Antecedents and Consequences of the Perceived Usefulness of Smoking Cessation Online Health Communities

Chenglong Li
University of Turku
chenglong.li@utu.fi

Hongxiu Li
Tampere University
hongxiu.li@tuni.fi

Reima Suomi
University of Turku
reima.suomi@utu.fi

Abstract

This study aims to investigate the antecedents and consequences of the perceived usefulness (PU) of smoking cessation online health communities (OHCs). In the proposed research model, the informational, emotional, and esteem supports are conceptualized as the antecedents of PU. Two different post-adoption behaviors of users are considered as consequences of PU: (1) continuance intention to use smoking cessation OHCs and (2) knowledge-sharing behavior. We tested the research model by using an online survey of 173 valid responses. The results show that emotional and esteem support are important determinants of PU, and that PU positively affects both knowledge sharing and continuance intention. Continuance intention was found to affect knowledge sharing positively. This study contributes to information systems (IS) post-adoption behavior research in smoking cessation OHCs from the social support perspective and offers practical implications for the administration of smoking cessation OHCs.

1. Introduction

For millions of smokers worldwide, the Internet plays a critical role in their smoking cessation. It is estimated that over 12 million American adult smokers sought smoking cessation help from the Internet in 2017 [1]. As Internet-based platforms, smoking cessation online health communities (OHCs) recently have attracted much attention from researchers and practitioners. Smoking cessation OHCs are collectives of people who interact with each other on smoking cessation online [2]. Smoking cessation OHCs apparently offer benefits to smokers. First, smoking cessation OHCs offer a channel through which smokers can communicate and interact with other smokers and ex-smokers without time and place limitations. Second, smoking cessation OHCs allow users to remain anonymous when communicating with other users. This could help smokers protect their privacy and avoid social stigma (e.g., embarrassment, blame, or shame). Previous studies have reported that use of smoking cessation OHCs could promote attempts to quit [3], abstinence [4], and relapse prevention [5]. However, low level of

usage and high rates of follow-up attrition are big challenges to smoking cessation OHCs [6]. Questions remain on how to ensure that smokers continue to use smoking cessation OHCs in their smoking cessation process. Bhattacherjee [7] posited that continuous use of an information system (IS) is critical to its long-term success. In addition, knowledge sharing also has been deemed critical to online communities' sustainability [8]. An online community's sustainability largely depends on whether members continually share their knowledge by asking questions, offering answers, and commenting on and debating issues [8]. Thus, it is important to investigate the determinants of continuance intention to use smoking cessation OHCs and knowledge-sharing behavior in them.

Prior studies have argued that perceived usefulness (PU) is a dominant driver of continuous usage of an IS [9, 10], as well as an important predictor of knowledge sharing in online communities [11, 12], and PU are determined by external factors, such as system characteristics, user trait, user experience, etc. [13]. The users of smoking cessation OHCs are smokers who are willing to quit or maintain the quit. They are in need of ongoing assessments and repeated interventions to cope with physical and psychosocial addiction to support their quit process [14]. Unlike the users of other online communities, the users of smoking cessation OHCs might concern about to what degree the smoking cessation OHCs can meet their needs in their smoking cessation rather than the functions of smoking cessation OHCs [15]. The needs of smoking cessation OHC users also vary in their smoking cessation OHC usage, e.g., those at different stages of smoking cessation might have different needs and require different support from smoking cessation OHCs [16]. Thus, it is meaningful to investigate the determinants of PU in the context of smoking cessation OHCs.

Unlike previous studies on determinant factors of PU from a technological perspective [13], this study examines users' perceptions of the usefulness of smoking cessation OHCs from the social support perspective. According to Agarwal [17], PU is affected by how users associate themselves with values obtained from using an IS. In the context of smoking

HƗCSS

cessation OHCs, users often would like to gain social support to deal with daily quitting-related difficulties and challenges [18]. In extant literature, little research has examined whether social support determines the PU of smoking cessation OHCs.

Thus, this study proposes a research model to explore the antecedents and consequences of PU in the context of smoking cessation OHCs. Three components of social support are deemed antecedents of the PU of smoking cessation OHCs, i.e., informational, emotional, and esteem support. The PU of smoking cessation OHCs is supposed to lead to continuance intention and knowledge sharing in smoking cessation OHCs. The proposed research model was tested empirically with data collected from two different countries (China and Finland).

This paper is structured as follows. In Section 2, a review of relevant literature on both IS post-adoption behaviors and social support is conducted. Next, the research model and hypotheses are presented in Section 3. The methods for data collection and analysis are introduced in Section 4, and the findings for theory and practice, as well as limitations and future research, are discussed in Section 5.

2. Theoretical background

The proposed research model draws on studies of IS post-adoption behaviors and social support. The theoretical background of these two lines of studies is presented in this section.

2.1 Post-adoption behaviors: IS continuance and knowledge sharing

IS continuance is conceived as a form of post-adoption behavior and has received much attention in the IS field. IS continuance stems from technology acceptance model (TAM) theory [9] and expectation confirmation theory (ECT) [19]. Bhattacherjee [7] integrated PU with ECT to explore IS continuance together with satisfaction. PU has been found to be a salient determinant of IS continuance. In other contexts, the positive relationship between PU and IS continuance also has been validated, such as in the context of e-learning [20], e-government [21], and OHCs in general [22].

Prior studies have shown that PU not only affects continuous use of an IS, but also other behavioral outcomes, such as knowledge sharing. The findings by Li and Liu [23] suggested that PU of e-service positively influences word-of-mouth (WOM) sharing. Yuan et al. [11] also found that PU positively influences knowledge sharing in online travel communities. In research by Hashim and Tan [12], the PU of online business communities has been found to motivate continuous knowledge-sharing intentions.

In TAM, PU refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" [9, p.320] and can be determined by external variables. Prior studies have investigated the determinants of PU from various perspectives. For instance, Agarwal and Karahanna [24] found that individual and situational factors affect PU, including individual traits of playfulness, personal innovativeness, and user experience. In the work of Zhang et al. [13], system characteristics were reported to be the antecedents of PU of computer-based communication systems. From utilitarian and hedonic perspectives, Wang and Li [25] found that information quality, curiosity fulfilment, and enjoyment determine the PU of travel-review websites. In the context of OHCs, Wu [22] discovered that social support, information quality, and service quality positively influence the PU of OHCs.

2.2 Social support

Social support refers to information and actions that make an individual believe that he or she is "cared for and loved, esteemed and valued, as well as belongs to a network of communication and mutual obligation" [26, p. 300]. Prior research findings indicate that social support can benefit both physical and mental health [27, 28], and can influence a broad range of health-related behavioral changes, such as alcohol use [29] and smoking cessation [30, 31]. Social support can also buffer negative effects from stress [32]. In traditional smoking cessation interventions, smokers are found to be more likely to advance their smoking cessation processes when they receive active social support from partners, family members, friends, or "buddies" [30, 31]. Some scholars also found that smokers seek social support in their usage of smoking cessation OHCs [18, 33]. Prior research on smoking cessation OHCs also empirically revealed that social support from OHCs is effective in helping achieve smoking abstinence [33]. In other words, social support in smoking cessation OHCs might enhance smokers' PU of smoking cessation OHCs, which can further enhance their smoking cessation performance. Thus, we chose social support as a theoretical basis on which to examine the PU of smoking cessation OHCs.

Cutrona and Suhr [34] divided social support into five different subcategories: (1) informational support, i.e., offering help to solve problems through advice, suggestions, and teaching or referrals; (2) tangible support, i.e., offering goods or services; (3) emotional support, i.e., offering comfort and love by expressing caring and concern; (4) esteem support, i.e., offering respect and confidence in abilities; and (5) network support, i.e., offering a sense of belonging to a group. Informational and emotional support have been found to be two major commonly shared support

mechanisms, and esteem and network support also have been deemed as another two main social support mechanisms in various OHCs, e.g., OHCs for cancer [35] and smoking cessation [18]. In the context of a smoking cessation OHC, Zhang and Yang [18] stated that posts and comments generated in smoking cessation OHCs offer different support to users, such as informational, emotional, esteem, and network support. In their research, they found that postings offer more informational support than the other three types of social support, whereas comments offer more informational support, esteem support, and emotional support compared with network support. However, tangible support has been reported to be uncommon in OHCs because such support is limited by geographical proximity [35].

In this study, three components of social support are deemed antecedents of the PU of smoking cessation OHCs, i.e., informational, emotional, and esteem support. We exclude tangible and network support from the five components of social support proposed by Cutrona and Suhr [34]. Tangible support has rarely been included in OHC research [35], and network support seems to be too general compared to emotional, information and esteem support in smoking cessation OHCs.

3. Research model and hypotheses
3.1 Proposed model
Following the literature on PU in online communities [7, 10, 11], we argue that PU is a key driver of both continuance intention and knowledge sharing, and continuance intention is associated with knowledge-sharing behavior in smoking cessation OHCs. The three components of social support—i.e., informational, emotional and esteem support—are deemed determinants of PU of smoking cessation OHCs in this study. Information support is suggested to be associated with emotional and esteem support. The definitions of the constructs included in the proposed research model are shown in Table 1. The proposed research model is depicted in Figure 1.

3.2 Research hypotheses
Emotional support provides care, encouragement, congratulations, and even love to people [34, 36]. Emotional support has been found to be shared frequently in smoking cessation OHCs [37, 38]. In smoking cessation OHCs, users often obtain empathy from peers who are or have been in similar situations and, thus, truly can understand their struggles and pain in the smoking cessation process. In addition, users can receive encouragement when they disclose their difficulties with smoking cessation in a smoking cessation OHC. Moreover, most smoking cessation OHCs provide anonymity and privacy protections so

that users can share their feelings with those whom they trust. Such emotional support could help users decrease the stress that they experience during the smoking cessation process and enhance their confidence in smoking cessation [18, 37, 38]. The positive effects from emotional support on smoking cessation have been reported during traditional interventions, such as phone counselling [39]. In addition, anticipated emotional support has been deemed an important reason for smokers to use doctors, quit lines, and community service organization staffs, as such emotional support can help them with smoking cession performance [40]. Here, we assume that emotional support from smoking cessation OHCs will help smokers enhance their confidence in smoking cessation, as well as their smoking cessation performance. The more emotional support smokers receive from smoking cessation OHCs, the more useful smoking cessation OHCs will be perceived. Thus, we propose the following hypothesis:

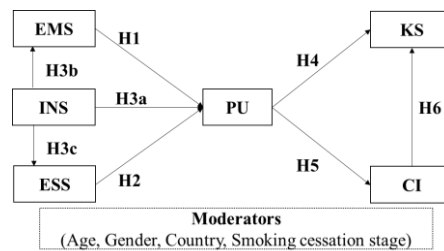*H1: Emotional support is associated positively with the PU of a smoking cessation OHC.*

Figure 1. Proposed research model

Table 1. List of constructs in the research model

Construct	Definition
Emotional support (EMS)	Communicating caring, empathy, encouragement, or even love in a smoking cessation OHC [34]
Informational support (INS)	Communicating information on smoking cessation—such as advice, facts, and referrals—in a smoking cessation OHC [34]
Esteem support (ESS)	Communicating compliments or relief from blame in a smoking cessation OHC [34]
Perceived usefulness (PU)	The degree to which a user believes that using a smoking cessation OHC would enhance his or her smoking cessation performance [9]
Knowledge sharing (KS)	The behavior of exchanging information, experience, and skills related to smoking cessation in a smoking cessation OHC [41]
Continuance intention (CI)	The willingness to continue using a smoking cessation OHC [7]

Esteem support offers compliments and relief from blame [34]. In smoking cessation OHCs, users often receive congratulations and positive feedback when they share their achievements. This could help users

cultivate positive attitudes and confidence toward smoking cessation. Furthermore, peers' expressions of confidence could strengthen their belief in quitting and might alleviate users' feelings of guilt and blame regarding failures. Esteem support from online settings has been identified as one of the main social benefits from healthy behaviors, such as physical activity [42]. Meanwhile, compliments have been suggested as a positive partner behavior that supports smoking cessation [43]. Therefore, it is reasonable to assume that esteem support that a user receives from a smoking cessation OHC will be connected to the user's PU of the smoking cessation OHC. The more esteem support received from a smoking cessation OHC, the more useful the smoking cessation OHC is perceived to be. Thus, we suggest the following hypothesis:

H2: Esteem support is associated positively with the PU of a smoking cessation OHC.

Similar to emotional support, informational support was found to be another major support mechanism provided in smoking cessation OHCs [37, 38]. In a smoking cessation OHC, users can get information on the consequences of smoking and benefits from quitting, or advice on how to cope with withdrawal symptoms and cravings [18, 37, 38]. Practical information that peers offer often is based on real-life experiences and meets the personalized information needs of smokers who want to quit. Such informational support could help users support their decisions and solve problems to avoid relapse. Therefore, it is reasonable to assume that the informational support that users receive from a smoking cessation OHC will make them perceive smoking cessation OHCs as useful. The more informational support one receives from a smoking cessation OHC, the more useful it will be perceived to be. Thus, we hypothesize accordingly:

H3a: Informational support is associated positively with the PU of a smoking cessation OHC.

In addition, information shared in smoking cessation OHCs may trigger a user's emotional reactions [44], which might lead to the exchange of emotional and esteem support eventually. For instance, when reading the advice or success stories of quitting posted on smoking cessation OHC by other users, a user might feel encouraged and would like to acclaim others' achievements. Meanwhile, the shared smoking cessation experience on avoiding slip and relapse by other users might also make a user feel companioned and less stressful. And the user may even response to them by posting messages to show thanks, encouragements, or caring. Thus, we assume that informational support affects emotional and esteem support, and propose the following hypotheses:

H3b: Informational support is associated positively with emotional support in a smoking cessation OHC.

H3C: Informational support is associated positively with esteem support in a smoking cessation OHC.

Previous research findings on knowledge sharing suggest that PU of an IS is a primary driver of knowledge-sharing behavior. In the work of Yuan et al. [11] in the context of online travel communities, PU has been found to exert a significant positive effect on knowledge sharing. In extant IS literature, PU has been deemed a dominant determinant of individuals' continuance intention to use an IS. Following prior literature, we suggest that PU will affect continuance intention and knowledge-sharing behavior in the context of smoking cessation OHCs, and we propose the following two hypotheses:

H4. PU is associated positively with users' knowledge sharing regarding smoking cessation OHCs.

H5. PU is associated positively with users' continuance intention to use a smoking cessation OHC.

Prior literature on IS post-adoption behavior focuses on users' continuous intention to use an IS or actual continued use of an IS, but little research has examined the relationship between IS continuance intention and knowledge sharing. In research by Li and Liu [23], they found that continuance intention is associated positively with other post-adoption behaviors, such as WOM behavior. Based on these findings, it is reasonable to assume that users who intend to continue using a smoking cessation OHC also will contribute their knowledge to smoking cessation OHCs. Thus, we propose the following hypothesis:

H6. Users' continuance intention to use a smoking cessation OHC positively affects their knowledge sharing in the smoking cessation OHC.

Previous research suggested that moderators like age and gender should be considered when testing how social support affects efforts to quit smoking [31]. Other scholars also have stated that the smoking cessation stage is linked to social support in OHCs [45]. As the data in this study were collected in both Finland and China, we also take factor in geographical location as a moderator. Therefore, in this study, age, gender, country, and smoking cessation stage were used as moderators of the proposed relationships in the research model.

4. Research methods
4.1 Measurement development
Six constructs are included in the proposed research model, i.e., informational support, emotional support, esteem support, PU, knowledge sharing, and continuance intention. All constructs were measured by using multiple items adopted from prior research. A five-point scale, ranging from (1) strongly disagree to (5) strongly agree, was used to measure items included

in the research model. The informational and emotional support items were based on research by Liang, Ho, Li and Turban [46]. The measurements for construct esteem support were taken from Oh, Lauckner, Boehmer, Fewins-Bliss and Li [47]. Perceived usefulness and continuance intention were measured with items adapted from Bhattacherjee [7]. Items for knowledge sharing were taken from the work of Hsu et al. [41]. The construct items are presented in the Appendix.

4.2 Data collection

This study employed an online survey for data collection. Two nonprofit smoking cessation OHCs were selected for this study, one in Finland (Stumppi.fi) and the other in China (smoking cessation bar on Baidu Post Bar). The Ethics Committee at the authors' home university approved the study before data collection began.

The survey questionnaire initially was developed in English, then translated into Finnish and Chinese. Other IS researchers (and native speakers of the respective languages) reviewed all three language versions of the questionnaire to ensure content and translation validity. One Stumppi.fi staff member also helped us review the survey in English and Finnish. Before the official launch of the online survey, 20 Stumppi.fi users were surveyed in a pilot study. The questionnaire was modified based on their feedback.

The online survey was launched officially on November 23, 2018, in China and December 17, 2018, in Finland. By April 30, a total of 235 users answered our survey (48 in Finland, 187 in China). Each respondent received an incentive for their participation in the online survey.

After excluding replies due to disagreements on joining in the survey (2 in Finland, 48 in China), as well as unreliable replies, such as same answer choices for all measurement items (12 in China), 173 replies were used as this study's sample. Table 2 presents all respondents' demographic and smoking cessation stage information.

4.3 Data analysis

In this study, both the measurement and structure models were tested using partial least squares (PLS) 3.0. The measurement model test involves assessment of convergent validity and discriminant validity.

The factor loading for each item, composite reliability (CR) and average variance extracted (AVE) for each construct were used to assess convergent validity [48-50]. We deleted two items (EMS3 and INS1) because their factor loadings were lower than the minimum criterion. As shown in Table 3, each item's factor loadings exceeded 0.70, and the value of AVE and CR satisfied the recommended threshold

values of 0.5 and 0.7, respectively, suggesting adequate convergent validity.

Table 2. Respondents' demographic and smoking cessation stage data

Measure	Items	Frequency	Percentage (%)
Country	Finland	46	26.6
	China	127	73.4
Gender	Male	103	59.5
	Female	64	37.0
	Unwilling to disclose	6	3.5
Age	15-24	17	9.8
	25-44	117	67.6
	45-65	35	20.2
	> 65	4	2.3
Smoking cessation stage	Pre-contemplation	4	2.3
	Contemplation	45	26.0
	Preparation	19	11.0
	Action	40	23.1
	Maintenance	50	28.9
	Termination	15	8.7

Table 3. Confirmatory factor analysis results

Construct	Item	Factor loading	Cronbach's alpha	CR	AVE
CI	CI1	0.871	0.807	0.886	0.723
	CI2	0.806			
	CI3	0.871			
EMS	EMS1	0.866	0.843	0.905	0.761
	EMS2	0.851			
	EMS4	0.899			
ESS	ESS1	0.812	0.822	0.894	0.738
	ESS2	0.865			
	ESS3	0.897			
INS	INS2	0.868	0.670	0.858	0.752
	INS3	0.866			
KS	KS1	0.926	0.935	0.954	0.838
	KS2	0.898			
	KS3	0.923			
	KS4	0.913			
PU	PU1	0.821	0.799	0.870	0.626
	PU2	0.842			
	PU3	0.785			
	PU4	0.711			

Table 4. Correlation matrix and discriminant validity

	CI	EMS	ESS	INS	KS	PU
CI	**0.850**					
EMS	0.428	**0.872**				
ESS	0.507	0.740	**0.858**			
INS	0.460	0.743	0.766	**0.867**		
KS	0.470	0.578	0.565	0.611	**0.915**	
PU	0.541	0.631	0.660	0.604	0.572	**0.791**

To evaluate discriminant validity, we calculated the square root of AVE for all constructs in the research model. As shown in Table 4, the value of the square root of AVE for each construct is higher than its correlation with other constructs, suggesting adequate discriminant validity for all constructs [48].

We applied the bootstrapping procedure in PLS to test the structural model, including the path significance and the hypotheses' effect. Figure 2 presents the overall explanatory power and estimated path coefficients. The proposed research model

explains 48.6 percent of the variation in PU of smoking cessation OHCs, 36.3 percent of knowledge sharing, 29.3 percent of continuance intention, 55.2 percent of emotional support, and 58.7 percent of esteem support. As postulated, PU exerts significant positive effects on knowledge sharing (β=0.450, p<0.001) and continuance intention (β=0.541, p<0.001), thereby supporting H4 and H5. Emotional support (β=0.267, p<0.05) and esteem support (β=0.367, p<0.001) exert positive influences on PU significantly, thereby supporting H1 and H2. Informational support was not found to affect PU significantly, but significantly affects emotional support (β=0.743, p<0.001) and esteem support (β=0.766, p<0.001); thus, H3a is not supported, and H3b and H3c are supported. Continuance intention was found to affect knowledge sharing significantly (β=0.226, p<0.05), thereby supporting H6.
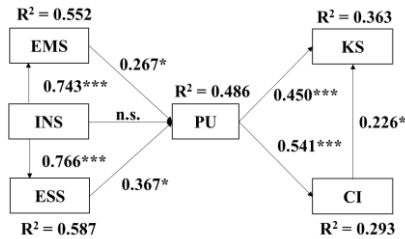
(Note: ***: p < 0.001; *: p <0.05; n.s.: not significant)
Figure 2. The structural model without mediators

4.4 Moderating analysis

In this study, we conducted a multi-group analysis (MGA) to test the moderating effects of age, gender, country, and smoking cessation stage to investigate whether the paths' strengths vary according to different groups. With respect to country and age, no significant difference has been found between Finnish and Chinese users, as well as among different age groups.

As presented in Table 5, a significant difference between male and female users in the relationship between emotional support and PU has been found. Emotional support is a significant determinant of PU for female users (β=0.599, p<0.001), but not for male users.

Following the main smoking cessation stage, we divided the users into three different subgroups: those who intend to quit, but take no action, including those at the contemplation and preparation stages (Group A); those who have entered an action stage (Group B); and those who have quit smoking for at least six months (Group C), including people in maintenance and temptation stages. Note that the four responses from those in the pre-contemplation stage without intention to quit smoking were excluded from the test. As shown in Table 6, emotional support and informational support were found to be the determinants of PU among Group A, and informational support was an

antecedent of PU among Group C. PU exerted significant influences on knowledge sharing despite the smoking cessation stage among the respondents. For Groups A and C, PU is related significantly to continuance intention, but continuance intention is associated significantly with knowledge sharing only for users in Group C.

Table 5. Test of gender as a moderator

	Comparison of gender	Path coefficients of separate structural models	
	Male vs. Female	Male [N = 103]	Female [N = 64]
H1	p<0.05	n.s.	0.599***
H2	n.s.	0.479***	n.s.
H3a	n.s.	n.s.	n.s.
H3b	n.s.	0.770***	0.692***
H3c	n.s.	0.799***	0.389***
H4	n.s.	0.327**	0.503***
H5	n.s.	0.596***	0.394***
H6	n.s.	0.391**	n.s.

Table 6. Test of smoking cessation stage as a moderator

	Comparison of smoking cessation stages			Path coefficients of separate structural models		
	A vs. B	B vs. C	A vs. C	A [N = 64]	B [N = 40]	C [N = 65]
H1	n.s.	n.s.	n.s.	0.386**	n.s.	n.s.
H2	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
H3a	n.s.	n.s.	n.s.	0.390*	n.s.	0.343*
H3b	n.s.	n.s.	p<0.05	0.845***	0.802***	0.623***
H3c	p<0.05	n.s.	p<0.05	0.887***	0.660***	0.705***
H4	n.s.	n.s.	n.s.	0.619***	0.713***	0.294*
H5	p<0.05	n.s.	p<0.001	0.803***	0.604***	n.s.
H6	n.s.	p<0.05	n.s.	n.s.	n.s.	0.368**

Table 7. Results of Mediation Analysis

Relationship	Direct effect	Indirect effect	Total effect	Mediation effect
EMS→PU→KS	0.156 n.s.	0.064 n.s.	0.220*	No effect
EMS→PU→CI	-0.037 n.s.	0.095 n.s.	0.058 n.s.	No effect
INS→PU→KS	0.291**	0.321***	0.621***	Partial effect
INS→PU→CI	0.099 n.s.	0.361***	0.460 ***	Full mediation
ESS→PU→KS	0.016 n.s.	0.128*	0.141 n.s.	Full Mediation
ESS→PU→CI	0.228 n.s.	0.129*	0.356 **	Full Mediation

4.5 Post hoc analysis

Following the SmartPLS guidelines [51], mediation analysis was performed to ascertain whether PU fully or partially mediates the relationships between social support and post-adoption. As presented in Table 7, indirect effects from esteem support on knowledge sharing (β=0.128, p<0.05) and continuance intention (β=0.129, p<0.05) are significant. The indirect effects from informational support on knowledge sharing (β=0.361, p<0.001) and continuance (β=0.361, p<0.001) are also significant. The research results demonstrate that PU fully mediates esteem support's impact on knowledge sharing and continuance intention, fully mediates informational support's influence on continuance intention, and partially mediates informational support' effect on knowledge sharing. PU exerts no mediating effect on the impact of

emotional support on knowledge sharing and continuance intention.

5. Discussion and conclusions
5.1 Discussion

This study raises several points of interest.

Emotional support was found to exert significant influence on PU. This finding is consistent with research findings by Wu [22] in the context of general OHCs, namely that social support positively affects the PU of general OHCs. Emotional support was found to be an antecedent of PU among female users of smoking cessation OHCs, but not among male users. Prior research stated that women value emotional support more than men in stress and coping contexts [52]. For female users of smoking cessation OHCs, they deem gaining emotional support from smoking cessation OHCs to be more important in coping with the stress in smoking cessation than male users. When female users get the emotional support from a smoking cessation OHC that they expect to help them with smoking cessation, they perceive that the smoking cessation OHC is useful.

Esteem support was found to determine the PU of smoking cessation OHCs together with emotional support, possibly because smokers' urges are related to cravings, and they often feel guilt, shame, or a lack of confidence when they relapse. Thus, they need esteem support to relieve their self-blame, as well as positive feedback to enhance their confidence and feelings of self-worth or self-efficacy.

Unexpectedly, informational support was found to exert no significant influence on PU of smoking cessation OHCs. This finding contrasts with research by Wu [22], which found that information support is a determinant of PU of general OHCs. This might be explained by the indirect impact that informational support exerts on PU, as we found that informational support has significant impacts on emotional support (β=0.743, p<0.001) and esteem support (β=0.766, p<0.001), which determine PU of smoking cessation OHCs. In a smoking cessation OHC, the exchanged information maybe not enough to enhance users' smoking cessation performance, but the content and the tone of information may activate the sharing of emotional and esteem support, which are determinants of PU. Thus, informational support exerts an indirect influence on the PU of smoking cessation OHCs via emotional and esteem support.

PU was found to exert significant influences on knowledge sharing and continuance intention. The significant relationship between PU and knowledge sharing is consistent with findings by Yuan et al. [11] in the context of online travel communities, namely that PU of online travel communities exerts positive effects on knowledge sharing in such communities.

Consistent with prior research findings regarding online banking [7], e-learning [20], e-government [21], and general OHCs [22], PU exerts positive effects on continuance intention to use smoking cessation OHCs. When users deem a smoking cessation OHC to be useful for them to improve their smoking cessation efforts, they are more likely to continue to use the smoking cessation OHC and contribute their knowledge to it.

The impacts of PU on knowledge sharing vary among the A, B, and C user groups at different smoking cessation stages. PU exerts the strongest impact on knowledge sharing with those in the process of smoking cessation (Group B) (β=0.713, p<0.001), followed by those who intend to quit but no action (Group A) (β=0.619, p<0.001), and those at the maintenance and termination stages (Group C) (β=0.294, p<0.01). Users who already have succeeded in quitting smoking for at least six months perceive smoking cessation OHCs as useful in enhancing smoking cessation efforts, but they are less likely to share knowledge in smoking cessation OHCs compared with those who are in the contemplation and preparation stage and in the process of smoking cessation stage. This might be due to the fact that users who already have quit smoking for at least six months might engage in smoking cessation OHCs less often than those who are in the contemplation and preparation stage and in the process of smoking cessation stage.

For smokers at different cessation stages, we found that PU exerts no significant impact on continuance intention to use OHCs among those who have succeeded in quitting for at least six months, but significant influence among those who are in the contemplation and preparation stage and in the process of smoking cessation stage. A significant difference was found between Groups A and B and Groups A and C, possibly due to the fact that those who already have achieved their smoking cessation goals, though they perceive smoking cessation OHCs as useful, have little intention to continue using them, compared with those in the contemplation and preparation stage and in the process of smoking cessation stage, who are more likely to continue using smoking cessation OHCs, as they need support from them to achieve their goal to quit smoking.

Finally, continuance intention was found to exert positive effects on knowledge sharing. This is similar to findings by Li and Liu [23], who found that continuance intention exerts significant positive effects on other post-adoption behavior, such as WOM behavior. Our results indicate that the stronger the continuance intention, the more likely users are to share their knowledge within the OHC.

5.2 Conclusions

This research findings in this study carry some theoretical implications.

First, the findings on emotional and esteem support as the two determinants of PU of smoking cessation OHCs imply that PU of them can be explained from the social support perspective, which is connected closely with the smoking cessation OHCs context. The findings enrich the existing body of knowledge about determinants of the PU of OHCs. The gender difference in the relationship between emotional support and PU also indicates that the determinants of user perceptions about the usefulness of smoking cessation OHCs vary among female and male user groups. The differences in relationships between PU and post-adoption behaviors among users at different smoking cessation stages also indicate the different role of PU in predicting knowledge sharing and continuance intention to use smoking cessation OHCs among users at different smoking cessation stages.

Second, the findings on the insignificant direct influence of informational support on PU and significant direct influence on emotional and esteem support indicate that information support is the prerequisite for emotional support and esteem support in smoking cessation OHCs. Though information support exerts no impact on PU, it is vital in the smoking cessation OHCs as it affects both emotional and esteem support. The findings indicate that the determinants of PU of smoking cessation OHCs vary compared with other OHCs. For example, the PU of a general OHC has been found to be determined by information support [22]. The findings provide new insights into the understanding of the relationships between the three components of PU and their different roles in determining PU of the smoking cessation OHCs.

Third, PU of smoking cessation OHCs has been found to be an important determinant of both continuance intention and knowledge sharing. This enriches IS post-adoption research. Prior studies have focused on impacts of PU on continuance intention [7]. Our findings indicate that PU also exerts an influence on different post-adoption behaviors, including continuance intention and knowledge sharing. Furthermore, PU has been found to mediate the association between esteem support and two post-adoption behaviors fully, and relationship between informational support and two post-adoption behaviors partially. These findings help add new insights to disentangle the complex nature of post-adoption behaviors in the context of smoking cessation OHCs.

Finally, this study found an association between continuance intention and knowledge sharing, suggesting that continuance intention also affects other post-adoption behaviors, such as knowledge sharing. Retaining users can facilitate knowledge-sharing activity within smoking cessation OHCs. This provides additional insights to understand the relationship between different post-adoption behaviors.

This study offers some practical implications for smoking cessation OHC service providers. In this study, PU was found to affect continuance intention and knowledge sharing positively, thereby providing new insights into both retaining existing users of smoking cessation OHCs and promoting knowledge sharing in smoking cessation OHCs by enhancing users' PU of smoking cessation OHCs. Specifically, emotional and esteem support were found to be the determinants of PU of smoking cessation OHCs, indicating that managers of smoking cessation OHCs should focus on the emotional and esteem support when formulating online service-development strategies to promote the use of smoking cessation OHCs among smokers. In addition, though information support is not a significant determinant of PU of smoking cessation OHCs, information sharing still should be encouraged as information support will affect PU indirectly via emotional and esteem support. In addition, smoking cessation OHC service providers should care about users' different characteristics with regard to smoking cessation OHCs, such as their gender and smoking cessation stages, to provide customized social support in smoking cessation OHCs to meet their needs and enhance their smoking cessation performance, which will be helpful in retaining users and knowledge sharing in smoking cessation OHCs.

5.3 Limitations and future research

This study has several limitations. First, this study only explored the effects of PU on post-adoption behaviors in the context of smoking cessation OHCs, including continuance intention and knowledge sharing. The impact of other factors on users' post-adoption behaviors, such as satisfaction and perceived ease of use, were not considered in this study. Further research should also examine different determinants of post-adoption behaviors in the research context. Second, we investigated only two post-adoption behaviors (continuance intention and knowledge sharing), while other post-adoption behaviors, such as recommendations, were not explored. Thus, further research should test whether our proposed model is also appropriate for exploring other post-adoption behaviors. Third, our data were limited to two smoking cessation OHCs in Finland and China, so this study's findings can be generalized only to smoking cessation OHCs, but not to other contexts. Further research should expand the research model to other contexts or cultures to validate this model empirically.

References

1. Graham, A.L. and M.S. Amato, *Twelve Million Smokers Look Online for Smoking Cessation Help Annually: Health Information National Trends Survey Data, 2005-2017.* Nicotine Tob Res, 2019. **21**(2): p. 249-252.
2. Mpinganjira, M., *Precursors of trust in virtual health communities: A hierarchical investigation.* Information & Management, 2018. **55**(6): p. 686-694.
3. Baskerville, N.B., S. Azagba, C. Norman, K. McKeown, and K.S. Brown, *Effect of a Digital Social Media Campaign on Young Adult Smoking Cessation.* Nicotine Tob Res, 2016. **18**(3): p. 351-60.
4. Graham, A.L., G.D. Papandonatos, B. Erar, and C.A. Stanton, *Use of an online smoking cessation community promotes abstinence: Results of propensity score weighting.* Health Psychology, 2015. **34S**: p. 1286-1295.
5. Cheung, Y.T., C.H. Chan, C.K. Lai, W.F. Chan, M.P. Wang, H.C. Li, S.S. Chan, and T.H. Lam, *Using WhatsApp and Facebook Online Social Groups for Smoking Relapse Prevention for Recent Quitters: A Pilot Pragmatic Cluster Randomized Controlled Trial.* J Med Internet Res, 2015. **17**(10): p. e238.
6. Saul, J.E., M.S. Amato, S. Cha, and A.L. Graham, *Engagement and attrition in Internet smoking cessation interventions: Insights from a cross-sectional survey of "one-hit-wonders".* Internet Interv, 2016. **5**: p. 23-29.
7. Bhattacherjee, A., *Understanding information systems continuance: An expectation-confirmation model.* Mis Quarterly, 2001. **25**(3): p. 351-370.
8. Chiu, C.M., M.H. Hsu, and E.T.G. Wang, *Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories.* Decision Support Systems, 2006. **42**(3): p. 1872-1888.
9. Davis, F.D., *Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology.* Mis Quarterly, 1989. **13**(3): p. 319-340.
10. Venkatesh, V. and F.D. Davis, *A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies.* Management Science, 2000. **46**(2): p. 186-204.
11. Yuan, D., Z. Lin, and R. Zhuo, *What drives consumer knowledge sharing in online travel communities?: Personal attributes or e-service factors?* Computers in Human Behavior, 2016. **63**: p. 68-74.
12. Hashim, K.F. and F.B. Tan, *Examining the determinant factors of perceived online community usefulness using the expectancy value model.* Journal of Systems and Information Technology, 2018. **20**(2): p. 152-167.
13. Zhang, P.Z., T. Li, R.Y. Ge, and D.C. Yen, *A theoretical acceptance model for computer-based communication media: Nine field studies.* Computers in Human Behavior, 2012. **28**(5): p. 1805-1815.
14. Clinical Practice Guideline Treating Tobacco, U., L. Dependence Update Panel, and Staff, *A clinical practice guideline for treating tobacco use and dependence: 2008 update. A U.S. Public Health Service report.* Am J Prev Med, 2008. **35**(2): p. 158-76.
15. Lederman, R., H. Fan, S. Smith, and S. Chang, *Who can you trust? Credibility assessment in online health forums.* Health Policy and Technology, 2014. **3**(1): p. 13-25.
16. Velicer, W.F., J.O. Prochaska, and C.A. Redding, *Tailored communications for smoking cessation: past successes and future directions.* Drug Alcohol Rev, 2006. **25**(1): p. 49-57.
17. Agarwal, R., *Individual Acceptance of Information Technologies*, in *Framing the Domains of IT Management: Projecting the Future Through the Past.* 2000, Pinnaflex Educational Resources: Cincinnati. p. 85-104.
18. Zhang, M. and C.C. Yang, *Using Content and Network Analysis to Understand the Social Support Exchange Patterns and User Behaviors of an Online Smoking Cessation Intervention Program.* Journal of the Association for Information Science and Technology, 2015. **66**(3): p. 564-575.
19. Oliver, R.L., *A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions.* Journal of Marketing Research, 1980. **17**(4): p. 460-469.
20. Alraimi, K.M., H.J. Zo, and A.P. Ciganek, *Understanding the MOOCs continuance: The role of openness and reputation.* Computers & Education, 2015. **80**: p. 28-38.
21. Hamid, A.A., F.Z.A. Razak, A.A. Bakar, and W.S.W. Abdullah, *The effects of perceived usefulness and perceived ease of use on continuance intention to use e-government.* Procedia Economics and Finance, 2016. **35**: p. 644-649.
22. Wu, B., *Patient Continued Use of Online Health Care Communities: Web Mining of Patient-Doctor Communication.* J Med Internet Res, 2018. **20**(4): p. e126.
23. Li, H.X. and Y. Liu, *Understanding post-adoption behaviors of e-service users in the context of online travel services.* Information & Management, 2014. **51**(8): p. 1043-1052.
24. Agarwal, R. and E. Karahanna, *Time flies when you're having fun: Cognitive absorption and beliefs about information technology usage.* Mis Quarterly, 2000. **24**(4): p. 665-694.
25. Wang, P. and H.X. Li, *Understanding the antecedents and consequences of the perceived usefulness of travel review websites.* International Journal of Contemporary Hospitality Management, 2019. **31**(3): p. 1086-1103.
26. Cobb, S., *Social Support as a Moderator of Life Stress.* Psychosomatic Medicine, 1976. **38**(5): p. 300-314.
27. Wright, K.B., S.B. Bell, K.B. Wright, and S.B. Bell, *Health-related Support Groups on the Internet: Linking Empirical Findings to Social Support and Computer-mediated Communication Theory.* J Health Psychol, 2003. **8**(1): p. 39-54.
28. Cohen, S., *Social relationships and health.* Am Psychol, 2004. **59**(8): p. 676-684.
29. Peirce, R.S., M.R. Frone, M. Russell, M.L. Cooper, and P. Mudar, *A longitudinal model of social contact, social support, depression, and alcohol use.* Health Psychology, 2000. **19**(1): p. 28-38.
30. Wagner, J., M. Burg, and B. Sirois, *Social support and the transtheoretical model: Relationship of social support to smoking cessation stage, decisional balance, process use, and temptation.* Addict Behav, 2004. **29**(5): p. 1039-43.
31. Westmaas, J.L., J. Bontemps-Jones, and J.E. Bauer, *Social support in smoking cessation: reconciling theory and evidence.* Nicotine Tob Res, 2010. **12**(7): p. 695-707.
32. Cohen, S. and T.A. Wills, *Stress, social support, and the buffering hypothesis.* Psychol Bull, 1985. **98**(2): p. 310-57.
33. Graham, A.L., G.D. Papandonatos, H. Kang, J.L. Moreno, and D.B. Abrams, *Development and validation of the online social support for smokers scale.* J Med Internet Res, 2011. **13**(3): p. e69.
34. Cutrona, C.E. and J.A. Suhr, *Controllability of stressful events and satisfaction with spouse support behaviors.* Communication Research, 1992. **19**(2): p. 154-174.
35. Wang, X., K. Zhao, and N. Street, *Analyzing and Predicting User Participations in Online Health Communities: A Social Support Perspective.* J Med Internet Res, 2017. **19**(4): p. e130.
36. Huang, K., I. Chengalur-Smith, and W. Ran, *Not Just for Support: Companionship Activities in Healthcare Virtual Support Communities.* Communications of the Association for Information Systems, 2014. **34**(29): p. 561-594.
37. Rocheleau, M., R.S. Sadasivam, K. Baquis, H. Stahl, R.L. Kinney, S.L. Pagoto, and T.K. Houston, *An observational study of social and emotional support in smoking cessation Twitter accounts: content analysis of tweets.* J Med Internet Res, 2015. **17**(1): p. e18.
38. Granado-Font, E., C. Ferre-Grau, C. Rey-Renones, M. Pons-Vigues, E. Pujol Ribera, A. Berenguera, M.L. Barrera-Uriarte,

J. Basora, A. Valverde-Trillo, J. Duch, and G. Flores-Mateo, *Coping Strategies and Social Support in a Mobile Phone Chat App Designed to Support Smoking Cessation: Qualitative Analysis*. JMIR Mhealth Uhealth, 2018. **6**(12): p. e11071.

39. Burns, R.J., A.J. Rothman, S.S. Fu, B. Lindgren, and A.M. Joseph, *The relation between social support and smoking cessation: revisiting an established measure to improve prediction*. Annals of Behavioral Medicine, 2014. **47**(3): p. 369-375.

40. Parnell, A., E. Box, B. Bonevski, T. Slevin, J. Anwar-McHenry, L. Chapman, and S. Pettigrew, *Potential sources of cessation support for high smoking prevalence groups: a qualitative study*. Aust N Z J Public Health, 2019. **43**(2): p. 108-113.

41. Hsu, M.H., T.L. Ju, C.H. Yen, and C.M. Chang, *Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations*. International Journal of Human-Computer Studies, 2007. **65**(2): p. 153-169.

42. Cavallo, D.N., J.D. Brown, D.F. Tate, R.F. DeVellis, C. Zimmer, and A.S. Ammerman, *The role of companionship, esteem, and informational support in explaining physical activity among young women in an online social network intervention*. J Behav Med, 2014. **37**(5): p. 955-66.

43. Cohen, S. and E. Lichtenstein, *Partner Behaviors That Support Quitting Smoking*. Journal of Consulting and Clinical Psychology, 1990. **58**(3): p. 304-309.

44. Derks, D., H.F. Agneta, and A.E.R. Bos, *The role of emotion in computer-mediated communication: A review*. Computers in Human Behavior, 2008. **24**(3): p. 766-785.

45. Ploderer, B., W. Smith, S. Howard, J. Pearce, and R. Borland. *Patterns of support in an online community for smoking cessation*. in *Proceedings of the 6th International Conference on Communities and Technologies*. 2013. Munich, Germany: ACM: p. 26-35.

46. Liang, T.P., Y.T. Ho, Y.W. Li, and E. Turban, *What Drives Social Commerce: The Role of Social Support and Relationship Quality*. International Journal of Electronic Commerce, 2011. **16**(2): p. 69-90.

47. Oh, H.J., C. Lauckner, J. Boehmer, R. Fewins-Bliss, and K. Li, *Facebooking for health: An examination into the solicitation and effects of health-related social support on social networking sites*. Computers in Human Behavior, 2013. **29**(5): p. 2072-2080.

48. Chin, W., W. Marcoulides, and A. George, *Modern methods for business research Methodology for business and management*. 1998: p. 295-336.

49. Hulland, J., *Use of partial least squares (PLS) in strategic management research: A review of four recent studies*. Strategic Management Journal, 1999. **20**(2): p. 195-204.

50. Tenenhaus, M., V.E. Vinzi, Y.-M. Chatelin, and C. Lauro, *PLS path modeling*. Computational Statistics & Data Analysis, 2005. **48**(1): p. 159-205.

51. Hair Jr, J.F., G.T.M. Hult, C. Ringle, and M. Sarstedt, *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. 2nd ed. 2016, Thousand Oaks: Sage.

52. Matud, M.P., *Gender differences in stress and coping styles*. Personality and Individual Differences, 2004. **37**(7): p. 1401-1415.

Appendix. Measurement items

Construct	Measurement items	References
Emotional support	1. When faced with difficulties, some people in the smoking cessation OHC are on my side. 2. When faced with difficulties, some people in the smoking cessation OHC comforted and encouraged me. 3. When faced with difficulties, some people in the smoking cessation OHC listened to me talk about my private feelings. 4. When faced with difficulties, some people in the smoking cessation OHC expressed interest and concern in my well-being.	[46]
Informational support	1. Some people in the smoking cessation OHC would offer suggestions when I needed help. 2. When I encountered a problem, some people in the smoking cessation OHC would give me information to help me overcome the problem. 3. When faced with difficulties, some people in the smoking cessation OHC would help me discover the cause and offer suggestions.	[46]
Esteem support	1. Some members in the smoking cessation OHC showed confidence in my ability to deal with smoking. 2. Some members in the smoking cessation OHC made me feel that I was good at making decisions toward smoking cessation. 3. Some members in the smoking cessation OHC made me feel that I was capable of handling my smoking cessation.	[47]
Perceived usefulness	1. Using the smoking cessation OHC made my smoking cessation proceed faster (productivity). 2. Using the smoking cessation OHC made my smoking cessation proceed better (performance). 3. Using the smoking cessation OHC helped me make better decisions toward smoking cessation (effectiveness). 4. Overall, using the smoking cessation OHC was useful in smoking cessation.	[7]
Knowledge sharing	1. I frequently participate in knowledge-sharing activities in the smoking cessation OHC. 2. I usually spend lots of time in knowledge-sharing activities in the smoking cessation OHC. 3. I usually share information actively with others in the smoking cessation OHC. 4. I usually involve myself in discussions of various topics in the smoking cessation OHC.	[41]
Continuance intention	1. I intend to continue using the smoking cessation OHC rather than discontinue its use. 2. I intend to continue using the smoking cessation OHC rather than use any alternative online communities. 3. If I can, I will continue using the smoking cessation OHC.	[7]