Preventing Smoking Relapse After a Clinical Smoking Cessation Program - A Mixed Methods Case Study Evaluation of a Facebook-Based Peer-Support Platform

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Abstract

Background: Smoking-relapse prevention after completion of a smoking cessation program is highly germane to reducing smoking rates. The purpose of this study was to 1) evaluate the one-year outcomes of a social media-based and peer-supported smoking cessation program on Facebook and 2) examine communication patterns that could support smoking cessation and identify risk of relapse.

Methods: We utilized a mixed-methods case study evaluation approach featuring a single-case holistic design. We recruited volunteers who signed up after successful completion of a 12-week clinical smoking cessation program in a general medicine department in Japan. The participants accessed a closed Facebook page, and we analyzed their posts including text and emoticons. We utilized joint display analysis which involved iterative structuring and restructuring construct-specific tables with both types of data to find the most effective approach for integrating the quantitative results with the qualitative results of content analysis.

Results: One successful participant and two relapse participants were analyzed to explore the specific patterns of postings. Decisive comments about quitting smoking were common among participants, but encouraging messages for peers were more common from the successful participant. Comments for social support and reassurance were warning signs of relapse. Conflicted comments also may be a warning sign of relapse risk.

Conclusions: These findings based on a mixed methods case study of a social media platform supporting smoking cessation could be utilized to guide messaging in other online social networking services communities after a smoking-cessation program to help reduce smoking relapse.

Trial registration: The trial is registered at the UMIN Clinical Trials Registry. Registration number: UMIN000031172. Registered 28 February 2018, <https://www.umin.ac.jp/ctr/index-j.htm>

Background

Smoking rates in developed countries are generally decreasing as a consequence of the multidimensional approaches based on governments and private sector initiatives. In 2017, the overall smoking rate in Japan was 17.7%, which was higher than the 2016 rate of 15.8% in the UK and 15.5% in the United States [1, 2, 3]. Cigarette smoking is estimated to cause about one of every five deaths both in Japan and in the United States each year compared to about one of every six deaths in the UK [2, 4, 5]. The Ministry of Health, Labour and Welfare in Japan (MHLW) set an aim of achieving an overall smoking rate of less than 12% by the end of 2022 [6]. Several communication methods, such as mobile phone- and email-based counseling, have been found effective for supporting cessation [7]. However, estimates from the MHLW suggested that about seventy percent of people who quit smoking relapsed in the first year following smoking cessation in Japan [8]. Therefore, reducing the rate of relapse after completion of a smoking cessation program remains an important need for achieving Japan's national aim of smoking reduction.

Various interventions for relapse prevention have been attempted, and only pharmacotherapy with extended treatment with varenicline has been effective based on a moderate certainty of evidence [9]. Results from the National Epidemiologic Survey found that significant predictors of relapse included both the first year timeframe after attempting to quit and younger age at the time of smoking cessation; the probability of relapse decreased over time [10]. These findings suggest there is a special need to prevent smoking relapse within the first year of quitting. Few studies have been designed to develop effective interventions to prevent smoking relapse after smoking cessation programs and novel strategies are needed.

At the home institution of this study, a smoking cessation outpatient clinic was established in 2011. Clinical operations originally were organized by a cardiologist and a nurse, and in 2015, operations were transferred to general medicine clinicians specialized in behavioral change interventions. The primary concern of the team members was the challenge of smoking relapse one year after completion of the clinical program. Among participants in the program 70% had achieved a satisfactory rate of smoking cessation upon completion of the 12-week program. Previous studies have suggested that popular social media platforms, such as Facebook and Twitter might be effective in supporting smoking cessation [11]. Thus, our group sought to prevent smoking relapse after completion of a smoking cessation clinic program through peer counseling on a social media platform.

Due to the recent increase in online activity, we posited that online social networking services (SNSs) might contribute to the maintenance of smoking cessation after the completion of a smoking cessation program [12]. As an extension of a 12-week clinic-based smoking cessation program, we created a platform on Facebook as an intervention for peer-supported smoking cessation (Fig. 1). The aims of this study were to evaluate the one-year outcomes of this peer-supported smoking cessation program that used Facebook, and to identify patterns that supported smoking cessation or, conversely, were associated with relapse during the one-year observational period after smoking cessation.

Methods

Design

We conducted a mixed-methods case study evaluation approach featuring a single-case holistic design [13, 14, 15]. We bounded the case evaluation to the one-year period of April 2018 to March 2019 within an ambulatory general medicine department in Japan. Relevant stakeholders included clinical physicians, staff and all participants who received counseling during a 12-week clinical smoking cessation program including three who joined the online Facebook-based smoking cessation app.

Setting

A smoking cessation outpatient clinic at an urban hospital operated by general physicians, nurses, and pharmacists served as the setting for this research. The clinic is located in a city with a population of 47,000 in Hyogo Prefecture in Western Japan. Serving roughly 20 patients per year, the appointment-only smoking cessation clinic was staffed by three physicians who had more than three years of experience each and 16 years among them in smoking cessation treatment. In the program, patients could choose either oral varenicline or nicotine patches in light of indications for their medical treatment. The treatment program was structured such that physicians provided patient consultations at the clinic five times over 12 weeks to ensure coverage by medical insurance (Fig. 1).

Sample

The target population for this study was adult patients who had made an appointment for smoking cessation in the clinic. The primary inclusion criteria were an interest in participating in the program and having a smartphone. Patients aged below twenty or above sixty-nine were excluded from the study. Eligible patients were told they could begin participating in the study during any of their visits to the smoking cessation clinic. This arrangement allowed individuals who were unfamiliar with Facebook time to practice using the app before a subsequent visit. Among individuals indicating interest, written consent for participation was obtained by the researchers. After registering on the social media site, participants could access the dedicated Facebook platform. Smoking cessation program participants could opt in or out of participating in the Facebook platform.

Online peer-supported social media interventions on Facebook

Our smoking cessation group on Facebook was developed by one of the team researchers. The program was designed to allow users who had Facebook on their smartphones to post comments, photos, and videos. The use and browsing of the Facebook links were limited to registered participants. Contributors included 1) registered patients, 2) the physicians in charge of the smoking cessation outpatient clinic, and 3) clinic nurses. This approach ensured the development of a closed Facebook group. Individual identities were concealed from everyone on Facebook, including all contributors' friends. The privacy of participants was secured using a setup feature on the Facebook app to create a closed community for our program. Staff members were expected to help patients who struggled with the temptation to smoke by utilizing several communication methods, such as active listening (i.e., verbal technique to show attention to the patients by repeating their messages or responding thoughtfully) and showing empathy. The interview guide was not developed in this study. Successful abstainers were encouraged to support others by offering advice based on their own experiences of coping with difficult situations and maintaining smoking cessation. The convenience of peer-access anywhere and anytime was designed to support patients both during and after the smoking cessation clinic program. The content of each thread was monitored by each physician using the flag system function on the Facebook app. Our clinic team members strived to respond to any posts or questions on the same day posed by the participants.

Theory underlying the intervention

The transtheoretical model provides a widely utilized guide for the development of interventions for high-risk populations to change multiple health risk behaviors [16]. The constructs of the transtheoretical model are composed of stages and processes of change, decisional balance, and self-efficacy or temptation. The transtheoretical model was utilized by study clinicians to support smokers in the clinic to help them progress through the stages of change to tailor interventions to individual needs at each stage of change. The stages of change include six constructs: precontemplation, contemplation, preparation, action, maintenance, and termination. Moreover, there are ten constructs in the process of change in this model: 1) consciousness raising, 2) dramatic relief, 3) self-reevaluation, 4) environmental reevaluation, 5) self-liberation, 6) helping relationships, 7) social liberation, 8) counterconditioning, 9) stimulus control, and 10) reinforcement management. To analyze the participants' posts, we focused on the specific constructs relating to each stage: 3) self-reevaluation in the preparation stage; 5) self-liberation in the action stage; and 6) helping relationships, 8) counterconditioning, 9) stimulus control, and 10) reinforcement management in the maintenance stage. We assumed that participants in the smoking cessation outpatient clinic were in the action stage because they had made an appointment to quit smoking. In the action stage, participants' smoking cessation experiences were supported with medical treatment until the fifth and final consultation when smoking abstinence was confirmed in a clinical interview with an exhaled carbon monoxide test (Picoplus Smokerlyzer, Harada Corp.). As our participants proceeded from the action stage to the maintenance stage, our clinical care and app-based intervention was guided by the transtheoretical model theory and entailed providing social support and reassurance to help participants overcome any relapse crises. We designed the research to observe patterns in the posts on the app that supported smoking cessation, or, conversely, pointed to a smoking relapse during the action and maintenance stages.

Data collection procedures

Quantitative data collection

Data on participant demographics, confidence to quit smoking, and the Fagerstrom Test for Nicotine Dependence (FTND) were obtained at the initial clinic visit [17]. The duration of smoking cessation was confirmed by self-report in a follow-up telephone interview by a smoking cessation clinic physician. Each participant's number of posts was counted at the end of the study.

Quantitative data analysis

Demographic data, confidence to quit smoking, the FTND, and the duration of smoking cessation were compared between participants and non-participants. The number of postings, codes and categories were counted and compared between participants.

Qualitative data collection

Typed comments and three types of emoticons: typographic face marks (small-size illustrations added at the end of words or sentences, e.g., #^_^#), nonlinguistic symbols (e.g., ♥), and colorful inline graphics (e.g., emoji 🍌) submitted by participants on the Facebook discussion board were downloaded and saved in Microsoft Word® by the authors for analysis [18]. The research team organized the data in chronological order.

Qualitative data entry and analysis

We performed inductive content analysis to explore the differences in categories that emerged from the full range of data sources from the participants’ postings [19]. This method has been used to analyze social media content from Facebook, Twitter, and YouTube [20]. The content of the comments and responses from our Facebook platform were coded by two independent researchers using MAXQDA 2018 (VERBI Software, 2018). Discrepancies in their coding were resolved through group discussion among the team researchers who reviewed the original data to interpret the context. Similar codes were merged into categories reflecting the underlining meaning of the original data. Analytical rigor was achieved through attention to credibility, dependability, and confirmability [15]. For credibility, the research team spent time immersed in the original data and discussing the underlying meanings of posted comments. Dependability was achieved through the use of data code-recode procedures. Confirmability was achieved by recording notes in the extracted codes. We also performed content analysis of the emoticons attached to the textual comments and responses.

The participants’ typed data and emoticons were analyzed descriptively to examine their influences on smoking cessation. After coding the qualitative comments of each participant, frequency analysis was conducted to examine the distribution of codes for each participant using MAXQDA 2018. Each of three types of emoticons were also analyzed as an independent code simultaneously. Additionally, MAXMaps, one of the graphic functions of MAXQDA, was used to explore connections among the different elements of the codes visually in a workspace as a map; the goal was to find deeper relationships among the codes. The primary outcome was a description of factors contributing to smoking cessation among the participants, which was based on a comparison of patterns in the MAXMaps between the successful and the relapsed participants.

Mixed methods joint display analysis

We used an interactive approach in the joint display analysis to arrive at a deeper understanding of the results [21]. The analysis involved structuring and restructuring a table by juxtaposing both types of data to find the most effective approach for integrating the quantitative results of the statistical analysis with the qualitative results of the content analysis [22, 23]. First, the frequencies of the categories in the text were summarized for each case and linked with the relevant quotes that had produced these categories. Second, we reorganized the master table based on the frequencies of posts, from the most often to the least. Third, we created a new joint display to compare the successful abstainer (participant 1), and the two who relapsed (participants 2 and 3). Fourth, we redesigned the table to include a classification of the category types according to the transtheoretical model, an interpretation of the quantitative frequency counts, and the qualitative characteristics of the comments. Through this process, we identified three primary categories of comments, namely, helping relationships (7 types), self-liberation (1 type), and self-reevaluation (2 types). Fifth, we divided the very long master table into two tables featuring 1) helping relationships, and 2) self-liberation and self-reevaluation.

Results

Sample

Thirteen people attended the clinic during the study period. Four patients were ineligible due to hospitalization (n = 2) and dropout (n = 2) from the study. The remaining nine patients were deemed eligible as they committed to quitting smoking at the initial visit. All nine were invited to utilize the social media peer support group. Three joined while six declined.

Quantitative findings

There were no significant differences between the characteristics of the Facebook abstention support platform participants and those of the non-participants (Table 1). The total number of postings by physicians, nurses, and three participants was 33, 13, and 43, respectively.

Table 1
Characteristics of Facebook participants compared to non-Facebook participants during the study period

	Eligible		Non-eligible	
	Participants	Non-participants	<i>p</i> *	
Number of patients	3	6		4
Gender (Male, Female)	(3, 0)	(4, 2)		(3,1)
Age (yrs)	55.6 ± 6.0	51.7 ± 13.5	0.65	49.8 ± 16.6
Confidence (%)	77 ± 25	62 ± 28	0.48	50 ± 0
FTND (points)	5.0 ± 1.7	6.2 ± 2.4	0.48	6.3 ± 1.5
Duration of smoking cessation (month)	5 ± 6.1	4.5 ± 3.5	0.89	NA

Numerical data, e.g., age, confidence, FTND, and duration of smoking cessation are reported as mean ± standard deviation. The FTND level of nicotine dependence indicates: low 0–3, middle 4–6, and high 7–10. The percentage of confidence to succeed in smoking cessation and the FTND were obtained at the first encounter of the smoking cessation outpatient clinic.

FTND: Fagerstrom Test for Nicotine Dependence

* *p* value of *t*-test between Facebook participants and non-Facebook participants

Successful smoking cessation and relapse

Based on a telephone interview conducted at one-year follow-up telephone interview after completing the smoking cessation program, one patient (participant 1) had succeeded in smoking cessation. Two patients had relapsed: one patient (participant 2) at two months, and the other (participant 3) at one month after completing the smoking cessation clinic program (Table 2). Confidence in successful smoking cessation at baseline was 80% in participant 1, 50% in participant 2, and 100% in participant 3. The FTND at the initial visit showed a low-level nicotine dependence in participants 1 and 3, and a moderate level in participant 2.

Table 2
Demographics of the three participants who joined the peer support Facebook group

	participant 1	participant 2	participant 3
Outcome	Success	Relapse	Relapse
Age	62	50	55
Gender	Male	Male	Male
Confidence (%)	80	50	100
FTND (points)	4	7	4
Months continuing smoking cessation after the clinic program	12	2	1

FTND: Fagerstrom Test for Nicotine Dependence

Qualitative Findings

We identified a total of 11 codes for the coding scheme. The codes and their relationships to the transtheoretical model are presented in Table 3. The distribution of codes fell primarily into three constructs in the process of change. The codes assigned to the category “helping relationships” were gratitude, special gratitude, one’s updates, encouragement, agreement, anticipation of support, one’s own ideas for smoking cessation, and health problem consultations. The codes assigned to the category, self-reevaluation, were worry and happiness during smoking cessation. The code assigned to self-liberation was the decision.

Table 3
The coding scheme and its relationship to the transtheoretical model

Code Name	Explanation	Corresponding construct in the transtheoretical model
Gratitude	Expressing gratitude toward staff of the smoking cessation clinic. It can strengthen the relationship between participants and staff to focus on successful smoking cessation.	Helping relationships
Special gratitude	Expressing special gratitude toward staff.	Helping relationships
One’s updates	A report of one’s present smoking status. The participant acknowledges their smoking cessation or relapse. Being honest about oneself can strengthen the mutual relationships between participants and staff.	Helping relationships
Encouragement	Posting encouraging messages to peers aimed at sustaining smoking cessation.	Helping relationships
Agreement	Agreeing with peer’s ideas relating to smoking cessation.	Helping relationships
Anticipation of support	Anticipating the staff tracking one’s smoking cessation, and giving advice if necessary for support.	Helping relationships
Own ideas for smoking cessation	Own ideas of maintaining smoking cessation such as rebuilding a positive image of smoking cessation to aim for success.	Helping relationships
Health problem consultation	Asking for advice from staff about one’s health condition during smoking cessation.	Helping relationships
Worry	Commenting about concern about continuing smoking cessation.	Self-reevaluation
Happiness during smoking cessation	Expressing one’s happiness about discovering positive results of smoking cessation.	Self-reevaluation
Decision	Announcing one’s decision to quit smoking formally just before starting smoking cessation based on one’s belief.	Self-liberation

Focus on helping relationships on the Facebook abstention support platform

The vast majority of comments posted on the platform from the participants concerned helping relationships. A comparison of the decreasing order of frequencies and illustrative comments for the successful abstainer and the two participants who relapsed are provided in Table 4. ‘An additional table file shows this in greater detail [see Additional file 1]’ Seven categories relating to helping relationships were identified through the coding scheme. In terms of the frequency and percentage of comments posted on the platform, encouraging messages were specifically observed in the successful participant 1, while

reports of smoking cessation status were observed similarly among all three participants. Encouraging messages posted by the successful participant 1 were more descriptive than those of the relapsed participant 2.

Table 4 Smoking cessation and helping relationships from the transtheoretical model

Categories (total number of comments made)	Smoking Cessation Success		Smoking Relapse			Overall interpretation (metainferences)
	P #1		P #2	P #3	P #2, #3	
	Freq. (%)	Illustrative quotes	Freq. (%)		Illustrative quotes	
Helping relationships						
Expressions of gratitude (n=9)	6 (22)	“The staff have been wonderful (#^.^#)” “After all, your ‘backup’ had a profound effect on me(#^.^#)” “Thank you”	3 (17)	0	“Thank you”(P#2) “Thanks for your advice”(P#2)	There were more frequent, and more descriptive comments from successful P#1.
Reports about smoking cessation status (n=9)	5 (19)	“So far, so good, but I’m not so confident, so please give me your support and advice” Well, I’m doing rather well.” “I’m trying to spend more days without the pill. So far, I’m keeping smoking cessation.” “Two weeks has passed since April 9th when I stopped taking Chantix, just before tenth week of treatment. I’m doing well keeping smoking cessation.” “Thank you, I’m still quitting smoking.”	2 (11)	2 (50)	“One week has passed since quitting smoking.” (P#2) “Somehow I got through it.” (P#2) “This is the second clinic. I have been quitting smoking for one week.”(P#3) “I got it how to post. Now, I am somehow still quitting smoking.” (P#3)	Both the frequency and meanings of the comments were similar among all participants.
Encouraging messages (n=9)	7 (26)	“Let’s do our best” “Try your best” “If you quit smoking, you will find you can rediscover various smells around you” “I’m on your side(#^.^#)” “As there are fewer smoking-allowed areas, the price has risen, now is a chance to quit smoking!”	2 (11)	0	“Let’s do our best together.” (P#2) “Yes, let’s try our best.” (P#2)	There were more frequent, and more descriptive comments from successful P#1.
Agreement with other’s comments (n=4)	2 (7)	“I agree(#^.^#). We are taking a good challenge, but (smoking cessation) is stigmatized negatively (#^.^#)”	2 (11)	0	“Hmmm, motivation. I will try to find it.” (P#2) “Carbon monoxide concentration, which we had examined before when seeing the doctor.” (P#2)	The frequency and descriptive comments were similar between successful P#1 and relapse P#2.
Anticipating support of smoking cessation from staff	1 (4)	“Please watch over me from Tottori(#^.^#)”*	0	0	N.A.	This category was specific in successful P#1.
Own ideas for continued smoking cessation (rebuilding positive image of smoking cessation)	1 (4)	“Smoking cessation has a negative image. I think we need to change the image of smoking cessation into positive one (#^.^#)”	0	0	N.A.	This category was specific in successful P#1.
Asking advice about own health	0	N.A.	1 (6)	0	“Good evening. I don’t know if it is a problem related to tobacco, but I’d like to ask you about difficulty sleeping.” (P#2)	This category was specific in relapse P#2.

Notes: Comparison of the participants with smoking cessation success and relapse using the frequency of comments and illustrative comments using a joint display. Helping relationships refer to the process of change that mediates progression in the maintenance stage. The numbers of each cell represent frequencies of codes with percentage of all codes noted in brackets in each case.

N.A.: Not applicable, no comments were provided.

The frequency of categories referable to helping relationships was 22 out of 27 (81%) in the successful participant 1, 10 out of 18 (56%) in relapsed participant 2, and 2 out of 4 (50%) in relapsed participant 3 (Table 4).

Self-liberation and self-reevaluation on the Facebook abstention-support platform

Of the categories in the transtheoretical model, self-liberation was more commonly mentioned. There were two categories of self-reevaluation (Table 5). ‘An additional table file shows this in greater detail [see Additional file 2]’ The category, decision to stop smoking was observed in all participants with similar descriptive comments. Notably, participant 2 mentioned most frequently concern about sustaining smoking cessation in his comments. In addition, the category, expressing happiness about the successful result of smoking cessation, was specific to participant 2. Content analyses of the emoticons attached to textual comments and responses showed that participant 1 used them thirty times during the study period. They were especially common in his expressions of gratitude and encouraging messages. Participants 2 and 3 only used a few emoticons, thus precluding deeper analysis.

Table 5 Smoking cessation as relates to self-liberation and self-reevaluation based on the transtheoretical model

Categories (total number of comments made)	Smoking cessation Success		Smoking Relapse			Overall interpretation (metainferences)
	P #1		P #2	P #3	P #2, #3	
	Freq. (%)	Illustrative quotes	Freq. (%)	Illustrative quotes		
Self-liberation						
Decision about smoking cessation (n=7)	2 (7)	“I’ll do my best, and say goodbye to tobacco forever 🙏🙏🙏🙏” “I’ll do my best not to go fail expectations 🙏🙏🙏🙏”	3 (17)	2 (50)	“Looking ahead, I’ll try to continue smoking cessation, so please give me your support” (P#2) “I am going to do it🙏(^o^)” (P#2) “I’ll try.” (P#2) “I will do my best” (P#3) “The three month-study* is over. I received a certification of having quit smoking. This is the start of the struggle within myself. If I fail, I will be back for support again in a year. (^O^” (P#3)	The frequency was higher in relapse P#2 and P#3, but descriptive comments were similar among P#1, P#2 and P#3.
Self-reevaluation						
Concern about sustaining smoking cessation (n=4)	1 (4)	“I worry about (doing too well after quitting smoking)”	3 (17)	0	“Today I feel 70% like smoking, what should I do...” (P#2) “I have been in the building all day long, so I feel like going out.” (P#2) “It was very difficult to improve the (carbon monoxide) value from one to zero🙏. Every time, I had to laugh wryly with the nurse🙏. Next time, I will achieve zero. Maybe🙏” (P#2)	Both the frequency and descriptive comments were more in relapse P#2.
Expressing happiness about positive result of smoking cessation (n=1)	0	N.A.	1 (6)	0	“Ah! Oh yeah, I changed my toothbrush and toothpaste. I feel better because I was annoyed by tar and coffee stains ❤️🙏 (P#2)	This category was specific in relapse P#2.

Note: : Comparison of the participants with smoking cessation success and relapse using the frequency of comments and illustrative comments in a joint display. Self-liberation is the process of change that is seen in the action stage while the category, self-reevaluation, refers to the process of change that mediates progression between the contemplation and preparation stages. The numbers of each cell represent the frequencies of codes with the percentage of all codes noted in brackets in each case.

N.A.: Not applicable, no comments were provided.

*The participants used the phrase “referred to the smoking cessation clinic program.”

Longitudinal findings for successful smoking cessation and relapse

The transitions between the major categories in the transtheoretical model during the study period in participant 1 and participant 2 are demonstrated in Fig. 2.

Evolution of comments made by the participant who succeeded in smoking cessation

Participant 1 commented on the decision of smoking cessation twice during the first month after completing the 12-week clinical smoking cessation program. This category never appeared after that time. It was followed by seven encouraging messages toward peers (Fig. 2). Afterwards, other categories corresponding to the maintenance stage accounted for the comments.

Evolution of the comments by participants who relapsed after smoking cessation

Participant 2 joined in the Facebook abstention support platform after the first visit of the 12-week clinical smoking cessation program. He quit smoking at the initial visit and sustained smoking cessation with medical treatment by oral varenicline. In contrast to participant 1, participant 2 wrote encouraging messages only twice after his decision to stop smoking. He asked for advice on managing insomnia, which was followed by concerns about sustaining smoking cessation three times (Table 5, Fig. 2). Notably, he expressed happiness toward a positive result of smoking cessation, and especially, restoration of oral hygiene. These categories were regarded as one of the constructs in the processes of change, self-reevaluation, generally seen in the stages of contemplation or preparation. On the other hand, he posted encouraging messages around the same time. In short, the categories belonging to both the stage of contemplation (or preparation) and the stage of maintenance were observed around the same time (Fig. 2). The frequency of categories referable to self-reevaluation accounted for only one out of 27 (4%) in the successful participant 1, while these constituted four out of 18 (22%) in the relapsed participant 2 (Table 5). Three months after his last comment, he relapsed into smoking, as confirmed by a follow-up telephone interview. In short, participant 2 retreated from the maintenance stage after completing the smoking cessation clinic program.

Participant 3, who also relapsed, posted four comments during the study period. Similar to participant 2, he posted only two comments referable to the category, decision to stop smoking (Table 5). The comments were related to self-liberation just after completing the smoking cessation clinic program. The participant did not post any encouraging messages (Table 5). He relapsed to smoking one month after his last post.

Repetitive posting of encouraging messages contribute to the consolidation of the maintenance stage of smoking cessation

Based on the stages of change in the transtheoretical model, we integrated the categories of our results into a conceptual framework (Fig. 3). In the transtheoretical model, self-liberation is necessary for the process of change from the action stage to the maintenance stage [16]. We interpreted the category of decision about smoking cessation to represent self-liberation. Concern about sustaining smoking cessation is considered as a category in self-reevaluation, usually seen in the preparation stage. The relationships between the processes and the stages have not been strictly consistent [16]. Therefore, this category was interpreted as one of the needs of reassurance for social support, as well as other three categories in helping-relationship such as 1) anticipating support of smoking cessation from staff, 2) own ideas for continued smoking cessation, and 3) asking for advice about own health.

Additionally, we observed repeated encouraging messages as helping relationships, which were necessary for maintaining smoking cessation. We propose a “Repetitive Encouraging Message” model as highly important to the maintenance stage of smoking cessation.

Discussion

Regarding the first study purpose of evaluating the one-year outcomes of the peer-supported program, the findings were lackluster. Of the nine who met eligibility criteria, three had quit smoking after starting the smoking cessation clinical program. Of the three participants who chose to participate in the Facebook-based peer-support platform, only one of three participants continued smoking cessation to the one-year end-point. Among the six non-participants in the original clinical smoking cessation program, two successfully quit smoking. The social media platform intervention outcome proved no better than the non-intervention group, nor the natural history after smoking cessation according to national data in Japan where it is estimated that about seventy percent of people who quit smoking relapse in the first year after smoking cessation [8]. Additionally, the mean values of the FTND and confidence to quit at the initial visit were not statistically different between participant and non-participant groups.

Regarding decision making about whether to enroll in the program, it is plausible that the least confident patients would tend to enroll in a peer-support program. If true, it is possible that the intervention might have increased the success rate of smoking cessation compared to having no intervention. Regarding the non-participants, two of the six refused enrollment due to concerns about insufficient security of personal data on Facebook. The study was ongoing when the leakage of private data of Facebook users was reported widely in the media in Japan, as elsewhere [24]. This issue almost certainly negatively affected eligible participants decision making about participation in the study. Lack of trust and confidence in security of the platform could obviously limit the use of this method in the future.

There are several plausible reasons why a higher rate of sustained smoking cessation success was not achieved. First, the idea of a social media platform for support of smoking cessation, at least for the demographic in this region, may not have been sufficiently appealing. This could be related to the demographic of participants as older individuals, who are more likely to be smokers. Being older, they may also have been less facile with technology and social media platforms. Second, the effectiveness of the platform may have been suboptimal as there was limited time available for usability testing. It is encouraging that all three participants who started on the platform remained engaged for several months. Third, achieving greater success on a platform such as the one evaluated may require a critical mass. Three people may not suffice, especially if only one provides positive comments. With a larger number of participants, interactivity between multiple subscribers may have demonstrated more beneficial effects. Fourth, the optimal involvement of program staff is unknown. It is notable that some comments were directed to the health professionals who were known by the platform users. We did not collect data on participants' views of clinic program staff involvement.

Specific signs of successful smoking cessation and relapse

Our second study aim was to identify patterns supporting smoking cessation or related to relapse. We observed that repetitive encouragement for peers during the early smoking cessation period appeared to help solidify the maintenance stage, as seen in participant 1 and not in participant 2. On the other hand, the

need for reassurance through social support, such as in the form of concern about sustaining smoking cessation, was in hindsight an important warning sign of smoking relapse risk. Conflicting comments, such as encouragement for others while endorsing annoyance with concerns about sustainability of smoking cessation, might be a potential warning sign as there were both positive and negative feelings at the same time. Smoking relapse is caused by various factors, such as withdrawal symptoms, negative affect, and cravings [25]. We observed negative feelings and craving during the second month of enrollment in participant 2. The participant made encouraging comments and expressed gratitude and happiness about a positive result of smoking cessation during this tough time. But, in hindsight, he was struggling to maintain abstinence. Emotional distress has been reported as an immediate precursor factor in smoking relapse in a longitudinal study [26]. While encouraging messages were sent by medical staff soon after he posted comments, if his conflicted feelings had been noted, more active management could have been possible.

Potential utility of online SNSs to send helpful messages

The effectiveness of behavioral change through mobile health software apps has been noted in terms of perceived psychological empowerment and enhanced hedonic well-being [27]. The development of apps to discriminate among text messages could focus on distinctions among the decision of smoking cessation, encouragement for peers, and need for social support, such as concern about sustaining smoking cessation. It could alert health professionals supporting patients within the peer group to intervene quickly, or it could automatically reply with helpful messages for those participants. Mobile phone users with these apps appreciate the time-sensitive aspect of such devices. A systematic review has reported that social support is a partially efficacious method for quitting smoking [11]. Automatic responses to messages from abstainers could help health professionals support patients trying to quit smoking on a nationwide scale.

The potential benefits of mobile phone-based smoking cessation interventions have been reported in a systematic review. Text message-based smoking cessation interventions, either alone or in combination with face-to-face assessments or online programs, were effective for those trying to quit smoking in high-income countries with existing tobacco control policies, media, and education [7]. We used a similar strategy involving text message-based support on a Facebook group page. In another study using Twitter-based support networks for adult smoking cessation, researchers elucidated reciprocated ties among abstainers and non-abstainers in both dyadic and small-group communication patterns [28]. We found similar reciprocated comments and responses between participants 1 and 2 (data not reported, available upon request). This finding may imply that the spirit of mutual aid was shared among participants aiming for successful smoking cessation.

Potential usefulness of developing an online SNS community for patients after completing a smoking cessation clinic program

A second consideration relates to the usefulness of creating a private community on Facebook for adult smoking-cessation interventions that support collaboration between patients and health professionals. The classic pattern in smoking cessation clinics is rapid relapse soon after treatment termination [16]. The sudden loss of social support can threaten the stability of smoking abstinence. The merit of a private community is a continuous mutual relationship between staff members and patients after completing a maximum twelve-week smoking-cessation outpatient clinic. Such a community may ensure that participants share their feelings and ideas without shame. The utility of Facebook as a platform for smoking cessation has been previously reported [29, 30]. Likewise, the previous study revealed potentially useful features of iPhone apps for smoking cessation that focused on exploring behavioral change techniques in apps [31]. We did not find these steps to be helpful.

The main components of behavioral change techniques for smoking cessation include: 1) supporting identity changes, 2) rewarding smoking cessation, and 3) offering advice on changing routines, coping strategies, and medication use [32]. The healthcare providers on our team were accustomed to using these techniques. Each member had engaged in a smoking cessation outpatient clinic for multiple years. However, if an app, such as an automatic reminder, is developed using smartphones, the method and outcome should be assessed in the context of evidence-based practice. Few apps available by popular app stores are rooted in evidence-based science [33].

Tobacco control challenges are universally problematic in East Asia [34]. For example, Japan, China, and the Republic of Korea face similar problems such as high rates of adult men who are current smokers, a low rate of men planning to quit smoking, and less opportunity to use nicotine replacement therapy than in Western countries. Sharing the knowledge and skills of smoking cessation strategies and supporting apps may enhance smoking cessation programs and reduce tobacco-related diseases in these countries.

Methodological Insights

This article provides several methodological insights and novel illustrations. First, the study illustrates a qualitatively-oriented mixed methods case study using a single-case holistic design [35]. However, the presentation of the findings followed a quantitatively oriented approach. That is, the quantitative data provided a useful organizational structure, but the qualitative data were prominent in the analysis [36]. Second, the study illustrates the use of a qualitatively-oriented longitudinal mixed methods case study. Both the quantitative and the qualitative findings were used interactively and were essential for the study [37], but the qualitative data provided the greatest insight about how the participants responded to the intervention. Third, the study illustrates the integration of emoticons into qualitative data analysis. Emoticons are commonly used on social media in text messaging and platforms such as Facebook and researchers need examples for use in their work. A previous study quantitatively analyzed emoticons posted on Facebook using correlation analysis [38]. Their findings supported the feasibility and validity of studying individual emotional well-being by means of examination of Facebook profile including emoticons. Fourth, the study provides a detailed explanation of steps of the mixed methods joint display analysis that were utilized to integrate the findings [21]. Fifth, the study illustrates the use of theory, namely, the transtheoretical model in the mixed methods analysis of the data [39]. Sixth, the mixed methods integration dimensions are illustrated in multiple ways [40]. Connecting of the participants from the larger population, was used to select the participants for the intensive case study analysis.

Limitations

A key limitation of this mixed methods case study was that it was conducted in a single smoking cessation clinic in Japan. Data collection in other settings is necessary to assess the relevance of our findings. The success rate for quitting after completing the smoking cessation program in our hospital has hovered at about sixty percent, which is slightly above the average of Japanese medical agencies [8]. Smoking relapse one year after completing the program is about seventy percent in our hospital, which is similar to trends in another report [8]. These findings suggest that we had a typical setting for this case study. A limitation of case study is sometimes misunderstood as insufficient transferability. However, an in-depth analysis of a case study with systematic procedures provides important insights that may be missed in experimental studies [14].

Conclusions

The private Facebook page to prevent smoking relapse enabled us to communicate without meeting together in the same physical space, a factor not to be ignored given the need for alternative approach during the Covid 19 pandemic. Decisive comments about quitting smoking were common among participants, but encouraging messages for peers primarily came from one successful person. The need for social support and reassurance, such as in the form of concern about sustainability of smoking cessation, was a warning sign of smoking relapse. In addition, conflicting comments, such as encouragement for others while admitting annoyance at worrying about sustaining smoking cessation, might be a potential warning sign. It should be regarded as occurring before the maintenance stage. Further analyses of these messages are needed to identify a significant pattern in comments and responses to prevent smoking relapse. Finally, this article provided methodological illustrations relative to the use of a longitudinal mixed methods case study, the use of information from Facebook including text and emoticons, and detailed explanation of the mixed methods joint display analysis.

Abbreviations

MHLW
The Ministry of Health, Labour and Welfare in Japan
SNSs
social networking services
FNTD
Fagerstrom Test for Nicotine Dependence

Declarations

Ethics approval and consent to participate

This study was approved by the regional ethics review board at Ako City Hospital [AkoHospital2017-0021]. Eligible patients were explained about the study, and written consent was obtained from each participant by the researchers.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available because all data are from the closed Facebook group to keep confidentiality of the participating individuals. Parts of data are included in this published article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

NI, YT, and MK conceptualized the study, and analyzed the data. NI prepared the initial draft of the manuscript. MF contributed to the study design, data analysis procedures, and manuscript authoring, revising and editing of the final manuscript. All authors contributed substantively to interpretation of the findings, and approved final manuscript for publication.

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Figures

Figure 1

Overview of study procedures The 12-week clinical smoking cessation program included up to five consultations. After an initial consultation, subsequent consultations were set at 2, 4, 8, and 12 weeks. Completion of quitting was confirmed by a breath test for carbon monoxide concentration at the final consultation. The original smoking cessation clinic program ended at the final consultation as indicated by the dotted square in Figure 1. Participants of the social media-based peer-supported care were enrolled during consultations. Participants' postings were followed up as long as they participated up to one year from their initial consultations.

Categories	Months after completing the program for successful participant 1					Months before completing the smoking cessation clinical program for relapsed participant 2	
	1	2	3	11		3	2
Reports about smoking cessation status	■	■	■	■	■	■	■
Decision about smoking cessation	■	■	■	■	■	■	■
Encouraging messages	■	■	■	■	■	■	■
Expressions of gratitude	■	■	■	■	■	■	■
Agreement with other's comments	■	■	■	■	■	■	■
Concern about sustaining smoking cessation	■	■	■	■	■	■	■
Anticipating support of smoking cessation from staff	■	■	■	■	■	■	■
Own ideas for continued smoking cessation	■	■	■	■	■	■	■
Asking for advice about own health	■	■	■	■	■	■	■
Expressions of happiness toward positive result of smoking cessation	■	■	■	■	■	■	■

Figure 2

Comment categories appeared in successful participant 1 and relapsed participant 2 during the observed period. Boxes represent the appearance of each category in time sequence after the participant completed the smoking cessation program at the clinic. Filled, striped and dotted boxes represent categories corresponding to 'helping relationships', 'self-liberation' and 'self-reevaluation', respectively. The number in the box represents the frequency of the observed category. Boxes without numbers represent one observed frequency. Participant 1 enrolled in the peer-supported smoking cessation program just after he completed the 12-week clinical smoking cessation program. Participant 2 enrolled in the peer-supported smoking cessation program just after his initial visit to the smoking cessation clinic program, so he posted comments and responses before completing the clinic program. Participant 2 posted comments only during five visits. Participant 2 continued the smoking cessation program after confirmed smoking abstinence at the fifth and last visit.

Figure 3

The repetitive encouraging message model for smoking cessation aligned with stages in the transtheoretical model. The categories identified in this study are described in the squared boxes. The stages of change are described as the round corner boxes. The constructs in the process of change are described in the arrow tab.