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A Systematic Review on the Impact of Digital Interventions for Smoking Cessation in Asian Populations

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Abstract

Tobacco consumption continues to be a leading cause of avoidable illness and premature death globally. Digital health interventions have shown substantial benefits in improving clinical outcomes and have demonstrated effectiveness in supporting smoking cessation among the general population, mainly due to their adaptability and capacity for individualized support. Despite this, evidence regarding their efficacy in Asian contexts remains limited. Addressing this gap, the present study seeks to evaluate the available evidence regarding the effectiveness of digital tools in supporting smoking cessation among Asian populations. A systematic search of three electronic databases—Web of Science (WOS), Scopus, and PubMed—was conducted to identify studies published from 1 January 2010 to 12 February 2023 that assessed the effectiveness of digital approaches to smoking cessation in Asian countries. 25 eligible studies, encompassing 22,005 participants across nine Asian countries, were included. Among the different digital interventions, the highest abstinence outcome (70%) was reported for a Facebook-based smoking cessation program grounded in cognitive behavioural theory (CBT). This was followed by smartphone applications (60%), WhatsApp (59.9%), and pharmacist counselling combined with the Quit US app (58.4%). Notably, WhatsApp was preferred over Facebook due to its association with lower relapse rates. WeChat interventions achieved 7-day point prevalence abstinence rates of 15.6% and 41.8%. Telephone- and text message–based programs showed abstinence rates ranging from 8% to 44.3% and quit rates between 6.3% and 16.8%. In contrast, media/multimedia messaging and web-based education interventions demonstrated no significant impact on cessation outcomes. The findings indicate that digital health tools may serve as effective and economically viable alternatives to traditional smoking cessation strategies in Asian populations.

Keywords: Medicine, Tobacco use, Human and health, Cognitive behavioural theory, Public health, Tobacco addiction, Tobacco control

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Introduction

Tobacco use remains one of the leading preventable contributors to illness, death, and financial hardship

worldwide [1]. Cigarette smoking poses serious health hazards, both for smokers themselves and for people exposed to second-hand smoke. Globally, tobacco use causes over eight million deaths annually, of which more than seven million are due to direct consumption, while approximately 1.2 million result from passive exposure [2]. If current smoking behaviors persist, global tobacco-related mortality could rise to 8.3 billion deaths by 2030 [3].

In the 20th century alone, tobacco use caused around 100 million deaths, predominantly in high-income countries [4, 5]. Looking ahead, as many as one billion lives may be lost during this century, mainly in low- and middle-income nations, if tobacco consumption continues unchecked [1, 3, 5, 6]. Evidence shows that nearly 80% of the world's smokers live in these lower-income countries, where the use of tobacco-related products continues to escalate [2, 7]. In South Asia, smoking prevalence is particularly concerning, with about 25.2% of men and 3.26% of women using tobacco [8]. This not only endangers public health but also represents a modifiable risk factor for major non-communicable diseases (NCDs) across the region [9]. Alarmingly, South and Southeast Asia report over one million tobacco-related deaths annually [10]. Beyond its health toll, smoking contributes significantly to economic strain by driving up healthcare costs and productivity losses associated with smoking-related illnesses, even in technologically advanced nations [11].

To support the World Health Organization's global objective of reducing premature mortality (ages 30–70 years) from cardiovascular disease, cancer, diabetes, and chronic respiratory conditions by 25% by 2025, one of the most cost-effective strategies is cutting tobacco consumption—particularly in South Asian countries [1]. Evidence from high-income countries indicates that the self-reported quit rate was approximately 19% for 28 days or more [12], while another study found a 13% quit rate associated with mobile application use [13]. Nevertheless, cessation is often difficult, requiring multiple attempts due to the complexity of nicotine addiction [14]. Concerns about privacy, data security, and the lack of effective, evidence-based apps add further barriers for those seeking to quit [15]. Many commercially available cessation apps have not undergone rigorous clinical evaluation, raising doubts about their reliability and success in real-world settings [16, 17].

Within Asia, tobacco use continues to present a pressing public health challenge. Prevalence differs across countries, but trends remain consistent: in China, tobacco use is widespread, with smoking rates of about 52.1% among men and 2.7% among women [18]. Indonesia ranks among the world's highest, with smoking prevalence of 63% for men and 5% for women in 2019 [19]. Japan also shows elevated rates, with 38.4% of men and 13% of women smoking during 2001–2016 [20]. In South Korea, 40%–50% of men and 4%–8% of women smoke [21]. India has comparatively lower rates—17.5% of men and 1.2% of women [22]—yet, given its population size, the burden remains substantial. Similarly, the Philippines (40.9% men, 8.2% women) [23] and Vietnam (45.3% men, 1.1% women) [24] report high prevalence levels.

Despite well-documented risks—including links to cancer, cardiovascular disease, and respiratory conditions—many smokers struggle to quit [25]. Advances in digital health have introduced new possibilities for tobacco cessation, ranging from mobile apps and online platforms to social media–based interventions [14]. However, their effectiveness remains debated, and limited evidence is available concerning their impact in Asian countries, where smoking prevalence and health risks are particularly concerning.

Although previous research has demonstrated promising outcomes with digital cessation tools in other regions, a systematic review focusing on Asia is still lacking. Addressing this gap, the present study seeks to evaluate the available evidence regarding the effectiveness of digital tools in supporting smoking cessation among Asian populations.

Methods

This systematic review adhered to the methodological framework recommended by the Cochrane Collaboration and was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [26].

Study duration

A comprehensive search was conducted in three major databases—Web of Science (WOS), Scopus, and PubMed—to identify relevant studies published between 1 January 2010 and 12 February 2023.

Search strategy

The search process incorporated both medical subject headings (MeSH) and free-text keywords. Terms were systematically combined using Boolean operators. The following concepts were included: (digital tools OR digital interventions OR eHealth OR mHealth OR smartphone apps OR text messaging OR social media OR web-based interventions OR online interventions OR internet OR telemedicine OR mobile applications OR health education OR health promotion) AND (tobacco cessation OR smoking cessation OR nicotine dependence OR quit smoking OR quit tobacco OR nicotine replacement therapy OR NRT OR varenicline OR bupropion OR counselling OR e-cigarette OR vape).

Study selection

Inclusion criteria: Studies were eligible if they were original research articles, used either experimental or observational designs, were published in peer-reviewed English-language journals between 1 January 2010 and 12 February 2023, applied digital approaches for smoking cessation, and were conducted in Asian countries.

Exclusion criteria: Review articles, systematic reviews, meta-analyses, conference abstracts, theses, case reports, letters to the editor, opinion papers, advertisements, and qualitative-only studies were excluded.

Data extraction

Two independent reviewers (IUR and ZA) screened and extracted data using a standardized form designed explicitly for this review. Extracted details included: study author(s), year of publication, study design, year of study implementation, country of origin, participant characteristics, sample size, digital or mobile intervention, intervention duration, baseline and endpoint measures, type of statistical analysis, and outcomes—particularly point prevalence abstinence (PPA) assessed at 24 hours, 7 days, or longer follow-ups. Any disagreements during selection or data extraction were resolved through discussion. If consensus was not reached, a third reviewer (LCM) was consulted.

Data synthesis

Given the heterogeneity across study designs, interventions, and outcome reporting, pooling of results for meta-analysis was not feasible. Therefore, the findings were summarized through qualitative synthesis rather than quantitative methods.

Results

Study selection

The initial search identified n = 41,058 records, comprising n = 434 from PubMed, n = 13,974 from Web of Science (WOS), and n = 26,650 from Scopus. After removing duplicates (n = 5721), 35,337 unique articles remained. Applying filters for English language, human studies, and the publication period (2010–2023) reduced this number to n = 4792. Title and abstract screening yielded n = 324 potentially relevant articles. Following an additional filter to retain only studies conducted in Asian countries, 25 studies ultimately met the eligibility criteria and were included in this systematic review **(Figure 1)**.

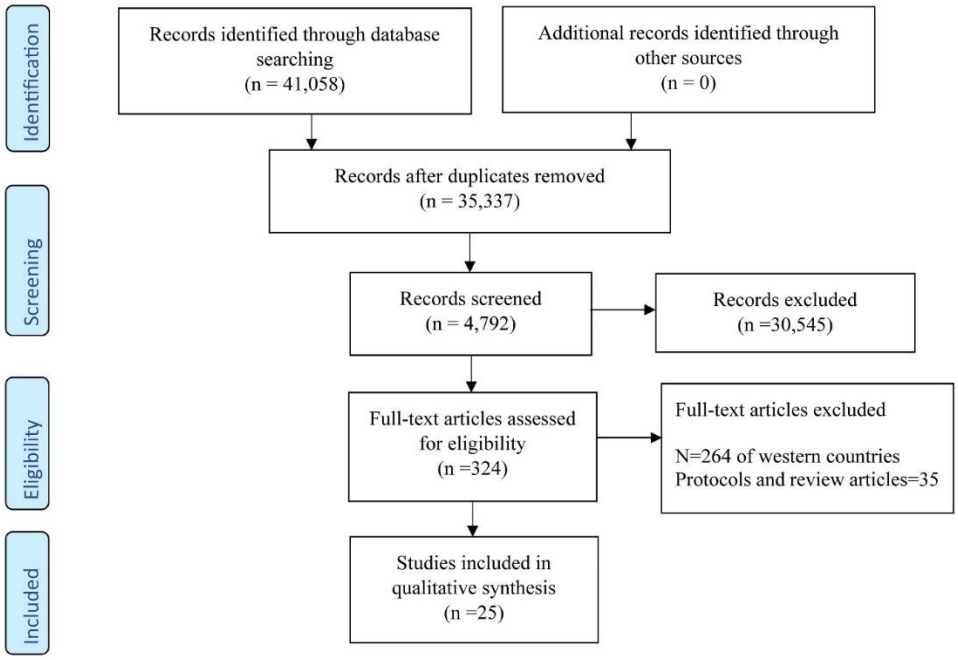

Figure 1. PRISMA flow diagram of study selection

Characteristics of the selected studies

Among the 25 studies that met the inclusion criteria, nine originated from China [2, 27–34]; three each were conducted in Hong Kong [10, 35, 36], Turkey [37–39], and Thailand [40–42]; two were carried out in Taiwan [43, 44]; and another two in Japan [45, 46]. Single studies were reported from South Korea [47], Indonesia [48], and Jordan [23]. A summary of these studies is presented in **Table 1**.

Table 1. Summary of study characteristics

Author	Year	Country	Intervention type	Control group	Intervention for the experimental group	Duration	Study design	Total subjects	Control	Experimental

SMS										
Ybarra *et al.* [37]	2012	Turkey	Text messaging	Brochure with smoking cessation information	Daily text messages for 6 weeks to build smoking cessation skills	3 months	Randomized controlled trial	151	75	76
White *et al.* [42]	2013	Thailand	Counseling + SMS	Smoking cessation counseling	Counseling with additional text message reminders	6 months	Randomized controlled trial	215	69	132
Lin *et al.* [33]	2023	China	Text messaging for smoking cessation	Non-personalized text messages with general cessation advice	Personalized text messages (1–2/day) for 3 months via an app	6 months	Randomized controlled trial	722	362	360
Telephone, SMS										
Guo *et al.* [44]	2014	Taiwan	Telephone + SMS	None	Education, acupressure, telephone calls, and SMS	4 months	Pre-post study	143	65	78
Chan *et al.* [10]	2015	Hong Kong	Telephone + SMS	No telephone or SMS	5-minute nurse-led telephone counseling within 7 days post-enrollment + eight text messages	12 months	Randomized controlled trial	1003	330	Tel: 338, SMS: 335
Social Media										
Cheung *et al.* [35]	2015	Hong Kong	WhatsApp + Facebook	Smoking cessation self-help booklet	2-month online group discussion led by a trained counselor via WhatsApp or Facebook, plus a self-help booklet	6 months	Randomized controlled trial	82	54	WhatsApp: 42, Facebook: 40
Durmaz *et al.* [39]	2019	Turkey	WhatsApp	Standard care (motivational interview or quitting counseling by trained physicians)	Standard care + WhatsApp support	6 months	Randomized controlled trial	132	88	44
Luo *et al.* [31]	2022	China	WeChat (“Quit smoking help”)	No SMS	Group 1: 20 smoking-related messages over 2 weeks; Group 2: 20 smoking-related messages + 1 week of oral health messages	4 weeks	Randomized controlled trial	403	132	271

Wang *et al.* [34]	2019	China	Chat-based instant messaging	Face-to-face cessation support by ambassadors	Face-to-face cessation support + WhatsApp chat-based support	6 months	Randomized controlled trial	1185	594	591
Luk *et al.* [36]	2023	Hong Kong	Personalized WhatsApp chat for relapse prevention	Standard cessation treatment (behavioral support, NRT, bupropion, varenicline)	Standard cessation treatment + WhatsApp chat for relapse prevention	3 months	Randomized controlled trial	108	54	54
Chu *et al.* [32]	2023	China	WeChat + quitline (WQ)	Not specified	Quitline + three WeChat-based cessation services	Not specified	Prospective cohort study	2221	Not specified	Not specified
Telephone										
Huang *et al.* [2]	2016	China	Telephone counseling	Not specified	Telephone counseling	3 months	Pre-post study	107	Not specified	Not specified
Wu *et al.* [27]	2016	China	Face-to-face + telephone counseling	Face-to-face counseling	Face-to-face counseling + telephone counseling	6 months	Non-randomized study	570	117	340
Cheung *et al.* [28]	2021	China	Telephone counseling	Brief advice on vegetable/fruit consumption	30-second physician advice + brief booster telephone advice	12 months	Randomized controlled trial	10122	6656	3466
Smartphone										
Nomura *et al.* [45]	2019	Japan	Internet-based video counseling + CASC app	Face-to-face visits with the CASC app	Internet-based video counseling + CASC (CureApp Smoking Cessation) app	6 months	Randomized controlled trial	115	57	58
Liao *et al.* [29]	2022	China	CBT-based smartphone app	Not specified	CBT-based smoking cessation intervention via smartphone app	33 days	Pre-post study	180	90	90
Chulasai *et al.* [40]	2022	Thailand	Pharmacist counseling + Quit US app	Face-to-face/group pharmacist counseling	Pharmacist counseling + Quit US smartphone app	12 weeks	Randomized controlled trial	273	136	137
Liao *et al.* [30]	2022	China	Text messaging ("Happy quit")	1 non-interventional message/week	High-frequency (3–5 messages/day) or low-frequency (3–5 messages/week) text messaging via "Happy quit"	6 months	Randomized controlled trial	1369	411	958

Asayut *et al.* [41]	2019	Thailand	Pharm quit app	Standard smoking cessation services	Pharm quit smartphone app for smoking cessation	6 months	Randomized controlled trial	156	78	78
Miscellaneous										
Shukr *et al.* [23]	2023	Jordan	Tobacco-related media messages	Not specified	Tobacco-related media messages	3 years	Longitudinal study	2174	None	2174
Choi *et al.* [47]	2018	South Korea	Web-based e-learning	Not specified	Blended e-learning + face-to-face program (10 courses, 30 min each)	5 weeks	Quasi-experimental design	44	21	23
Koyun *et al.* [38]	2019	Turkey	Web-based education	Not specified	Web-based educational intervention	6 months	Interventional pre-post study	314	-	314
Wang *et al.* [43]	2010	Taiwan	Multimedia	Auricular acupressure	Auricular acupressure + multimedia instruction	10 weeks	Quasi-experimental study	64	32	32
Ismail *et al.* [48]	2021	Indonesia	Audiovisual health education	15–20 min health education on smoking risks	4–5 min audiovisual health education videos (Group 1: smoking risks; Group 2: smoking laws; Group 3: cancer risks)	Not specified	Quasi-experimental	152	38	38 × 3

Among the 25 included studies, nine focused on telephone or text message–based counseling approaches [2, 10, 27, 28, 30, 33, 37, 42, 44]. Eleven studies delivered smoking cessation support through social media platforms or mobile applications [29, 31, 32, 34–36, 39–41, 45, 46]. Two studies evaluated multimedia or mass media–based messaging [23, 43], while another two implemented web-based e-learning programs [38, 47]. One study investigated the impact of audio-visual health education as a cessation aid [48].

Study design

The selected studies employed diverse research designs. Fifteen were randomized controlled trials [10, 28, 30, 31, 33–37, 39–42, 45, 46]; four used quasi-experimental or non-randomized designs [27, 43, 47, 48]; another four applied pre–post assessments [2, 29, 38, 44]; one was a prospective cohort study [32]; and one employed a longitudinal design [23]. The follow-up periods also varied considerably: 33 days [29]; 4 weeks [31]; 5 weeks [47]; 10 weeks [43]; 12 weeks [40]; 3 months [2, 36, 37]; 4 months [44]; 6 months [27, 30, 33, 34, 38, 39, 41, 42, 45]; 12 months [10, 28, 46]; and up to 3 years for the longitudinal study [23]. One trial assessed outcomes at four points—baseline, post-intervention, and at two subsequent follow-ups [35].

Smoking cessation outcomes

Marked variation was observed in effectiveness across intervention types. Eleven trials using social media platforms and mobile applications [29, 31, 32, 34–36, 39–41, 45, 46] reported particularly promising results. A Facebook-based intervention achieved the highest quit rate at 70% [35]. WhatsApp demonstrated abstinence rates of 59.5% [35] and 65.9% when integrated with standard care [39]. A smartphone application grounded in cognitive behavioural theory (CBT) enabled 60% of users to quit smoking [29]. WeChat interventions yielded 7-day point prevalence abstinence (PPA) rates of 41.8% when combined with a quitline [32]. The quit US app, delivered alongside pharmacist counselling, achieved a 58.4% abstinence rate [40]. Another WeChat program ("Quit smoking help") demonstrated 28- and 7-day PPA rates of 15.6% in one group receiving two weeks of smoking-related messages, and 20.6% in another group that additionally received dental health content [31].

Telephone- and text–message–based interventions [2, 10, 27, 28, 30, 33, 37, 42, 44] generally produced more modest outcomes. For example, abstinence rates were 9.1% at 7 days and 8.0% at 12 months in one trial [28]. "Happy quit" text messaging interventions produced quit rates of 6.3% and 6.9% in separate studies [2, 30, 33]. A higher

continuous abstinence rate of 16.8% was observed when face-to-face counselling was supplemented with follow-up telephone support [27]. Another trial reported an 11% quit rate with text messages [37], while one study found no significant difference at 12 months [10]. A combination of counselling and SMS achieved 44.3% abstinence by study end [42].

In contrast, web-based e-learning approaches [38, 47] did not demonstrate a notable effect on cessation outcomes. Similarly, media and multimedia messaging [23, 43] failed to produce significant improvements in smoking behavior. By comparison, the audio-visual health education intervention [48] showed encouraging results by enhancing participants' motivation to quit, surpassing traditional health education alone.

Discussion

Technological progress has significantly contributed to improvements in health care delivery, particularly through the introduction of digital interventions. In the present review, the impact of such interventions on smoking cessation was assessed. Social media platforms appear to provide a practical and engaging medium for delivering cessation support, as they can attract smokers, sustain their participation, and deliver customized interventions while simultaneously collecting valid smoking-related data. These digital approaches generally work by enhancing smokers' motivation to quit, maintaining abstinence, and encouraging quit attempts. Despite their promise, further well-designed trials are still needed to validate their effectiveness, evaluate cost-effectiveness and long-term feasibility, and determine whether these resources can be effectively accessed by socioeconomically disadvantaged groups, youth, and other populations with higher smoking prevalence.

Among the included studies, Facebook [35] and WhatsApp [34–36, 39] were frequently evaluated and showed notable success. For instance, one study reported that 70% of participants in a Facebook-based cessation program quit smoking [35]. Similar investigations conducted internationally also highlighted Facebook as an effective cessation platform for young adults [49–51]. WhatsApp interventions demonstrated comparable effectiveness, with Cheung *et al.* [35] reporting that 59.5% of participants in the WhatsApp group successfully quit smoking, experiencing fewer relapses compared to the participants in the Facebook group. Likewise, Durmaz *et al.* [39] and Luk *et al.* [36] documented abstinence rates of 40.9% and 31.4%, respectively, at six months.

Smartphone applications also demonstrated encouraging outcomes. Interventions delivered through WeChat [31, 32], pharmacist-supported cessation using the Quit US app [40], and programs integrating Cognitive Behavioral Theory (CBT) [29] all facilitated successful quitting. For example, Luo *et al.* [31] found that participants receiving smoking-related messages via WeChat achieved 15.6% and 20.6% 7-day PPA rates, depending on message type, while Chu *et al.* [32] reported a higher rate of 41.8%. A meta-analysis further confirmed that WeChat-based programs significantly improved abstinence compared to conventional interventions [52]. Given WeChat's extensive use in China, participants often expressed that these digital reminders boosted their motivation, confidence, and knowledge about quitting [53]. Similarly, the integration of face-to-face counseling with the Quit US app produced an abstinence rate of 58.4% [40], while CBT-oriented app-based interventions enabled 60% of participants to remain abstinent from the designated quit date through program completion [29]. The integration of CBT into a digital interface allows clinicians to deliver tailored support and combine behavioral therapy with pharmacological treatment, which has proven to be an effective strategy for smoking cessation [54].

Instant messaging platforms such as WhatsApp, WeChat, and Facebook Messenger offer a widely accessible, low-cost, and interactive alternative to traditional SMS-based services, making them an appealing option for smokers seeking support in quitting [34].

Counseling delivered through telephone or text messaging has shown promise as a supportive strategy for smoking cessation, offering motivation, guidance, and encouragement to individuals attempting to quit. In this review, abstinence outcomes ranged from 8% to 44.3% [28, 42], while quit rates varied between 6.3% and 16.8% when such interventions were applied [2, 27, 30, 33, 37]. These observations align with evidence from a meta-analysis conducted in Western populations, which reported that individuals receiving text message support were 1.37 times more likely to remain abstinent compared with those in control groups [55]. Still, findings are not entirely consistent—one included study observed no significant difference in smoking cessation rates between intervention and control arms when using SMS or telephone support [10]. Notably, the degree of effectiveness appears to depend on factors such as the format and intensity of the intervention, characteristics of the study population, and length of follow-up. For instance, a US trial demonstrated significantly higher PPA among participants who received text messages compared to those who did not [56].

Strengths and Limitations

This review holds particular value as the first to synthesize evidence on the use of digital platforms—including Facebook, WhatsApp, WeChat, and smartphone applications—together with telephone and text-based interventions for smoking cessation in Asian populations. One of its strengths lies in identifying which digital tools

are associated with favorable outcomes, particularly in achieving 7-day PPA, thereby providing insight into the most promising approaches for future cessation programs in the region. Nonetheless, several limitations should be noted. First, the wide variety of interventions tested, often in combination with additional methods, limited the ability to isolate the independent effect of each tool through quantitative meta-analysis. Moreover, heterogeneity in study design, participant demographics, and sample sizes posed additional challenges. Another limitation was the restriction to English-language publications, which raises the possibility that relevant findings from non-English sources were excluded. Future research should address these methodological gaps by employing larger, more uniform study designs and incorporating non-English literature.

Conclusion

Evidence from the included studies suggests that digital platforms represent effective tools for promoting smoking cessation. Social media platforms, such as Facebook and WhatsApp, have produced encouraging results, with Facebook-based interventions demonstrating particularly high quit rates among younger populations. In contrast, WhatsApp interventions yielded comparable abstinence levels but somewhat lower relapse rates. Similarly, smartphone apps—including WeChat and the Quit US application—proved effective, particularly when combined with Cognitive Behavioral Theory (CBT) frameworks or pharmacist counseling. Instant messaging applications, such as WhatsApp, Facebook Messenger, and WeChat, are increasingly viewed as practical, inexpensive, and interactive alternatives to SMS-based approaches. Telephone and text messaging interventions were also shown to be beneficial, though outcomes varied across studies. Ultimately, this review concludes that digital cessation tools can serve as cost-effective alternatives or complements to traditional cessation programs. However, optimal effectiveness depends on tailoring the intervention to individual needs, preferences, and contexts.

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