The 11th "Quit to Win" Contest – A Pragmatic Randomized Controlled Trial on Smoking-related COVID-19 Risk Messaging to Increase Abstinence

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1. Introduction

Smoking prevalence in Hong Kong decreases steadily in the past few decades and dropped to 10.2% in 2019[1]. Although it is one of the lowest in the world, there were still 637,900 daily smokers in Hong Kong and in fact the smoking prevalence had slightly rebounded from 10.0% in 2017. A large number of smokers were threatened by smoking and half of them were killed each year[2]. Increased morbidity of smoking resulted in about 7,000 deaths each year in Hong Kong. Smoking also accounts for a large amount of medical costs, long-term healthcare costs and productivity loss of about HK$5.6 billion a year (0.3% of Hong Kong GDP) in 2011[3]. Smoking is a highly addictive behaviour, and it is hard for smokers with strong nicotine dependence to quit without assistance. Free smoking cessation (SC) service provided by various organizations is available in community. However, current smokers seldom actively sought advices from those service providers. Therefore, it is important to develop brief and novel interventions to motivate and assist smokers to quit smoking.

Hong Kong "Quit to Win" (QTW) Contest, which is a smoking cessation competition, annually organized by Hong Kong Council on Smoking and Health (COSH) in collaboration with School of Nursing and School of Public Health, The University of Hong Kong (HKU). It provides an opportunity to reach and motivate a large number of community smokers to make quit attempts by providing professional support, prizes and incentives[4]. The contest also provides a unique platform to conduct and evaluate the effect of randomized controlled trials (RCTs) in order to develop and refine novel smoking cessation interventions for public health application.

Messages regarding the risk of smoking on COVID-19 susceptibility and severity may influence smoking and quitting behaviours. Unverified claims that smoking can protect against COVID-19 have been widely disseminated, especially during the early phase of the pandemic in 2020[5]. Our population-based survey found that exposure to such misinformation was associated with increased tobacco use[6]. On the other hand, observational studies in the US and UK showed that a higher perceived risk of COVID-19 related to smoking was associated with increased cessation-related behaviours (e.g., smoking reduction, quit attempts, and intentions)[7,8]. Similar results were also shown in our study in Hong Kong[9]. Several online experiments have found that exposure to messaging on smoking-related COVID-19 risk can increase smokers' motivations to quit[10,11]. which may be mediated by fear arousal[12]. The 8th QTW showed the effectiveness of mobile instant messaging in promoting smoking cessation[13]. Our subsequent trial showed the feasibility of using mobile instant messaging to deliver cessation support amid the COVID-19 pandemic[14], in which access to in-person cessation services might be constrained.

In 2020, COSH collaborated with HKU, District Council, various district partners and supporting organizations to organize the 11th QTW Contest. It included a two-arm, pragmatic randomized controlled trial which compared the effectiveness of communications on smoking-related COVID-19 risks on top of generic cessation support using mobile instant messaging with generic cessation support versus text messaging with generic information on smoking hazards and quitting benefit, in increasing abstinence on participated community smokers.

2. Methods

2.1 Recruitment

Participants were recruited from smoking hotspots in all 18 districts of Hong Kong, online platforms and calls to previous participants. From 13 June to 30 October 2020, a total of 55 recruitment activities (booths in shopping malls, public areas and venues provided by supporting organizations) were organized and 4 recruitment sessions were conducted to inmates of Correctional Services Department (CSD) in Stanley Prison, Pik Uk Prison, Lo Wu Correctional Institution and Tong Fuk Correctional Institution. 176 university students and volunteers from non-governmental organizations attended a full-day online workshop and were trained as smoking cessation counselors. Similar to previous trials, trained smoking cessation counselors proactively approached, screened and recruited eligible smokers at smoking hotspots into the QTW Contest and RCT using the "foot-in-the-door" approach, and delivered assigned interventions to participants. Compared with the pre-pandemic period, fewer smokers were observed in outdoor smoking hotspots because putting off masks for smoking was prohibited due to diseases prevention measures. Also, recruitment booths were unable to be held due to social distancing measures. Therefore, online advertisements and calls to previous participants who were failed to quit, were the contingent measures to recruit current smokers. Those smokers enrolled by online and phone call promotion were followed-up and screened by smoking cessation counselors through video calls. Details of the research method of the RCT has been published in an international peer-refereed journal[15].

Eligibility criteria for RCT participation included:

1. Hong Kong residents aged 18 years or above;
2. Daily smokers who smoked at least 1 stick of cigarette or heated tobacco product (HTP) per day or used e-cigarettes daily in the past 3 months;
3. Able to communicate in Cantonese and read Chinese;
4. Salivary cotinine level of ≥30 ng/ml;
5. Intended to quit/ reduce smoking
6. Able to use an instant messaging mobile app for communication
7. Currently did not participate in other smoking cessation programmes in enrollment

Written informed consent were obtained from all eligible participants who enrolled in the QTW Contest prior to delivery of the assigned treatment to the participants.

A computer-generated randomization list was produced by an independent statistician using a randomized blocking schema (2, 4, or 6). Participants were individually assigned at random to groups with a 1:1 allocation ratio. Blinding of the interventionists and participants was not possible because of the nature of the intervention. Outcome assessors and statistical analysts remained masked until the pre-specified analyses were completed.

At recruitment, QTW participants were given the option to participate in two parallel programmes: the QTW Lucky Draw Programme or Smoking Cessation Ambassadors Programme. A total of 5 biochemically validated quitters at 3-month in the Lucky Draw Programme won a lottery prize of HK$10,000 supermarket coupon each. Three validated quitters in Smoking Cessation Ambassador Programme at 3-month were interviewed and chosen by a selection committee to win electronic appliance coupon valued at HK$25,000 (champion), HK$15,000 (1st runner-up) and HK$10,000 (2nd runner-up). Nominators of winners from both programmes were awarded HK$2,000 supermarket coupon each.

2.2 Interventions and Follow-up

Intervention group:

At baseline, all participants received the face-to-face brief interventions, including the AWARD brief advice, active referral, and a 12-page self-help booklet at recruitment site or video contact. AWARD-guided advice comprised the following components: **A**sking about the participants' smoking history, **W**arning about the hazard of continuing smoking using the result of saliva test and a health warning leaflet , **A**dvising them to quit as soon as possible, **R**eferring them to SC services, and **D**oing-it-again, i.e. to repeat the intervention; participants who fail to quit or relapse will be encouraged to quit again (and those who have quitted will be encouraged to prevent relapse) during each telephone follow-up.

Participants in the intervention group received COVID-specific advice which emphasized the risks of smoking associated with the COVID-19. They received a health warning leaflet that highlighted the smoking-related COVID-19 risk and be advised to quit as soon as possible during the pandemic. Content included the risk of respiratory infection, impaired immunity and COVID-19 complications in smokers, i.e. 1.4- to 2.4-fold increased risk of requiring intensive care, using ventilators and death, as well as the higher risk of viral exposure because of mask removal, the hand-to-mouth action of smoking, the clustering of smokers and secondhand smoke.

They also received cessation advice via mobile instant messaging for three months. The messaging schedule was the same as that in the control group. The contents were similar to those of the control group except the messages on smoking hazards focused on smoking-related COVID-19 risk. These messages were adopted from tweets and Facebook posts from the World Health Organization, Centre for Health Protection of the Hong Kong Government, and The University of Hong Kong. Similar to our previous trials on mobile instant messaging support, the participants of intervention group could respond to the messages and initiate conversations

with a research nurse to receive cessation coaching in real time during office hours (9 am – 6 pm, Monday to Friday). Behavioural change techniques (e.g., eliciting and answering questions, providing feedback on current behaviours, boosting motivation and self-efficacy) were used based on the needs of the participants.

Control group:

Participants received AWARD-guided advice and a 12-page self-help smoking cessation booklet which was designed by COSH and routinely used in QTW Contests. They also received text messages with generic cessation advice for three months from baseline, with a tapering schedule from twice a week in the first month to once a week in the following two months (16 messages in total). The messages included advice on smoking hazards and quit benefits, strategies for quitting and coping, psychosocial support, and encouragement to initiate a quit attempt.

Non-trial group and CSD group:

Participants who joined the Smoking Cessation Ambassador Programme, those who did not own a smartphone with an instant messaging app installed, or those who were unable to read or communicate in Chinese were assigned to the non-trial group. The non-trial participants received the same intervention as the trial group recruited from the same recruitment sessions, To ensure the homogenous results of community smokers, participants recruited from prisons or correctional institutions were enrolled as the CSD Group and were excluded from data analyses.

All participants completed the baseline questionnaire and were followed at 1-, 2-, 3- and 6-month from baseline. RCT and non-trial participants were followed by telephone survey and CSD participants were followed by self-administrated questionnaire. To enhance the retention rate, an incentive of HK$100 was given to participants who completed all four telephone follow-up interviews. Those participants who failed to be contacted after a maximum of seven telephone calls and a voice message at the scheduled follow-up time points were considered as lost to follow-up. Participants who self-reported quit in the past seven days at 3- and 6- month follow-ups were invited for biochemical validation. All validated quitters received a small cash incentive of HK$500 each at 3- and 6-month follow-ups.

The primary outcome was biochemically validated abstinence at 3-month (end of treatment) and 6-month after treatment initiation, verified by salivary cotinine concentrations of <30 ng/mL or exhaled carbon monoxide concentrations of <4 ppm. Biochemical validations were conducted via in-person visit and real time video call for those participants who reported having abstained from smoking for at least seven days at 3- and 6-month.

The baseline socio-demographic and smoking profile of all participants at baseline (N=1,261) were presented descriptively. The primary and secondary outcomes were compared between the two study groups by chi-square tests. The primary outcomes were biochemically validated abstinence (exhaled carbon monoxide<4 ppm and salivary cotinine<10 ng/mL) at 3- and 6-month. The secondary outcomes include self-reported past 7-day point prevalence abstinence (PPA), smoking reduction rate and intervention engagement defined as having read the instant messages or text messages in the respective intervention condition (none/some/all). Analyses were by intention-to-treat (ITT), such that participants with missing data were assumed to have no change in their smoking behaviour, and by complete case (CC), in which participants with missing outcomes were excluded. We also assessed participants' use of smoking cessation services, change in perception of quitting, quit attempt and reasons. Withdrawal symptoms experienced, perceived social support for quitting, perceptions and use of smoking cessation aids provided, and perception of follow-up calls.

3. Results

A total of 55 recruitment sessions were held with over 80,770 people passers-by. Over 11,000 people made enquiries about the QTW Contest and smoking cessation, or visited the recruitment booth. The 176 trained smoking cessation counselors have approached about 7,700 smokers and 17,000 non-smokers in the promotional activities and recruitment sessions. A total of 1,340 smokers were recruited and screened for eligibility by the smoking cessation counselors. 28 smokers (2.1%) declined to give consent were excluded. Finally, 1,312 smokers joined the 11th QTW contest. After excluding participants who joined the Smoking Cessation Ambassador Programme, non-trial group (n=95) or CSD group (n=51), 1,166 (88.9%) participated in the RCT and were randomized to either the intervention group (n=583) or the control group (n=583).

3.1 Socio-demographic characteristics

Table 1 shows among 1,261 participants, most were male (79.8%) and aged 30-59 years (63.6%). 51.5% were married or cohabited and 65.7% were not living with a child; nearly two-third attained secondary education (59.6%). Nearly half resided in rented public housing (42.1%) and had monthly household income below HK$25,000 (40.0%); and most were self-employed or employed (77.8%).

3.2 Smoking profile

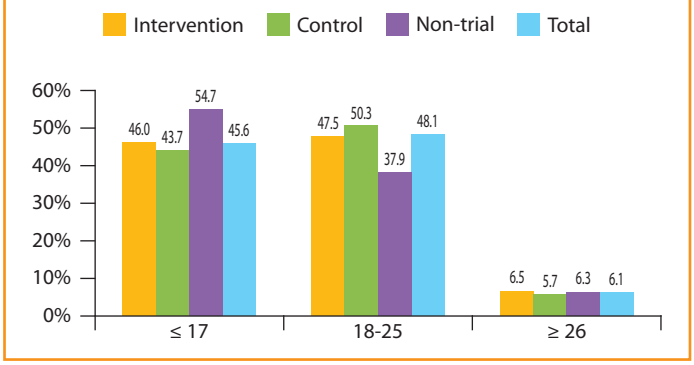
The participants' mean age of smoking initiation was 18.2 (SD=5.2) years, 45.6% started smoking before the age 18 (Figure 1). More than half of the participants smoked not greater than 10 cigarettes daily (56.6%) (Figure 2). Participants smoked 13.4 (SD=9.4) cigarettes on average.

Table 1. Participants' baseline demographic characteristics (N=1,261)

n (%)	Total (N=1,261)	Intervention (N=583)	Control (N=583)	Non-trial (N=95)
Gender				
Male	1,006 (79.8)	452 (77.5)	470 (80.6)	84 (88.4)
Female	255 (20.2)	131 (22.5)	113 (19.4)	11 (11.6)
Age group (years)				
18-29	283 (22.4)	118 (20.2)	143 (24.5)	22 (23.2)
30-39	323 (25.6)	151 (25.9)	149 (25.6)	23 (24.2)
40-49	277 (22.0)	136 (23.3)	123 (21.1)	18 (18.9)
50-59	202 (16.0)	90 (15.4)	93 (16.0)	19 (20.0)
≥60	164 (13.0)	81 (13.9)	71 (12.2)	12 (12.6)
Missing	12 (1.0)	7 (1.2)	4 (0.7)	1 (1.1)
Marital status				
Single	509 (40.4)	225 (38.6)	254 (43.6)	30 (31.6)
Married/Cohabited	650 (51.5)	311 (53.3)	282 (48.4)	57 (60.0)
Divorced/Widowed	90 (7.1)	43 (7.4)	39 (6.7)	8 (8.4)
Missing	12 (1.0)	4 (0.7)	8 (1.4)	0 (0.0)
Living with a child				
No	828 (65.7)	371 (63.6)	395 (67.8)	62 (65.3)
Yes	389 (30.8)	189 (32.4)	170 (29.2)	30 (31.6)
Missing	44 (3.5)	23 (3.9)	18 (3.1)	3 (3.2)
Education level				
Primary education or below	71 (5.6)	35 (6.0)	27 (4.6)	9 (9.5)
Secondary education	751 (59.6)	354 (60.7)	350 (60.0)	47 (49.5)
Post-secondary or above	400 (31.7)	170 (29.2)	193 (33.1)	37 (38.9)
Missing	39 (3.1)	24 (4.1)	13 (2.2)	2 (2.1)
Employment status				
Student	43 (3.4)	19 (3.3)	19 (3.3)	5 (5.3)
Self-employed/employed	981 (77.8)	455 (78.0)	460 (78.9)	66 (69.5)
Unemployed	73 (5.8)	30 (5.1)	34 (5.8)	9 (9.5)
Housewife	32 (2.5)	17 (2.9)	12 (2.1)	3 (3.2)
Retired	106 (8.6)	47 (8.1)	48 (8.2)	11 (11.6)
Missing	26 (2.1)	15 (2.6)	10 (1.7)	1 (1.1)
Housing Condition				
Public rental housing	531 (42.1)	256 (43.9)	226 (38.8)	49 (51.6)
Public housing (purchased)	167 (13.2)	71 (12.2)	91 (15.6)	5 (5.3)
Private housing (rented)	294 (23.3)	138 (23.7)	136 (23.3)	20 (21.1)
Private housing (purchased)	208 (16.5)	90 (15.4)	103 (17.7)	15 (15.8)
Others	24 (1.9)	9 (1.5)	12 (2.1)	3 (3.2)
Missing	37 (2.9)	19 (3.3)	15 (2.6)	3 (3.2)
Monthly household income				
Less than (HK$)25,000	505 (40.0)	243 (41.7)	220 (37.7)	42 (44.2)
(HK$)25,000 - (HK$)60,000	545 (43.2)	240 (41.2)	267 (45.8)	38 (40.0)
Above (HK$)60,000	166 (13.2)	75 (12.9)	78 (13.4)	13 (13.7)
Missing	45 (3.6)	25 (4.3)	18 (3.1)	2 (2.1)

Figure 1

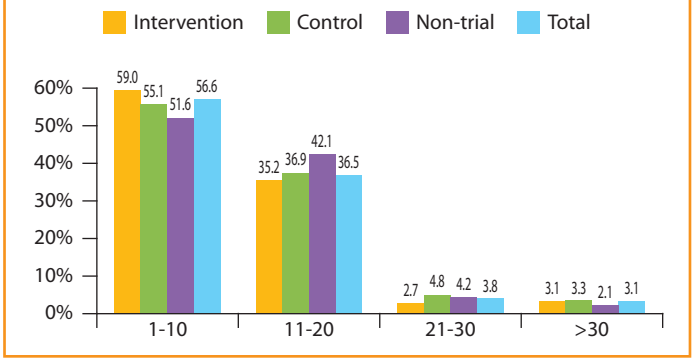
Age of starting weekly smoking in all participants (N=1,261)[1]



[1] Missing data were not shown.

Figure 2

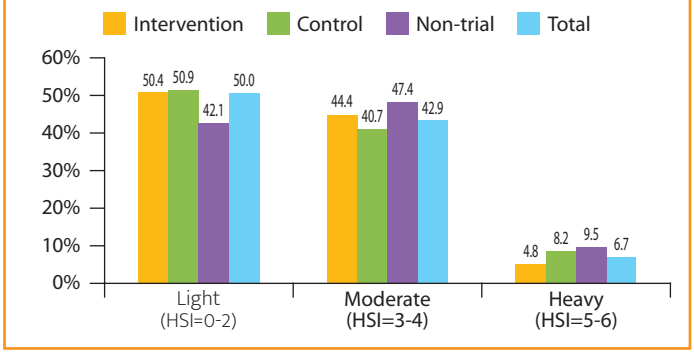
Daily cigarette consumption at baseline in all participants (N=1,261)[1]



[1] Missing data were not shown.

Figure 3

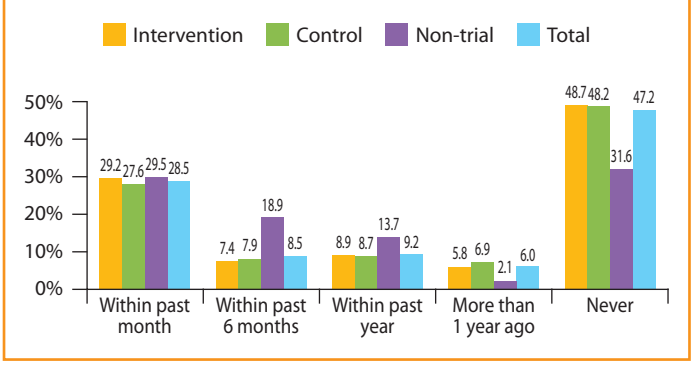
Nicotine dependence at baseline in all participants (N=1,261)[1,2]



[1] Nicotine dependence was measured by Heaviness of Smoking Index (HSI) items (1) time to first cigarette of the day and (2) number of cigarettes smoked per day.
[2] Missing data were not shown.

Figure 4

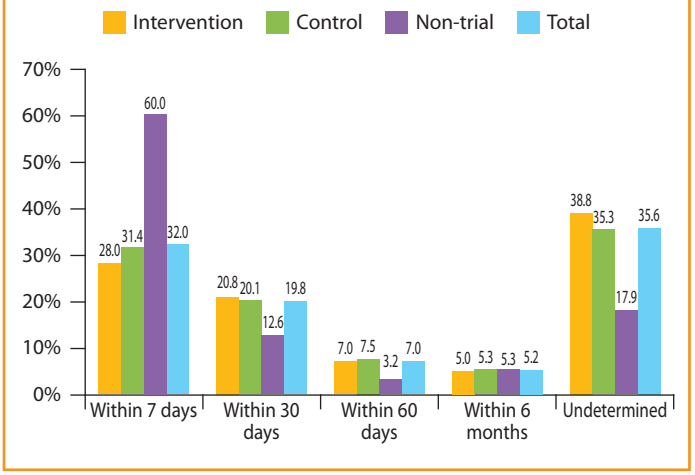
Past quit attempt at baseline in all participants (N=1,261)[1]



[1] Missing data were not shown.

Figure 5

Intention to quit at baseline in all participants (N=1,261)[1]



[1] Missing data were not shown.

Over one-third of the participants (35.1%) smoked their first cigarette of the day within five minutes after waking up. Nearly half had moderate to heavy nicotine dependence (49.6%) (Figure 3). Around half had no previous quit attempt (47.2%) (Figure 4). Nearly half was not ready to quit within 30 days at baseline (47.8%), indicating a low intention to quit according to the Transtheoretical Model (Figure 5). The intervention and control groups showed similar smoking behaviours and history.

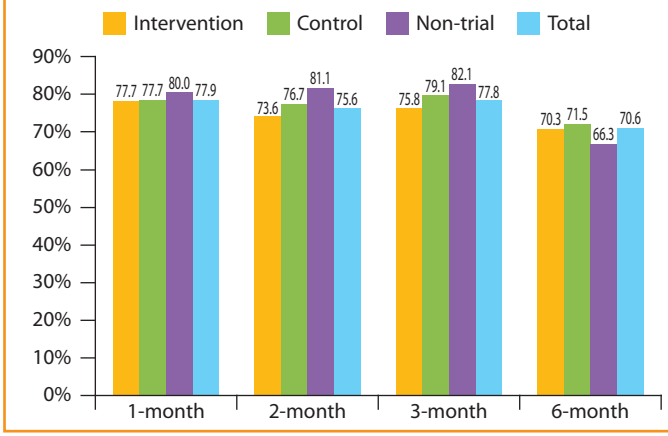
3.3 Study outcomes

Retention rate

Figure 6 shows that of all 1,261 participants joining the QTW Contest, 982 (77.9%), 953 (75.6%), 981 (77.8%) and 890 (70.6%) were successfully followed at 1, 2, 3 and 6 months, respectively. The retention rates were similar between the intervention and control groups at 1-month (77.7%), 2-month (73.6% vs. 76.7%; P=0.22), 3-month (75.8% vs. 79.1%; P=0.18) and 6-month (70.3% vs. 71.5%; P=0.65).

Figure 6

Retention rate of 1-, 2-, 3- and 6- month follow-ups (N=1,261)

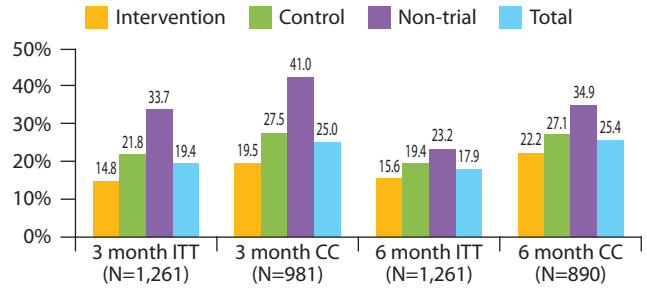


Self-reported 7-day point prevalence abstinence rate at 3- and 6-month follow-ups

By ITT analysis, the overall self-reported 7-day point prevalence abstinence (PPA) was 19.4% at 3-month and 17.9% at 6-month follow-ups. Significantly, the self-reported 7-day PPA in the intervention group is lower than in the control group at 3-month (14.8% vs. 21.8%, P<0.01), but not at 6-month (15.6% vs. 19.4%, P=0.09). The CC analysis also corroborated the ITT results and yielded similar results (Figure 7).

Figure 7

Self-reported abstinence rate at 3- and 6-month follow-ups, by ITT and CC analysis



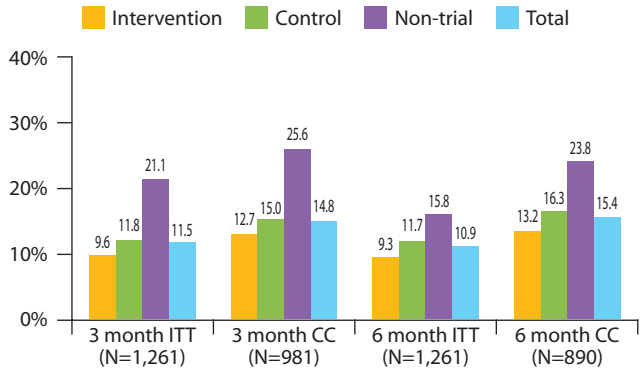
ITT: Intention-to-treat analysis; CC: Complete-case analysis

Biochemically validated abstinence rate at 3- and 6-month follow-ups

The overall biochemically validated quit rate was 11.5% at 3-month and 10.9% at 6-month by ITT analysis. The biochemically validated abstinence was not significantly different between the intervention and control groups at 3-month (9.6% vs 11.8%, P=0.22) or 6-month (9.3% vs 11.7%, P=0.18) (Figure 8).

Figure 8

Biochemically validated abstinence rate at 3- and 6-month follow-ups, by ITT and CC analysis



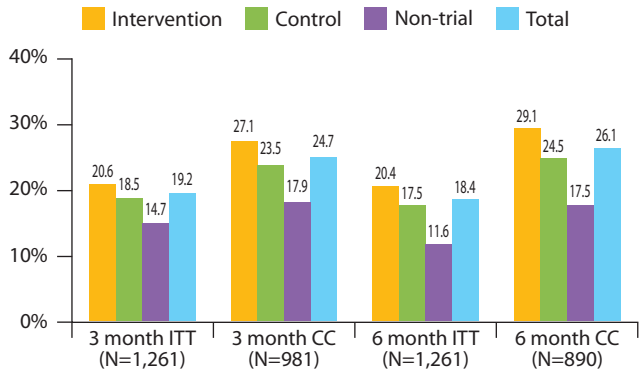
ITT: Intention-to-treat analysis; CC: Complete-case analysis

Smoking reduction rate at the 3- and 6-month follow-ups

By ITT analysis, the proportion of participants who cut down their daily cigarette consumption by half or more after joining the 11th QTW Contest was 19.2% at 3-month and 18.4% at 6-month among those who failed to quit (Figure 9). The smoking reduction rate is not significantly different in two groups at all follow-ups (all P>0.05).

Figure 9

Rate of smoking reduction by at least half in smokers at 3- and 6-month follow-ups, by ITT and CC analysis

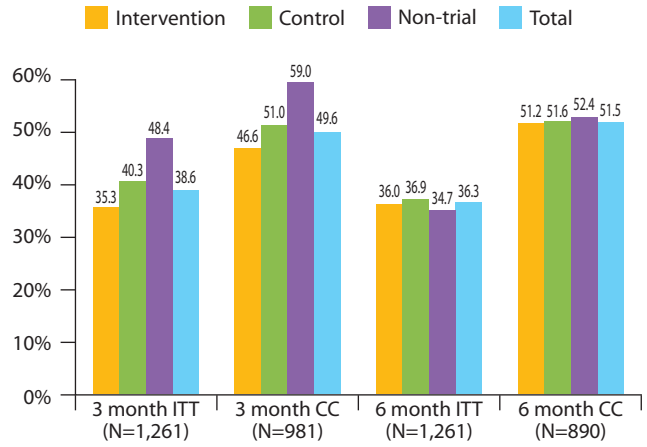


ITT: Intention-to-treat analysis; CC: Complete-case analysis

By ITT analysis, the overall smoking reduction or quit rate were 38.6% and 36.3% at 3- and 6-month follow-ups, respectively (Figure 10). The smoking reduction or quit rates were lower in the intervention than in control groups at 3-month (35.3% vs 40.3%; P=0.08), but were similar at 6-month (36.0% vs 36.9%; P=0.76) follow-ups. CC analysis yielded similar results.

Figure 10

Rates of smoking reduction by at least half or quit at 3- and 6-month follow-ups, by ITT analysis and CC analysis



ITT: Intention-to-treat analysis; CC: Complete-case analysis

Use of smoking cessation services at 1-, 2-, 3- and 6-month follow-ups

Throughout the entire study period, there were 417 participants (33.1%) had made a referral request for the smoking cessation services (Table 2). The cumulative number of referral requests were 172 in the intervention group, compared with 204 in the control group.

Table 2 Status of referral to smoking cessation service in all participants (N=1,261)

n (%)	Total (N=1,261)	Intervention (N=583)	Control (N=583)	Non-trial (N=95)
Had made a referral request	417 (33.1)	172 (29.5)	204 (35.0)	41 (43.2)

Table 3 shows that 12.5% of all participants had used smoking cessation services at least once during the 6-month period after baseline. The cumulative prevalence of smoking cessation service use was similar in the intervention group and the control group at 1-, 3- and 6-month follow-ups (all P>0.05), but showed significant difference at 2-month follow-up (P<0.001).

Table 3 Use of smoking cessation service (N=1,261)

n (%)	Total (N=1,261)	Intervention (N=583)	Control (N=583)	Non-trial (N=95)
1-month	61 (4.8)	24 (4.1)	28 (4.8)	9 (9.5)
2-month	124 (9.8)	51 (8.7)	54 (9.3)	19 (20)
3-month	145 (11.5)	57 (9.8)	63 (10.8)	25 (26.3)
6-month	158 (12.5)	57 (9.8)	73 (12.5)	28 (29.5)

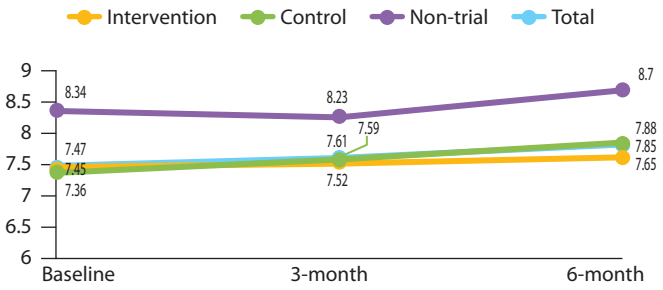
Self-efficacy of quitting

Perceived importance to quit smoking

Among participants whose data were available at all time-points, the mean scores of perceived importance to quit smoking was 7.47 at baseline and 7.85 at 6-month follow-up. Scores of the intervention group (from 7.45 to 7.52, P=0.65) and control group (from 7.36 to 7.59, P=0.101) slightly increased from baseline to 3-month, and the score of control group significantly increased from baseline to 6-month (from 7.36 to 7.88, P<0.001). The mean scores in both groups were not significantly changed from 3-month to 6-month follow-up (P>0.05) (Figure 11).

Figure 11

Perceived importance to quit smoking (N=623)[1]



	P value for within-group comparisons		P value for between-group comparisons
	Intervention	Control	
Baseline to 3-month	0.650	0.101	0.644
3-month to 6-month	0.402	**0.024**	0.659
Baseline to 6-month	0.220	**<.001**	0.243

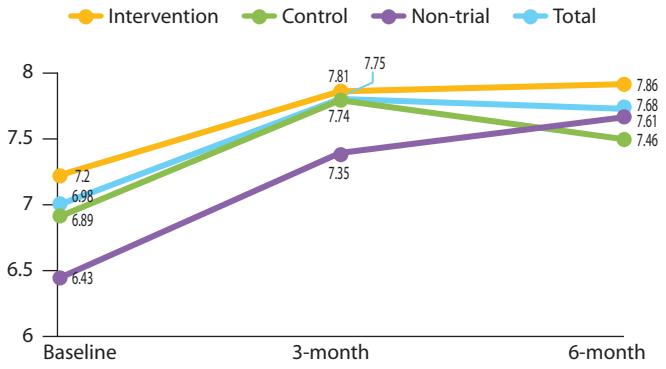
[1] From 0 (not important at all) to 10 (very important); missing data excluded.

Perceived difficulty to quit smoking

In participants whose data were available at all time-points, the mean score of perceived difficulty to quit smoking increased from 6.98 at baseline to 7.75 to 3-month and 7.68 at 6-month. In both RCT groups, the scores significantly increased from baseline to 3-month (7.2 to 7.81 P<0.001; 6.89 to 7.74, P<0.001), also from baseline to 6-month (7.2 to 7.86, P<0.001; 6.89 to 7.46, P<0.001). There was no notable change of mean score from 3-month to 6-month in both groups. No significant difference was found in the mean score of perceived difficulty to quit smoking between the intervention and control groups (all P>0.05) (Figure 12).

Figure 12

Perceived difficulty to quit smoking (N=623)[1]



	P value for within-group comparisons		P value for between-group comparisons
	Intervention	Control	
Baseline to 3-month	**<.001**	**<.001**	0.166
3- month to 6-month	0.713	0.057	0.647
Baseline to 6-month	**<.001**	**0.002**	**0.042**

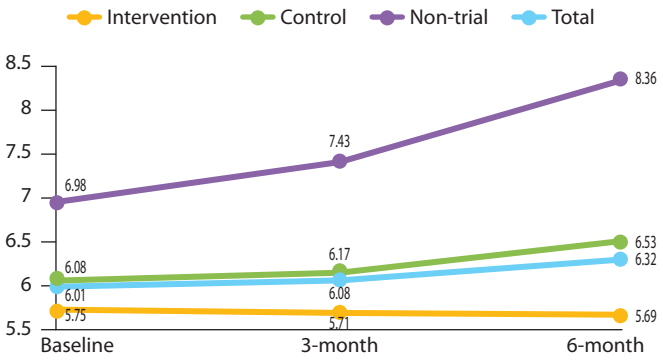
[1] From 0 (not difficult at all) to 10 (very difficult); missing data excluded.

Perceived confidence to quit smoking

Figure 13 indicates increases in the mean scores of perceived confidence to quit smoking increased from 6.01 to 6.32 throughout the study period. In the RCT groups, there were significant increases in the mean scores in the control group from 3-month to 6-month (from 6.17 to 6.53, P=0.026), but no significant change in the mean scores of the intervention group. There are significant difference of the mean scores between groups from 3-month to 6-month (P=0.038) and from baseline to 6-month (P<0.001).

Figure 13

Perceived confidence to quit smoking (N=622)[1]



	P value for within-group comparisons		P value for between-group comparisons
	Intervention	Control	
Baseline to 3-month	0.842	0.582	0.102
3-month to 6-month	0.905	**0.026**	**0.038**
Baseline to 6-month	0.759	**0.009**	**<.001**

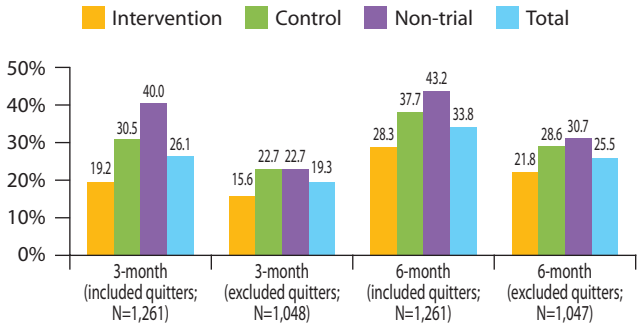
[1] From 0 (not confident at all) to 10 (very confident); missing data excluded.

Quit attempt at 3- and 6-month follow-ups

By ITT analysis, with inclusion of quitters, the proportion of participants with at least one quit attempt was 26.1% at 3-month and 33.8% at 6-month follow-up. The respective rates were 19.3% and 25.5% when quitters were excluded. The proportion of participants with a quit attempt at 3- and 6-month were significantly higher in the control group than in the intervention group with inclusion of quitters (P<0.01), and the results were consistent when excluding quitters (P<0.01) (Figure 14).

Figure 14

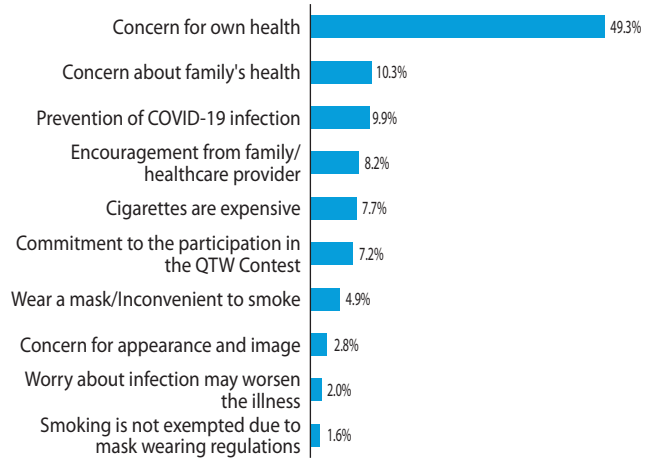
Quit attempt rates at 3- and 6-month follow-ups



Among participants who made at least one quit attempt during the study period, the leading reasons for making the quit attempts were "concern for own health" (49.3%), followed by "concern about family's health" (10.3%) and "prevention of COVID-19 infection" (9.9%) (Figure 15).

Figure 15

Reasons for quit attempts in participants who had at least one quit attempt during the study period[1,2] (N=426)[1,2]

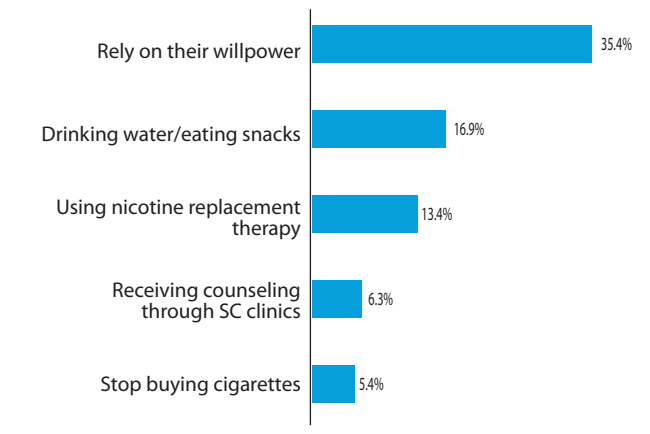


[1] Participants who were lost to follow-up were exclude.
[2] Participants could choose more than one option.

For participants who made at least a quit attempt, the most common methods to quit smoking were "relying on willpower" (35.4%), "drinking water/ eating snacks" (16.9%) and "using Nicotine Replacement Therapy" (13.4%) (Figure 16).

Figure 16

Methods of quitting in participants who had at least one quit attempt during the study period (N=426)[1,2]

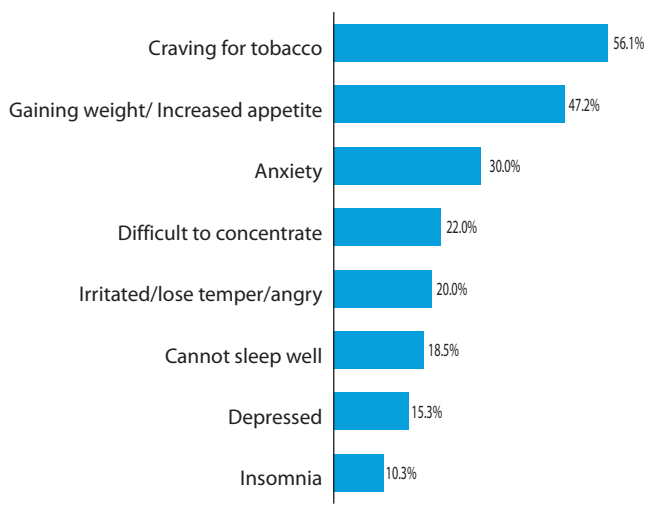


[1] Participants who were lost to follow-up were exclude.
[2] Participants could choose more than one option.

Withdrawal symptoms were assessed at 1-, 2- and 3-month follow-ups. Among the participants who had at least one quit attempt, the most common withdrawal symptoms were "craving for tobacco" (56.1%), followed by "gaining weight/ Increased appetite" (47.2%) and "anxiety" (30.0%) (Figure 17).

Figure 17

Withdrawal symptoms experienced by participants who had at least one quit attempt by 3-month follow-up (N=426)[1,2]



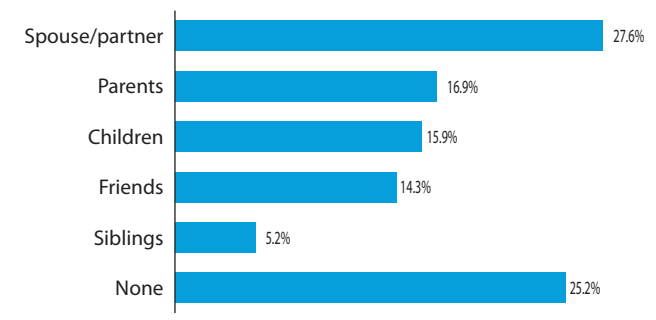
[1] Participants who were lost to follow-up were excluded.
[2] Participants could choose more than one option.

Perceived social support for quitting

Among the 1,027 participants who responded to 3- and/or 6-month follow-ups, the major sources of perceived support for quitting were from "spouse/partner" (27.6%), followed by "parent" (16.9%) and "children" (15.9%), and "friends" (14.3%) (Figure 18). However, nearly a quarter (25.2%) of participants perceived no social support.

Figure 18

Perceived social support for quitting in all participants who responded to follow-ups in the study period (N=1,027)[1,2]



[1] Participants who were lost to follow-up were excluded.
[2] Participants could choose more than one option.

Use and satisfaction of smoking cessation aids provided

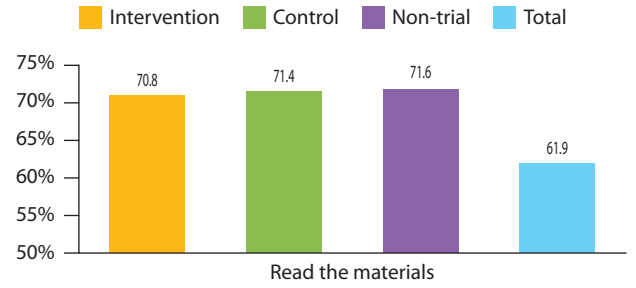
Printed materials

Among the participants who responded to the 6-month follow-up, most (70.8%) reported having read the printed SC materials (Figure 19). Slightly more participants in control group had read the printed materials (71.6% vs 71.4%, P<0.01).

On a scale of 1 (not helpful at all) to 5 (very helpful), the mean (SD) score of perceived helpfulness of printed SC materials was 3.8 (0.94) in participants who had ever read printed materials at the follow-up at 6 months. The score was significantly higher among participants in the control group than in the intervention group (3.92 vs 3.79; P<0.001).

Figure 19

Experience of reading the printed materials at 6-month follow-up (N=888) [1, 2]

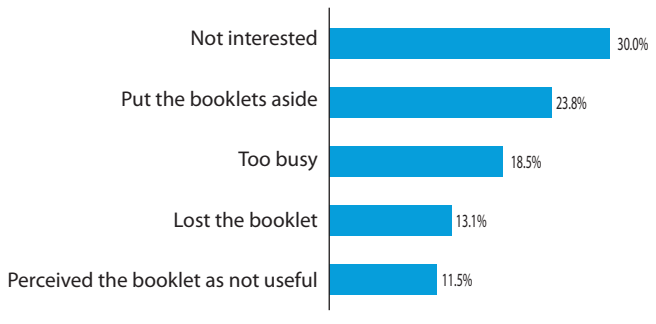


[1] Participants who were lost to follow up at 6 months were excluded.
[2] Missing data were not shown.

Among the participants who had never read the printed SC materials, "not interested" was the most frequently reported reason (30.0%), which was followed by "put the booklet aside" (23.8%) and "too busy" (18.5%) (Figure 20).

Figure 20

Reasons for not reading the printed materials of participants (N=130)[1,2]



[1] Participants could choose more than one option.
[2] Participants who were lost to follow up at 6- month or with missing data were excluded.

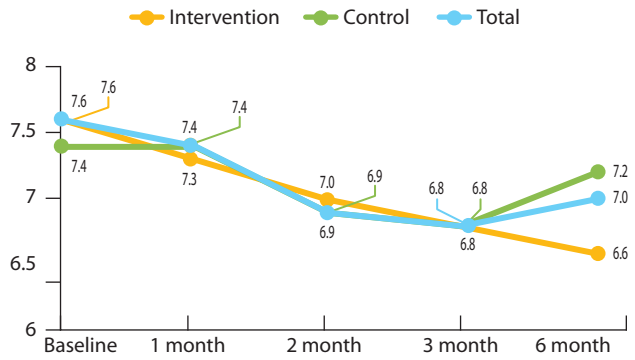
Change in perceived susceptibility and severity of COVID-19 infection related with smoking

The perceived susceptibility and severity were measured by related items in all follow-ups by the scale of 0 (totally disagree) to 10 (totally agree). Figure 21 and 22 show that the perceived susceptibility and severity of COVID-19 infection were not significantly different between the groups at baseline and follow-ups, except perceived severity was higher in the intervention group than in the control group at 2 months at baseline (6.4 vs 5.9; P=0.02) and two months (7.3 vs 7.1; P=0.04). Mixed effect models showed no significant intervention effect on the changes in perceived susceptibility (P for group × time interaction=0.2) and perceived severity (P for group × time interaction=0.28) from baseline through 6 months.

Our secondary analyses also showed that a greater perceived severity of COVID-19 due to smoking was associated with 6-month validated abstinence, adjusting for known determinants of successful cessation. However, we did not find a significant difference in changes in perceptions between the two groups, which may explain the null effect on abstinence.

Figure 21

Changes in perceived susceptibility of COVID-19 due to smoking by groups (N=409) [1]

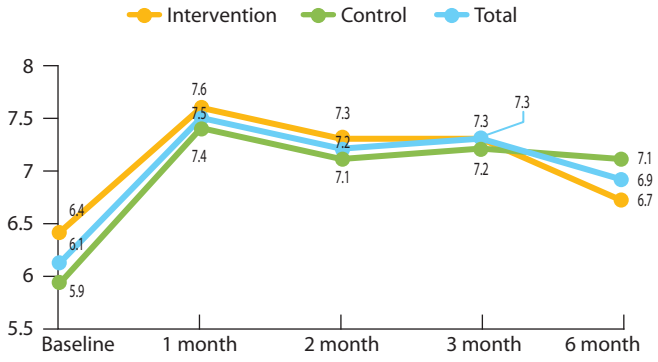


	Mean difference	P value for mean difference between groups	P value for group × time interaction
Baseline	0.2	0.13	0.20
1-month	-0.70	0.60	
2-month	-0.05	0.80	
3-month	0.06	0.71	
6-month	0.32	0.10	

[1] Assessed on a scale of 0 to 10, with higher scores indicating greater perceived susceptibility

Figure 22

Changes in perceived severity of COVID-19 due to smoking by groups (N=406) [1]



	Mean difference	P value for mean difference	P value for group × time interaction
Baseline	0.50	**0.02**	0.28
1-month	0.21	0.47	
2-month	0.22	**0.04**	
3-month	0.03	0.82	
6-month	-0.28	0.06	

[1] Assessed on a scale of 0 to 10, with higher scores indicating greater perceived severity

Intervention engagement and ratings

Table 4 shows that the proportion of participants who had read the instant/text messages was similar between the two groups. The perceived appropriateness of the intensity of messages was high overall, although it was significantly lower in the intervention group than in the control group (72.6% vs. 73.1%, P=0.04). Similarly, the perceived usefulness of the messages in increasing motivation to quit (2.3 vs. 2.4, P=0.02) and quit attempts (2.2 vs. 2.4, P=0.02) was significantly lower in the intervention group.

Almost half of the participants (49.4%) in the intervention group had conversations with the research nurse via mobile instant messaging, with a mean satisfaction score of 8.5 (SD-1.9) on a scale of 0 (not satisfied at all) to 10 (very satisfied). Being "too busy"(49.5%) and "don't want to talk about cessation-related topics online" (32.9%) were the two most common reasons for not being engaged.

Compared the exposure to information on COVID-19 and smoking between two groups, intervention group had greater exposure than control group significantly (P<0.001). Such differences were narrowed in 2- and 3-mouth follow-ups, and the cumulate exposure was similar between two groups (P=0.09) in 6-mouth follow-up.

Table 4. Intervention engagement and ratings (N=1,166)

n (%)	Intervention group (N=583)	Control group (N=583)	P-value
Intervention engagement			
Have ever read instant/ text messages			0.81
None[a]	111 (19.0)	113 (19.4)	
Some	125 (21.4)	116 (19.9)	
All	347 (59.5)	354 (60.7)	
Rating of the messages			
The intensity of messages was appropriate, n (%)	423 (72.6)	426 (73.1)	**0.04**
The contents of messages increased motivation to quit[b], mean (SD)	2.3 (1.0)	2.4 (1.1)	**0.02**
The contents of messages increased quit attempts[b], mean (SD)	2.2 (1.0)	2.4 (1.1)	**0.01**
Exposure to information on COVID-19 and smoking			
Baseline	192 (33.3)	207 (36.1)	0.32
1-month (cumulative)	372 (64.2)	309 (53.4)	**<0.001**
2-month (cumulative)	426 (73.6)	388 (66.7)	**0.01**
3-month (cumulative)	482 (83.2)	448 (77.0)	**0.008**
6-month (cumulative)	489 (84.5)	470 (80.8)	0.09

[a] Participants with missing data were counted as "none" in the analysis.
[b] Score: 0-4, higher scores indicating higher usefulness of messages.

4. Discussion

From June to October 2020, the 11th "Quit to Win" Contest successfully spread the smoking cessation messages in the community by holding 55 recruitment sessions in streets and shopping malls with the help from 110 university students, NGO helpers and volunteers in 18 districts throughout Hong Kong. Totally about 7,700 smokers were approached by the smoking cessation ambassadors and over 1,260 smokers participated in the Contest. Compared with the pre-pandemic period, fewer smokers were observed in outdoor smoking hotspots amid the pandemic. Therefore, online advertisements were also used to recruit smokers, who were screened by a cessation advisor through video calls. By intention-to-treat analysis, the overall self-reported abstinence rate was 19.4% at 3-month and 17.9% at 6-month for all participants. The abstinence rate of the 11th "Quit to Win" Contest was similar to the previous results.

A pragmatic RCT was nested within the 11th QTW Contest to examine the effectiveness of messaging on smoking-related COVID-19 risk in increasing smoking abstinence comparing to generic smoking cessation messages in the real world setting. This is the first RCT showing that additional warning messaging about increased COVID-19 harms associated with smoking did not increase biochemically validated abstinence at 3- and 6-month follow-up amid the pandemic compared with brief cessation advice. Both groups showed quite high validated abstinence (about 10%) and yielded high levels of intervention engagement (80% read messages and about 50% engaged in instant messaging cessation support) than our prior RCTs conducted under the QTW Contests. A proportion of participants that mentioned their reasons to quit were related with COVID-19 pandemic and anti-epidemic measures. It suggests that COVID-19 pandemic is a teachable moment for smoking cessation.

There are several possible explanations for the similar abstinence rate between groups. First, our trial participants showed relatively high levels of perceived susceptibility and severity (mean scores=7.7 and 6.2 out of 10, respectively) at baseline. This "ceiling effect" might have constrained the room for increasing the risk perception level. Second, over 80% of the participants in both groups reported exposure to information on COVID-19 and smoking from any sources during the study period. The control group likely was exposed to such information from other sources, such as publicity by the local health authority and cessation services. Such contamination might have biased the intervention effect toward the null. Finally, participants' ratings for the messages were significantly lower in the intervention group than in the control group, which suggested that messaging on smoking-related COVID-19 risk was less preferred compared to generic messages and cessation support. Prior qualitative studies on mobile messaging showed that smokers may not be receptive to messages that repeatedly emphasize the hazards of smoking (loss-framed messages)[15,16]. Further research is warranted to determine the optimal intensity communicate smoking-related COVID-19 risk without demotivating smokers.

The strengths of the study included the randomized trial design conducted with a large cohort of smokers (N=1,166) in a real-world setting with the use of an active comparison group. Another strength was the use of biochemically validated abstinence as the outcome with a satisfactory participation rate despite the difficulties of conducting in-person validation amid the pandemic. However, we did not find a significant difference in changes in perceptions toward smoking-related COVID-19 risk between the two groups, which may explain the null effect on abstinence.

This study also had several limitations. First, the trial embedded in a contest that had a fixed period of recruitment and follow-ups. We were unable to recruit and track smokers' cessation-related behaviour during the pandemic in the long-term. Second, as discussed, most participants in the control group were exposed to information on COVID-19-related smoking risks, which might reduce the intervention effect size, if any. However, such contamination is difficult to control given the real-world trial design[17]. Third, our pragmatic trial used a combined intervention and cannot discern the relative contribution of the individual intervention components. Fourth, our trial was conducted in Hong Kong, where the prevalence of smoking is low (9.5%) and smokers are predominantly male[18]. The generalizability of the findings to other places is unclear.

5. Conclusions

In conclusion, the 11th QTW Contest and its affiliating publicity features, including smoking cessation counselors training, smoke-free community promotion, community involvement, media promotion and a trial, successfully delivered smoke-free messages to a large number of non-smokers and promoted smoking cessation in smokers in the Hong Kong community. Communicating smoking-related COVID-19 risk on top of generic cessation support via instant messaging was not more effective in increasing smoking abstinence than generic cessation support via text messaging. Further research is warranted to determine the optimal intensity to communicate smoking-related COVID-19 risk without demotivating smokers.

6. Clinical trial Registration

Trial registry: ClinicalTrials.gov, number NCT04399967.

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