

DOCTORAL THESIS

Web-based sequentially delivered interventions on health-enhancing physical activity and fruit-vegetable consumption in Chinese college students

Liang, Wei

Date of Award:
2020

[Link to publication](#)

General rights

Copyright and intellectual property rights for the publications made accessible in HKBU Scholars are retained by the authors and/or other copyright owners. In addition to the restrictions prescribed by the Copyright Ordinance of Hong Kong, all users and readers must also observe the following terms of use:

- Users may download and print one copy of any publication from HKBU Scholars for the purpose of private study or research
- Users cannot further distribute the material or use it for any profit-making activity or commercial gain
- To share publications in HKBU Scholars with others, users are welcome to freely distribute the permanent URL assigned to the publication

ABSTRACT

Background: Evidence has indicated a high prevalence of physical inactivity and insufficient consumption of fruit and vegetables among Chinese college students. As college students are in a crucial transition stage from adolescent to adulthood, such unhealthy lifestyle behaviors at this stage can result in numerous negative consequences for both individuals and society. Therefore, it is urgently necessary to promote health-enhancing physical activity (HEPA) and fruit-vegetable consumption (FVC) among Chinese college students.

Interventions focused on multiple health behavior change (MHBC) have shown advantages over those targeting only a single health behavior, and have therefore gained popularity over the last decade. Despite the increasing use of Internet technology and apparent promise of web-based MHBC interventions, there have been few such interventions for HEPA and FVC among Chinese college students. In addition, within the overarching scope of web-based MHBC interventions, there are several remaining questions that need to be addressed, including the timing of MHBC intervention delivery, the high dropout rate of participants, and the psychological mechanisms behind MHBC.

Purpose: The main purposes of the thesis were to (1) examine the comparative effectiveness of sequentially delivered web-based MHBC interventions for HEPA and FVC in Chinese college students from both quantitative and qualitative perspectives; (2) investigate characteristics of dropouts (using quantitative method) and the underlying reasons (using qualitative method); and (3) identify the active ingredients (“key mediators”) of successful health interventions for changing single health behavior (HEPA or FVC), and examine the psychological mechanisms of MHBC (HEPA and FVC) in Chinese college students based on an integrated social-cognitive model.

Method: In Study 1, two web-based MHBC interventions were developed based on the health action process approach (HAPA) model. In a randomized controlled trial (RCT), 552 eligible college students ($M = 19.99$ years, $SD = 1.04$, 58.3% female) were randomly assigned to one of three groups: HEPA-first (4 weeks of HEPA followed by 4 weeks of FVC intervention), FVC-first (4 weeks of FVC followed by 4 weeks of HEPA intervention), and a control group (8 weeks of placebo treatment unrelated to HEPA or FVC). All of the participants were asked to complete online questionnaires at four time-points: at baseline (T1, the beginning of the intervention), after 4 weeks (T2, after the first behavior

intervention), after 8 weeks (T3, after the second behavior intervention), and after 12 weeks (T4, 1-month post-intervention follow-up). The questionnaires addressed health behaviors (HEPA and FVC), social-cognitive determinants of behavior change (intention, self-efficacy, planning, and social support for each behavior) and health outcomes (BMI, depression and perceived quality of life). All of the data were analyzed using IBM SPSS 25.0, applying a series of generalized linear mixed models (GLMMs) to evaluate the intervention effectiveness. The mediation analysis was performed using IBM SPSS Process, with residualized change scores and the bias-corrected bootstrap approach (5000 resamples).

Following the quantitative intervention study, to further evaluate the effects of aforementioned web-based MHBC interventions and to address dropout issues from a qualitative perspective, 30 students ($M = 19.53$ years, $SD = 0.92$, 56.7% female) who had participated in Study 1 (18 completers and 12 dropouts), were invited to attend one-to-one and face-to-face semi-structured interviews (Study 2). The interviews covered three topics: 1) students' perceptions about their changes after participating in the web-based health program, 2) students' user experience and suggestions related to the design of the intervention content and the website layout and functionality, and 3) the reasons for dropping out. The audio-recorded interview data was transcribed orthographically and organized using QSR NVivo 11. Thematic analysis was adopted to analyze the qualitative data.

In addition, a two-layer integrated social-cognitive model was hypothesized in Study 3 based on the HAPA model and Carry-over and Compensatory Action Model (CCAM). With a prospective design, 322 college students ($M = 19.47$ years, $SD = 0.99$, 55.6% female) were invited to report their past HEPA and FVC behavior, HEPA and FVC intentions, and demographics at baseline. After two months, an online questionnaire survey was used to collect data on their compensatory cognitions, combined volitional predictors of behavior change (self-efficacy + planning), and current HEPA and FVC behavior. All of the data were analyzed using Mplus 8.0. The proposed model was examined using structural equation modeling (SEM) with path analysis approach.

Results: (1) Both the quantitative and the qualitative data fully supported the effectiveness of the web-based MHBC interventions for HEPA and FVC behavior. In addition, the effects on social-cognitive determinants of behavior change were partially supported by the quantitative data, and fully supported by the qualitative data. For health outcomes, the quantitative data supported the intervention effects on body mass index (BMI), and the qualitative data supported the effects on both

BMI and perceived quality of life. Moreover, the two delivery sequences did not show significantly different effects on HEPA after either 8 weeks or 12 weeks, whereas the FVC-first sequence showed superior effects over the HEPA-first sequence for FVC behavior after 12 weeks.

(2) In terms of dropout, more male than female students withdrew from the interventions, and the dropouts showed lower HEPA self-efficacies, lower FVC planning, and inferior BMI status than completers. The interview results indicated two themes of dropout reasons: internal reasons (e.g., participants perceiving the health interventions as less necessary and less important) and external reasons (e.g., unfavorable living surroundings and problems with the program's delivery mode, intervention content, and technology).

(3) In terms of the mediators of successful interventions for changing each single health behavior, the RCT results indicated that self-efficacy and intention mediated the effectiveness of the intervention on immediate changes (after 8 weeks) in HEPA and FVC, and that intention had a mediating effect on sustained change (after 12 weeks) in both HEPA and FVC. In addition, the prospective study found that the two-layer integrated social-cognitive model proposed in this thesis successfully explained the psychological mechanisms of MHBC in Chinese college students. In particular, the first layer identified the mediating effects of the volitional predictors on the intention-behavior relation for each type of health behavior. The second layer identified a positive association between volitional predictors of HEPA and volitional predictors of FVC, as well as a mediating effect of compensatory cognition between FVC intention and HEPA behavior.

Discussion and Conclusions: To the best of our knowledge, this is the first study to examine the comparative effectiveness of sequentially delivered web-based MHBC interventions on HEPA and FVC in Chinese college students, and the first to identify the psychological mechanisms of MHBC in a Chinese context. The findings provide both theoretical and practical implications for future research and the application of MHBC. Future studies should more comprehensively compare simultaneous vs. sequential designs, more systematically examine dropout and its determinants, and further explore the psychological mechanisms of MHBC, especially the transfer mechanisms between the volitional predictors of one health behavior on another.

TABLE OF CONTENT

CHAPTER I: INTRODUCTION.....	1
1.1 Background of study.....	1
1.2 Problem statement.....	10
1.3 Research questions.....	12
1.4 Structure of the thesis.....	14
1.5 Significance of the study.....	18
CHAPTER II: LITERATURE REVIEW.....	20
2.1 Health-enhancing physical activity and fruit-vegetable consumption.....	21
2.1.1 Definitions of HEPA and FVC.....	21
2.1.2 Health recommendations for HEPA and FVC.....	23
2.1.3 Health benefits of HEPA and FVC.....	25
2.1.4 HEPA and FVC in college students.....	29
2.2 Theoretical Basis of Research.....	31
2.2.1 Psychosocial theories of single health behavior change.....	31
2.2.2 Psychosocial theories of multiple health behavior change.....	42
2.3 Timing for delivering MHBC interventions.....	51
2.4 Web-based interventions.....	57
2.4.1 Definition of web-based interventions.....	57
2.4.2 Application of web-based interventions for health promotion.....	57
2.4.3 Advantages of web-based interventions for health promotion.....	59
2.4.4 Limitations of web-based interventions for health promotion.....	62
CHAPTER III: EFFECTIVENESS AND MEDIATION MACHINISMS OF WEB-BASED MHBC INTERVENTIONS FOR CHINESE COLLEGE STUDENTS: A RANDOMIZED CONTROLLED TRIAL.....	65
3.1 Study purpose and hypotheses.....	65

3.2 Methods	67
3.2.1 Study design.....	67
3.2.2 Participants.....	68
3.2.3 Procedures.....	71
3.2.4 Measures	78
3.2.5 Statistical analyses	84
3.3 Results.....	87
3.3.1 Randomization-check and sample characteristics	87
3.3.2 Intervention effects on HEPA and FVC behavior.....	89
3.3.3 Intervention effects on combined lifestyle indicator	93
3.3.4 Intervention effects on social-cognitive determinants of behavior change	97
3.3.5 Intervention effects on health outcomes	105
3.3.6 Dropout analyses.....	109
3.3.7 Mediation mechanisms of changes in each health behavior.....	111
3.4 Discussion	116
CHAPTER IV: STUDENTS' EXPERIENCES OF PARTICIPATING IN THE PREVIOUS WEB-BASED HEALTH PROGRAM AND REASONS FOR DROPPING OUT FROM THE MHBC INTERVENTIONS: A QUALITATIVE STUDY	123
4.1 Study purpose.....	123
4.2 Methods	124
4.2.1 Study design.....	124
4.2.2 Participant recruitment.....	125
4.2.3 Data collection	127
4.2.4 Data analysis	133

4.3 Results.....	134
4.3.1 Topic 1: Students’ perceptions of their changes after participating in the web-based health program	134
4.3.2 Topic 2: Students’ user experience and suggestions for the web-based MHBC interventions.....	146
4.3.3 Topic 3: Reasons for dropping out.....	150
4.4 Discussion	154
4.4.1 Findings for Topic 1	155
4.4.2 Findings for Topic 2.....	158
4.4.3 Findings for Topic 3.....	159
4.4.4 Trustworthiness of the findings.....	162
CHAPTER V: EXAMINING THE PSYCHOLOGICAL MECHANISMS OF MULTIPLE HEALTH BEHAVIOR CHANGE IN CHINESE COLLEGE STUDENTS: A PROSPECTIVE STUDY.....	164
5.1 Study background.....	164
5.2 Methods	166
5.2.1 Participants and procedures	166
5.2.2 Measures	167
5.2.3 Statistical analysis.....	169
5.3 Results.....	170
5.3.1 Preliminary results	170
5.3.2 Path analysis	170
5.4 Discussion	174
CHAPTER VI: GENERAL DISCUSSION AND CONCLUSION.....	178
6.1 Summary	178
6.2 Implications of the research findings	182

6.2.1 Theoretical implications.....	182
6.2.2 Practical implications.....	184
6.3 Methodological merits and limitations	185
6.4 Suggestions for future research	188
6.5 Conclusion	190
REFERENCES	192
APPENDICES	242
Appendix 1: Questionnaire package in Chapter III and V.....	242
Appendix 2: Results of sensitivity analyses in Chapter III.....	261
Appendix 3: CONSORT 2010 checklist for Study 1	262
Appendix 4: 32-item COREQ checklist for Study 2.....	264
CURRICULUM VITAE	267