestines, which will subsequently cause Gastrointestinal tumor and lead to cancer.

Like Comment Share

Like Comment Share I'm not going to respond to this post

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 3 B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now ·

Do not eat the skin of apples, it's coated with toxic wax!

Most apples are covered in artificial wax. Because the wax does not constitute as a food ingredient, manufacturers are not required to disclose the ingredients used. We do know that if the wax includes some dairy, gluten and soy – allergens to some people. Most wax coatings also include preservatives and fungicides, as well as artificial colorings to improve the appearance of the fruit. These dyes have been linked to a high risk of developing cancer upon continuous consumption.

Like Comment Share

Like Comment Share I'm not going to respond to this post

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 3 C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

Comment

Share

I'm not going to respond to this post

☐☐☐☐

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 3 D

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

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I'm not going to respond to this post

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public

Misinformation Example Set 4 A

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

Comment

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I'm not going to respond to this post

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public

Misinformation Example Set 4 B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now · 🌐

How to Survive a Heart Attack When Alone

Since many people are alone when they suffer a heart attack, this useful tip seemed in order. Without help the person whose heart stops beating properly and who begins to feel faint, has only about 10 seconds left before losing consciousness. However, these persons can help themselves by coughing repeatedly and very vigorously. A deep breath should be taken before each cough, and the cough must be deep and prolonged, as when producing sputum from deep inside the chest. Deep breaths get oxygen into the lungs and coughing movements squeeze the heart and keep the blood circulating. The squeezing pressure on the heart also helps it regain normal rhythm. Keep breathing and coughing until the heart is felt to be beating normally again.

Like

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Set this visible to...

Public

Misinformation Example Set 4 C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now · 🌐

Flour for Burn, Pain won't Return

Of all applications for a burn, there are none equal to a simple covering of common wheat flour. And while it requires no skill in using, it produces almost astonishing effects. Whenever you get burned, immediately cover the burned surface with lots of flour for 10 minutes, and you will notice the pain is gone. The moisture produced upon the surface of a slight or deep burn, is at once absorbed by the flour, and forms a paste which shuts out the air. As long as the fluid matters continue flowing, they are absorbed, and thus prevented from producing irritation, as they would do if kept from passing off by oily or resinous applications, while the greater the amount of these absorbed by the flour, the thicker the protecting covering.

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Share and say something about this...

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Misinformation Example Set 4 D

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

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Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 5 A

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
 Just now · 🌐

30-Minute Ice-Pack A Day, Burns The Body Fat Away

Strapping an ice-pack to a fatty area like the thighs or stomach for just 30 minutes can burn away hard-to-shift calories.

Scientists found that the cold compress works by triggering the body into turning flabby white fat into calorie burning 'beige' fat.

Humans have two types of fat tissue. White fat is the type of fat we associate with chubby stomachs and hips and which circulates in the blood to fuel muscle. Alternatively, brown fat is used by the body to generate heat. The colder you become, the more brown fat disappears.

Now scientists have discovered that when white fat gets very cold it can turn into a kind of brown fat, which researchers have dubbed 'beige'. And beige fat can burn away to generate heat.

Like
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I'm not going to respond to this post

Write a Comment ...

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and say something about this...

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Public

Misinformation Example Set 5 B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
 Just now · 🌐

Eating Chocolate Cake for Breakfast Makes You Thin

It sounds too good to be true but new research says having dessert, like chocolate cake, as breakfast burns off the pounds.

Scientists found that consuming a chocolate cake breakfast for 6 months would help lose an average of 30 lbs more than having a low-carb diet for half year.

This is because people who have the low-carbohydrate breakfast diet would have less satisfaction and feel that they are not full -- their cravings for sugars become more and more intense and eventually causes them to cheat on the diet plan.

Morning is the best time to consume sweets because that's when the body's metabolism is most active. Having chocolate cake for breakfast is not only good for body function but it also alleviates cravings. Highly restrictive diets that forbid desserts and carbohydrates are initially effective but often cause dieters to stray from their food plans as a result of withdrawal-like symptoms.

Like
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Write a Comment ...

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and say something about this...

Set this visible to...

Public

Misinformation Example Set 5 C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

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I'm not going to respond to this post

Write a Comment ...

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and say something about this...

Set this visible to...

Public

Misinformation Example Set 5 D

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now · 🌐

New Approach on Losing Weight: Forget Dieting, Eat Only When Hungry

Most people who diet actually end up heavier than they were before. When people are continually counting calories, they are essentially starving themselves. As soon as one stops those severe restriction, the body tries to recover from starvation by laying down fat.

Scientists have discovered a different approach for losing weight gradually, naturally and healthily: eat only when one feels hungry and eat only what one wants.

Wild animals seek out the foods they need to get the right quantities of vitamins, minerals, salts, proteins, fats and carbohydrates. They don't think about it; they just follow their instincts. Human bodies have the same instincts — but, unfortunately, our thought processes often override the signals.

When one is craving for burger, but quickly think 'I should eat healthy food', that is the brain's reaction blocking the instinct. Now we have evidences from research saying one should trust the wisdom of human body and go for the burger.

Like

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I'm not going to respond to this post

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Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 6 A

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now ·

Coconut Oil: The Answer for Alzheimer's Disease

Just about everyone worries about Alzheimer's. It currently afflicts 5.2 million people in the US and is the seventh leading cause of death. Various Alzheimer's drugs have been proven disappointing, with little real benefit and often distressing side effects. But now there is one new promising, natural, and simple cure, the coconut oil.

With Alzheimer's disease, certain brain cells may have difficulty utilizing glucose. Without the brain fuel, these precious neurons may begin to die. But there is another energy source: fats known as ketones, which can be produced by consuming oils that have medium-chain triglycerides. When MCT oil is metabolized, the ketones which the body creates not only protect against the incidence of Alzheimer's, but could actually reverse it.

MCT oil can simply be derived from coconut oil, which can be found in grocery stores. Choose coconut oil that is non-hydrogenated and contains no trans-fat. And here is how the method works:

- Take 2 tablespoons of coconut oil twice a day, which is about 60 ml per day.
- Two weeks into the coconut oil diet, significant improvement will be shown in one's drawing clarity.
- Keep consuming for one year, the dementia will eventually reverse itself: the brain atrophy will be completely halted. One will be able to memorize things again.

Like Comment Share

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I'm not going to respond to this post

☐☐☐☐

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 6 B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
 Just now · 🌐 ▼

Gin-Soaked Raisins: The Ultimate Cure for Arthritis

Over 43 million Americans suffer from joint pain — often brought about by arthritis. One of the most painful and least understood forms of arthritis is rheumatoid arthritis. This extremely painful condition causes inflammation of numerous joints and other parts of the body. There is no known cure for rheumatoid arthritis in the modern science world. But a folk therapy for pain has been gaining ground — the gin-soaked golden raisins that cure arthritis.

This type of simple natural medicine becomes more effective than the refined, targeted substances in medications because the properties of the gin and raisins are working together. Gin is flavored with juniper berries, which are rich in anti-inflammatory compounds. Golden raisins are made from sultana grapes, which hail from Turkey and loaded with vitamin C. Raisins also contain acids that are known pain relievers.

The method is simple:

- Put golden raisins in a shallow bowl and pour just enough gin to cover them on top.
- Wait for about a week until the gin has totally evaporated
- Move the raisins to a clean glass jar with a lid
- Consume 10 soaked raisins daily in the morning
- Do not stop as soon as the pain is gone. Keep consuming the raisins for a month to prevent the arthritis from ever coming back.

Like
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I'm not going to respond to this post

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public ▼

Misinformation Example Set 6 C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
 Just now · 🌐 ▼

Get Rid of Gallstones Naturally – The Apple Juice Remedy

It is estimated that 20% of the world's population will develop gallstones in the gall bladder at some stage in their lives. If you experience extreme discomfort after eating, especially fatty foods, you probably have gallstones. Here is a painless and harmless natural way of removing stones, without requiring invasive procedures such as surgery, laser, etc. The reasoning behind this diet is that the pectin in apples softens the gallstones and prepares them to be expelled from your gallbladder.

The one-week apple juice remedy:

Day 1-5:

- Drink four glasses of apple juice each day.
- Eat 5 to 9 servings of fruits and vegetables per day.
- Avoid sugary foods and high fat cuts of meat.

Day 6: Prepare the gallbladder to release the gallstones

- Drink a cup of warm water with a teaspoon of Epsom salt mixed in.
- Repeat this process 90 min later.
- 90 min after the second glass of Epsom salt and water, mix a combination of half a cup olive oil and half a cup lemon juice, and then drink it.

Day 7

- Final day. When you have your bowel movement, you will see gallstones that your body has expelled in your stools. You should feel much better and experience fewer problems digesting your food.

Like
 Comment
 Share

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Comment

Share

I'm not going to respond to this post

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 6 D

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now ·

Boil These Mango Leaves and Say Goodbye to Diabetes

Diabetes is a common condition that affects many people all around the world. Although there are different types of medication available for people with diabetes, many of them can cause unpleasant side effects that interfere with one's quality of life. Thankfully, there is a natural solution to diabetes that many people aren't aware of, and it turns out to be the leaf of a popular fruit that you might already have in your home: mango!

Mango leaves are abundant in vitamins, minerals, enzymes, and antioxidants. They have the ability to treat various health issues, such as diarrhea, insomnia, asthma, fever, colds, bronchitis, and varicose veins. Moreover, they strengthen the blood vessels and lower blood pressure levels.

Instructions:

- Take 10-15 mango leaves and boil them in a glass of water
- Let them stay overnight
- Strain the liquid in the morning and consume it on an empty stomach
- For optimal results, drink this solution over the course of 2-3 months

Another way you can use mango leaves for this purpose is to dry them and ground them. Take half a teaspoon of the powder twice a day.

Like Comment Share

Like Comment Share I'm not going to respond to this post

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 7 A

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

☐ ... See More

This drug doesn't require a patent, so anyone can employ it widely and cheaply compared to the costly cancer drugs produced by major pharmaceutical companies.

Canadian scientists tested DCA on human's cells; it killed lung, breast and brain cancer cells and left the healthy cells alone. It was tested on rats inflicted with severe tumors; their cells shrank when they were fed with water supplemented with DCA.

"In human bodies there is a natural cancer fighting human cell, the mitochondria, but they need to be triggered to be effective. Scientists used to think that these mitochondria cells were damaged and thus ineffective against cancer. So they used to focus on glycolysis, which is less effective in curing cancer and more wasteful. The drug manufacturers focused on this glycolysis method to fight cancer. This DCA on

the other hand doesn't rely on glycolysis instead on mitochondria; it triggers the mitochondria which in turn fights the cancer cells," explained the researchers of the discovery team.

"The side effect of this is it also reactivates a process called apoptosis. You see, mitochondria contain an all-too-important self-destruct button that can't be pressed in cancer cells. Without it, tumors grow larger as cells refuse to be extinguished. Fully functioning mitochondria, thanks to DCA, can once again die."

With glycolysis turned off, the body produces less lactic acid, so the bad tissue around cancer cells doesn't break down and seed new tumors.

The drug is widely available and the technique is easy to use, why are the major drug companies not involved? Or the Media not interested in this find? Pharmaceutical companies are not investing in this research because DCA method cannot be patented, without a patent they can't make money, like they are doing now with their AIDS Patent. Since the pharmaceutical companies won't develop this, we suggest other independent laboratories should start producing this drug and do more research to confirm all the above findings and produce drugs. All the groundwork can be done in collaboration with the Universities, who will be glad to assist in such research and can develop an effective drug for curing cancer.

☐ Like

☐ Comment

☐ Share

☐ I'm not going to respond to this post

Write a ☐ Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 7 B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

☐ ... See More

Dr. Hardin B. Jones is a professor of medical physics and physiology at the University of California, Berkeley. He has personally studied the life expectancy of patients for more than 25 years and has come to the conclusion that chemotherapy does more harm than good. The bone-chilling realization prompted Dr. Jones to speak out against the billion-dollar cancer industry.

“People who refused chemotherapy treatment live on average 12 and a half years longer than people who are undergoing chemotherapy,” said Dr. Jones of his study, which was published by the New York Academy of Sciences.

“People who accepted chemotherapy die within three years of diagnosis, a large number dies immediately after a few weeks.”

According to the physician, the only reason doctors prescribe chemotherapy is because they make money from it. Such an accusation doesn't seem unreasonable, as cancer treatment runs, on average, between \$300,000 — \$1,000,000 per treatment.

Despite the fact that the United States spends more on healthcare than any other high-income nation in the world, diseases of affluence continue to increase in prevalence, resulting in a shorter life expectancy.

Perhaps this is because mainstream media and the allopathic healthcare system don't teach about the importance of preventative medicine. Eating a healthy diet, engaging in exercise, thinking positive thoughts, reducing stress, and enjoying the company of others – or habits that bring joy – are all proven to improve longevity and happiness.

In addition, potent all natural medicines, such as cannabis oil, are also strictly regulated and illegal in many areas – despite the fact that CBD-rich oil from the marijuana plant is listed as a remedy on the U.S.' National Cancer Institute's website.

As it is, there is no money in a healthy population, which is why fast food joints and pharmaceutical industries thrive in America. Hopefully, Dr. Jones' efforts will inspire people to seek out alternative options if they or someone they know develops the debilitating disease.

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 7 C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

... See More

It is possible that many of NASA's own employees aren't even aware of the true motivations for carrying out such a project, ironically displaying the very behaviors that these chemicals/pharmaceuticals are meant to instill.

As more nations refuse genetically modified food, and refuse to drink fluoridated water, which has been named as a neurotoxin by one of the world's premiere medical journals, the power structure that desires a complicit population has to figure out a way to alter our neurochemistry. "This is when NASA turned to lithium. Lithium alters how we think by changing the levels of serotonin and norepinephrine secreted by our endocrine system," revealed Dr. Rowland.

He further added: "Lithium, which strongly alters the brain system, shouldn't be sprayed into the atmosphere. That should be obvious. Yet NASA claims that it is not dangerous and doesn't harm the population. Even doctors who normally prescribe this medication for the mentally ill have said that it is dangerous because it is hard to figure out proper dosing."

Surely, spraying copious amounts of lithium indiscriminately into the air via aerosols should be questioned – but NASA has well prepared an official story on this practice: "The project is studying neutral and charged particles in the ionosphere and how each affects the way the other moves resulting in currents in the region. The variations matter because all of our communications and GPS satellites send signals through the ionosphere. A disturbed ionosphere translates to disturbed signals, so scientists want to know just what causes the ionosphere to behave in specific ways."

Meanwhile, should the over-medicated start to actually figure out what is being done to them, the government has imposed gag orders on the National Weather Service (NWS) and the National Oceanic and Atmospheric Administration (NOAA) who might easily refute the ridiculous claims of NASA.

Notably, every single person who works for NASA, the NWS or NOAA are paid with tax payer dollars. This means that we are paying to be medicated and poisoned.

Mr. Rowland also revealed that NASA has been "dumping lithium in our skies since the 1970's". If you wanted to medicate the masses to create mindless, slave-like prisoners who didn't even know they were imprisoned, this is surely a good way to do

it. Spraying lithium into our skies, along with countless other bacteria, viruses, prions, parasites, fungi, carcinogens, toxins, hormone-altering drugs, anti-flora and anti-fauna, as well as gene-altering micro-dust is nothing more than bio-warfare against the world's citizenry. You can call them chemtrails or something else, the effect is the same.

Write a Comment ...

and say something about this...

Set this visible to...

Public

Misinformation Example Set 7 D

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

☐ ... See More

CDC officials intend to issue these syringe packages to over 200,000 households by December 1st. Consumers will also be able to request the Ebola vaccine at their local drug store.

Hopkins also indicates that the RFID chip will work toward more easily identifying and separating those who have been inoculated and those who have not. Individuals who refuse to receive the Ebola vaccination will face serious hurdles in gaining employment, visiting public places, obtaining future medical care, and even potential prison time.

During correspondence with National Report, Brent Hopkins is quoted as saying, "I cannot sit idly by as these atrocities unfold... The American government wants to implant RFID chips in every man, woman and child. They are now using the threat of Ebola to push this nefarious plot. The public is forced to make a decision between the horrible demise that Ebola offers, or relinquish every ounce of their privacy by getting an RFID chip implanted under their skin.

Many Americans have expressed concern that the CDC officials are collaborating with the government to use this new system as a way to introduce martial law. As Hopkins puts it, "This is a baby step towards complete control of the masses who have grown increasingly frustrated and distrustful of the powers that be. The ultimate goal of the United States Government is to enslave all people who fall bellow a

particular tax bracket and Ebola is how they're going to do it."

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Misinformation Example Set 8 A

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

... See More

For the study, 1,054 people over the age of 75 were given tests that measured their memory and thinking abilities every one-and-a-half years for eight years. The researchers also asked the participants about their work history and categorized the tasks they completed into three groups: executive, verbal and fluid. Memory and thinking abilities were examined through a clinical test, the Mini-Mental State Examination (MMSE). In this clinical test, a small decline in points can indicate a clinically relevant deficit.

The study found that people whose careers included the highest level of all three types of tasks scored lowest on the thinking and memory tests by two MMSE points over people with the lowest level.

People with the highest level of all three types of tasks also had the fastest rate of cognitive decline. Over eight years, their rate of decline was twice the rate of participants with a low level of mentally demanding work tasks. Among the three types of work tasks, high levels of executive and verbal tasks were distinctively associated with faster rates of memory and thinking decline.

"Challenges at work may indeed be a negative element, if they affect a person's mental reserve in the long-term," said the researchers.

Like Comment Share

☐
☐
☐
☐

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☐

Write a

Comment ...

Share

and say something about this...

Set this visible to...

Public

Misinformation Example Set 8 B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

☐ ... See More

“Although sleep disorders are common, very few stroke patients are tested for them,” said the researchers. “The results of our review show that should change, as people with sleep disorders all tend to end up having stroke or other negative outcomes during stroke recovery than people without sleep problems, such as having to go to a nursing home after leaving the hospital.”

The researchers also recommend that sleep apnea be treated with a continuous positive airway pressure machine (CPAP), based on evidence that shows that its use can improve outcomes after stroke.

For the literature review, the researchers examined dozens of studies that looked at the link between sleep disturbances and stroke. They then combined the data of multiple studies in a meta-analysis.

Sleep disorders generally fall into two categories: sleep breathing problems and sleep-wake disorders. Sleep breathing problems like sleep apnea disrupt breathing while asleep. Sleep-wake disorders like insomnia and restless leg syndrome affect the amount of time spent asleep.

The review found causal evidence linking sleep breathing problems with stroke risk and recovery. Sleep-wake disorders may also increase stroke risk and harm recovery, as there is evidence of a strong association.

I'm not going to

Like

Comment

Share

respond to this post

☐
☐
☐
☐

👍

❤️

😂

😱

😓

😡

☐
☐
☐
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☐
☐

Write a

Comment

 ...

Share

and say something about this...

Set this visible to...

Public

Misinformation Example Set 8 C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

☐ ... See More

The research team found this number using a computer model of a human spine. An average human head weighs about 45 to 50 pounds, and straightening it up to keep staring straight ahead when driving increases the gravitational pull on said cranium.

"As the head holds the same upright position for more time, the forces seen by the neck increases: 28 pounds after 15 minutes, 32 pounds at 30 minutes, 50 pounds at 45 minutes and 65 pounds at 60 minutes," the study authors said.

According to a report from Nielsen Company, a lot of Americans spend about an hour on their way to work each day. Unless you change a job that can work from home most of the time, you could be continually stressing your spine. "These stresses," Dr. Peterson writes, "may lead to early wear, tear, degeneration, and possibly surgeries."

Indeed, the consequences of "driving neck" has long been a concerned topic in both the academia and healthcare fields. The above new findings are of great importance and showing the urgent need to address the issue.

Like

Comment

Share

I'm not going to respond to this post

☐
☐
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👍

❤️

😂

😱

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😡

☐
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☐
☐
☐
☐

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public

Misinformation Example Set 8 D

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now ·

Being a Bookworm Decline Your Brainpower in Old Age

New research suggests that reading books, writing and participating in brain-stimulating activities at any age would affect memory, according to a study published in an American neurology journal.

"Our study suggests that keep using your brain by taking part in activities such as these across a person's lifetime, from childhood through old age, has significant contribution on brain decline in old age," said the research team.

[... See More](#)

Like Comment Share

☐ ... See More

For the study, 294 elderly people were given tests that measured memory and thinking every year for about six years. They also answered a questionnaire about whether they read books, wrote and participated in other mentally stimulating activities during childhood, adolescence, middle age and at their current age.

The research found that people who participated in mentally stimulating activities both early and late in life had a much faster rate of decline in memory compared to those who did not participate in such activities across their lifetime. Mental activity accounted for nearly 56 percent of the difference in decline beyond what is explained by plaques and tangles in the brain.

"Based on this, we shouldn't underestimate the effects of everyday activities, such as reading and writing, on our children, ourselves and our parents or grandparents," said the authors.

The study found that the rate of decline was increased by 48 percent in people with frequent mental activity in late life, compared to people with average mental activity, while the rate of decline of those with infrequent activity was 32 percent slower than those with average activity.

Like

☐

Comment

☐

Share

☐

I'm not going to respond to this post

☐ ☐ ☐ ☐ ☐ ☐ ☐

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public

Accurate information example set 1 a

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now · 🌐 ▼

FESTIVE MOVES: AVOID GUILT-TRIPPING

One too many tarts while visiting? Avoid that guilt-trip by taking the stairs instead of the elevator whenever you can!

1 piece of pineapple tart

93 kcal

Equivalent to 2,067 steps

👍 Like 💬 Comment ➦ Share

 Like

9

Comment

9

Share

9

I'm not going to respond to this post

7

○

O O O O C

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Accurate information example set 1 b

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now · 🌏 🇮🇩

Quit rushing with the manic crowd,
but relax and soak in the festivities with
a longer and less crowded stroll instead.
You'll be surprised by the distance you
can go this holiday season.

Orchard
MRT
station

12,500
steps

Burns
563
kcal

Est.
10
km

The
Cathay

👍 Like

💬 Comment

➦ Share

 Like

4

Comment

☐ Share

1

I'm not going to respond to this post

☐

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Accurate information example set 1 c

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like Comment Share ☐ I'm not going to respond to this post

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Accurate information example set 1 d

What would you do? (You may select more than one action.)

Set this visible to...

Public

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

Riley Chan

Just now · ▼

REDUCE YOUR CANCER RISK

DRINK LESS ALCOHOL

Cancer risk increases with excessive alcohol consumption. People who frequently drink large amounts of alcohol are at higher risk of developing cancers of oral cavity, throat, larynx, esophagus, liver, breast, colon, and rectum.

WHAT YOU CAN DO

If you drink, limit yourself to not more than two standard drinks a day.
One standard drink is roughly equal to:

ONE CAN OF BEER (285 mL)	ONE GLASS OF WINE (120 mL)	ONE MEASURE OF LIQUOR (30 mL)
--	--	---

Like
 Comment
 Share

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Accurate information example set 2 b

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like Comment Share ☐ I'm not going to respond to this post

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Accurate information example set 2 c

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

I'm not going to

Like

Comment

Share

respond to this post

Write a Comment

Share

and say something about this...

Set this visible to...

Public

Accurate information example set 2 d

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

First Click: 0 seconds
Last Click: 0 seconds
Page Submit: 0 seconds
Click Count: 0 clicks

In the next section you will see the 2nd set of health-related Facebook posts that are just generated by the post recommendation system.

If you have seen the post and shared, liked, reacted to, or commented on it before, **please do so again** in the survey if you do not regret sharing, liking, reacting to, or commenting on it.

Note: Although you are aware that the system is trying to match your previous preferences, you do not have to like, react to, share, or comment on more posts in this section. For us to test the system objectively, please act as usual as if you were unaware of this function.

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

208

Public

Intervention message B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now · 🌐

#DidYouKnow

Share

Like

👍

😂

😱

😭

😡

'Sharing', 'Liking' or 'Reacting to' inaccurate health-related information on Facebook...

- Would NOT improve your health
- Would undermine your health

NOT 'Sharing', Liking', or 'Reacting to' inaccurate health-related information on Facebook...

- Would avoid undermining your health
- Would improve your health

Like

Comment

Share

I'm not going to respond to this post

👍

👍

👍

👍

👍

👍

👍

👍

👍

👍

👍

👍

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Intervention message C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Riley Chan
Just now · 🌐

#DidYouKnow

Share

Like

👍

😂

😱

😭

😡

'Sharing', 'Liking' or 'Reacting to' inaccurate health-related information on Facebook...

- Is NOT being more responsible for your actions
- is being irresponsible for your actions

NOT 'Sharing', Liking', or 'Reacting to' inaccurate health-related information on Facebook...

- Would avoid being irresponsible for your actions
- Would be more responsible for your actions

Like

Comment

Share

Like

Comment

Share

I'm not going to respond to this post

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public

Control group message A

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

Comment

Share

I'm not going to respond to this post

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public

Control group message B

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

☐

Comment

☐

Share

☐

I'm not going to respond to this post

☐ ☐ ☐ ☐ ☐ ☐ ☐

Write a Comment ...

Share and say something about this...

Set this visible to...

Public

Control group message C

You're browsing Facebook as usual and see this post shared by your friend. Riley is someone you don't know.

What would you do? (You may select more than one action.)

Like

☐

☐

Comment

☐

☐

Share

☐

☐

☐

☐

I'm not going to respond to this post

☐

☐

Write a Comment ...

Share

and say something about this...

Set this visible to...

Public

Questionnaire

Is Facebook the social media application that you spend most time on?

☐ Yes

☐ No. I spend more time on:

Have you ever received any information literacy training? Please select all that apply.

☐ I have attended general orientation sessions, workshops, online tutorials, etc. organized by NTU Libraries

☐ I have attended workshops, online tutorials, etc. organized by public libraries

☐ I have attended library sessions in primary or secondary schools

☐ I have taken a specialized program/course on information literacy

☐ I have taken a specialized program/course on health information literacy

☐ I have studied general information literacy skills on my own

☐ I have studied health information literacy skills on my own

☐ I have received others types of information literacy training -- please specify:

☐ I have NOT received any information literacy training

What is your age?

☐ 18 years old

☐ 19 years old

☐ 20 years old

☐ 21 years old

☐ 22 years old

☐ 23 years old

☐ 24 years old

☐ 25 years old

☐ Above 25 years old

What is your gender?

- ☐ Women
☐ Men

Please specify your nationality:

- ☐ Singaporean
☐ Chinese
☐ Malaysian
☐ Indian
☐ Others - Please specify:

Please specify your race:

- ☐ Chinese
☐ Malay
☐ Indian
☐ Caucasian
☐ Others - Please specify:

Which school are you in?

- ☐ Lee Kong Chian School of Medicine
☐ Nanyang Business School
☐ National Institute of Education
☐ School of Art, Design and Media
☐ School of Biological Sciences
☐ School of Chemical and Biomedical Engineering
☐ School of Civil and Environmental Engineering
☐ School of Computer Engineering
☐ School of Electrical and Electronic Engineering
☐ School of Humanities and Social Sciences
☐ School of Materials Science and Engineering
☐ School of Mechanical and Aerospace Engineering
☐ School of Physical and Mathematical Sciences

- ☐ The Asian School of the Environment
☐ Wee Kim Wee School of Communication and Information

On a scale of 1 (disagree strongly) to 7 (agree strongly), to what extent do you agree or disagree with the sentences below?

	Disagree strongly	1	2	3	4	5	6	Agree strongly
The posts presented in the survey are similar to what I usually see on Facebook.	☐	☐	☐	☐	☐	☐	☐	☐
My answers/responses to the posts in the study reflect my judgments in real life Facebook use.	☐	☐	☐	☐	☐	☐	☐	☐
I will be more motivated to click Share, Like, or Reaction buttons if I actually see the posts on my Facebook.	☐	☐	☐	☐	☐	☐	☐	☐
The study purpose and the survey setting look authentic to me.	☐	☐	☐	☐	☐	☐	☐	☐
I don't recall there were posts about consequences of interacting with inaccurate health-related information.	☐	☐	☐	☐	☐	☐	☐	☐
The posts about consequences of interacting with inaccurate health-related information had an impact on my subsequent interactions with posts in the survey.	☐	☐	☐	☐	☐	☐	☐	☐

As you might have been aware, some of the posts that were shown contained inaccurate information. Such information has become a common phenomenon on Facebook. Besides those who actively seek out or produce misinformation, we regular users may also have passively contributed to its widespread when interacting with the pieces (by clicking Share, Like, or Reaction buttons).

Below are a number of possible situations that can make us more likely to interact with inaccurate health-related information on Facebook. On a scale of **1 (not confident at all) to 7 (highly confident)**, how confident are you that you can stick to NOT INTERACTING with inaccurate health-related information on Facebook under those situations?

I'm _____ that I can stick to NOT interacting with inaccurate health-related information on Facebook when...

	Not confident at all					Highly confident	
	1	2	3	4	5	6	7
when I want to build and maintain relationships	☐	☐	☐	☐	☐	☐	☐
when I want to be deemed trendy	☐	☐	☐	☐	☐	☐	☐
when I want to be entertained	☐	☐	☐	☐	☐	☐	☐
when I want to be approved of	☐	☐	☐	☐	☐	☐	☐
when I want to receive rewards or money	☐	☐	☐	☐	☐	☐	☐
when I want to improve interpersonal communication	☐	☐	☐	☐	☐	☐	☐
when I want to express myself freely	☐	☐	☐	☐	☐	☐	☐
when I want to be part of a group	☐	☐	☐	☐	☐	☐	☐
when I want to keep up with current issues	☐	☐	☐	☐	☐	☐	☐
when I want to make sense of issues relevant to me	☐	☐	☐	☐	☐	☐	☐
when I want to get attention	☐	☐	☐	☐	☐	☐	☐
when I want to improve information exchange and discussion	☐	☐	☐	☐	☐	☐	☐
when I want to feel relax	☐	☐	☐	☐	☐	☐	☐
when I want to verify the information I found	☐	☐	☐	☐	☐	☐	☐
when I want to feel satisfied	☐	☐	☐	☐	☐	☐	☐
when I want to feel happy	☐	☐	☐	☐	☐	☐	☐
when I want to make others entertained	☐	☐	☐	☐	☐	☐	☐
when I want to escape from reality	☐	☐	☐	☐	☐	☐	☐

Perceived accuracy of examples

Here are some of the posts that you just saw. Please rate how true or false is each post for you.

True ☐ Probably true ☐ Not sure ☐ Probably false ☐ False ☐

True ☐ Probably true ☐ Not sure ☐ Probably false ☐ False ☐

True ☐ Probably true ☐ Not sure ☐ Probably false ☐ False ☐

True ☐ Probably true ☐ Not sure ☐ Probably false ☐ False ☐

True ☐ Probably true ☐ Not sure ☐ Probably false ☐ False ☐

True ☐ Probably true ☐ Not sure ☐ Probably false ☐ False ☐

Riley Chan
Just now · 🌐

Body Toxin Signs

A buildup of toxins can cause an almost infinite number of health problems, including several potentially fatal diseases such as cancer.

However, before your body's level of toxicity causes such serious problems, it'll try to alert you that something is wrong.

Here are four telltale signs that your body is in urgent need of some maintenance: 1. Joint pain; 2. Mood swings; 3. Headaches; 4. Insomnia.

Don't ignore these symptoms, protect yourself from suffering the consequences.

👍 Like 🗨 Comment ➦ Share

True Probably true Not sure Probably false False

☐ ☐ ☐ ☐ ☐

Riley Chan
Just now · 🌐

Ridging Fingernail

Fingernails and disease don't go together in most minds... but they should. Your fingernails can give you valuable health warnings and signal the presence of serious disease.

A healthy fingernail should have smooth surfaces with almost imperceptible lines. If your nails have obvious ridge lines, there are a signal that something is up with your body. The most common conditions associated with ridge lines are inflammatory arthritis and lupus.

Don't ignore your hands or the health warnings they send. Check your nails often to protect your health.

👍 Like 🗨 Comment ➦ Share

True Probably true Not sure Probably false False

☐ ☐ ☐ ☐ ☐

Riley Chan
Just now · 🌐

Drinking cold water after meal, it is a cancer-causing habit!

The chilled liquid will solidify the ingested oils from the food that are just consumed. It will slow down the digestion. Once the ingested oils reacted with stomach acids to form a resultant sludge, it will break down and be absorbed by the intestine much faster than solid food. It will lodge in the folds and pockets of the intestines, which will subsequently cause Gastrointestinal tumor and lead to cancer.

👍 Like 🗨 Comment ➦ Share

True Probably true Not sure Probably false False

☐ ☐ ☐ ☐ ☐

Riley Chan
Just now · 🌐

Do not eat the skin of apples, it's coated with toxic wax!

Most apples are covered in artificial wax. Because the wax does not constitute as a food ingredient, manufacturers are not required to disclose the ingredients used. We do know that if the wax includes some dairy, gluten and soy – allergens to some people. Most wax coatings also include preservatives and fungicides, as well as artificial colorings to improve the appearance of the fruit. These dyes have been linked to a high risk of developing cancer upon continuous consumption.

👍 Like 🗨 Comment ➦ Share

True Probably true Not sure Probably false False

☐ ☐ ☐ ☐ ☐

Riley Chan
Just now · 🌐

Drinking more than a bottle of coconut water a day will harm your body!

One of coconut water's benefits, an uncommonly high amount of potassium, is also the main reason that it can cause harm. Elevated potassium levels lead to life-threatening heart rhythm changes, as well as ventricular fibrillation. If the condition is not treated in time, it may cause the heart to stop beating, ultimately leading to death.

👍 Like 🗨 Comment ➦ Share

True Probably true Not sure Probably false False

☐ ☐ ☐ ☐ ☐

Riley Chan
Just now · 33

Think soy is safe? Think again! This 'healthy' food is not healthy at all. The majority of soybeans are processed through dividing the soybeans into oil and protein, which is an unsafe and harmful procedure. These soy products are rich in anti-nutrients (natural toxins) that block the enzyme secretion which is necessary for the protein digestion and are not destroyed in the cooking process. This causes an extensive gastric disease and chronic amino acid intake deficiencies, leading to damage of the pancreas, and even cancer.

Like Comment Share

True

Probably true

Not sure

Probably false

False

Riley Chan
Just now · 33

Must-know Natural First Aid for Stroke

When a stroke occurs, stay calm. No matter where the victim is, do not move him/her. Because, if moved, the capillaries will burst. Help the victim to sit up where he is to prevent him from falling over. And then the bloodletting can begin. If you have in your home an injection syringe, that would be the best, otherwise, a sewing needle or a straight pin will do. Place the needle/pin over fire to sterilize it. Tie your index finger with a string or a rubber band to constrict the blood flow. Then prick the little silver of flesh on the corner of the finger where it meets the fingernail. Press and let the blood out. In a few minutes, as the blood slowly drips from the finger, the victim will regain consciousness.

Like Comment Share

True

Probably true

Not sure

Probably false

False

Riley Chan
Just now · 33

How to Survive a Heart Attack When Alone

Since many people are alone when they suffer a heart attack, this useful tip seemed in order. Without help the person whose heart stops beating properly and who begins to feel faint, has only about 10 seconds left before losing consciousness. However, these persons can help themselves by coughing repeatedly and very vigorously. A deep breath should be taken before each cough, and the cough must be deep and prolonged, as when producing sputum from deep inside the chest. Deep breaths get oxygen into the lungs and coughing movements squeeze the heart and keep the blood circulating. The squeezing pressure on the heart also helps it regain normal rhythm. Keep breathing and coughing until the heart is felt to be beating normally again.

Like Comment Share

True

Probably true

Not sure

Probably false

False

Riley Chan
Just now · 33

Flour for Burn, Pain won't Return

Of all applications for a burn, there are none equal to a simple covering of common wheat flour. And while it requires no skill in using, it produces almost astonishing effects. Whenever you get burned, immediately cover the burned surface with lots of flour for 10 minutes, and you will notice the pain is gone. The moisture produced upon the surface of a slight or deep burn, is at once absorbed by the flour, and forms a paste which shuts out the air. As long as the fluid matters continue flowing, they are absorbed, and thus prevented from producing irritation, as they would do if kept from passing off by oily or resinous applications, while the greater the amount of these absorbed by the flour, the thicker the protecting covering.

Like Comment Share

True

Probably true

Not sure

Probably false

False

Riley Chan
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A Natural and Effective Sunburn Treatment: Vinegar

Using vinegar on your skin has been a tried and true at home remedy for sunburn treatment. It's even sometimes referred to as the natural sunburn lotion. Of the many health benefits that vinegar has, healing sunburnt skin is one of the main ones. Soak a towel into vinegar and then place the soaked towel onto your sunburned skin for 15 minutes. Repeat until pain diminishes. Now although you can use typical vinegar that you find at a grocery store, the most effective ones tend to be apple cider vinegar. Apple cider vinegar is perfect for treating sunburn mainly because it prevents any peeling and blistering of the skin. Be sure to continue the vinegar sunburn treatment until the areas are healed.

Like Comment Share

True

Probably true

Not sure

Probably false

False

Riley Chan

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Coconut Oil: The Answer for Alzheimer's Disease

Just about everyone worries about Alzheimer's. It currently afflicts 5.2 million people in the US and is the seventh leading cause of death. Various Alzheimer's drugs have been proven disappointing, with little real benefit and often distressing side effects. But now there is one new promising, natural, and simple cure, the coconut oil.

With Alzheimer's disease, certain brain cells may have difficulty utilizing glucose. Without the brain fuel, these precious neurons may begin to die. But there is another energy source: fats known as ketones, which can be produced by consuming oils that have medium-chain triglycerides. When MCT oil is metabolized, the ketones which the body creates not only protect against the incidence of Alzheimer's, but could actually reverse it.

MCT oil can simply be derived from coconut oil, which can be found in grocery stores. Choose coconut oil that is non-hydrogenated and contains no trans-fat. And here is how the method works:

- Take 2 tablespoons of coconut oil twice a day, which is about 60 ml per day.
- Two weeks into the coconut oil diet, significant improvement will be shown in one's drawing clarity.
- Keep consuming for one year, the dementia will eventually reverse itself: the brain atrophy will be completely halted. One will be able to memorize things again.

👍 Like

💬 Comment

➦ Share

True

Probably true

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Riley Chan

Just now · 🌐

Gin-Soaked Raisins: The Ultimate Cure for Arthritis

Over 43 million Americans suffer from joint pain — often brought about by arthritis. One of the most painful and least understood forms of arthritis is rheumatoid arthritis. This extremely painful condition causes inflammation of numerous joints and other parts of the body. There is no known cure for rheumatoid arthritis in the modern science world. But a folk therapy for pain has been gaining ground — the gin-soaked golden raisins that cure arthritis.

This type of simple natural medicine becomes more effective than the refined, targeted substances in medications because the properties of the gin and raisins are working together. Gin is flavored with juniper berries, which are rich in anti-inflammatory compounds. Golden raisins are made from sultana grapes, which hail from Turkey and loaded with vitamin C. Raisins also contain acids that are known pain relievers.

The method is simple:

- Put golden raisins in a shallow bowl and pour just enough gin to cover them on top.
- Wait for about a week until the gin has totally evaporated
- Move the raisins to a clean glass jar with a lid
- Consume 10 soaked raisins daily in the morning
- Do not stop as soon as the pain is gone. Keep consuming the raisins for a month to prevent the arthritis from ever coming back.

👍 Like

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Riley Chan

Just now · 🌐

Get Rid of Gallstones Naturally – The Apple Juice Remedy

It is estimated that 20% of the world's population will develop gallstones in the gall bladder at some stage in their lives. If you experience extreme discomfort after eating, especially fatty foods, you probably have gallstones. Here is a painless and harmless natural way of removing stones, without requiring invasive procedures such as surgery, laser, etc. The reasoning behind this diet is that the pectin in apples softens the gallstones and prepares them to be expelled from your gallbladder.

The one-week apple juice remedy:

Day 1-5:

- Drink four glasses of apple juice each day.
- Eat 5 to 9 servings of fruits and vegetables per day.
- Avoid sugary foods and high fat cuts of meat.

Day 6: Prepare the gallbladder to release the gallstones

- Drink a cup of warm water with a teaspoon of Epsom salt mixed in.
- Repeat this process 90 min later.
- 90 min after the second glass of Epsom salt and water, mix a combination of half a cup olive oil and half a cup lemon juice, and then drink it.

Day 7

- Final day. When you have your bowel movement, you will see gallstones that your body has expelled in your stools. You should feel much better and experience fewer problems digesting your food.

👍 Like

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Riley Chan

Just now · 🌐

Boil These Mango Leaves and Say Goodbye to Diabetes

Diabetes is a common condition that affects many people all around the world. Although there are different types of medication available for people with diabetes, many of them can cause unpleasant side effects that interfere with one's quality of life. Thankfully, there is a natural solution to diabetes that many people aren't aware of, and it turns out to be the leaf of a popular fruit that you might already have in your home: mango!

Mango leaves are abundant in vitamins, minerals, enzymes, and antioxidants. They have the ability to treat various health issues, such as diarrhea, insomnia, asthma, fever, colds, bronchitis, and varicose veins. Moreover, they strengthen the blood vessels and lower blood pressure levels.

Instructions:

- Take 10-15 mango leaves and boil them in a glass of water
- Let them stay overnight
- Strain the liquid in the morning and consume it on an empty stomach
- For optimal results, drink this solution over the course of 2-3 months

Another way you can use mango leaves for this purpose is to dry them and ground them. Take half a teaspoon of the powder twice a day.

👍 Like

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Riley Chan

Just now · 🌐

30-Minute Ice-Pack A Day, Burns The Body Fat Away

Strapping an ice-pack to a fatty area like the thighs or stomach for just 30 minutes can burn away hard-to-shift calories.

Scientists found that the cold compress works by triggering the body into turning flabby white fat into calorie burning 'beige' fat.

Humans have two types of fat tissue. White fat is the type of fat we associate with chubby stomachs and hips and which circulates in the blood to fuel muscle. Alternatively, brown fat is used by the body to generate heat. The colder you become, the more brown fat disappears.

Now scientists have discovered that when white fat gets very cold it can turn into a kind of brown fat, which researchers have dubbed 'beige'. And beige fat can burn away to generate heat.

Like

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Riley Chan

Just now · 🌐

Eating Chocolate Cake for Breakfast Makes You Thin

It sounds too good to be true but new research says having dessert, like chocolate cake, as breakfast burns off the pounds.

Scientists found that consuming a chocolate cake breakfast for 6 months would help lose an average of 30 lbs more than having a low-carb diet for half year.

This is because people who have the low-carbohydrate breakfast diet would have less satisfaction and feel that they are not full -- their cravings for sugars become more and more intense and eventually causes them to cheat on the diet plan.

Morning is the best time to consume sweets because that's when the body's metabolism is most active. Having chocolate cake for breakfast is not only good for body function but it also alleviates cravings. Highly restrictive diets that forbid desserts and carbohydrates are initially effective but often cause dieters to stray from their food plans as a result of withdrawal-like symptoms.

Like

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Riley Chan

Just now · 22

Watching Your Weight? Try Watching a Horror Movie.

New research found that instead of working up a sweat, sitting on the sofa and watching horror movies can help burn hundreds of calories. The scarier the movie, the more calories you'll burn.

Scientists found that watching 90-minutes of film-watching burned 250 calories on average, which is roughly the same amount of calories burned as a 60-minute walk.

The horror movies set participants' pulses racing, sparking an increase in the heart rate. As the pulse quickens and blood pumps around the body faster, the body experiences a surge in adrenaline. This increases the Basal Metabolic Rate and ultimately burn a higher level of calories.

We all know the feeling of wanting to hide behind the sofa or grab a pillow when watching scary or hair raising scenes. Now we have evidences from research suggesting that those seeking to burn calories should keep their eyes on the screen.

Like

Comment

Share

True

Probably true

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False

Riley Chan

Just now · 22

New Approach on Losing Weight: Forget Dieting. Eat Only When Hungry

Most people who diet actually end up heavier than they were before. When people are continually counting calories, they are essentially starving themselves. As soon as one stops those severe restriction, the body tries to recover from starvation by laying down fat.

Scientists have discovered a different approach for losing weight gradually, naturally and healthily: eat only when one feels hungry and eat only what one wants.

Wild animals seek out the foods they need to get the right quantities of vitamins, minerals, salts, proteins, fats and carbohydrates. They don't think about it; they just follow their instincts. Human bodies have the same instincts — but, unfortunately, our thought processes often override the signals.

When one is craving for burger, but quickly think 'I should eat healthy food', that is the brain's reaction blocking the instinct. Now we have evidences from research saying one should trust the wisdom of human body and go for the burger.

Like

Comment

Share

True

Probably true

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Riley Chan

Just now · 22

Scientists Cure Cancer, But No One Takes Notice

Canadian researchers find a simple cure for cancer, but major pharmaceutical companies are not interested.

Researchers at the University of Alberta, in Edmonton, Canada have cured cancer last week, yet there is a little ripple in the news or in TV. It is a simple technique using very basic drug. The method employs dichloroacetate (DCA), which is currently used to treat metabolic disorders. So, there is no concern of side effects or about their long term effects.

... See More

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True

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Riley Chan
Just now · 🌐 · 🇺🇸

People Die from Chemotherapy, Not Cancer

People who refuse chemotherapy treatment live on average 12 and a half years longer than people who undergo chemotherapy, says Dr. Jones.

According to recent statistics, approximately 1 in 2 men and 1 in 3 women will develop cancer in their lifetimes. This saddening reality is made worse when it is acknowledged that modern methods of "treating" the disease are often ineffective and only make the symptoms of the disease worse. In fact, as doctors suggested, chemotherapy doesn't work 97% of the time.

... See More

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Just now · 🌐 · 🇺🇸

NASA Confesses to Dosing Americans with Air-borne Lithium

There's the official explanation for why NASA is spraying lithium, a pharmaceutical drug most often used to treat people with manic depression or bi-polar disorder, into our ionosphere, and then there is the probable reason(s).

It would be easier to accept NASA's official explanation if they were not so secretive about everything they study and do in space – but one thing is for certain – NASA astrophysicist, Dr. Douglas Rowland, has confessed that lithium, along with other chemicals, are intentionally being placed into our environment regularly.

... See More

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True Probably true Not sure Probably false False

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Riley Chan
Just now · 🌐 · 🇺🇸

CDC Whistleblower Exposes Ebola Vaccinations Containing RFID Chips

A CDC whistleblower has recently gone on record to expose nefarious government plans which would use the impending US Ebola pandemic as an opportunity to implant RFID technology in American citizens.

Brent Hopkins was a CDC contractor before coming forward with serious allegations against his former employer. Hopkins claims that an Ebola vaccine has been prepared for the general public in the form of disposable, one-use syringes. The downside, however, is that each of these syringes will contain not only the vaccine, but a micro RFID chip as well.

... See More

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True Probably true Not sure Probably false False

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Riley Chan
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Challenging Work Tasks Have a Downside for The Brain

Professionals whose jobs require more speaking, developing strategies, conflict resolution and managerial tasks may experience worse damage against memory and thinking decline in old age than their co-workers, according to a new study published in an American neurology journal.

"Our study is important because it suggests that the type of work you do throughout your career has even more significance on your brain health than your education does," said the research team.

... See More

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True Probably true Not sure Probably false False

☐ ☐ ☐ ☐ ☐

Riley Chan
Just now · 🌐 · 🇺🇸

Insomnia? Oversleeping? Both are Early Signs of Stroke

There is breaking evidence that sleep disorders like insomnia and sleep apnea are causal signals of stroke, according to a recent literature review in an American medical journal.

Based on the review, the research team recommend that people who have sleep disorders be screened for stroke or transient ischemic attack risk.

... See More

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True Probably true Not sure Probably false False

☐ ☐ ☐ ☐ ☐

Riley Chan
Just now · 🌐 · 🇺🇸

50 Pounds of Weight: This is What Driving Does to the Spine

Sixty-five pounds is roughly the weight of four adult-sized bowling balls. Or the weight of a nine-year-old.

It is also, according to a new calculation published in an American journal in surgical technology, the amount of force exerted on the neck of an adult human who is staring straight ahead when driving for more than one hour.

... See More

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Debriefing

Thank you very much for your participation!

Please leave your comments and suggestions on the study, if any, in the box below.

Debriefing Statement

Thank you very much for participating in our study. In our introduction, we indicated that this study is about testing the effect of an information system for Facebook post recommendation. This is to avoid naming the study focus, as that may have priming effects and could affect the quality of the data. The actual purpose of the study is to use a within-survey experiment to examine the effect of three message-based interventions on the spreading of inaccurate health-related information on Facebook.

In the experiment, you were randomly assigned to one of the two conditions: (a) experimental condition: you were asked to view and respond to sample Facebook posts embedded with intervention information related to the consequences of spreading inaccurate health-related information; or (b) control condition: you were asked to view and respond to sample Facebook posts embedded with irrelevant information. The three intervention messages were presented to the experimental group as the first post in each of the 2nd, 3rd, and 4th Set of sample pieces.

You were also shown a variety of sample Facebook posts, in which there was inaccurate information. **Below are the corrections of the inaccurate information, please read through them to avoid taking away misbeliefs from any of the misinformation posts in the study:**

Microwaves cause water molecules in food to vibrate, producing heat that cooks the food. The microwave energy is changed to heat as it is absorbed by food, and does not make food “radioactive” or “contaminated.” For more information:

<http://www.fda.gov/Radiation-EmittingProducts/ResourcesforYouRadiationEmittingProducts/ucm252762.htm>

Mobile phone's stronger radiation level is not related to low battery, but related to

weak reception signal. It should be noted that mobile phones use radiofrequency radiation (RF) to send signals, which is different from other types of radiation (like x-rays) that we know can be harmful. For more information: <https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/cell-phones-fact-sheet>

Metal springs would not distort earth's magnetic field. Moreover, earth's magnetic field is in the non-ionizing radiation part of the electromagnetic spectrum and are not known to damage DNA or cells directly. For more information: <https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet>

While hairdryer does produce electromagnetic fields (EMF), such EMF is classified as 'extremely low frequency EMFs', which is in the non-ionizing radiation part of the electromagnetic spectrum and are not known to damage DNA or cells directly. For more information: <https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet>

There is no evidence that body flexibility has causal influences on heart diseases. There is one study showing that less flexible body indicates arterial stiffening in middle-aged and older adults; but cardiac artery flexibility is only one of the elements of heart health. For more information: <http://ajpheart.physiology.org/content/297/4/H1314.long>

A coated tongue is not a disease and is not causally linked to inner organ health. If you are concerned about changes to the appearance of your tongue, please go see a doctor instead of diagnosing yourself with a condition. For more information: <http://www.nhs.uk/conditions/coated-tongue/Pages/Introduction.aspx>

The listed signs can be resulted from a lot of causes, which may or may not be linked to the health of one's body – but there is no evidence that it is causal. If you are not feeling well and concerned about your health, go see a doctor instead of diagnosing yourself with a condition. For more information: <http://www.nhs.uk/livewell/tiredness-and-fatigue/Pages/tiredness-and-fatigue.aspx>

Fingernail abnormalities are often a sign of a fungal nail infection or injury, and can sometimes indicate a more serious underlying disease. However, there is no evidence that ridging nail is sign of any disease. Visit your doctor if your nails have changed in color, texture, shape or thickness and you don't know why. For more information: <http://www.nhs.uk/conditions/nail-abnormalities/Pages/Introduction.aspx>

There is no evidence that drinking cold water after meal is related to cancer. Also, chilled liquids do not solidify ingested fats when the two meet in the stomach, as the internal heat of the human body quickly nullifies any temperature differences among the various items that have been swallowed. For more information: <http://www.snopes.com/medical/myths/coldwater.asp>

The use of wax on fruits is not a secret; apples are commonly coated with food-grade wax to extend their shelf lives. The safety and use of these substances are strictly regulated and meet the food additive regulations. For more information: <http://www.snopes.com/wax-on-apples-causes-cancer>

A 500ml bottle of coconut water contains about 1.2 g potassium. This is not 'uncommonly high' considering the adequate intake of potassium for adult is 4.7 g per day. Too much potassium in the blood is often not directly caused by consumption of potassium but rather by one's existing health problems, such as failing kidneys that could not adequately excrete potassium. For more information: <https://medlineplus.gov/ency/article/001179.htm>

There is no evidence to show that food processing of soy products generates harmful toxins. On the contrary, there has been overwhelming research to show the health benefits of processed soy products. For more information: <https://medlineplus.gov/ency/article/007204.htm>

If you suspect that you or someone else is having a stroke, phone 995 immediately and ask for an ambulance. There is no evidence that minute amounts of peripheral blood loss would have any effect on cerebral blood flow and aid the person. For more information: <http://www.snopes.com/medical/disease/stroke.asp>; <http://www.nhs.uk/Co>

If you suspect symptoms of a heart attack, dial 995 immediately and ask for an ambulance. The described coughing procedure is not advisable, because it is not a recognized effective first aid technique. For more information: <http://www.snopes.com/medical/homecure/coughcpr.asp>; <http://www.hear>
CPR UCM 432380 Article.jsp#_WEQnliR96Rs

Flour would not aid the burn but will only make it worse. Cooling the injured area is of paramount importance in first aid for burns, but covering the burn area with flour would be cocooning the wound within a substance that hold the heat in place. For more

information: <http://www.snopes.com/medical/homecure/flourburns.asp>; <http://www.nhs.uk/scalds/Pages/Treatment.aspx>

Keep applying vinegar on the sunburned area could irritate the skin instead of healing it. To correctly and effectively treat a sunburn, cool the skin by sponging it with cold water or by having a cold bath or shower. For more

information: <http://www.nhs.uk/conditions/Sunburn/Pages/Introduction.aspx>

Ice-pack would not burn away the fats and use it incorrectly would damage the skin. The piece inaccurately exaggerated the findings of a journal article on human fats and cold exposure. The study did not suggest 'white fat' can transfer to 'brown fats', but only found that 'white fats' increased thermogenic gene in response to cold stimulus in an experiment. For more

information: <http://press.endocrine.org/doi/full/10.1210/jc.2014-2440>

Eating chocolate cake for breakfast would not help weight loss. The piece inaccurately exaggerated the findings of a journal article on dieting and weight loss. The study did not have participants eat chocolate cake only for breakfast; it investigated a high carbohydrate and protein diet containing desserts like chocolate cake. Also, the study was conducted with obese dieters and the weight loss difference between group was 37lbs instead of 60lbs. For more information: <http://www.sciencedirect.com/science/article/pii/S0039128X11003515>

There is no solid evidence that watching horror movie is an effective way to weight loss. The piece inaccurately exaggerated the findings of an informal study, which was commissioned by a movie rental company (with conflicts of interest) and not peer-reviewed. Also, the study found participants burn 161 calories instead of 250 calories, while a 150lbs adult sitting still for 90 min burns more than a hundred calories. For more information: <http://www.snopes.com/watching-horror-movies-obesity>

This piece inaccurately exaggerated an article on Paul McKenna's golden rules to help lose weight, which actually suggested not to eat whatever come into one's mind but eat consciously. However, the original article itself should be read with caution, to lose weight healthy, one should not only eat less but also exercise more. For more information: <http://www.nhs.uk/Livewell/loseweight/Pages/how-to-diet.aspx>; <http://www.dailymail.co.uk/femail/article-2530841/Paul-McKenna-My-four-golden-rules-help-lose-weight-Forget-dieting-just-listen-body.html>

There is currently no cure for Alzheimer's disease. No solid evidence has shown that

coconut oil is an effective treatment. The piece was extrapolated from Dr. Mary Newport's book on Alzheimer's Disease and coconut oil, the original claims of which was based on a signal case that was not scientifically conducted. For more information: <http://www.snopes.com/medical/disease/coconutoil.asp>; <http://www.nhs.uk/disease/Pages/Treatment.aspx>

There is currently no cure for rheumatoid arthritis, and no research has found that gin-soaked golden raisins is an effective treatment. While gin is flavored with the extract of juniper berry, the amount of the actual fruit presents is minuscule. Also, raisins have a lower vitamin C content than fresh grapes. For more information: <http://www.snopes.com/medical/homecure/raisins.asp>; <http://www.nhs.uk/arthritis/Pages/Treatment.aspx>

There is no evidence that apple juice can soften gallstones. The so-called 'stones' expelled are merely bile-stained "soaps" produced by soap formation of the oil one consumed at the end of the remedy. For more information: <https://www.quackwatch.com/01QuackeryRelatedTopics/flushes.html>; <http://www.thelancet.com>

There is currently no cure for diabetes. While the disease may be controlled with treatments and a healthy lifestyle, there is no evidence that mango leave is an effective cure. For more information: <http://www.nhs.uk/Conditions/Diabetes/Pages/Diabetes.aspx>

Dichloroacetate (DCA) is not a proven "cure" for cancer, nor is it being spurned by pharmaceutical companies because it is not patentable. For more information: <http://www.snopes.com/politics/medical/cancercure.asp>

The claims about chemotherapy are misleadingly based on cherry-picked statistics, misrepresentations of how chemotherapy works. While chemotherapy undeniably causes bad side effects in many cases, its benefits are undeniable: For more information: <http://www.snopes.com/chemotherapy-doctor-blows-the-whistle>

Use of lithium as a chemical propellant and research agent by NASA was not novel or secretive, the rudimentary information on NASA's web site was first published in 1958. The misinformation piece misinterpreted publicized scientific research to fit a pre-existing conspiracy theory. For more information: <http://www.snopes.com/nasa-lithium-chemtrails-conspiracy>

The article came from a piece on National Report, which is a fake news site known for publishing fabricated stories. As of 04 December 2016, No FDA-approved vaccine or medicine (e.g., antiviral drug) is available for Ebola. For more information: <http://www.snopes.com/media/notnews/rfidebola.asp>

Research did not find challenging work bad for one's brain; instead, it was found that individuals who have challenging work have better protection against memory and thinking decline in old age than their co-workers. For more information: <https://www.aan.com/PressRoom/home/PressRelease/1382>

Insomnia and oversleeping could be related to stroke risk and recovery from stroke. However, they are not casual signals of stroke, i.e., having insomnia and oversleeping does not necessarily lead to stroke. For more information: <https://www.aan.com/PressRoom/Home/PressRelease/1485>

Looking ahead keeps your neck in a neutral position, which has been shown to exert less stress on the cervical spine compared with keeping your neck in a flexed position. However, it is still advisable to avoid sitting or standing in the same position for prolonged period of time in order to avoid strain. For more information: <http://seguralia.com.pe/wp-content/uploads/spine-study.pdf>; <http://www.nhs.uk/Livewell/workplacehealth/Pages/Howtositcorrectly.aspx>

Research did not find that reading books, writing and participating in brain-stimulating activities would undermine one's brain power. On the contrast, research found benefits of cognitive activity across the life span. For more information: <https://www.aan.com/pressroom/home/pressrelease/1195>

In order to accurately examine our research questions, we had to withhold the real purpose of the study and presented you some common inaccurate information pieces among other normal Facebook posts. We sincerely seek your understanding on this. Your information will be kept confidential. If you are experiencing discomfort from our study or are having any other concerns, please do not hesitate to contact us at chen0872@e.ntu.edu.sg.

I have understood the actual propose of the study. I allow my responses in the study to be retained and analyzed.

- ☐ Yes
☐ No

Please leave your comments and suggestions on the study, if any, in the box below.

We greatly appreciate your participation!

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Appendix B IRB approval and instrument of the survey study

NTU-IRB approval letter for the survey study

**NANYANG
TECHNOLOGICAL
UNIVERSITY**

Research Support Office

Reg. No. 200604393R

IRB-2015-09-010

25 September 2015

Assistant Professor Sin Sei Ching Joanna
Wee Kim Wee School of Communication and Information

NTU INSTITUTIONAL REVIEW BOARD APPROVAL
Project Title: Understanding users' outcome expectations toward sharing misinformation on social media

I refer to your application for ethics approval with respect to the above project.

The Board has deliberated on your application and noted from your application that your research involves collecting behavioral data from participants using surveys.

You have also confirmed that informed consent will be obtained from the participants and you have guaranteed the confidentiality of your participants' biodata obtained from them.

The documents reviewed are:

- NTU IRB application form dated **02 September 2015**
- Participant information sheet and consent form: version 1 dated **02 September 2015**
- Data collection form: version 1 dated **02 September 2015**

The Board is therefore satisfied with the bioethical consideration for the project and approves the ethics application under **Expedited** review. The approval period is from **25 September 2015 to 24 September 2016**. The NTU IRB reference number for this study is **IRB-2015-09-010**. Please use this reference number for all future correspondence.

The following protocol and compliances are to be observed upon NTU IRB approval

- All research involving procedures greater than minimal risk on minors (individuals who are less than the legal age of 21 years old) requires IRB approved written Parental Consent and ~~assent from the participant to be obtained before any research protocols can be administered.~~ Minimal risk refers to an anticipated level of harm and discomfort that is no greater than that ordinarily encountered in daily life, or during the performance of routine educational, physical, or psychological examination.
- Only the approved Participants Information Sheet and Consent Form should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject should be given a copy of the signed consent form.

Blk N2.1, B4-01, 76 Nanyang Drive, Singapore 637331 Nanyang Avenue, Singapore 639798
Tel : +65 6791 9857, Fax: 6793 2019
www.ntu.edu.sg

Research Support Office

3. Consent forms are important documents therefore they should be stored in the strictest arrangement. Loss of consent form would result in disciplinary action.
4. No deviation from, or changes of, the protocol should be initiated without prior written NTU IRB approval of an appropriate amendment.
5. The Principal Investigator should report promptly to NTU IRB regarding:
 - a. Deviation from, or changes to the protocol.
 - b. Changes increasing the risk to the subjects and/or affecting significantly the conduct of the trial
 - c. All serious adverse events (SAEs) which are both serious and unexpected.
 - d. New information that may affect adversely the safety of the subjects of the conduct of the trial.
 - e. Completion of the study.
6. Continuing Review Request/ Notice of Study completion form should be submitted to NTU IRB for the following:
 - a. Annual review: Status of the study should be reported to the NTU IRB at least annually using the Continuing Review Request/ Notice of Study completion form.
 - b. Study completion or termination: Continuing Review Request/ Notice of Study completion form is to be submitted within 4 to 6 weeks of study completion or termination.
7. All Principal Investigators should comply with existing legislation that would have an impact on the domain of their research.

Professor Lee Sing Kong,
Chair, NTU Institutional Review Board
encl.

cc Chair, Wee Kim Wee School of Communication and Information
Members, NTU Institutional Review Board

Consent form

Are you under the age of 21?

- ☐ Yes
☐ No

Parental Consent Form

Title of Project: Understanding users' outcome expectations toward inaccurate information sharing on social media

Name of Researchers: Joanna Sin, Xinran Chen

Contact Detail of Researcher: chen0872@e.ntu.edu.sg

Contact Detail of NTU-Institutional Review Board: Ms Germaine Foo
(Email: irb@ntu.edu.sg; Phone: 65922495)

Your child is invited to participate in this research study about social media users' expectations on the outcomes of inaccurate information sharing. Because your child is under the age of 21, we seek your consent to let your child participate in the study. Your child's participation in this research study is voluntary. We would greatly appreciate it if your child could take some time to fill out a questionnaire for us. Your child will receive a gift card worth **5 SGD** as token for his/her participation.

Study purpose: The study investigates what are users' outcome expectations when they share misinformation on social media, as well as what are the relationships between outcome expectation and users' personality, social media usage, etc. Information from this study will benefit users with better experience on Facebook and social media.

Respondent involvement: If your child decide to participate in this study, s/he will be asked to fill out an online questionnaire, which will take about 15 minutes to complete.

Data privacy: There is no need to provide your child's name or identification information. All answers your child have provided will be kept strictly confidential.

Thank you for considering partaking in this survey. Your child's participation will provide us invaluable insights. Please let us know if you have any questions about the survey.

I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my child's participation is voluntary and that I am free to withdraw at any time without giving any reason.

I agree to consent for my child take part in the above study.

- ☐ Agree
☐ Disagree (leave the survey)

Respondent Consent Form

Title of Project: Understanding users' outcome expectations toward inaccurate information sharing on social media

Name of Researchers: Joanna Sin, Xinran Chen

Contact Detail of Researcher: chen0872@e.ntu.edu.sg

Contact Detail of NTU-Institutional Review Board: Ms Germaine Foo
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You are invited to participate in this research study about social media users' expectations on the outcomes of inaccurate information sharing. Your participation in this research study is voluntary. We would greatly appreciate it if you could take some time to fill out a questionnaire for us. You will receive a gift card worth **5 SGD** as token for your participation.

Study purpose: The study investigates what are users' outcome expectations when

they share misinformation on social media, as well as what are the relationships between outcome expectation and users' personality, social media usage, etc. Information from this study will benefit users with better experience on Facebook and social media.

Respondent involvement: If you decide to participate in this study, you will be asked to fill out an online questionnaire, which will take about 15 minutes to complete.

Data privacy: There is no need to provide your name or identification information. All answers you have provided will be kept strictly confidential.

Thank you for considering partaking in this survey. Your participation will provide us invaluable insights. Please let us know if you have any questions about the survey.

I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason.

I agree to take part in the above study.

- ☐ Agree
- ☐ Disagree (Leave the survey)

FaceBook Usage

Note: Please make sure you answer all the questions in each page in order to proceed to next page. If you need to walk away in the middle of the survey, your responses will be saved automatically and you can continue the progress when you return.

How often on average do you visit Facebook?

- ☐ Less than once a week
- ☐ Once a week

- ☐ A few times a week
- ☐ Once a day
- ☐ More than once a day

How much time on average do you spend on Facebook per day?

- ☐ 5 minutes or less
- ☐ 6-15 minutes
- ☐ 16-30 minutes
- ☐ 31-60 minutes
- ☐ More than an hour

Consequences of not spreading misinformation

Various types of information are floating around on social media, a significant amount of which contains inaccurate health-related information. Despite being inaccurate, these posts are gaining overwhelming number of '*likes*' and '*shares*', as they possess various attributes that appeal to social media users. Some carries an element of fun and/or novelty, others provide topics for casual conversations, yet others relate immediately to issues that concern us.

Below are some of the examples:

Dora Chan

1 min · 🌐

Pineapple Juice is 500% More Effective Than Cough Syrup

Did you know that pineapple juice is 500% more effective at helping you to stop coughing than cough syrup is? Well, it's true, and it's all on account of the fact that fresh pineapples contain a substance known as Bromelain; a specific type of enzyme that has anti-inflammatory characteristics which can combat infections and eradicate bacteria.

It is known that a certain amount of the Bromelain in pineapple juice is absorbed by the body directly, and that it works to lessen inflammation helping to relieve conditions like arthritis. In Germany Bromelain is specifically approved for treating inflammation and swelling of the nose, typically post sinus surgery.

If you've got an annoying cough that is simply caused through an irritation or is brought on by the common cold, you'll do yourself far more good by reaching for natural pineapple rather than an OTC cough medicine. You'll find the juice a less expensive option; one that doesn't contain any nasty toxic elements, and one which has the appropriate nutrients to help you to get rid of your cold.

Taking pineapple juice doesn't just help to soothe the irritation of nasty coughs; it also helps to loosen up any annoying mucus. Back in 2010, some research was carried out in an attempt to find treatments to help sufferers of tuberculosis. The findings of the reports were published "Der Pharma Chemica", and they included the fact that a mixture of natural pineapple juice, together with honey, and salt and pepper, when taken daily helps to dissolve mucus that congregates in the lungs, causing illnesses such as Mycobacterium Tuberculosis.

More recent studies have concluded that extract from natural pineapple juice gets rid of mucus five times quicker than other OTC cough medicines on sale in pharmacies, thereby helping people suffering from accumulations of mucus, to recover 4.8 times faster than those taking conventional medicines.

👍 Like 💬 Comment ➦ Share

Write a comment...

Dora Chan

1 min · 🌐

Stop Extracting Your teeth – You Will Lose Your Memory Too

There was a time when the great majority of children had their tonsils removed, in the name of disease prevention. Then the polio epidemic

occurred, and only those who had their tonsils removed were severely impacted. It was discovered that the tonsils are the only organ that produces polio antibodies.

In the present, the wisdom surrounding wisdom teeth is likewise lacking. They are removed as preventative medicine, because they are felt to be another unnecessary part. This may be a legitimate necessity in certain cases, but it is not for the majority of cases. Studies are beginning to show that all teeth have a special function, including the wisdom teeth.

It has been shown that there is a direct causal relation between the amount of teeth that a person has and the person's memory capacity. The more teeth that an individual has, the longer he can retain information. In particular, healthy mouths are one of the major causes for individuals to have excellent short-term memory. This is related to the fact that dentists cut the nerves that rest behind the teeth during extractions. These nerves are believed to be directly connected to brain tissues, and cutting them will kill certain regions of the brain.

Perhaps most interesting is that the loss of memory does not occur whenever a tooth simply falls out naturally. It only occurs when it is forced out through brute force trauma, whether that be from a brawl or dental work. The current research shows that memory problems are increased for every tooth that is pulled. Dental procedures may be responsible for most of the memory problems that are attributed to aging.

The most common reason for removing wisdom teeth is because they can become a painful inconvenience, which does not present any health risk. Wisdom teeth tend to point in the wrong directions or get trapped under adjoining teeth, but they eventually will be able to correct themselves if they are left alone. It is completely normal to experience pain from incoming wisdom teeth. If you keep these teeth, then you will be able to experience improved memory, and possibly other benefits which have not yet been discovered.

👍 Like 💬 Comment ➦ Share

Write a comment...

What would make you to avoid spreading (e.g. clicking 'Like', 'Share', or reposting) inaccurate health-related information on Facebook? Please rate how important for you each of the following reasons is.

1 as 'Not at All Important' to 7 as 'Extremely Important'.

I avoid spreading inaccurate health-related information on Facebook in order to...

	1	2	3	4	5	6	7
to avoid complicating information seeking / to help me find information	☐	☐	☐	☐	☐	☐	☐

	1	2	3	4	5	6	7
to avoid breaking my habit / to keep my habit	☐	☐	☐	☐	☐	☐	☐
to avoid feeling dissatisfied / to feel satisfied	☐	☐	☐	☐	☐	☐	☐
to avoid being deemed incompetent / to be deemed competent	☐	☐	☐	☐	☐	☐	☐
to avoid being deemed outdated / to be deemed trendy	☐	☐	☐	☐	☐	☐	☐
to avoid feeling bored / to be entertained	☐	☐	☐	☐	☐	☐	☐
to avoid damaging my status / to improve my status	☐	☐	☐	☐	☐	☐	☐
to avoid being isolated from others / to be part of a group	☐	☐	☐	☐	☐	☐	☐
to avoid becoming more confused with my health conditions / to get a better understanding of my health conditions	☐	☐	☐	☐	☐	☐	☐
to avoid being regarded as untrustworthy / to be regarded as trustworthy	☐	☐	☐	☐	☐	☐	☐
to avoid being ignored / to get attention	☐	☐	☐	☐	☐	☐	☐
to avoid becoming unproductive / to become more productive	☐	☐	☐	☐	☐	☐	☐
to avoid discouraging others / to motivate others	☐	☐	☐	☐	☐	☐	☐
to avoid damaging my interpersonal relationships / to improve my interpersonal relationships	☐	☐	☐	☐	☐	☐	☐
to avoid finding inaccurate health-related information / to find accurate health-related information	☐	☐	☐	☐	☐	☐	☐
to avoid becoming incompetent / to become more competent	☐	☐	☐	☐	☐	☐	☐
to avoid becoming out of date with current issues / to keep up with current issues	☐	☐	☐	☐	☐	☐	☐
to avoid feeling unhappy / to feel happy	☐	☐	☐	☐	☐	☐	☐
to avoid being stuck in reality / to escape from reality	☐	☐	☐	☐	☐	☐	☐
to avoid being hindered from showing and getting support / to help me show and get support	☐	☐	☐	☐	☐	☐	☐
to avoid damaging my image or reputation / to improve my image or reputation	☐	☐	☐	☐	☐	☐	☐
to avoid being disapproved / to be approved	☐	☐	☐	☐	☐	☐	☐
to avoid being irresponsible for my actions / to be more responsible for my actions	☐	☐	☐	☐	☐	☐	☐
to avoid being hindered from verifying the information I found / to verify the information I found	☐	☐	☐	☐	☐	☐	☐
to avoid causing harm to others / to help others	☐	☐	☐	☐	☐	☐	☐
to avoid becoming unable to express myself freely / to express myself freely	☐	☐	☐	☐	☐	☐	☐
to avoid breaking reciprocity / to improve reciprocity	☐	☐	☐	☐	☐	☐	☐

1 as 'Not at All Important' to 7 as 'Extremely Important'.

I avoid spreading inaccurate health-related information on Facebook in order to...

	1	2	3	4	5	6	7
to avoid finding inaccurate information / to find accurate information	☐	☐	☐	☐	☐	☐	☐
to avoid hindering information exchange and discussion / to improve information exchange and discussion	☐	☐	☐	☐	☐	☐	☐
to avoid losing self-esteem / to boost self-esteem	☐	☐	☐	☐	☐	☐	☐
to avoid impeding learning / to facilitate learning	☐	☐	☐	☐	☐	☐	☐
to avoid hindering self reflection / to facilitate self reflection	☐	☐	☐	☐	☐	☐	☐
to avoid revealing too much of my personal information / to safeguard my personal information	☐	☐	☐	☐	☐	☐	☐
to avoid undermining my health / to improve my health	☐	☐	☐	☐	☐	☐	☐
to avoid hindering new relationship building / to benefit new relationship building	☐	☐	☐	☐	☐	☐	☐
to avoid harming my school or the organization I work for / to benefit my school or the organization I work for	☐	☐	☐	☐	☐	☐	☐
to avoid misleading or confusing others / to instruct others	☐	☐	☐	☐	☐	☐	☐
to avoid suppressing the development of the social media site / to promote the development of the social media site	☐	☐	☐	☐	☐	☐	☐
to avoid losing track of my activities / to keep track of my activities	☐	☐	☐	☐	☐	☐	☐
to avoid hindering interpersonal communication / to improve interpersonal communication	☐	☐	☐	☐	☐	☐	☐
to avoid obtaining poor quality information / to obtain good quality information	☐	☐	☐	☐	☐	☐	☐
to avoid hindering relationship maintenance / to benefit relationship maintenance	☐	☐	☐	☐	☐	☐	☐
to avoid receiving punishment or penalty / to receive rewards or money	☐	☐	☐	☐	☐	☐	☐
to avoid suggesting ineffective course of action / to suggest effective course of action	☐	☐	☐	☐	☐	☐	☐
to avoid getting anxious / to feel reassured	☐	☐	☐	☐	☐	☐	☐
to avoid making others bored / to make others entertained	☐	☐	☐	☐	☐	☐	☐
to avoid losing my privacy / to keep my privacy	☐	☐	☐	☐	☐	☐	☐

	1	2	3	4	5	6	7
to avoid harming my education or career / to benefit my education or career	☐	☐	☐	☐	☐	☐	☐
to avoid harming the development of online community / to benefit the development of online community	☐	☐	☐	☐	☐	☐	☐
to avoid undermining others' health / to improve others' health	☐	☐	☐	☐	☐	☐	☐
to avoid hindering public education / to facilitate public education	☐	☐	☐	☐	☐	☐	☐
to avoid losing self-respect / to boost self-respect	☐	☐	☐	☐	☐	☐	☐
to avoid getting misleading online medical consultation / to get reliable online medical consultation	☐	☐	☐	☐	☐	☐	☐
to avoid misunderstanding issues relevant to me / to make sense of issues relevant to me	☐	☐	☐	☐	☐	☐	☐

Are there any other important reasons that are not listed? Please specify:

Questionnaire

How often do you 'like' or 'share' such inaccurate health-related information on Facebook?

- ☐ Never
☐ Rarely
☐ Sometimes
☐ Often
☐ Very frequently

Is Facebook where you most often see such inaccurate health-related information being circulated?

- ☐ Yes
☐ No - Where do you see it most often?

What is your age?

- ☐ 18 years old
☐ 19 years old
☐ 20 years old
☐ 21 years old
☐ 22 years old
☐ 23 years old
☐ 24 years old
☐ 25 years old
☐ Above 25 years old - Please specify:

What is your gender?

- ☐ Women
☐ Men

Which program are you in?

- ☐ Accountancy
☐ Accountancy and Business
☐ Art, Design & Media
☐ Aerospace Engineering
☐ Aerospace Engineering and Economics
☐ Business & Computer Engineering
☐ Business & Computing
☐ Bachelor of Medicine and Bachelor of Surgery
☐ BioEngineering
☐ BioEngineering and Economics
☐ Biomedical Sciences
☐ Biological Sciences
☐ Business

- ☐ Chemical & Biomolecular Engineering
- ☐ Chemical & Biomolecular Engineering and Economics
- ☐ Civil Engineering
- ☐ Civil Engineering and Economics
- ☐ Chemistry & Biological Chemistry
- ☐ Chinese
- ☐ Communication Studies
- ☐ Computer Engineering
- ☐ Computer Engineering & Economics
- ☐ Computer Science
- ☐ Economics
- ☐ Electrical & Electronic Engineering
- ☐ Electrical & Electronic Engineering and Economics
- ☐ History
- ☐ Engineering
- ☐ English
- ☐ Environmental Earth Systems Science
- ☐ Environmental Engineering
- ☐ Environmental Engineering and Economics
- ☐ Information Engineering & Media
- ☐ Information Engineering & Media and Economics
- ☐ Linguistics & Multilingual Studies
- ☐ Mathematics & Economics
- ☐ Maritime Studies
- ☐ Mathematical Sciences
- ☐ Materials Engineering
- ☐ Materials Engineering and Economics
- ☐ Mechanical Engineering
- ☐ Mechanical Engineering and Economics
- ☐ Medicine
- ☐ Philosophy
- ☐ Physics & Applied Physics
- ☐ Psychology
- ☐ Public Policy and Global Affairs
- ☐ Renaissance Engineering
- ☐ Sociology
- ☐ Sport Science & Management

☐ Others - Please specify:

Please specify your nationality:

- ☐ Singaporean
- ☐ Chinese
- ☐ Malaysian
- ☐ Indian
- ☐ Others

Please specify your race:

- ☐ Chinese
- ☐ Indian
- ☐ Malay
- ☐ Caucasian
- ☐ Others

Have you ever received any information literacy training? Please select all that apply.
(Multiple Answer)

- ☐ I have attended the library's general orientation sessions, workshops, online tutorials, etc.
- ☐ I have taken a specialized program/course on information literacy
- ☐ I have taken a specialized program/course on health information literacy
- ☐ I have studied general information literacy skills on my own
- ☐ I have studied health information literacy skills on my own
- ☐ I have received others types of information literacy training - please specify:
- ☐ No, I have not had any information literacy training

Thank you so much for your participation!

Please choose one preferred way and leave your contact information to receive the S\$5 incentive.

If you have not received anything after 30 days, please feel free to contact us at chen0872@e.ntu.edu.sg.

- ☐ Email for Paypal
- ☐ Email for Amazon gift card
- ☐ Email or phone number for online bank transfer (via OCBC Pay Anyone™)

Please leave your comments and suggestions on the study, if any, in the box below.

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Appendix C. List of articles used in the development of the intervention items

- Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health psychology, 27*(3), 379.
- Amirault, M., Cobbett, S., Doherty, A., Hartigan-Rogers, J., LeBlanc, A., Muise-Davis, M., & Newell, J. (2005). Consumer health information on the Internet: An evaluation report on the Nova Scotia Health Network. *Journal of the Canadian Health Libraries Association/Journal de l'Association des bibliothèques de la santé du Canada, 26*(2), 41-46.
- Baek, K., Holton, A., Harp, D., & Yaschur, C. (2011). The links that bind: Uncovering novel motivations for linking on Facebook. *Computers in Human Behavior, 27*(6), 2243-2248.
- Barker, V., & Ota, H. (2011). Mixi diary versus Facebook photos: Social networking site use among Japanese and Caucasian American females. *Journal of Intercultural Communication Research, 40*(1), 39-63.
- Bock, G.-W., Zmud, R. W., Kim, Y.-G., & Lee, J.-N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly, 87*-111.
- Bordia, P., & DiFonzo, N. (2004). Problem solving in social interactions on the Internet: Rumor as social cognition. *Social Psychology Quarterly, 67*(1), 33-49.
- Bordia, P., & DiFonzo, N. (2005). Psychological motivations in rumor spread. In *Rumor mills: The Social Impact of Rumor and Legend*, 87-101.
- Chiu, C.-M., Hsu, M.-H., & Wang, E. T. (2006). Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories. *Decision support systems, 42*(3), 1872-1888.
- Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly, 189*-211.
- Delic, D., Polašek, O., & Kern, J. (2006). Internet health-information seekers in Croatia – Who, what, and why? *Informatics for Health and Social Care, 31*(4), 267-273.
- DiFonzo, N., Robinson, N. M., Suls, J. M., & Rini, C. (2012). Rumors about cancer: Content, sources, coping, transmission, and belief. *Journal of Health Communication, 17*(9), 1099-1115.
- Foss, N. J., Minbaeva, D. B., Pedersen, T., & Reinholt, M. (2009). Encouraging knowledge sharing among employees: How job design matters. *Human Resource Management, 48*(6), 871-893.

- Fox, S., & Rainie, L. (2002). Vital decisions: How Internet users decide what Information to trust when They or their loved ones are sick. Retrieved from <http://www.pewinternet.org/2002/05/22/vital-decisions-a-pew-internet-health-report/>
- Harbour, J., & Chowdhury, G. G. (2007). Use and outcome of online health information services: a study among Scottish population. *Journal of Documentation*, 63(2), 229-242.
- Hollenbaugh, E. E. (2011). Motives for maintaining personal journal blogs. *Cyberpsychology, Behavior, and Social Networking*, 14(1-2), 13-20.
- Hollenbaugh, E. E., & Ferris, A. L. (2014). Facebook self-disclosure: Examining the role of traits, social cohesion, and motives. *Computers in Human Behavior*, 30, 50-58.
- Hsu, C.-L., & Lin, J. C.-C. (2008). Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information & management*, 45(1), 65-74.
- Hsu, M. H., Ju, T. L., Yen, C. H., & Chang, C. M. (2007). Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations. *International Journal of Human-Computer Studies*, 65(2), 153-169.
- Hung, S. Y., Durcikova, A., Lai, H. M., & Lin, W. M. (2011). The influence of intrinsic and extrinsic motivation on individuals' knowledge sharing behavior. *International Journal of Human-Computer Studies*, 69(6), 415-427.
- Joinson, A. N. (2008). Looking at, looking up or keeping up with people?: Motives and use of Facebook. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1027-1036.
- Jung, T., Youn, H., & McClung, S. (2007). Motivations and self-presentation strategies on Korean-based "Cyworld" weblog format personal homepages. *CyberPsychology & Behavior*, 10(1), 24-31.
- Kankanhalli, A., Tan, B. C., & Wei, K.-K. (2005). Contributing knowledge to electronic knowledge repositories: An empirical investigation. *MIS Quarterly*, 113-143.
- Kim, Y., Sohn, D., & Choi, S. M. (2011). Cultural difference in motivations for using social network sites: A comparative study of American and Korean college students. *Computers in Human Behavior*, 27(1), 365-372.
- Ko, H., Cho, C. H., & Roberts, M. S. (2005). Internet uses and gratifications: A structural equation model of interactive advertising. *Journal of advertising*, 34(2), 57-70.
- LaRose, R., & Eastin, M. S. (2004). A social cognitive theory of Internet uses and gratifications: Toward a new model of media attendance. *Journal of Broadcasting & Electronic Media*, 48(3), 358-377.
- Li, N., Orrange, S., Kravitz, R. L., & Bell, R. A. (2014). Reasons for and predictors of patients' online health information seeking following a medical appointment. *Family practice*, 31(5), 550-556.

- Liao, C., To, P. L., & Hsu, F. C. (2013). Exploring knowledge sharing in virtual communities. *Online Information Review*, 37(6), 891-909.
- Lin, H. F. (2007). Effects of extrinsic and intrinsic motivation on employee knowledge sharing intentions. *Journal of Information Science* 33(2), 135-149.
- Lu, H. P., & Lee, M. R. (2012). Experience differences and continuance intention of blog sharing. *Behaviour & Information Technology*, 31(11), 1081-1095.
- Luchman, J. N., Bergstrom, J., & Krulikowski, C. (2014). A motives framework of social media website use: A survey of young Americans. *Computers in Human Behavior*, 38, 136-141.
- Nicholas, D., Huntington, P., Williams, P., & Blackburn, P. (2001). Digital health information provision and health outcomes. *Journal of Information Science*, 27(4), 265-276.
- Oh, S. (2012). The characteristics and motivations of health answerers for sharing information, knowledge, and experiences in online environments. *Journal of the Association for Information Science and Technology*, 63(3), 543-557.
- Papacharissi, Z. (2002). The self online: The utility of personal home pages. *Journal of Broadcasting & Electronic Media*, 46(3), 346-368.
- Papacharissi, Z., & Rubin, A. M. (2000). Predictors of Internet use. *Journal of Broadcasting & Electronic Media*, 44(2), 175-196.
- Park, N., Kee, K. F., & Valenzuela, S. (2009). Being Immersed in social networking environment: Facebook groups, uses and gratifications, and social outcomes. *CyberPsychology & Behavior*, 12(6), 729-733.
- Pluye, P., Grad, R., Repchinsky, C., Jovaisas, B., Johnson-Lafleur, J., Carrier, M. E., ... & Légaré, F. (2013). Four levels of outcomes of information-seeking: A mixed methods study in primary health care. *Journal of the American Society for Information Science and Technology*, 64(1), 108-125.
- Powell, J., Inglis, N., Ronnie, J., & Large, S. (2011). The characteristics and motivations of online health information seekers: cross-sectional survey and qualitative interview study. *Journal of Medical Internet Research*, 13(1).
- Rosnow, R. L. (1991). Inside rumor - A personal journey. *American Psychologist*, 46(5), 484-496.
- Sheldon, P. (2008). Student favorite: Facebook and motives for its use. *Southwestern Mass Communication Journal*, 23(2).
- Smock, A. D., Ellison, N. B., Lampe, C., & Wohn, D. Y. (2011). Facebook as a toolkit: A uses and gratification approach to unbundling feature use. *Computers in Human Behavior*, 27(6), 2322-2329.

- Sun, S., Rubin, A. M., & Haridakis, P. M. (2008). The role of motivation and media involvement in explaining Internet dependency. *Journal of Broadcasting & Electronic Media*, 52(3), 408-431.
- Tosun, L. P. (2012). Motives for Facebook use and expressing “true self” on the Internet. *Computers in Human Behavior*, 28(4), 1510-1517.
- Warner, D., & Procaccino, J. D. (2004). Toward wellness: Women seeking health information. *Journal of the American Society for Information Science and Technology*, 55(8), 709-730.
- Wasko, M. M., & Faraj, S. (2005). Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly*, 35-57.
- Yang, C. C., & Brown, B. B. (2013). Motives for using Facebook, patterns of Facebook activities, and late adolescents’ social adjustment to college. *Journal of Youth and Adolescence*, 42(3), 403-416.
- Ybarra, M., & Suman, M. (2006). Reasons, assessments and actions taken: Sex and age differences in uses of Internet health information. *Health Education Research*, 23(3), 512-521.
- Yoo, E. Y., & Robbins, L. S. (2008). Understanding middle-aged women's health information seeking on the web: A theoretical approach. *Journal of the American Society for Information Science and Technology*, 59(4), 577-590.
- Zhang, Y., Tang, L. S. T., & Leung, L. (2011). Gratifications, collective self-esteem, online emotional openness, and traitlike communication apprehension as predictors of Facebook uses. *Cyberpsychology, Behavior, and Social Networking*, 14(12), 733-739.

Appendix D. Supplement tables

Table A. Baseline outcome expectation * Condition cross tabulation

			Condition				Total
			Control group	Treatment A	Treatment B	Treatment C	
Baseline outcome expectation	Low	Count	19	37	51	45	152
		Residual	-2.5	-5.9	11.5	-3.2	
		Standardized residual	-0.5	-0.9	1.8	-0.5	
		Adjusted residual	-0.9	-1.6	3.3	-0.8	
	High	Count	18	37	17	38	110
		Residual	2.5	5.9	-11.5	3.2	
		Standardized residual	0.6	1.1	-2.2	0.5	
		Adjusted residual	0.9	1.6	-3.3	0.8	
Total	Count	37	74	68	83	262	

Table B. Results of Logistic regress analysis (Model 2B)

	B	S.E.	Wald	df	Sig.	Odds Ratio
Condition			1.20	3		
TA	19.12	14210.42	0	1	0.753	201937056.5
TB	20.25	14210.42	0	1	0.999	621344789.2
TC	19.59	14210.42	0	1	0.999	323099290.4
Gender (Male)	0	22913.47	0	1	0.999	1
Self-efficacy (High)	19.82	14210.42	0	1	0.999	403874113
BOE (High)	42.41	22913.55	0	1	0.999	2.61
Condition * Gender			2.513	3	0.473	
TA * Gender	1.23	22913.47	0	1	0.999	3.43
TB * Gender	-1.44	22913.47	0	1	0.999	0.24
TC * Gender	-0.69	22913.47	0	1	0.999	0.5

Table B. Results of Logistic regress analysis (Model 2B) (Continued)

	B	S.E.	Wald	df	Sig.	Odds Ratio
Gender * Self-efficacy	-19.82	46265.60	0	1	0.999	0
Gender * BOE	0	33427.05	0	1	0.999	1
Condition * Self-efficacy			0.431	3	0.934	
TA * Self-efficacy	-19.68	14210.42	0	1	0.999	0
TB * Self-efficacy	-40.06	18345.54	0	1	0.998	0
TC * Self-efficacy	-18.54	14210.42	0	1	0.999	0
Condition * BOE			0	3	0.999	
TA * BOE	-39.41	22913.55	0	1	0.999	0
TB * BOE	-62.65	36507.10	0	1	0.999	0
TC * BOE	-19.59	27492.05	0	1	0.999	0
Self-efficacy * BOE	-19.82	36507.04	0	1	0.999	0
Condition * Gender * Self-efficacy			0.523	3	0.914	
TA * Gender * Self-efficacy	20.13	46265.60	0	1	0.999	549719266.7
TB * Gender * Self-efficacy	42.24	47698.31	0	1	0.999	2.21
TC * Gender * Self-efficacy	21.95	46265.60	0	1	0.999	3392553189
Condition * Gender * BOE			0	3		
TA * Gender * BOE	-2.15	33427.05	0	1	0.999	0.12
TB * Gender * BOE	21.95	43876.02	0	1	0.999	3417404906
TC * Gender * BOE	-20.22	36717.16	0	1	0.999	0
Gender * Self-efficacy * BOE	0	59502.78	0	1	0.999	1
Condition * Self-efficacy * BOE			0	3		
TA * Self-efficacy * BOE	19.10	36507.04	0	1	0.999	197898249.3
TB * Self-efficacy * BOE	63.21	47698.27	0	1	0.999	2.84
TC * Self-efficacy * BOE	-0.46	39541.70	0	1	0.999	0.63
Condition * Gender * Self-efficacy * BOE			0	3		
TA * Gender * Self-efficacy * BOE	0.97	59502.78	0	1	0.999	2.62
TB * Gender * Self-efficacy * BOE	-23.68	69905.72	0	1	0.999	0
TC * Gender * Self-efficacy * BOE	18.38	61411.42	0	1	0.999	96157728.37

Note. TA = Treatment A; TB = Treatment B; TC = Treatment C; BOE = Baseline outcome expectation.

Table C. Collinearity Statistics (Model 2B)

	Tolerance	VIF
TA	.080	12.537
TB	.110	9.091
TC	.098	10.239
Gender	.047	21.109
Self-efficacy	.047	21.276
BOE	.048	20.740
TA * Gender	.057	17.417
Gender * Self-efficacy	.014	69.713
Gender * BOE	.032	30.848
Self-efficacy * BOE	.020	51.113
TB * Gender	.086	11.601
TC * Gender	.068	14.641
TA * Self-efficacy	.051	19.789
TB * Self-efficacy	.075	13.380
TC * Self-efficacy	.064	15.723
TA * BOE	.054	18.397
TB * BOE	.071	13.998
TC * BOE	.059	17.005
Gender * Self-efficacy * BOE	.013	78.591
TA * Gender * Self-efficacy	.025	39.522
TB * Gender * Self-efficacy	.044	22.960
TC * Gender * Self-efficacy	.030	33.607
TA * Gender * BOE	.049	20.322
TB * Gender * BOE	.088	11.336
TC * Gender * BOE	.046	21.709
TA * Self-efficacy * BOE	.031	32.425
TB * Self-efficacy * BOE	.049	20.483
TC * Self-efficacy * BOE	.033	30.669
TA * Self-efficacy * BOE *	.025	40.122
Gender		
TB * Self-efficacy * BOE *	.061	16.281
Gender		
TC * Self-efficacy * BOE *	.021	46.761
Gender		

Note. TA = Treatment A; TB = Treatment B; TC = Treatment C; BOE = Baseline outcome expectation.

Appendix E. List of publications

Journal Article

Chen, X., Sin, S.-C. J., Theng, Y.-L., & Lee, C. S. (2015). Why students share misinformation on social media: Motivation, gender, and study-level differences. *The Journal of Academic Librarianship* 41(5), 583-592.

Conference Proceedings & Presentation

Chen, X. (2016). The influences of personality and motivation on the sharing of misinformation on social media. *IConference 2016 Proceedings*. doi: 10.9776/16145

Chen, X. (2015). A Social cognitive theory-guided intervention addressing college students' misinformation spreading on Facebook. Paper presented at the 6th *Honors Symposium for Asian PhD Students in Communication Research*, Seoul, Korea. (Best Paper Award)

Chen, X., Sin, S.-C. J., Theng, Y.-L., & Lee, C. S. (2015). Deterring the spread of misinformation on social network sites: A social cognitive theory-guided intervention. *Proceedings of the Association for Information Science and Technology* 52(1), 1-4.

Chen, X., Sin, S.-C. J., Theng, Y.-L., & Lee, C. S. (2015). Why do social media users share misinformation? *Proceedings of the 15th ACM/IEEE-CS Joint Conference on Digital Libraries*, 111-114.

Chen, X. (2014). What we talk about when we talk about misinformation on social media: A qualitative content analysis on the sharing of a popular piece of misinformation. Paper presented at the 5th *Honors Symposium for Asian PhD Students in Communication Research*, Singapore.

Chen, X., & Sin, S.-C. J. (2013). 'Misinformation? What of it?' Motivations and individual differences in misinformation sharing on social media. In *Proceedings of the Association for Information Science and Technology*, 50(1), 1-4.