Effectiveness of WhatsApp online group discussion for smoking relapse prevention: a pragmatic randomized controlled trial

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PROPOSED RESEARCH PROJECT

a) Title:

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b) Introduction:

Background

Tobacco control is one of the most cost-effective public health interventions[1]. There are about 650 thousands daily smokers in Hong Kong, and half of them will be killed by smoking-related diseases if they continued smoking[2]. “Offer help to quit tobacco use” is an effective tobacco control measure recommended by the World Health Organization to reduce smoking prevalence[3]. Hong Kong government surveys showed that the decline of smoking prevalence has been slowed down since 2007 (Smoking prevalence in 1998: 15.0%; 2007: 11.8%; 2012: 10.7%; 2015: 10.5%)[4], suggesting more cost-effective smoking cessation services are needed to achieve a single-digit smoking prevalence. As most existing cessation services target to achieve short-term abstinence (less than 2 months) without specific measures for relapse prevention, many quit attempters resume smoking. In quitters who received cessation services and achieved abstinence, about half of them would relapse in 6 months[5].

Risk factors of smoking relapse in recent quitters can be affective (e.g. anxiety and depressed mood), physiological (e.g. nicotine dependence and withdrawal symptoms), cognitive (e.g. self-efficacy and knowledge), behavioural (e.g. slips), and social (e.g. social network and social support)[6]. Among all these factors, slip or lapse, meaning a single act of smoking after quitting, is the strongest predictor of relapse. Marlatt and Gordon (1980) suggested a cognitive-behavioral model, which addressed that a lapse leads to “abstinence violation effect”[7]. This effect shows a person’s inability to have coping responses towards the lapse, and lead to decrease in self-efficacy. Therefore, relapse prevention strategies typically addressed the need to identify coping strategies for high-risk situation, increase self-efficacy, improve skills and knowledge, and confront “failure” and “mistakes” perception of lapse[6].

Evidence to support the effectiveness of behavioural interventions for smoking relapse prevention is scarce. A systematic review of only 2 randomized controlled trials (RCT) showed that group counselling is an effective relapse prevention intervention[8]. Quitting experiences and methods shared by participants are more convincing than expert advice and can increase engagement[9]. Mutual support developed via peer interactions addresses recent quitters’ need for psychosocial support[10]. Yet group counselling can only engage participants with few counselling sessions and fail to offer instant interventions to manage craving and relapse. Face-to-face counselling sessions, which are often led by trained counsellors, cannot appeal many people and incur high cost.

To increase the applicability of group-based intervention, some online platforms via mobile device (“m-health”) and social media for smoking cessation have been developed. These m-health interventions not only reach many smokers in the community, but also increase interaction and mutual support among smokers[11]. As text messaging services through mobile phone for smoking cessation have

been well established in many countries and is effective to increase abstinence (RR=1.77) [12], progression from the platform of text messaging services to a more interactive internet-based platform is warranted. Online platform and use of mobile device can potentially enhance immediate assistance when participants experience craving and other withdrawal symptoms[13]. However, some m-health interventions had low participants' engagement, poor adherence of cessation treatment guidelines, and lack of tailored feedback to participants[14]. In contrast, social medias (e.g WhatsApp and Facebook) already have high popularity, hence are more preferable than other smartphone applications to deliver interventions and sustain higher adherence, as users do not need to learn and adapt new tools for interventions. From our thorough search of literature (source: PubMed and Cochrane Library; until 28 February 2017), some feasibility studies on m-health smoking cessation intervention have been conducted, but only two randomized trials (including the pilot RCT conducted by the PA) reported the effectiveness of social media[15, 16]. We identified only 5 studies (1 for WhatsApp, 2 for Facebook and 2 for Twitter) examining the effectiveness of social media for smoking cessation from the trial registries (ClinicalTrials.gov & ISRCTN), and none are investigating its effectiveness for relapse prevention.

We conducted a pilot RCT to examine the feasibility and efficacy of a relapse prevention with a 2-month online group discussion via WhatsApp or Facebook[16] (Appendix 1), which are the two most popular mobile phone apps. The 3-arm pilot RCT recruited 136 quitters who completed the 8-week cessation treatment in the Integrated Centre on Smoking Cessation (ICSC) of Tung Wah Group of Hospitals (TWGH). Results, which have been published in a top medical informatics journal (JMIR), showed that the WhatsApp group discussion significantly increased self-reported tobacco abstinence at 6-month follow-up (WhatsApp: 64% versus Control: 39% odds ratio (OR) & 95%CI=2.86, 1.22-6.67), but the 95% confidence interval was wide due to small sample size[16]. The difference in validated tobacco abstinence (WhatsApp: 26.0% versus Control: 15.0%, OR & 95%CI 2.04, 0.74-5.65) was found but marginally insignificant. No significant difference in these outcomes between Facebook and control arm were found. Therefore, the pilot RCT provided a proof of concept evidence to support a trial with larger sample size.

Following the main RCT paper published in JMIR, we published another paper about the content analysis of that pilot RCT in the journal "Telemedicine and e-health" in 2016 (Appendix 2).[17] That analysis showed that the WhatsApp participants had established both emotional and informational support relevant to relapse prevention. In addition, we showed that about half of the participants' posts addressed the components for helping recent quitters prevent relapse recommended in the US Clinical Practice Guideline[18]. Some participants were satisfied about the informational reminders of maintaining abstinence and other's successful quitting experience. On average, each participant received 57 messages from other participants and 60 messages from the moderator in their social groups in 2 months[17]. Therefore, WhatsApp social groups are useful platforms for smoking relapse prevention with satisfactory involvement and adherence.

The limitations in the pilot RCT can be improved in our present proposal. First, many participants had been abstinent for more than a month at baseline, so they reported few cravings. Given that most

relapses occur within the first few weeks of abstinence[19], this can be improved by recruiting quitters who have just quit, and starting the WhatsApp groups as soon as possible. Second, the intervention content and dosage through social media needs to be revised to increase participation. For instance, only 6 out of the 16 participants, who reported relapse at 2-month, shared their relapse experience in the group. The few number of reports of relapse posed barriers for early intervention. Due to limited number of eligible participants, some groups had only 2 to 5 participants, which led to inactive discussion. About one-fourth of the participants only stayed in the group, but did not post anything. These findings highlighted the importance of skilful and theory-driven group moderation, and inclusion of more updated and interesting content to increase the level of participation. Lastly, for a larger RCT, we shall add more recruitment sites to increase participant recruitment and generalizability. A subsequent cost-effectiveness analysis based on trial data will establish the optimal balance between costs and health effectiveness outcomes, and provide health economic data to policymakers to facilitate informed decision-making of health interventions for tobacco control

c) Aims and Hypotheses to be Tested:

This study aims to examine the effectiveness and cost-effectiveness of WhatsApp group discussion for smoking relapse prevention. To assess the effect due to treatment modality through the WhatsApp social group, we will analyse the frequency and topics of the posts in each social group and in each participant. The primary hypothesis is whether quitters who participate in the WhatsApp group discussion will have a higher prevalence of validated tobacco abstinence at 12-month follow-up than those who do not. Our second hypothesis is that greater participation in the social groups, indicated by number of posts received, posted and/or viewed, was associated with higher likelihood to quit at 12-month. The third hypothesis is that the WhatsApp intervention for a recent quitter is a more cost-effective option for tobacco abstinence and prolonged survival when compared to the control group.

d) Plan of Investigation:

(i) <u>Subjects</u>

Inclusion criteria:

- Smoke at least 1 cigarette per day at the service intake
- Aged 18 years or above
- Have enrolled or re-enrolled in the smoking cessation treatment for no more than 8 weeks
- No smoking for 7 to 14 days
- Able to communicate in Cantonese/Mandarin and read Chinese
- Have a smart phone with local network connection

Exclusion criteria:

- Have unstable physical or psychological conditions as advised by doctors or counsellor in charge
- Have become pregnant in the past 2 months

The fourth criterion will be used because our proposed RCT will target the quitters who have recently quit, and exclude those who will have maintained a longer period of abstinence. Our pilot RCT showed that 10 participants on average could be recruited in 8 clinics each week[16]. Our proposed RCT with 30 clinics of the 3 major service providers of smoking cessation, and recruiting quitters who have quit for 7 to 30 days will recruit 25 to 35 participants each week.

<u>Sample size calculation</u>

Our pilot RCT showed that the OR of the CO validated quit rates between the intervention and

control group was 2.04 (95%CI 0.74-5.65) (Intervention: 26.0%, Control: 15.0%)[16]. Because our proposed RCT will recruit quitters who have recently quit, we have conservatively estimated that the OR will be 1.70 (23.0% vs 15.0%). To detect a significant difference of quit rate with 2-tailed z-test by *GPower 3.1* between the two groups with a power of 90% (to reduce type II error) and 5% significant level (type I error), we will need 1,008 participants in total (504 participants per group).

(ii) Methods

Design

This is a 2-arm open-labelled pragmatic randomized controlled trial, by comparing the 12-month tobacco abstinence between the recent quitters who will join WhatsApp group discussion (Intervention group) and those who will not (Control group). A 1:1 allocation will be used. The intervention content for both trial arms in the proposed trial will be the same and based on the US practice guidelines for smoking cessation[18], therefore the intervention effects due to the treatment content will be the same in both groups. Only the intervention platform (WhatsApp vs text messaging service) and the communication mode (one-way vs interactive) will be different between the 2 groups. This trial will be a pragmatic effectiveness trial to examine the effect of our intervention delivered under a real-life setting. We will apply less stringent eligibility criteria for the subjects, unobtrusive measurement on adherence, and include all subjects in the final analysis regardless of intervention compliance of each subject. The study design and recruitment setting were similar to our pilot RCT, which obtained ethics approval from the Institutional Review Board of the University of Hong Kong/Hong Kong Authority Hong Kong West Cluster (IRB reference no. UW-13-528) (Appendix 3).

Setting

The recruitment sites will be in all smoking cessation clinics under Hospital Authority (n=16), Tung Wah Group of Hospitals (n=6) and Pok Oi Hospital (n=8), which are the major smoking cessation service providers in Hong Kong offering free behavioural and pharmacological interventions. According to the record from Department of Health, the number of clients who attended smoking cessation clinic in the three service providers was 6,419, 2,756 and 1,380 per year, respectively. The 6-month quit rate (by intention-to-treat) of these services was ranged from 30 to 40%, and we expect the quit rate at earlier follow-up would be greater. These records, together with 55.1% recruitment rate from our pilot RCT, support that our proposed RCT can recruit sufficient participants (n=1,008) within our recruitment period (about 7 months). The representative from the Tung Wah Group of Hospitals is one of the co-A, and the other 2 service providers have already agreed to support this RCT (Appendix 4 & 5).

Procedures

The recruitment staff will screen the eligibility of the clients at the first or later follow-up of their cessation treatment, and invite eligible participants to join the RCT. Then, the participants will be required to sign a consent form (Appendix 6), complete a baseline self-administered

questionnaire, and receive a self-help booklet on relapse prevention (about 10 pages). All participants will be informed that they will receive messages about relapse prevention either through a WhatsApp social group (Intervention group) or text messaging service (control group), where the option of platform will be determined by a randomization procedure. If the subject is not familiar with WhatsApp, the recruitment staff will introduce several key features of using WhatsApp to the subject such as texting in a group and sending emoji or pictures. Secondly, they will be reassured that all the WhatsApp posts can only be read by the participants and the moderator in the group. The HKU research team will only analyse all the data and WhatsApp posts anonymously. Thirdly, they will be informed that their telephone numbers will appear in their group, To prevent any misconduct, harassment or unauthorized marketing using the contact information, we will introduce the regulations of using the WhatsApp groups to all participants before the group discussion (Appendix 7). A trained group moderator will monitor the group conversation and report any events of misusing the contact information to the PA. Lastly, participants can withdraw from the intervention study anytime over the study period. In our pilot RCT, about 83.4% of the eligible participants agreed to participate in the WhatsApp social groups after they were informed the above ethical issues[16].

After the recruitment, the recruitment staff will immediately send the contact details of the consented participant to our research staff for the randomization procedures.

Randomization

Simple individual randomization by sequentially numbered, opaque sealed envelopes (SNOSE) will be used to ensure the recruitment staff and the participants will be concealed to the allocation sequence before the group allocation. The principal investigator will prepare about 1,100 identical, opaque, sealed, A5-sized envelops, with a unique 3-digit serial number on the cover of each envelope as an identifier. Half of them will contain a card indicating the intervention group, and the others will contain a card indicating the control group. When a participant is recruited, the research staff will open 1 envelope according the serial number to allocate the recruited participant, according to the card inside.

Interventions

When the research staff collects 10 participants in the intervention group (a few groups will have 11 participants), probably within one week, he/she will set up the WhatsApp group with them. Each WhatsApp group (about 50 groups in total) will allow real-time group discussion for 8 weeks. They will receive each week at least 3 text messages or videos from a moderator, which will be based on the six approaches delineated in “Treatments for the Recent Quitter” of the US Clinical Practice Guidelines on Treating Tobacco Use and Dependence[18]. Based on the Positive Psychology theories[20], and our experience of the FAMILY project, we developed a framework of four principles to enhance the online group moderation: (1) Using active listening skills to understand the thoughts and feelings behind participants’ sharing; (2) Showing sincere,

immediate, specific, and concrete appreciation and gratitude towards their sharing; (3) Mindful awareness of the group dynamics and giving strategic reactions; (4) Enhancement of self-efficacy, sense of control and satisfaction among the participants. In addition, if any participant shares their relapse experience in the group, the moderator will engage other participants to provide appreciation and support, or, if preferred, actively refer him/her to existing cessation services.

To ensure quality assurance and intervention fidelity, all moderators will be provided a training of smoking cessation knowledge, and moderating skills to motivate participants to share. Our co-investigator (Prof. Tai Hing Lam), who has the experience of using Positive Psychology theories in the FAMILY project, will train the moderators to use specific texts, “emoji” and short videos to express gratitude and appreciation towards participants’ sharing. Also, a research nurse will review the discussion contents, provide service referral for the participants who relapse, and organize case conference with the moderators each month to improve group moderation skills.

The control group will only receive 3 mobile phone text messages each week in the 8 weeks after recruitment. These message contents will be the same as those received by the intervention group. Our intervention will not interrupt the services that all participants will be receiving in the cessation clinics.

Follow-up

All participants will be followed up via telephone by an allocation-blinded interviewer at 3-, 6- and 12-month after the random group allocation. Only the participants who report abstinence in the past 7 days will be invited to provide samples of exhaled breath and/or saliva for biochemical validation at their residence, workplace or nearby, as preferred by the quitters. The Bedfont Smokerlyzer and iScreen OFD Cotinine Saliva Test Kit will be used for validations. To increase participation, the participants will be given HK$100 (approximately equivalent to US$12.8) as a compensation for their time cost. All participants will not know the validation incentive at baseline. The validation takes very short time (3 minutes) and is easy.

Allocation concealment

All recruitment staff and participants will be concealed to the group allocation at recruitment. The research staff will open the envelope of group allocation according to the serial number on the envelope, so he/she will not know the group sequence.

Blinding

Participants and group moderators cannot and will not be blinded to the intervention. Assessors of the follow-up outcomes and the research analysts will not be involved in the recruitment and intervention delivery, and will be blinded to the group allocation (single blindness).

Outcomes

The primary outcome is biochemically validated (exhaled carbon monoxide < 4ppm; or/and saliva cotinine < 10ng/ml) tobacco abstinence at 12-month follow-up, which have been confirmed as a stringent criterion for abstinence verification for quitters who use nicotine replacement therapy[21]. Secondary outcomes include prevalence of self-reported 7-day and continuous abstinence over the study period, and relapse rate, which is defined as the proportion of quitters who smoke at least 5 cigarettes in 3 consecutive days over the study period. Ancillary outcomes include change in frequency and intensity of smoking urge, change in the Minnesota Nicotine Withdrawal Scale (MNWS), and the change in HRQOL measured by Short-form 6-item instrument and EuroQoL 5-dimension 5-level (EQ-5D-5L) health utility scores from baseline to follow-ups. For cost-effectiveness analysis, the outcomes are the incremental cost-effectiveness ratio (ICER) in terms of cost per an additional tobacco abstinence gained for intervention compared to control group, and the ICER in terms of cost per life-years gain or quality-adjusted life-years gained for intervention versus control group.

(iii) Study design A pragmatic open-labelled 2-arm randomized controlled trial

(iv) Data processing and analysis

Statistical analysis

By intention-to-treat analysis (in line with CONSORT guideline), participants who are lost or refuse the follow-up will be treated as smokers with no changes in daily cigarette consumption. The analysis with multiple imputation (MI) procedure to impute the missing exhaled CO will be conducted as sensitivity analysis. Considering the correlated outcomes of participants within the same WhatsApp group, a post-hoc analysis by generalized estimating equation (GEE) model will be used to summarise the intervention effect with the odds ratios, with and without adjustment for baseline characteristics. Number needed to treat (NNT), which shows the number of treated subjects needed to have one additional quitter at 12-month, will be computed by taking the reciprocal of the risk difference between the 2 RCT groups. Number of posts received, posted or/and viewed in each participant and in each social group will be documented, and then included in the final GEE model to assess their association with the cessation outcome.

Text mining of the WhatsApp groups

All discussion content will be archived and anonymized to remove identifying personal information. Due to a huge number of messages from the 50 WhatsApp groups, we will use automatic, computational text mining and visualization of the dataset for the content analysis. First, utilizing a lexicon of keywords derived from our qualitative analysis of the pilot RCT, we will develop a heatmap visualization to illustrate the prevalence of the discussion topics[22]. Second, we will apply topic modelling to investigate emerging themes in our WhatsApp dataset, using the Mallet[23] implementation of the Latent Dirichlet Allocation topic modelling algorithm[24]. Topic modelling algorithms take as input a text dataset (in this case, the WhatsApp dataset), and output a set of topics (and their associated keywords) in addition to estimates of the proportion of each topic[25].

Qualitative interview

To collect opinions towards the WhatsApp group intervention, we will use purposive sampling to select 20 participants from the intervention group including both sexes, all age groups and all smoking status at 12-month, to participate in a qualitative interview after the intervention. An interview guide with open-ended and iterative questions will be used to probe for more experiences from the interviewees. Each interview will be conducted by the PI and a trained research assistant, and will last about 30 to 60 minutes. Each participant will be offered HK$300 cash (US$38.5) to compensate for their travel expenses and time.

The interview content will be transcribed verbatim in Chinese for further analysis. We will analyze the qualitative interview transcripts using framework analysis[26] to construct a coherent and logical structure from the classification of many opinions and perceptions of social groups. The first author and two trained research assistants will use the open-coding method to identify relevant content in the transcripts; next, the first author will classify all labelled content into several independent themes showing distinct features of the social groups. The results will then be discussed and consolidated in the panel meetings with the co-authors.

Cost-effectiveness analysis

Cost-effectiveness analysis will be undertaken to indicate whether the intervention will be more cost-effective or even cost-saving option for a quitter over a time horizon of one year (within trial period) and lifetime. Within and lifetime cost-effectiveness analyses will be populated based on the healthcare provider perspective.

Model parameters input will be identified through within trial data and a review of local and overseas literature, where necessary. Within trial cost-effectiveness of WhatsApp intervention versus control group will be evaluated using total costs, the number of tobacco abstinence and total QALYs over the study period. EQ-5D-5L utility data at baseline and follow-ups from trial will estimate QALYs in two groups using area under the curve technique. Lifetime cost-effectiveness will be performed via Markov modelling that will simulate the annual health status progression of subjects in either intervention or control group (Appendix 8). Both the successful and unsuccessful quitters after the trial will be subject to the annual transition probability from a status of no diseases to lung cancer, cardiovascular diseases, and other diseases, and then mortaity. Former smokers may be relapsed after abstinence. Discounting will only be applied to total costs and QALY calculation under the lifetime horizon. Sensitivity analyses will be conducted where each parameter will be set at plausible lower and upper bounds based on 95% confidence interval of estimates in above data analysis.

The incremental cost-effectiveness ratio (ICER) in terms of cost per an additional tobacco abstinence gained, life-years gained, or QALYs gained for the intervention group in comparison to the control group will be reported. The WhatsApp intervention will be considered as cost-

effective if its ICER will be less than 3 times per capita gross domestic product in Hong Kong recommended by WHO or the potential ICER threshold in Hong Kong. The cost-effectiveness model will be built using Microsoft Excel or Treeage Pro software.

[Word Count: 4,000]

e) Existing Facilities:

The School of Nursing and the School of Public Health of the University of Hong Kong have good reputation and academic track record in the research and practice of smoking cessation. The project team has been collaborating with the Department of Health, Hong Kong Council on Smoking and Health (COSH), Integrated Centre on Smoking Cessation of Tung Wah Group of Hospitals and other relevant non-governmental organisations to promote smoking cessation. The research team has expertise from different disciplines (e.g. medical doctors, nurses, social workers and statisticians) who have sufficient capacities to organize the training, promotion and vigorous evaluation with various methods. The project team has its own essential equipment including counselling room, computers, telephone, and validation tools for smoking abstinence for the project implementation.

The PA (YTDC) is a primary investigator of many randomized trials of examining cutting-edge smoking cessation interventions, who have published numerous journal papers and have been awarded for many smoking cessation trials. His 2 HMRF applications in the 2016 round (as co-A), which are also related to m-health interventions, have obtained ratings “3” and are potentially funded (Project no. 14151111 and 16150752). He has extensive statistical knowledge and experience in manpower management for randomized trials. One of the co-A (CW) has extensive experience in the cost and cost-effectiveness analysis of healthcare interventions in Hong Kong. Another co-A (MC) is an international scholar who has strong track record of publications and grants in the analysis of social media activities with advanced text mining skills.

f) Justification of Requirements:

Total: $ 967,620

Staff cost - $ 696,200

1. A full-time Research Assistant II (pt5, RAII) will assist the principal investigator in coordinating all data collection, implementing the whole project, performing data analysis, and preparing reports and all other result dissemination activities. The RA will be moderator of some WhatsApp social groups

- Total amount = 24 months x $18,806 per month incl. MPF = $451,344

2. 5 part-time Research Assistants II, moderators (pt5, RAII): They will be the moderators of the 50 WhatsApp social groups to facilitate discussions and delivering advices to smokers (8 weeks for each group)

- Hours required = 50 groups x 8 weeks x 2 hours per week = 800 hrs
- 800 hours x 112 per hour incl. MPF /5 staff /9 months =$1991 per staff per month
- Total amount = $1991 per month incl. MPF x 5 staff x 9 months = $89,595

3. A part-time Registered Nurse (pt3, Nurse) with rich experience in smoking cessation:

- design intervention guidelines and the self-help booklet, providing training workshop to the recruitment staff and moderators (40 hrs x 2 months =80hrs)
- hold case conference with the moderators, recruitment staff and telephone interviewers each month (4 hrs x 19 months =76hrs)
- 80 hrs + 76 hrs x $167 per hour incl. MPF /21 months=$ 1241 per staff per month
- Total amount = $1,241 per month incl. MPF x 21 months =$26,061

4. 10 part-time Student Research Assistants/ Technical Assistants (pt 2, Student RA/TA):
    - Recruitment for subjects in clinics (4 hrs x 5 times per week x 30 weeks = 600 hrs)
    - Telephone follow-ups at 6-month and 12-month: 1,008 participants x 15 minutes x 2 follow-ups = 504 hrs;
    - Exhaled carbon monoxide (CO) validation at 6-month and 12-month: 504 intervention group participants x 23% quit rate = 116 participants; 504 control group participants x 15% quit rate = 76 participants, total: 192 quitters x 2 validations x 2 hrs = 768 hrs;
    - Total hours = 600hrs +504 hrs + 768 hrs = 1,872 hours
    - 1,872 hours x $69 per hour incl. MPF / 10 staff / 19 months = $680 per staff per month
    - Total amount =$680 per month incl. MPF x 10 staff x 19 months = $129,200

General Expenses - $ 271,420

1. Conference (i.e. Travel and subsistence) ($10,000)
2. Publication costs ($20,000)
3. Audit fee ($5,000)
4. Incentives for participants
   Incentives for quitters who complete the exhaled CO validation at the 6-month and 12-month follow-ups: 504 intervention group participants x 23% quit rate = 116 participants; 504 control group participants x 15% quit rate = 76 participants, total: 192 quitters, 192 quitters x 2 validations x $100 cash incentive = $38,400
5. Incentives for participants who complete the telephone follow-up (1,008 participants x 2 follow-ups x $50 supermarket coupon = $100,800)
6. Incentive for participants who complete the in-depth interview (20 participants x $300 = $6,000)

- Total = $38,400 + $100,800 + $6,000 = $145,200

7. Production of self-help booklet (1,100 booklets x $5 = $5,500)
8. Mobile phones for WhatsApp social group (3 phones x $1,000 = 3,000)
9. CO monitors and mouthpieces for the validations (3 monitors x $6000 = $18,000)
10. Mouthpieces for CO monitors for participants at baseline and validations (1,400 x $3 = $4,200)
11. Local travelling expense (192 validation tests x 2 validations x $30 = $11,520)
12. Standard license of TreeAge Pro Suite software for cost-effectiveness analysis ($9,000)
13. Registered mails for posting coupons to subjects who have completed follow-ups at the 6-month and 12-month follow-ups (1008 subjects x 2 follow-ups x $17.2 per registered mail=$34,675

14. Phone service for WhatsApp group discussion and telephone follow-up ($2,500)
15. Stationeries and other expenses (e.g. printing etc) $2,825

g) Purpose and Potential:

Effective relapse prevention in recent quitters is critical for sustained smoking cessation. Most existing cessation services target to achieve short-term abstinence (less than 2 months) without specific measures for relapse prevention. Evidence of effective interventions for relapse prevention is scarce. By delivering low-cost and non-pharmaceutical relapse prevention intervention for recent quitters, our RCT expects to increase long-term validated abstinence, thus making important contribution to improve cessation treatment outcome. Our findings will make important contribution to lower the smoking prevalence in Hong Kong by contributing much needed knowledge and experiences in delivering relapse prevention intervention via the use of Positive Psychology theories and information technology. Our pragmatic RCT design alongside economic evaluation will provide scientific evidence to show a real-world effectiveness, cost-effectiveness and high generalizability of using low-cost and popular social media for improving existing smoking cessation services and achieving better long-term cessation outcomes. WhatsApp is the most popular communication tool in Hong Kong, which will enhance the adherence of our intervention. This online communication tool will be developed to enhance peer social support among smokers and quitters. Also, it will be developed as an alternative channel for healthcare providers to deliver informational cessation support to general smokers. The results and experiences of our published pilot RCT supported the feasibility of our proposed study.

h) Key References:

1 Mackay JM, Bettcher DW, Minhas R, Schotte K. Successes and new emerging challenges in tobacco control: addressing the vector Tob Control 2012;21:77-79. 10.1136/tobaccocontrol-2012-050433.

2 Lam TH. Absolute risk of tobacco deaths: One in two smokers will be killed by smoking: comment on “smoking and all-cause mortality in older people” Arch Intern Med 2012;172:845-846. 10.1001/archinternmed.2012.1927.

3 World Health Organization. Parties to the WHO framework convention on tobacco control, 2012. http://www.who.int/fctc/signatories_parties/en/index.html#. Geneva: World Health Organization, 2012.

4 Census & Statistics Department (Hong Kong SAR government). Thematic Household Survey, Report No. 59: Pattern of Smoking. Hong Kong: Census & Statistics Department 2016.

5 Segan CJ, Borland R, Greenwood KM. Can transtheoretical model measures predict relapse from the action stage of change among ex-smokers who quit after calling a quitline? Addict Behav 2006;31:414-428. http://dx.doi.org/10.1016/j.addbeh.2005.05.023.

6 Ockene JK, Emmons KM, Mermelstein RJ, Perkins KA, Bonollo DS, Voorhees CC, Hollis JF. Relapse and maintenance issues for smoking cessation Health psychology : official journal of the Division of Health Psychology, American Psychological Association 2000;19:17-31. 10.1037/0278-6133.19.suppl1.17.

7 Marlatt G, Gordon J. Determinants of relapse: implications for the maintenance of behavior change. In: Davidson PO, Davidson SM (eds). Behavioral Medicine: Changing Health Lifestyles. New York: Brunner/Mazel, 1980, 410 - 452.

8 Agboola S, McNeill A, Coleman T. A systematic review of the effectiveness of smoking relapse prevention interventions for abstinent smokers Addiction 2010;105:1362 - 1380.

9 Coley HL, Sadasivam RS, Williams JH, Volkman JE, Schoenberger Y-M, Kohler CL, . . . Houston TK. Crowdsourced Peer- Versus Expert-Written Smoking-Cessation Messages Am J Prev Med 2013;45:543-550. http://dx.doi.org/10.1016/j.amepre.2013.07.004.

10 Phua J. Participating in Health Issue-Specific Social Networking Sites to Quit Smoking: How Does Online Social Interconnectedness Influence Smoking Cessation Self-Efficacy? J Commun 2013;63:933-952. 10.1111/jcom.12054.

11 Struik LL, Baskerville BN. The Role of Facebook in Crush the Crave, a Mobile- and Social Media-Based Smoking Cessation Intervention: Qualitative Framework Analysis of Posts J Med Internet Res 2014;16:e170. 10.2196/jmir.3189.

12 Whittaker R, McRobbie H, Bullen C, Borland R, Rodgers A, Gu Y. Mobile phone-based interventions for smoking cessation Cochrane Database of Systematic Reviews 2012 2012:CD006611. 10.1002/14651858.CD006611.pub3.

13 Selby P, van Mierlo T, Voci CS, Parent D, Cunningham AJ. Online Social and Professional Support for Smokers Trying to Quit: An Exploration of First Time Posts From 2562 Members J Med Internet Res 2010;12:e34. 10.2196/jmir.1340.

14 Duke CJ, Hansen H, Kim EA, Curry L, Allen J. The Use of Social Media by State Tobacco Control Programs to Promote Smoking Cessation: A Cross-Sectional Study J Med Internet Res 2014;16:e169. 10.2196/jmir.3430.

15 Pechmann C, Delucchi K, Lakon CM, Prochaska JJ. Randomised controlled trial evaluation of Tweet2Quit: a social network quit-smoking intervention Tob Control In press. 10.1136/tobaccocontrol-2015-052768.

16 Cheung YTD, Chan CHH, Lai C-KJ, Chan WFV, Wang MP, Li HCW, . . . Lam T-H. Using WhatsApp and Facebook Online Social Groups for Smoking Relapse Prevention for Recent Quitters: A Pilot Pragmatic Cluster Randomized Controlled Trial J Med Internet Res 2015;17:e238. 10.2196/jmir.4829.

17 Cheung YTD, Chan CHH, Wang MP, Li HCW, Lam T-h. Online Social Support for the Prevention of Smoking Relapse: A Content Analysis of the WhatsApp and Facebook Social Groups Telemedicine and e-Health 2017;23:507-516. 10.1089/tmj.2016.0176.

18 Fiore MC, Jaén CR, Baker TB, Bailey WC, Benowitz NL, Curry SJ, . . . Henderson PN. Treating tobacco use and dependence: 2008 update. Rockvill: MD: Department of Health and Human Services, 2008.

19 Hughes JR, Keely J, Naud S. Shape of the relapse curve and long-term abstinence among untreated smokers Addiction 2004;99:29-38. 10.1111/j.1360-0443.2004.00540.x.

20 Snyder CR, Lopez SJ. Positive psychology : the scientific and practical explorations of human strengths Thousands Oaks, Calif: SAGE Publications,2007.

21 Cropsey KL, Trent LR, Clark CB, Stevens EN, Lahti AC, Hendricks PS. How Low Should You Go? Determining the Optimal Cutoff for Exhaled Carbon Monoxide to Confirm Smoking Abstinence When Using Cotinine as Reference Nicotine Tob Res 2014;16:1348-1355.

10.1093/ntr/ntu085.

22 Chen AT, Zhu S-H, Conway M. What Online Communities Can Tell Us About Electronic Cigarettes and Hookah Use: A Study Using Text Mining and Visualization Techniques J Med Internet Res 2015;17:e220.

23 McCallum AK. "MALLET: A Machine Learning for Language Toolkit" http://mallet.cs.umass.edu, 2002.

24 Blei DM, Ng AY, Jordan MI. Latent dirichlet allocation J Mach Learn Res 2003;3:993-1022.

25 Blei DM. Probabilistic topic models Commun ACM 2012;55:77-84. 10.1145/2133806.2133826.

26 Ritchie J, Lewis J. Qualitative Research Practice: A Guide for Social Science Students and Researchers. London, UK: SAGE Publication,2003.