

The Contribution of Digital Treatment to Efforts to Reduce Global Tobacco Use

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Opportunities for using digital tools to access tobacco-cessation treatment are growing rapidly. The number of people using tobacco-cessation apps worldwide was projected to increase from 5 million in 2022 to 33 million in 2026, partly because of an increase in the proportion of the global population with access to a mobile phone (71% in 2024). Four in 5 of these devices are smartphones, a figure predicted to rise to 9 in 10 by 2030. High-income countries tend to have the highest rates of mobile-phone access, but many low- and middle-income countries (LMICs) are quickly closing this gap, as indicated by increasing use of health-related smartphone apps.

We define digital tobacco-cessation interventions as treatments delivered by means of digital media, without direct human involvement. A key strength of digital tobacco treatments is their potential to be delivered at low cost. It can cost \$100 in practitioner time to deliver a traditional 8-week tobacco-treatment program to an individual patient, for example, whereas an app that costs \$100,000 to develop will cost only \$0.10, plus running costs, per user to deliver if 1 million people use it. When digital tools have broad reach, the per-user cost can be very low — whereas for traditional tobacco-treatment approaches, the per-user cost changes little with increased scale. Low-cost cessation-support tools with

broad reach are critical in LMICs in particular, given health care systems' inadequate financial and human resources.

Digital tobacco treatments vary in their scope and cost. Broadly, these tools can be divided into two categories: interventions attempting to replicate human-delivered support and interventions providing forms of support that humans cannot deliver.

The first type of intervention can involve digitalization of analogue "stop-smoking" support, such as self-help guides or tobacco-cessation programs delivered to people in "bite-sized" pieces and sometimes tailored to individual characteristics. Features not typically part of traditional tobacco-cessation programs, such as user forums, "money saved" counters, or stress-reduction tools and cravings diaries, are also built into many cessation apps. Some of these tools can provide prescriptions for pharmacotherapy, though prescribing is typically done by a human. Recently, chatbots and "virtual advisors" have been used to imitate human-delivered support. Although most of these systems are relatively primitive, generative artificial intelligence (AI) is enhancing their capabilities. Such tools, with their ability to provide 24/7 support, offer services at the limits of what humans could reasonably deliver.

One example of an approach that moves beyond services that humans can realistically provide, on the other hand, is just-in-time adaptive interventions. These aim to deliver support in real time typically linked to situations that cause strong cravings or temptation, to prevent lapses (tobacco use during a quit attempt). Such interventions can be driven by sensors that track geolocation, movement (accelerometry), time, or other metrics that can indicate a meaningful vulnerability (a smoking cue) or an opportunity to intervene (optimal timing for nicotine replacement).¹ Self-adapting systems, including just-in-time interventions, can dynamically adjust support in response to a user's characteristics,

behaviors, quitting progress, and engagement with and reaction to the intervention.

Evidence of effectiveness for these tools is lacking, however, particularly for forms of support that humans cannot deliver¹ and in LMICs. Although there is emerging evidence of the acceptability (e.g., in India) and effectiveness of digital tobacco-cessation interventions (e.g., in China and Turkey), scaled-up programs, such as mCessation in India, haven't been rigorously evaluated.

Digital tobacco treatments vary in their effectiveness. As is common in the context of innovation driven by technological advancement, there has been an evaluation lag for such tools. Most RCT evidence is for messaging and website interventions, but smartphone app evaluations are increasing. The evaluation lag is longer in LMICs than in high-income countries; a recent review that we conducted found no LMIC-based trials evaluating cessation apps.² The World Health Organization's 2024 tobacco clinical treatment guideline lists conducting research on cessation apps and on AI-based interventions as a priority.

The most robust evidence generated on digital cessation interventions has pertained to text- or instant-messaging–based interventions. Although effectiveness varies among these interventions, according to a Cochrane review, there is moderate-certainty evidence that, as compared with minimal support, messaging interventions increase people's chances of quitting by 3 to 4 percentage points, from 6% to about 9%.³ Such interventions typically resemble bite-size tobacco-cessation programs, delivering tips, encouragement, and support, generally once or twice a day for between 4 and 12 weeks. Effect sizes have generally been similar for messaging interventions evaluated exclusively in LMICs and those evaluated in high-income countries, although some studies in LMICs have found larger between-group differences in cessation rates,² potentially because of the limited existing access to cessation treatment in these regions.

Evaluating effectiveness is more complex for apps than for messaging interventions because of the wide variation in app designs. Ideally, apps would be considered a delivery method, rather than a type of intervention. Various digital cessation-support interventions — including “serious games”, “third-wave” cognitive behavioral therapy, and just-in-time adaptive interventions — could be delivered using apps. Some evidence suggests that digital interventions, including apps, that provide personalized or interactive support may be more effective than those without this feature, potentially because such support helps promote engagement. Additional evaluations, particularly evaluations conducted in LMICs, are needed for each broad app-based approach to cessation support, with characterization of the intervention and targeted populations and settings to enable clear contextualization of evidence.

To maximize the population-level benefits of digital support, opportunity costs and preferences should be considered. Many digital treatments are less effective than interpersonal treatment approaches, in part because of low levels of engagement with digital tools. In regions where access to interpersonal treatment is inadequate, as it is in many LMICs, the decision to broadly deploy digital support — even tools with low-to-moderate effectiveness — would be straightforward: something is better than nothing. In regions where both digital and interpersonal interventions are available and have appeal, people might choose easier-to-access digital options, which could reduce their chances of quitting relative to interpersonal support. Alternatively, for some people, using digital support tools could facilitate the uptake of interpersonal support, particularly if digital tools prompted them to seek additional assistance. In areas where multiple treatment options are available, people would ideally be triaged by health professionals or digital systems to the most promising option on the basis of their preferences and potential treatment benefits.

A key factor influencing the effectiveness of digital cessation treatment, but one that has received relatively little attention, is uptake. Very few studies have quantified uptake of these tools, and we aren't aware of any such studies conducted in LMICs. One large study from the United Kingdom found that, at most, 10% of people making a quit attempt used digital support.⁴ Most people find apps using app stores. Selection depends heavily on app-store rankings, which are driven primarily by popularity metrics. For example, one of us recently found that a 4.8-star app-store rating was twice as important as a 4.0-star rating or having a credible developer for influencing smoking cessation app choice.⁵ As a result, popular apps dominate. But research has suggested that popular tobacco-cessation apps are seldom evidence based and typically don't align with clinical guidance. This evidence was reinforced by the U.K. study, which found that "real-world" cessation-app use isn't associated with abstinence.⁴ Factors such as data-privacy concerns, lack of smartphone compatibility with some apps, and insufficient phone memory can also limit uptake.

Dedicated efforts will therefore be required to promote access to and use of effective cessation apps. One option is for clinicians and public health bodies to ensure that people wanting to use digital tobacco-cessation treatment are directed to evidence-based interventions. Health care programs, including maternity, tuberculosis, and HIV programs, could integrate these interventions into their care models. Digital portals can also provide access to high-quality, evidence-based tools. But experience with the U.K. National Health Service's apps library, which was rebooted multiple times before being decommissioned, highlights the challenges associated with maintaining a digital intervention library that requires entries to adhere to evidence standards.

Another approach is to allow clinicians to prescribe digital interventions, as Germany has done by creating a digital health applications directory. But the lack of evidence-based

apps — this directory currently has only two smoking-cessation apps available to be prescribed — restricts people’s choices for digital support. Variation in digital data-security standards among countries, particularly LMICs, is another challenge.

Despite the predicted rise in the use of digital tobacco-cessation treatments, the extent to which these tools will help reduce global tobacco use is unclear. Such interventions hold great promise, particularly amid conceptual and technological advances. Digital interventions will undoubtedly evolve and incorporate enhanced use of AI, though not without raising complex ethical questions. Additional components, such as medication prescribing that doesn’t require direct human contact, will also probably be incorporated into these tools, where local funding allows. While clinicians, public health practitioners, and policymakers await the results of additional research to help identify the most effective digital cessation treatments, we can work to ensure that the environment will facilitate the uptake and use of evidence-based approaches once they are known.

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References

1. Perski O, Hébert ET, Naughton F, Hekler EB, Brown J, Businelle MS. Technology-mediated just-in-time adaptive interventions (JITAIs) to reduce harmful substance use: a systematic review. *Addiction* 2022;117:1220-41.

2. Nadkarni A, Gaikwad L, Sequeira M, et al. Behavioral interventions for tobacco cessation in low- and middle-income countries: a systematic review and meta-analysis. *Nicotine Tob Res* 2025;27:575-85.
3. Whittaker R, McRobbie H, Bullen C, Rodgers A, Gu Y, Dobson R. Mobile phone text messaging and app-based interventions for smoking cessation. *Cochrane Database Syst Rev*. 2019;10:CD006611.
4. Jackson SE, Brown J, Buss V, Shahab L. Prevalence of popular smoking cessation aids in England and associations with quit success. *JAMA Netw Open* 2025;8:e2454962.
5. Szinay D, Cameron RA, Jones A, Whitty JA, Chadborn T, Brown J, Naughton F. Eliciting preferences for the uptake of smoking cessation apps: discrete choice experiment. *J Med Internet Res* 2025;27:e37083.