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DIGITAL TECHNOLOGIES IN TOBACCO CESSATION: A NARRATIVE REVIEW OF SMARTPHONE APPLICATIONS, WEB-BASED PROGRAMMES, AND AI CONVERSATIONAL AGENTS

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ABSTRACT

Background: Tobacco smoking causes over eight million deaths annually and remains the leading preventable cause of disease worldwide (World Health Organization, 2023). Structural barriers limit access to counselling and pharmacotherapy, motivating the development of digital cessation tools across three modalities: smartphone applications, web-based programs, and AI conversational chatbots.
Objective: This narrative review synthesises peer-reviewed evidence (2021–2026) on the efficacy, engagement, and equity of digital smoking-cessation interventions across these three modalities.
Methods: PubMed and PMC were searched using MeSH and free-text terms for smoking cessation combined with smartphone applications, eHealth, SMS, chatbots, and artificial intelligence. Primary studies enrolled smokers aged ≥16 years reporting abstinence outcomes; secondary literature included systematic reviews, meta-analyses, and qualitative evaluations. Findings were synthesised thematically.
Results: Smartphone apps combined with pharmacotherapy outperformed medication alone (OR 1.79, 95% CI 1.38–2.33; Guo et al., 2023), whereas standalone apps were non-significant. A 152-RCT network meta-analysis (Li et al., 2025) ranked personalized digital interventions above standard care (RR 1.86, 95% CI 1.54–2.24). AI chatbots showed early positive signals, including biochemically verified 6-month abstinence rates of 26.0% versus 18.8% under usual care (Olano-Espinosa et al., 2022). Engagement decay, self-reported outcomes, and limited population diversity were consistent weaknesses.
Conclusions: Digital tools deliver clinically meaningful benefits when grounded in behavioural science frameworks and integrated with pharmacotherapy or human support. Future research needs to prioritise head-to-head comparisons, biochemically verified outcomes, equity-centred deployment, and moral governance for AI-delivered support.

KEYWORDS

Smoking Cessation; Digital Health; Smartphone Applications; mHealth; Chatbot; Artificial Intelligence

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1. Introduction

Tobacco use remains both an individual behavioural challenge and a global public health problem. Despite decades of sustained public health efforts, approximately 1.3 billion people still smoke worldwide. The annual toll exceeds eight million deaths, with roughly 1.3 million of those occurring in non-smokers exposed to second-hand smoke (World Health Organization [WHO], 2023). Tobacco use, therefore, remains the leading preventable cause of disease worldwide.

Effective cessation treatments have existed for decades. Behavioural counselling, telephone quitlines, group-based support, and pharmacotherapies including nicotine replacement therapy (NRT), bupropion, and varenicline each carry a well-characterised efficacy profile.

In a comprehensive JAMA review, Rigotti et al. (2022) reported that combining pharmacotherapy with behavioural support achieved six-month quit rates of 15.2% compared with 8.6% for brief advice alone, while varenicline produced the highest individual pharmacotherapy quit rate at 21.8% in a direct head-to-head comparison. The principal challenge is therefore not the absence of effective treatments but the persistent gap between treatments that work in clinical settings and treatments that reach the populations who need them. Cost and insurance coverage gaps, limited availability in primary care, time demands on both patients and providers, and the social stigma that prevents many smokers from seeking help collectively act as structural barriers to access.

Digital technology provides one plausible answer. Smartphone ownership is near-universal across high-income nations and expanding rapidly in lower-income contexts, making mobile health platforms an increasingly viable channel for delivering cessation support at scale. Three distinct intervention models have

emerged from this opportunity. Smartphone applications deliver structured cessation programmes through interactive mobile platforms, typically incorporating craving management tools, motivational notifications, self-monitoring diaries, and in some cases, community features. Web-based and eHealth programmes use internet infrastructure to provide support through tailored websites, SMS messaging systems, online counselling, and clinician-facing dashboards. AI-driven conversational chatbots employ natural language processing and increasingly, large language models to simulate the kind of personalised therapeutic dialogue previously achievable only with a trained human counsellor.

The volume of peer-reviewed evidence in this area has grown substantially since 2021, with several high-quality meta-analyses and landmark randomised trials now available. Interpreting this literature, however, is complicated by at least four persistent tensions. First, profound heterogeneity in study designs, comparator conditions, outcome definitions, and follow-up durations makes cross-study comparisons genuinely difficult. Second, earlier meta-analyses frequently grouped together fundamentally different modalities: apps, SMS platforms, and websites. This conflation, treating them as though interchangeable, may obscure clinically meaningful differences between them. Third, AI chatbots barely existed as a distinct clinical research category before 2020 and require evaluative frameworks that differ from those developed for earlier digital tools. Fourth, a persistent divergence between efficacy estimates from tightly controlled trials and the population-level impact observed when interventions are deployed at scale remains poorly understood.

This review synthesises clinical evidence across all three modality categories to clarify what works and where critical gaps remain.

2. Methodology

This review applied a narrative synthesis methodology to integrate heterogeneous evidence on digital tobacco cessation interventions across three modality categories. A bibliographic search was conducted in PubMed and PubMed Central (NCBI, U.S. National Library of Medicine), covering publications from January 2021 through March 2026. The search strategy combined MeSH descriptors with free-text keywords covering smoking cessation, smartphone applications, web-based and eHealth interventions, SMS messaging, chatbots, conversational agents, and artificial intelligence.

The review focused on peer-reviewed evidence concerning three categories of digital cessation interventions: smartphone applications, web-based and eHealth programmes, and AI conversational chatbots. Priority was given to recent meta-analyses, large pragmatic randomised trials, and studies introducing novel platforms, particularly large language model-based chatbots, which represent a recently emerging and quickly evolving research area. Primary studies of smokers reporting cessation or abstinence outcomes formed the core of the synthesis, supplemented by qualitative process evaluations and research protocols that clarified the development, mechanisms, or implementation of included interventions. The epidemiological context was drawn from authoritative non-peer-reviewed sources such as WHO fact sheets, and the review focused on English-language literature on tobacco cessation.

Reference lists of key reviews and trials were screened for additional relevant work. Three pre-2021 publications (Bricker et al., 2020; Whittaker et al., 2019; Taylor et al., 2017) were retained as methodological reference points predating the current evidence cycle. Throughout the synthesis, particular attention was paid to the study design, the theoretical basis of each intervention, the comparator condition, the definition and duration of abstinence outcomes, and engagement patterns, where reported. The findings are organised thematically across the three intervention categories, without formal meta-analytic pooling or risk-of-bias scoring.

3. Results

3.1 Smartphone Applications for Smoking Cessation

3.1.1 Available Applications and Evidence Base

The consumer app marketplace offers hundreds of cessation tools. Quality, however, does not scale with quantity. A systematic framework analysis of 228 functional cessation apps by Bold et al. (2023) found that only 5–6% had any published efficacy or feasibility study. While basic features such as goal-setting and psychoeducation were common, few apps incorporated structured therapeutic content and skill-based components, such as acceptance and commitment therapy, cognitive behavioural therapy, mindfulness, deep breathing skill training, and peer support, all of which have demonstrated therapeutic value in controlled research. Market presence and clinical utility are poorly correlated.

Apps with substantive RCT evidence include iCanQuit (ACT-based), QuitGuide (USCPG-based, used as comparator), Smoke Free (UK behaviour-change), Quit Sense (JITAI), and PharmQuit (Thai pharmacy-integrated). These trials vary widely in design, theoretical orientation, and outcome measurement. This variability, as later meta-analyses would show, directly contributes to the modest pooled estimates for this intervention category.

3.1.2 Pooled Efficacy Estimates

The most rigorous meta-analysis of smartphone cessation app efficacy published to date (Guo et al., 2023, Journal of Medical Internet Research) drew on nine RCTs involving 12,967 adult participants from seven countries (the United States, Spain, France, Switzerland, Canada, Japan, and the United Kingdom) and searched seven academic databases. The pooled effect of smartphone apps versus comparators was not statistically significant (OR 1.25, 95% CI 0.99–1.56, $p = 0.06$, $I^2 = 73.6\%$). Comparators varied enormously across constituent trials, including standard care, face-to-face counselling, SMS programmes, other digital tools, and placebo apps. When only active comparators were retained, the point estimate shrank considerably (OR 1.03, 95% CI 0.85–1.26).

The most clinically significant finding in this analysis was a subgroup of three trials examining apps used alongside pharmacotherapy. Those combinations produced meaningfully better abstinence than pharmacotherapy administered without app support (OR 1.79, 95% CI 1.38–2.33), a result with direct relevance to prescribing practice.

A subsequent meta-analysis focused specifically on young people (Zhou et al., 2023) further indicated that evidence for dedicated cessation apps in those aged 16–30 years remained too sparse to permit firm conclusions.

The null-pooled estimate likely reflects dilution by low-quality apps in the meta-analytic sample rather than the absence of benefit in well-designed ones, an interpretive caveat for any clinician reading aggregate effect estimates.

3.1.3 The iCanQuit Trial

The iCanQuit randomised trial, reported by Bricker et al. (2020) in JAMA Internal Medicine, remains the most influential investigation of a smartphone cessation application to date. The trial enrolled 2,415 daily smokers wanting to quit, randomly assigning them to either iCanQuit, grounded in Acceptance and Commitment Therapy (ACT), or the NCI's QuitGuide app, which applies a more standard cognitive-behavioural approach. ACT teaches users to notice and tolerate tobacco-related urges rather than struggling to suppress them. At twelve months, iCanQuit users achieved higher 30-day point-prevalence abstinence (28.2% vs. 21.1%; OR 1.49, 95% CI 1.22–1.83; $p < 0.001$), an absolute difference of 7.1 percentage points that meets any reasonable clinical threshold for significance.

A serial mediation analysis (Bricker et al., 2021) showed that the iCanQuit effect operated through greater app engagement, which in turn increased acceptance of physical sensations and emotions cued by smoking. This pinpoints the specific therapeutic pathway rather than just the outcome.

Subsequent analyses confirmed that sustained engagement beyond four weeks predicted better twelve-month outcomes (Bricker et al., 2022), equivalent efficacy in Black participants (Santiago-Torres et al., 2022), and persistence of benefit regardless of concurrent pharmacotherapy use (Bricker et al., 2024c).

3.1.4 Other App-Based Trials

The Smoke Free app, among the most widely downloaded cessation tools globally, was evaluated in a pragmatic UK-based RCT by Jackson et al. (2024), in which the app's offer was compared with no active intervention. In the intent-to-treat analysis, cessation rates did not differ between groups. Within participants who actually downloaded and used the app, however, six-month continuous abstinence reached 12.7% versus 7.0% in the comparator condition (RR 1.80, 95% CI 1.30–2.45). The implication is important: the binding constraint on real-world effectiveness was uptake rather than the intervention's therapeutic content.

A companion trial within the same app platform, White et al. (2024), tested whether adding a gamification module ("Inner Dragon") improved cessation outcomes. The gamification element increased the time participants spent in the app, boosting user interaction metrics. That additional contact time did not translate into higher abstinence. This significant negative finding shows that greater engagement with the same therapeutic content does not, by itself, lead to more quitting.

The Quit Sense app, evaluated in a feasibility RCT by Naughton et al. (2024), was built around Just-in-Time Adaptive Intervention (JITAI) principles. Rather than delivering support at fixed intervals, Quit Sense uses location and behavioural context data to push assistance precisely when users are likely to encounter smoking triggers. Although designed as a feasibility study rather than a definitive efficacy test, the results were notable: biochemically verified sustained abstinence at six months reached 11.5% in the Quit Sense arm versus 2.9% in usual care (adjusted OR 4.57, 95% CI 1.23–16.94). A qualitative process evaluation by Hope et al. (2025) found participants considered the context-sensitive approach useful for managing real-world cravings, a finding that, combined with the efficacy signal, supports progression to a fully powered trial.

PharmQuit (Asayut et al., 2022), a community pharmacy-led cessation programme in Thailand that integrated smartphone tools with pharmacist consultation, showed the feasibility of integrating app-based tools into community pharmacy infrastructure in middle-income country contexts; however, adding the app did not significantly improve cessation rates over pharmacist counselling alone (continuous abstinence 11.5% vs. 12.8% at six months), pointing to delivery infrastructure rather than incremental app efficacy as the principal contribution.

3.2 Web-Based and eHealth Interventions

3.2.1 Meta-Analytic Evidence

Taylor et al. (2017), in a Cochrane review of 67 trials enrolling more than 110,000 participants, found that interactive and individually tailored internet programmes outperformed passive comparators at follow-ups of half a year or more, but conferred no measurable advantage over conventional active cessation treatments. This finding has shaped expectations for digital cessation work, as web-based tools expand access without necessarily exceeding what counselling and pharmacotherapy already achieve. The Taylor review and its companion Cochrane synthesis of mobile phone programmes (Whittaker et al., 2019) constitute the principal pre-2021 evidence base for the field.

Li et al. (2025), in a 152-RCT network meta-analysis published in Nature Human Behaviour, classified digital treatments along two independent dimensions. Methodologically, group-customised approaches (RR 1.93, 95% CI 1.30–2.86) and personalised approaches (RR 1.86, 95% CI 1.54–2.24) outperformed standard digital treatments (RR 1.50, 95% CI 1.31–1.72). Among technology types, SMS-based interventions ranked highest (RR 1.63, 95% CI 1.38–1.92), followed by telephone (RR 1.59, 95% CI 1.33–1.90), app-based (RR 1.53, 95% CI 1.29–1.81) and web-based interventions (RR 1.30, 95% CI 1.13–1.49). Shorter intervention durations outperformed extended programmes, and middle-aged participants showed greater benefit than younger cohorts. These findings have direct implications for both programme design and participant targeting.

3.2.2 SMS Programmes and Specific eHealth Platforms

The Whittaker et al. (2019) Cochrane review, pre-dating the primary search window but retained as a methodological anchor, covered 26 trials and 33,849 participants and found that automated text-messaging programmes produced higher quit rates than minimal cessation support at six months or longer (RR 1.54, 95% CI 1.19–2.00, moderate-certainty evidence). The same review pooled five smartphone app trials separately and found no benefit (RR 1.00, 95% CI 0.66–1.52, very low certainty). The SMS evidence base has since been extended by newer trials. A meta-analysis focused specifically on young people (Zhou et al., 2023; 13 RCTs, 27,240 participants aged 16–30 years) reported that SMS messaging programmes outperformed inactive controls for continuous abstinence (RR 1.51, 95% CI 1.24–1.84), while dedicated app evidence in this age bracket remained too sparse to permit firm conclusions.

An engagement-focused secondary analysis by Li et al. (2024), using data from a Hong Kong cluster RCT of a counsellor-delivered mobile instant-messaging intervention, applied trajectory modelling to identify four distinct engagement trends. All engaged trajectory groups achieved significantly higher biochemically validated six-month abstinence than the low-engagement reference (adjusted RRs 3.30–5.17). Notably, the highest gains accrued not to the most consistently engaged users but to those with gradually declining engagement (27.6% vs 24.2% in the high-engagement group), suggesting a non-monotonic relationship between engagement and outcomes. This pattern may reflect either reverse causation or genuine intervention effects; further investigation is needed. Reverse causation would mean that successful quitters disengage from the programme once they no longer need its support.

3.3 AI Conversational Chatbots

3.3.1 Overview of the Chatbot Evidence Base

AI chatbots are the newest addition to this field, and their evidence base reflects that recency; the majority of published evaluations are small, feasibility-oriented, and methodologically heterogeneous. A systematic review by Bendotti et al. (2023) in Digital Health pooled five RCTs (n=58,796); a meta-analysis of three comparable trials estimated that conversational AI interventions increased six-month abstinence rates by approximately 29% compared with controls (RR 1.29, 95% CI 1.13–1.46). The range of systems captured within that review was wide, spanning rule-based keyword-response platforms to early generative models. This heterogeneity is an essential context for interpreting the aggregate estimate.

A separate investigation by Albers et al. (2025) took a different angle, examining the psychological, economic, and ethical dimensions of incorporating human feedback into a chatbot-based cessation programme. Their finding that even brief, strategically placed human involvement significantly improved user retention is relevant to how services should be designed: a fully automated system may be more cost-efficient, but intermittent human contact appears to carry a motivational effect that automation struggles to replicate.

3.3.2 QuitBot

The most thoroughly documented AI cessation chatbot in the published literature is QuitBot, developed through an 11-step user-centred design process by Bricker and colleagues. The chatbot delivers content aligned with US Clinical Practice Guidelines through conversational interactions built around therapeutic alliance principles (bond with the agent, shared goals and tasks, perceived understanding). Bricker et al. (2024a) reported the design process and pilot RCT results: at three-month follow-up, intent-to-treat 30-day point-prevalence abstinence was 31.1% (QuitBot) versus 34.7% (SmokefreeTXT), a non-significant difference. However, among participants who completed all 42 days of program content, abstinence was 63% versus 38.5 % (OR 2.58, 95% CI 1.34–4.99; p=.005), suggesting engagement as a critical mediator. The pilot was explicitly not powered for formal inferential testing on the primary contrast, and the authors framed the cessation results as exploratory.

A full-scale trial is now underway. The QuitBot RCT protocol (Bricker et al., 2024b) describes a two-arm parallel design enrolling 1,520 US adults (760 per arm), with the primary endpoint set at 30-day point-prevalence abstinence twelve months post-randomisation.

The protocol also specifies a serial-mediation test (does QuitBot's advantage operate through working alliance processes and downstream engagement?) and prespecified moderator analyses for participant trust, perceived social support, and demographic background.

3.3.3 Other Chatbot Systems

The most methodologically rigorous chatbot RCT yet published comes from Olano-Espinosa et al. (2022), who evaluated Dejal@bot in a pragmatic randomised trial spanning 34 Madrid primary-care sites. Dejal@bot is an expert system that uses Bayesian probabilistic inference over a 1,127-term natural-language vocabulary, delivered via Telegram and developed over three years by tobacco-addiction specialists. Of 513 enrolled adult smokers, the intention-to-treat analysis showed biochemically verified six-month continuous abstinence of 26.0% in the chatbot arm versus 18.8% under usual care (OR 1.50, 95% CI 1.00–2.31; P=.05), with an adjusted estimate of OR 1.52 (95% CI 0.99–2.33; P=.053). Per-protocol estimates were substantially larger (OR 2.35, 95% CI 1.37–4.05). Abstinence was verified by CO-oximetry, distinguishing this trial from most chatbot evaluations that rely on self-report. Intensive chatbot use, defined as more than 4 contacts and more than 30 minutes of cumulative interaction across the 6-month follow-up, was associated with substantially higher abstinence in the intervention arm in an exploratory dose-response analysis (68.6% vs 40.9%; P=.02), a threshold effect absent in the control arm. The trial's principal limitations are a 54.8% dropout rate and the fact that 94 of 242 intervention participants (38.8%) opened the chatbot zero times. This non-

uptake rate has direct implications for effectiveness at scale. Dejal@bot remains the only published chatbot RCT with biochemically validated long-term abstinence outcomes, a distinction that renders it an important methodological reference point for interpreting the broader chatbot literature.

Liu et al. (2025) reported a single-arm, mixed-methods feasibility study of Aipaca, a GPT-4-powered chatbot delivering 5A's-framework counselling to 29 US adult smokers recruited via Amazon Mechanical Turk. Statistically significant pre-post improvements were observed across all four cessation-preparedness indicators, including knowledge of cessation methods, self-efficacy, and readiness to quit; conversation analysis of session transcripts identified counselling-relevant interactional patterns (contextual referencing, formulation-with-elaboration, progression toward collaborative planning). Formal cessation-outcome testing awaits a controlled trial.

Abroms et al. (2025b) conducted the first feasibility test of a ChatGPT-based cessation chatbot (BeFreeBot, GPT-4o-2024-11-20) integrated into an automated SMS programme. Among 23 MTurk-recruited US smokers, 70% engaged with the chatbot and self-reported 7-day point-prevalence abstinence at the 4-week follow-up was 30% (7/23 ITT). Without biochemical verification or a control arm, the result serves as a technical proof-of-concept rather than an efficacy estimate, demonstrating that an LLM can be safely integrated into an SMS-based cessation pipeline (no contradictions with USPSTF guidance were detected in coded responses).

3.4 Common Challenges Across Modalities

3.4.1 User Engagement

Engagement with digital cessation tools erodes rapidly. Across virtually every evaluated platform, most users disengage within the first two weeks. This attrition pattern is not unique to cessation applications; it mirrors dropout dynamics observed across mHealth. Its consequences for cessation are specifically acute, because the behavioural support these tools deliver operates through repeated exposure and skill-building over time.

The relationship between engagement and abstinence is empirically supported across several studies. Bricker et al. (2022) demonstrated that iCanQuit use sustained beyond four weeks predicted better twelve-month outcomes, and the secondary analysis by Li et al. (2024) documented substantially higher abstinence in all engaged trajectory groups versus a low-engagement reference in a counsellor-delivered chat programme, though the relationship was non-monotonic. Interpreting these associations requires caution, however: sustained engagement may lead to abstinence, or people who are already successfully quitting may find it easier to remain motivated to continue using the programme. Disentangling motivation from therapeutic benefit is methodologically difficult in observational engagement data.

JITAI designs, exemplified by the Quit Sense app, represent the most theoretically coherent response to engagement decay, delivering support at moments of contextually identified peak need rather than on a predetermined fixed schedule. The feasibility evidence for this approach (Naughton et al., 2024; Hope et al., 2025) is encouraging, and adequately powered effectiveness trials are needed to establish whether the theoretical advantage translates into measurable cessation benefit.

3.4.2 Population Diversity and Health Equity

Health equity is simultaneously a major concern and a persistent blind spot in this literature. Most evaluated interventions have recruited predominantly White, highly educated, English-speaking participants from high-income countries. This demographic sits at the opposite end of the spectrum from the populations bearing the greatest tobacco-attributable disease burden globally. A meta-analysis by Leppin et al. (2024), pooling 29 trials and 42,662 participants, reported an overall effect of digital cessation interventions of OR 1.29 (95% CI 1.10–1.51), with comparable estimates within low socioeconomic position (SEP) strata (OR 1.25, 95% CI 1.00–1.57) and high-SEP strata (OR 1.36, 95% CI 1.06–1.76); the magnitude of benefit did not differ significantly between low- and high-SEP groups. The implication that digital cessation does not systematically exclude lower-SEP populations from benefit is reassuring, but addresses only effectiveness among those who use the tools. This leaves open the upstream question of whether such groups are being reached at adequate rates in practice. The exception worth noting is Santiago-Torres et al. (2022), which documented equivalent iCanQuit efficacy among Black adults. This is a rare equity-stratified analysis in a field that systematically lacks them.

The challenges of equitable deployment extend well beyond logistics. Platforms validated in high-income, English-speaking populations may require substantial adaptation across linguistic, cultural, and technical dimensions before they can reach communities with limited smartphone penetration, high mobile

data costs, or health literacy contexts very different from those in which the tools were developed. Digital cessation tools that demonstrate success in US academic medical centre populations may need fundamental redesign before they reach or function effectively in the communities most affected by tobacco use worldwide.

4. Discussion

The evidence synthesized across this review supports several overarching conclusions, none of them simple.

The smartphone app literature warrants particular attention. The apparent tension between null meta-analytic estimates and positive individual trial results reflects heterogeneity in quality rather than a genuine contradiction. Bold et al. (2023) found that most commercially available cessation apps lack evidence-based content; iCanQuit's 7.1 percentage-point advantage over QuitGuide represents a clinically meaningful effect that is nonetheless diluted in Guo et al.'s (2023) pooled estimate, as it is outnumbered by results from inferior products. For clinicians, the practical message is that recommendations should rest on evidence for specific, named interventions, not on aggregate estimates that combine qualitatively dissimilar tools.

The pharmacotherapy combination finding (OR 1.79, 95% CI 1.38–2.33) is arguably the most actionable result in the smartphone app literature. Whether a standalone app can replace pharmacotherapy sets an implausibly high bar; whether a structured digital programme added to a pharmacotherapy prescription improves outcomes is the more tractable question. The evidence says yes, at a clinically meaningful effect size.

AI chatbots warrant reserved optimism. The approximately 29% relative improvement in six-month quit rates estimated by Bendotti et al. (2023; RR 1.29, 95% CI 1.13–1.46, pooled from three of five included RCTs) rests on a base of small feasibility studies with short follow-up, limited biochemical verification, and considerable self-selection risk. QuitBot's pilot RCT (Bricker et al., 2024a) reported 30-day point-prevalence abstinence of 31.1% vs. 34.7% (SmokefreeTXT) at three months; this non-significant intent-to-treat contrast reversed sharply among program completers (63.0% vs. 38.5%; OR 2.58, 95% CI 1.34–4.99). The pilot was underpowered for formal inference and suggests an engagement-mediated effect rather than a clean efficacy estimate. The full-scale QuitBot trial will be the decisive test: a confirmatory result would move the chatbot evidence base across a meaningful threshold; a null one would prompt substantial revision of current optimism.

Albers et al.'s (2025) finding that brief interspersed human feedback significantly improved retention in a chatbot-based programme has direct service-design implications: fully automated AI may be cheap and scalable, but appears to miss the motivational effect of genuine human presence. Hybrid architectures that couple automated delivery with strategically placed human touchpoints are likely to outperform either approach in isolation.

Across all three categories, rapid engagement decay remains the main unsolved problem. White et al. (2024) found that greater engagement did not translate into higher abstinence, suggesting that engagement is a vehicle for therapeutic content rather than an outcome in itself; optimising it in isolation is therefore unlikely to improve cessation outcomes.

This review identifies five major gaps that should shape the research agenda. First, outcome measurement: most trials rely on self-reported abstinence, which systematically overstates quit rates relative to biochemically verified outcomes; when effect sizes are already modest, this likely makes the true picture worse than the literature suggests. Second, follow-up duration: twelve months is the standard endpoint, but smoking relapse risk continues well beyond, and current evidence cannot distinguish durable abstinence from delayed relapse. Third, equity: the populations with the greatest tobacco burden are the least studied; recruiting diverse populations is not optional if digital cessation tools are meant to address the global problem rather than a narrow demographic. Fourth, comparative effectiveness: no published trial has compared apps, web programmes, and chatbots within the same population, leaving modality-matching guidance for clinicians absent. Direct comparisons of psychological frameworks within matched digital architectures remain similarly rare. Fifth, AI ethics and clinical accuracy: questions of algorithmic bias, data privacy, and informed consent remain largely theoretical rather than empirically investigated. Where evidence exists, it is unsettling: Abroms et al. (2025a) found mean guideline adherence of 57.1% across three ChatGPT-based cessation chatbots (Sarah from the WHO best at 72.2%; researcher-built BeFreeGPT and BasicGPT at 50.0% and 47.8%), with unsupported or contradictory advice in roughly one in five responses. In tobacco cessation, inaccurate guidance about pharmacotherapy or coping techniques can directly derail an ongoing quit attempt; as deployment scales, the gap between what these systems say and what evidence-based guidance recommends will require systematic regulatory attention.

This review carries notable limitations. The narrative methodology lacks formal risk-of-bias scoring and statistical pooling, limiting the precision of efficacy conclusions and the adjudication of conflicting findings. Reliance on a single primary database (PubMed and PubMed Central) without parallel searches of Scopus or the Cochrane Library may have missed publications indexed only in those sources. Chatbot-specific findings have limited temporal durability given the rapid pace of LLM evolution. Finally, the predominantly English-language evidence base constrains generalisability to non-Anglophone populations, particularly consequential given the global scope of the tobacco epidemic.

5. Conclusions

Digital cessation tools have evolved from experimental approaches to an increasingly evidence-informed category of health intervention. The conclusions that the available evidence currently supports are more specific and conditional than is sometimes acknowledged in broad summaries of the field.

Smartphone applications built on robust theoretical foundations, such as ACT-based platforms like iCanQuit, can achieve clinically meaningful cessation rates. Their value is substantially amplified when combined with pharmacotherapy. As standalone interventions without pharmaceutical support, they produce, on average, effects that fall just below statistical significance in pooled analyses, not because they are ineffective, but because the aggregate estimate conflates high-quality tools with a large number of inadequately designed products.

Web-based and eHealth programmes demonstrate consistent, moderate effectiveness relative to conventional offline care, particularly when content is individually tailored and interactive.

AI conversational chatbots represent the field's current frontier. Preliminary RCT evidence is encouraging. Olano-Espinosa et al. (2022) reported biochemically verified six-month abstinence of 26.0% versus 18.8% under usual care, the field's most rigorous chatbot result to date. However, the personalisation capabilities afforded by large language models remain largely unexploited. The full-scale QuitBot RCT will be the field's most consequential single publication in the next two years.

The following six priorities should define the research agenda: first, multi-arm RCTs directly comparing apps, eHealth programmes, and chatbots with biochemically verified abstinence endpoints and adequate statistical power; second, equity-centred designs that actively recruit diverse populations across ethnicity, age, socioeconomic status, and geographic region; third, systematic investigation of hybrid human-AI delivery models that couple automated scalability with targeted human involvement; fourth, follow-up periods extending well beyond twelve months to measure sustained abstinence rather than delayed relapse; fifth, rigorous cost-effectiveness analyses positioned against traditional cessation services to guide resource allocation; and sixth, ethical and regulatory frameworks governing AI-delivered health behaviour support, with explicit attention to transparency, safety, data governance, and equity.

As generative AI capabilities advance, the gap between the personalisation achievable through trained human counsellors and the scalability achievable through digital delivery is likely to narrow. Whether the resulting tools effectively reach the populations most severely affected by tobacco-attributable disease will depend on the methodological, equity-oriented, and ethical choices made by the research community in the coming years.

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