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Tales of hope and hesitation: Smoking cessation experts' views on the opportunities and risks of digital behaviour change interventions

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Abstract

Objective: Smoking remains a global health challenge, with 1.14 billion active smokers worldwide. Many of these smokers seek cessation support. The rise of mHealth offers novel intervention methods, providing monitoring and tailored feedback. This study aimed to map the opportunities and challenges of integrating digital behaviour change interventions (mHealth) into smoking cessation practices by understanding professionals' perceptions of these tools.

Methods: A qualitative study was conducted involving semi-structured interviews with 11 experienced smoking cessation professionals in Flanders, Belgium. Data collection occurred between January and April 2023. Inductive thematic analysis was performed to identify key patterns and themes in the experts' views regarding mHealth interventions.

Results: The analysis revealed four primary themes: (1) The Inexorable March of Technology – experts acknowledged the inevitability of technology in smoking cessation but varied in enthusiasm; (2) The Shimmering Mirage of Possibility – technology was viewed as supplementary, offering efficiency and support but limited in depth; (3) The Footnotes to Enthusiasm – experts expressed concerns over privacy, inclusivity, and the potential for technology to displace human care; and (4) The Human Anchor – the irreplaceable role of human connection and therapeutic alliance, which digital tools might not be able to replicate.

Conclusion: Experts believe mHealth interventions can augment smoking cessation support but should not replace human-driven care. A blended approach, integrating digital tools with traditional therapeutic relationships, offers the most promise. Addressing concerns about privacy, inclusivity, and most importantly the limits of digital therapeutic alliances is essential for successful mHealth implementation in smoking cessation.

Keywords

mHealth interventions, smoking cessation, digital therapeutic alliance, behaviour change technology, expert perspectives

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Introduction

Tobacco smoking is a persistent global public health crisis, responsible for nearly 8 million yearly deaths worldwide[1] and an estimated economic burden of $422 billion on healthcare systems.[2] There are currently an estimated 1.14 billion active smokers globally. A substantial portion of

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these smokers, however, are interested in quitting smoking, either now or in the near future.[3–5] To help these smokers with their smoking cessation efforts, an industry of digital mHealth tools has emerged that aims to support these individuals, among others by offering opportunities for monitoring and providing tailored feedback.

While mHealth tools appear promising, they have been criticised for their limited effectiveness compared to established methods, such as nicotine replacement therapy and counselling.[6,7] Additionally, scholars have warned that not all that is technologically possible within healthcare is necessarily also desirable and that there are biases inherent to these technologies that might discriminate against underrepresented or digitally lower-skilled populations.[8–10] Following these criticisms, there has been an overall call in the field to develop a stronger evidence base for the development and implementation of these technologies.[11,12]

Smoking cessation specialists likely play an essential role in developing such evidence, as their unique position at the intersection of behaviour change theory and practice provides them with first-hand insights into the challenges and opportunities presented by mHealth technologies in smoking cessation. To date, however, there is a lack of evidence documenting their views on the potential and pitfalls of digital interventions of smoking interventions. This is unfortunate, especially now with the rise of artificial intelligence and its potential integration into these interventions.

This study responds to the call to leverage further evidence on where and how mHealth applications might successfully support individuals in the process of smoking cessation by asking how 11 accredited smoking cessation professionals perceive and navigate the role of mHealth technology within their professional approaches to smoking cessation. Before elaborating on the findings of our study, however, we first share the state-of-the-art concerning the use of mHealth for smoking cessation.

State of the art

mHealth smoking cessation interventions

Although the prevalence of smoking has seen a general decline worldwide, a recent WHO report[13] indicates that this decrease is considerably slower than expected. Hence, there remains an urgent need for the development and implementation of smoking cessation interventions. When developing and implementing smoking cessation interventions, not only the efficacy of the intervention but also other factors such as its accessibility and cost matter; after all, ideally the highest standards of care are achieved at the lowest possible cost to society.[14–16]

The relatively recent emergence of technological health interventions, particularly mobile health interventions broadly known as mHealth, seem to naturally bridge this gap.[17,18] mHealth has been commonly defined as 'the use of mobile computing and communication technologies in health care and public health'.[19] By leveraging the global rise in smartphone usage,[20] mHealth solutions promise to not only enhance healthcare accessibility for a broader audience at a low cost but also offer highly personalised, interactive, and scalable support compared to traditional methods. In other words, by providing real-time, accessible support directly on users' smartphones, mHealth can make cessation assistance more inclusive and adaptable to individual needs, aligning with smokers' preferences for such interventions.[21,22]

Opportunities and challenges of mHealth for smoking cessation

Numerous studies consistently indicate that the majority of individuals who successfully quit smoking choose to do so either unassisted or through self-help strategies, presumably due to the significantly lower perceived barrier to entry.[23–25] This preference for self-guided quitting methods and self-tracking among smokers aligns well with the inherent self-help nature of mHealth interventions, which empower individuals to take an active role in their own health care.[26–29] mHealth tools such as the 'Quit with US' and 'iCanQuit' applications have been shown to be effective, leading to significantly greater smoking abstinence rates than their control conditions.[30,31] Two recent systematic reviews and meta-analyses also conclude that, at least in the short term (up to 3 months), both SMS and app-based mHealth interventions significantly increase abstinence compared to minimal cessation support.[32,33]

Yet, this optimism must be tempered with realism, as most mHealth studies currently show widely varying implementations and inconsistent outcomes in terms of effectiveness.[6,7] This concern is further exacerbated by the rapid commercial explosion of mHealth apps, driven more by market trends than scientific validation, leading companies to use 'health as a means towards profitable ends'.[34] According to some, this market-driven rush and so-called 'progress', often bypassing rigorous research validation, has even led to a 'retrogression in the science of mobile health'.[11]

Building on these concerns, scholars such as Lupton[9] caution against an overly techno-utopian perspective, where healthcare strategies focus too much on what is technologically possible rather than what is necessarily desirable. This becomes all the more worrisome when these technologies carry embedded assumptions about user capabilities and desires, which might alienate vulnerable populations.[35] There are also warnings about the risks of over-reliance on technology under the guise of patient autonomy and empowerment, as it may shift responsibility for healthcare onto patients without sufficient support.[10]

Consequently, before fully embracing the future adoption and development of technologies in healthcare, particularly for smoking cessation, it is important to determine whether their use is truly beneficial. After all, blind advancement without reflection can be dangerous, especially in the context of healthcare, where decisions have profound implications for the well-being of millions of people.[36]

The current study

Reflecting on the above issues, the landscape of mHealth in relation to smoking cessation is likely both promising and concerning, highlighting the need for a critical evaluation. This study responds to this need by mapping the perceptions of smoking cessation experts on this matter. As practitioners straddling the line between theory and practical implementation, smoking cessation experts can likely provide nuanced views that might illuminate paths forward, helping to shape future mHealth developments in ways that could potentially address and minimise current shortcomings. Hence, this study asks: How do experts in the field perceive the opportunities and challenges of technology within their smoking cessation approaches, both now and in the future?

To provide a more nuanced understanding of this complex issue, we opted for a qualitative approach to our study. This allowed us to examine the subtleties of expert opinions and challenge the prevailing survey-centric, model-based tradition of technology acceptance research, which often emphasises quantifiable factors at the expense of human-centric nuances.[37] Frequently used models such as UTAUT, while valuable for understanding technology adoption, may overlook the contextual factors critical for defining future applications.[38,39]

Method

Sample and data collection procedure

We opted for a qualitative design and conducted semi-structured expert interviews to explore perspectives on smoking cessation interventions and the role of digital technologies in behaviour change. Data collection was conducted online and video-recorded between January and April 2023, involving 11 purposively selected smoking cessation practitioners actively practicing in Flanders, Belgium. All participants were registered with the Flemish Association for Respiratory Healthcare and Tuberculosis Control (FARHTC, translated from the Dutch abbreviation of *'Vlaamse Vereniging voor Respiratoire Gezondheidszorg en Tuberculosebestrijding'*) database. To ensure a high level of expertise and up-to-date knowledge, practitioners were considered ineligible and excluded if they were inactive, offered limited patient treatments or had limited experience. The decision to recruit only FARHTC-registered experts was deliberate and requires us to explain to the reader that the approach to and expertise in smoking cessation is not uniform across countries.[40]

In Belgium, Tabakstop, the national authority on smoking cessation, provides two main forms of support for smokers: (1) a free quit line available on weekdays from 15:00 to 19:00 and (2) up to eight structured coaching sessions led by accredited smoking cessation specialists. These sessions are based on evidence-based practices, as outlined by FARHTC. Additionally, pharmacotherapy options, such as nicotine replacement therapy (NRT), are available and reimbursed. However, there are no official recommendations or endorsements for integrating digital tools into the cessation process.

FARHTC-certified professionals complete a year-long training program organised by several collaborating universities in Belgium, ensuring they have a comprehensive understanding of smoking cessation's complexities.[41] By contrast, certification processes in other countries, such as the UK, may offer shorter online courses,[42] resulting in a larger pool of practitioners with varying levels of expertise. As noted by Sheffer et al.,[43] smoking cessation training programs that prioritise accessibility over depth of knowledge may not adequately address the complexities of behaviour change required for effective interventions.

The sample reflected diverse expertise and perspectives, spanning both public and private sector roles. Experts included the CEO of a leading behaviour change company, as well as the former and current coordinators of a prominent smoking cessation agency in Flanders. These participants have contributed to national-level decision-making on smoking cessation policies and practices, offering insights into both strategic and practical applications. Their professional backgrounds included psychology, nursing, and pharmacy, with experience levels ranging from 5 to 25 years of seniority. Participants worked in various professional environments, including independent practices, collaborative group settings, and hospital-based roles. This cross-sector representation provided varied perspectives on smoking cessation practices in Belgium. Furthermore, as active practitioners, the participants engaged daily with smokers attempting to quit. This direct patient contact allowed them to assess both current patient needs and the potential utility of digital tools. Importantly, neither FARHTC nor any of the interviewed specialists officially recommended or used digital tools in smoking cessation.

Of the 52 experts initially contacted through FARHTC and Tabakstop, 11 participated in the study. The final sample size was primarily determined by theoretical considerations, as the literature suggests that the majority of new data tend to emerge between the 7th and 12th interviews.[44] An overview of the sample is provided in Table 1.

Table 1. Descriptive characteristics of the participants and the data collection.

Pseudonym	Gender	Academic background	Working situation	Interview duration (Minutes)[a]
Jeroen	Male	Sport Psychology	IP[b]	71
Elise	Female	Nursing	JP[c] + IP	97
Thomas	Male	Nursing	IP	76
Annelies	Female	Psychology	IP + Hospital	60
Sofie	Female	Pharmacy	IP	55
Maarten	Male	Psychology	JP	72
Wouter	Male	Orthopedagogy	IP	59
Lukas	Male	Psychology	Hospital + IP	63
Veerle	Female	Physiotherapy	Hospital	67
Hanne	Female	Pharmacy	JP + IP	70
Stijn	Male	Sport psychology	JP	45

[a]Mean interview duration is 61 (*SD* 13) minutes.
[b]IP: Individual practice.
[c]JP: Joint practices (outside a hospital environment).

Interview procedure and data analysis

This study was approved by the Political and Social Sciences Ethics Committee of Ghent University. Interviews were conducted by the first author, a male PhD student, as part of a broader preregistered project. Details of the project are available on the Open Science Framework website: https://osf.io/vz9hg. After collecting written informed consent, the interviewer first discussed current smoking cessation practices and then focused on experts' perceptions regarding the current and future integration of mHealth in smoking cessation, using a semi-structured interview guide. This guide (see supplemental material) evolved through three iterations, particularly refining and expanding questions related to technology, such as 'Do you think technology has a place in behaviour change?', 'What would you want from technology as a practitioner?' and 'Do you think technology adds value to the cessation process?'. The guide also explored the integration of chatbots in smoking cessation, providing a tangible reference point for reflection. It is worth noting that although advanced AI tools such as ChatGPT were available during data collection, they had not yet gained widespread recognition.

Interviews were transcribed using OpenAI's Whisper model[45] and analysed with NVivo 14.[46] Unless meaningful, non-verbal gestures and repeated words were omitted. A thorough manual review ensured transcription accuracy. The data analysis followed the inductive thematic analysis methodology by Braun & Clark.[47] The first author familiarised himself with the data, annotated important sections and initially recognised patterns. Open coding was applied to every interview, with preliminary codes remaining fluid and subject to change throughout the analysis. The dataset was then reviewed to refine codes and identify overarching themes. Following a comprehensive review, themes were fine-tuned, validated, and named.

Initially, 1096 annotations were made, later refined to 80 specific codes addressing the research question. Data saturation was likely achieved after the seventh interview, with minimal new codes identified in subsequent interviews. While saturation is often judged through the discovery of new codes alone, it is important to note that this approach is not infallible. Therefore, we also considered the conceptual depth within the dataset in determining if saturation had been achieved.[48] A last review of codes led to the merging of similar ones and the removal of redundant or unrelated ones, resulting in a final count of 61 distinct codes. Using this final set of refined codes, themes were constructed based on recurring patterns and overarching sentiments of the experts.

To enhance the trustworthiness of our findings, we implemented several strategies during the analysis phase. Peer debriefing was conducted with colleagues, including both co-authors and external reviewers, to incorporate

multiple perspectives and reduce potential individual biases in interpretation. Transparency was further ensured by pre-registering the study on the Open Science Framework (OSF), providing a detailed account of our research focus and decision-making processes. Finally, we communicated our findings with participants, though formal member-checking was not conducted.

Results

The analysis of our discussions with experts revealed four distinct themes: the undeniable presence and increasing popularity of tech; the elusive potentials of digital tools; deep-rooted reservations and concerns; and the irreplaceable value of human connection. These themes guide our exploration into the complex interaction between technology and smoking cessation through the lens of cessation specialists.

The inexorable march of technology

The first theme that emerged concerned how the ubiquity of technology was seen to have infiltrated every aspect of our lives, advancing at an unrelenting pace. Notably, healthcare, and more specifically smoking cessation, were seen by experts as not being immune to this technological tide. Experts in the field stated that they were consistently confronted with technology's influence, often as a result of patients inquiring about app recommendations or expecting technology integration into treatment protocols. While some practitioners eagerly welcomed this evolution, others approached it with greater caution or resistance. Yet, a common consensus emerged among all experts, irrespective of their age, gender, practice setting, or method of practice: Technology's presence in healthcare is undeniable and inevitable, thus compelling all experts to adapt and recalibrate their practices accordingly. In this process, practitioners voiced that they seem to have no choice but to accept and face the multifaceted implications of this integration. For instance, both Wouter and Hanne are generally optimistic about smoking cessation apps, but also indicate they cannot *not* talk about them given patients' demand for them:

> You have Kwit and Smokefree and Quit Smoking […] and I know a lot of people [want them], I always include them in my presentation, I always pass them along because they are really supportive for many people. (Wouter)

> I often advise them to distract their thoughts at the moments when they would usually smoke, and I find that apps are always helpful with this, especially for … but even, I would say, my feeling suggests that even those up to 60 or 65 years old ask for it, like, "Can you send me a list of apps?" And then you often refer to … And I receive a lot of positive feedback about those apps. (Hanne)

In their capacity as practitioners, experts thus find themselves in a position where they are expected to both provide information about and give access to technological resources, not only for younger but also older patients because their use is considered inevitable given the general 'app-ification' of society, or as Thomas states '*It is definitely the same as with sports. It should become a fixed part of smoking cessation, and there are a lot of patients who use that, I hear that often'*. The observation that patients simply want these apps and that their implementation fits in with the prevailing sentiment brings the risk, however, of experts not recommending apps purely based on their intrinsic value, but rather because of underlying pressure to cater to patient preferences.

It is worth noting that not all experts share this viewpoint uniformly, suggesting differing perceptions and experiences in the field. Some experts, such as Lukas, see the app as 'just a little something extra', and hint that users may have a warped perception of what drives their behaviour change, whereas others, such as Jeroen, see substantial potential in their further development:

> […] often people who come here say they have downloaded an app. They can see things like, "I've been able to quit for this long. I've already saved this much money." So those little things, which I also think, okay, that's nice to know. But that's not the reason why you stay smoke-free. It provides a bit of extra stimulus. (Lukas)

> I believe that there are possibilities there, that artificial intelligence and the translation of theories into self-help are getting better and better, and I think it is only logical that this is also being developed for smoking cessation. (Jeroen)

Jeroen follows up, however, by saying that it is 'only logical' for these apps to be developed for smoking cessation in our techno-dependant Zeitgeist, but not that this is an evolution he necessarily supports or sees fit. Elise reflects on this Zeitgeist effect, commenting that

> You should know that I started in 2005 with nothing but a phone to help smokers. And when I see everything that has been developed in recent years, I also think: is this all necessary now? Anyway, that's because I'm old-school and because I don't really want to spend all day on all those apps. (Elise)

Her scepticism towards the rapid technological advancements in the field, which contrast fiercely with the minimalism of past methods, appears to be indicative of a feeling of being overwhelmed by today's technological

barrage, or possibly even being left behind in the wake of the relentless march of technology. This sentiment, reflecting a broader possible issue of inclusivity, is shared by other experts and extends to some of their patients as well. This pace of technological change might not only challenge traditional practices but also risks excluding those who are less tech-savvy or resistant to change.

In sum, our analysis revealed a layered consensus among experts: regardless of individual perspectives, the impact of technology in the realm of smoking cessation is undeniably expansive, prompting experts to navigate the evolving landscape. While some perceive this progression as a natural evolution, others express reservations, and a few wholeheartedly welcome it. However, beneath these apparent reactions often lies a deeper understanding of technological progress as an unstoppable force, while not necessarily leading to fundamentally better outcomes.

The shimmering mirage of possibility

A second theme builds further on the perceived promise of technology, showing a 'shimmering mirage of possibility'. Experts regularly seemed to justify the transformative potential of technology, seeking arguments to rationalise the ongoing technological shift and, perhaps, reassure themselves of their continued relevance in the new age of digital healthcare. While many acknowledged the prospective benefits of mHealth for smoking cessation, there was a tangible hesitation to embrace technology as a central tool in their practice. Their reluctance to fully integrate this 'technological march' suggests an underlying unease about the immediate implications for their profession. Intriguingly, the term 'technology' remained somewhat limited within the experts' discourse. Their understanding tended to gravitate towards what is familiar – apps – which then became the primary lens through which future possibilities were envisioned and debated. As the quote below illustrates, some experts remain cautious about fully endorsing these technologies without robust scientific validation, reflecting a reluctance to embrace technology as a definitive solution.

> […] Patients find a lot of help in the feedback they get from these apps […] I know a few colleagues who do recommend it [certain apps] to their patients, who say, 'You should download this app.' I prefer not to do that because, if I don't have scientific confirmation, I'd rather not take a stance. (Thomas)

Additionally, the experts often explicitly articulated that technology is considered a supplementary asset, enhancing the practitioners' operations. Experts emphasised they needed to remain in control: Technology should therefore mostly augment their capabilities, making them more efficient in their roles. This sentiment is echoed throughout the dataset, with experts emphasising the convenience of automation, particularly for routine tasks. However, it is notable that these automations are mainly seen in straightforward contexts, such as collecting standard questionnaires or offering routine relaxation exercises that might be seen as inefficient uses of the experts' time. This suggests a cautious and one-sided optimism, recognising the *future* potential of technology for experts but seeing this potential restricted to bringing efficiency gains in tedious, practical tasks.

> I think you can make the psychologist [meaning the cessation expert] more efficient by automating a number of things, even if it is only a questionnaire, you can even automate relaxation exercises. It really isn't necessary for you to attend an hour-long session. (Maarten)

> […] I would make that [app]

> very, very extensive in the back office, so to speak. That you can create your own questionnaire. That you can specify a number of questions, send automatic messages, automatic notifications, send automatic motivation, […] (Thomas)

Some experts, like Wouter, emphasise technology's potential for supporting patients directly, highlighting an app's ability to serve as an ever-present tool, especially in pivotal moments such as sudden cravings where a practitioner cannot intervene in real time. Yet, despite the widespread acknowledgement of these advantages, the perceived possibilities of technology, even in these more patient-focused scenarios, remain simplistic at first. The technology's role, from the experts' perspective, seems to revolve around superficial facets of the cessation journey, such as sending basic positive reinforcements or simply calculating financial savings from quitting:

> But that's something very brief, it works. You always have something on hand, and we're not there when a craving comes up. And you can do all that via the app. I can't say off the top of my head, "You've now saved this much money, wait, let me get my calculator, you've saved this much." But an app can. An app can also, I can't with my phone, call all my patients and say, "Yes, good job", but an app can. (Wouter)

It is noteworthy that while experts see these functionalities as highly valuable – because they can be executed in real-time and in moments of need – they rarely mentioned apps replacing the intricate therapeutic facets of cessation.

Nonetheless, when probing deeper into the unique advantages that technology introduces, experts did arrive at particular features that human practitioners simply

cannot emulate. One standout advantage is the cloak of anonymity that interactions with technology afford, potentially supporting patients in discussing sensitive topics, devoid of the intimidation or self-consciousness one might feel when directly confronting a therapist. As Hanne stated, '*That it is anonymous, that it is fast. That it is day and night […]*'. And as Maarten pointed out:

> […] When we chat live with people, it's not the same [as a chatbot], but some of it is the same. I even noticed that sensitive topics are discussed more easily there because you don't have the discomfort of sitting in front of a therapist. They don't hear you cry, they don't hear you doubting. People sometimes feel more comfortable sharing very personal things anonymously, and chatting gives that kind of anonymous feeling. (Maarten)

Experts thus illuminated a comforting detachment, a buffer, that chat interfaces provide to users, allowing them to share without fear of judgment. Yet, for all its merits, not all experts were entirely convinced. Lukas, for instance, showed a more cautious optimism. He acknowledged the apps' potential, especially their ready accessibility in moments of crisis, as others have also pointed out, but he insisted that technology cannot necessarily 'fix' an emotion, it can at most offer a conduit to channel or address it:

> But for example, there are also those apps for suicide prevention. If they don't feel well, then they can send something. So, something like that could also help with such an app [for smoking cessation]. It's the easy accessibility of, "I don't feel good, and I can do something with that feeling". (Lukas)

Concluding, a nuanced consensus seemed to emerge among the experts. While there is a broad acknowledgement of the advantages that technology brings to the smoking cessation arena, the extent of its depth and efficacy remains a subject of debate. Particularly, the transformative potential of these technologies to foster *lasting* behavioural change remains in the realm of speculation. As Veerle notes: '*Perseverance? Yes. Awareness? Yes. [But] behaviour change? Well, I don't really know'*. This ambivalence underscores the broader understanding that, while technology is a promising tool in the smoking cessation toolkit, its role as a primary change agent remains to be demonstrated to experts.

The footnotes to enthusiasm

The implications and challenges of technology's role in smoking cessation are evident in experts' reservations and concerns. While the digital wave's potential benefits are clear, they are accompanied by significant hesitations. A third theme reveals further footnotes to this enthusiasm and builds further on the subtle criticisms, highlighting specific worries about technology's present and future impact, both on professionals' roles and patients' welfare. Thomas for example, expresses the angst amongst some practitioners, pointing out that they will resist technology 'to protect their sacred house', which implies both job security and established practices. His vocalisation of these fears might also reflect his personal uncertainties, potentially serving as self-reassurance.

> […] you have doctors and paramedics who want to protect their sacred house, who do not want their income to be affected by the loss of consultations, by creating that app. I think you'll have that anyway. That fear will be there. (Thomas)

This fear of digitisation is apparent from his next statement, framing technology as a potential tool to replace cessation specialists; '*I also think that they will be a bit scared because when they hear that you want to replace the cessation specialist a bit, many people will see that as the cessation specialist being digitised' (Thomas).*

Experts such as Annelies also brought up valid concerns regarding the potential undesired and negative outcomes of technology, possibly even causing more smoking behaviour.

> If there is a moment when you are not really thinking about your quit attempt, that [an app pop-up] can also be a trigger, I think, perhaps to stimulate the desire to smoke. […] if your app says, "Today, you haven't been smoking for so many days." [Then you might think] "Ah yes, smoking!". (Annelies)

The same critical sentiment is shared by virtually all experts. Not only when discussing the smoking cessation aspect of technology, but also examining broader topics such as a general mistrust in technology regarding privacy and data security concerns.

> Of course, people sometimes get suspicious and start to think that they [app developers] are not keeping track of those figures, but behind my back… [they do.] So, I think that is important that you also know, it is anonymous. The question is, of course, what is still anonymous in the online world? (Hanne)

This highlights the necessity for privacy safeguards, yet there remains a pervasive unease and mistrust toward technology, stemming from its perceived invasive and observing nature. Elise draws a chilling comparison between technology's ability to monitor activities at all times as an omnipresent observer, remarking, '*That's what Big Brother actually is, isn't it?'*. This statement is laden with

connotative meaning, hinting at the risks associated with nefarious agents accessing users' personal health data.

While experts expressed these reservations, acknowledging the potential downsides of technology, they recognised that their concerns might not resonate universally. In the quest for smoking cessation, users might prioritise their end goal over these apprehensions, pointing towards a privacy paradox. As Hanne observed, despite potential doubts, individuals' primary objective remains clear: '*[…] even though people are suspicious, if they want to quit smoking, they come to us, they put aside their principles, they get information. All people want is […] to stop smoking' (Hanne).*

In the interplay between technology and smoking cessation, experts voiced reservations, tempering their enthusiasm to adopt. Their insights, spanning from professional apprehensions to overarching societal implications, highlight the necessity for a critical approach. While the appeal of digital solutions is undeniable, addressing accompanying concerns is essential to ensure that they are effectively designed, integrated, and applied to enhance smoking cessation outcomes.

The human anchor

The final theme brings our discussions and analyses full circle, anchoring them within the broader human context of smoking cessation. Technology undoubtedly presents many benefits and potential pitfalls; however, it is essential to remember that at the core of behaviour change lies the human element. Jeroen illuminated this sentiment by emphasising the human backdrop and the limitations of only relying on technology in the smoking cessation journey, '*Smokers are still people with very human lives and contexts around them. We're going to hit a limit there. […] But if they hit a wall with that, I think we will need an extra step'*. Here, 'the wall' refers to the inherent limitations of technology in addressing emotional, psychological, or social factors that require human understanding and intervention. 'The extra step' signifies the necessary additional human measures or support that go beyond current technological solutions to overcome these barriers. Experts consistently emphasised the need for integrating human support lines within tech solutions to ensure users are not isolated when facing challenges. Vulnerable populations, such as older adults, may be especially at risk of being left behind in an increasingly digital healthcare environment.

> I think that older people are also being increasingly pushed towards the smartphone world. […] You have to take some [vulnerable] patients into account, those who are visually impaired or illiterate, or those who simply don't have the means to carry a smartphone. So, you will never have 100% coverage, that's something you'll never achieve. (Thomas)

This sentiment highlights the reality that not all patients are equipped to engage with digital tools and will be disadvantaged in an all-digital healthcare system. Beyond pure accessibility, experts overall believe that the profound therapeutic nuances required in the cessation process cannot be replicated by technology alone. In other words, while apps offer convenience and immediacy, the deeper therapeutic interventions seem to remain irreplaceably human. The 'human expert' should ideally be the primary point of contact, suggesting its superiority, with technology serving a complementary role.

> I always remain in favour of, shall I say, a human second line, or perhaps even, yes, a first line. That we regard technology as the zero line, but that if people get stuck, they can always say, I'll ask an expert, a human expert. (Jeroen)

All experts agreed that technology should not be the sole solution for individuals seeking help, stressing instead the indispensable role of having continuous access to *human* healthcare providers. Annelies firmly believed in this, '*I always want the option; do you now have an answer to your question, or do you need someone to call you or chat with you? That you really feel that there is someone, that option must also be there'*. Such an option preserves individual autonomy by ensuring that people are not pushed onto digital platforms. Maarten also underscored the importance of this human touch, noting its role in sustaining user engagement and reducing dropout rates: '*But if there is no one available at set times or if there is no one available, it is very easy to lose motivation'*.

Regarding chatbots, experts voiced similar concerns, pointing out that technology cannot fully emulate the nuanced understanding and empathy intrinsic to human practitioners, which is especially vital in the context of behaviour change. Lukas and Annelies highlighted the irreplaceable role of human emotions and the current limitations of chatbots and technology in addressing them. They cautioned against a 'robotic' future healthcare system devoid of emotional connection:

> Because a chatbot cannot capture the emotion, the feeling that is attached to something. […] And if we don't think about that emotional part, we won't be able to get any further in quitting smoking. […] And a chatbot won't be able to absorb that. Prove me wrong, I would say. But I think that's what makes us human, that we can feel, that we can attune. (Lukas)

> I also miss a bit of the human element in it [chatbots]. I hope that we do not go to a healthcare system where there are

> only robots, because I also think the human aspect is very important. (Annelies)

Lukas, echoing the sentiment of many experts, eloquently highlighted the irreplaceable role of human connection in smoking cessation. He stressed the value of intimacy and the bond that can form within therapeutic relationships. Through this lens, he highlighted the inherent limitations of technology, stressing that it cannot replicate the deep, emotional ties that define human interactions.

> […] intimacy and connection. […] The working relationship [alliance] is the most effective factor in any psychological and therapeutic relationship. For example, oxytocin, which is a hormone that is released when you feel connected, when you feel supported, loved, etc. It doesn't get released at all when working with apps or when calling or texting. It only happens during face-to-face encounters. So, it can be complementary, but that's why a robot, for example, can never take over the function of human connection and warmth.

Concluding this theme, it became evident that the advancements in technology, while substantial, cannot overshadow the fundamental importance of genuine human connections in smoking cessation. Although apps, chatbots, and other technological interventions provide valuable support, they are perceived by experts as complementary tools rather than standalone solutions. The essence of a therapeutic relationship lies in the human capacity for understanding and the meaningful bond established between practitioner and patient. This connection, grounded in empathy and mutual trust, constitutes a cornerstone of effective smoking cessation strategies.

Discussion

This study explored how accredited smoking cessation experts perceive the role of mHealth in supporting behaviour change. By examining their perspectives, we aimed to gain a nuanced understanding of the interplay between digital interventions and traditional, human-driven support. Our findings confirm the increasing normalisation and patient-driven demand for digital tools, mirroring the broader proliferation of mHealth in healthcare settings.[22,49] Additionally, critical tensions and opportunities for integrating these tools into existing cessation pathways were brought to light.

At the centre of our findings lies the concept of the therapeutic alliance, traditionally defined as a collaborative and affective bond between a healthcare provider and a patient, grounded in mutual trust, shared goals, and agreement on tasks.[50] As corroborated by the experts, this alliance is a well-established predictor of positive outcomes in smoking cessation and other behaviour change interventions. However, the advent of digital health solutions challenges our understanding of what this alliance means in a virtual context. Scholars debate whether a 'digital therapeutic alliance' is merely a technological proxy for the traditional relationship or something altogether distinct.[51,52] Although *digital* therapeutic alliance with mHealth tools is plausible, it may be weaker than its non-digital conceptual counterpart. This digital variant can approximate certain aspects of support and empathy but often differs in its depth and emotional resonance.[53] Nonetheless, this alliance offers us a conceptual linchpin for understanding both the promises and pitfalls of integrating technology into smoking cessation care. While our experts acknowledged that apps and chatbots could deliver timely, around-the-clock support and anonymity, potentially reaching individuals who might otherwise avoid help, they also emphasised that such tools rarely replicate the subtle emotional attunement and warmth defining a strong human alliance. Consequently, preserving or even enhancing this relational quality as we incorporate new technologies is essential to sustaining motivation, adherence, and meaningful behaviour change. Especially in the challenging context of smoking cessation, where ongoing commitment and coping with setbacks are central challenges.[16]

At the same time, the evolution of integrating technology into smoking cessation should not imply displacing human-driven care, which experts repeatedly warned about. On the contrary, the professionals we interviewed advocated for a complementary approach that situates mHealth as part of a broader ecosystem of support rather than as a standalone replacement. Digital interventions can augment existing practices by offering just-in-time, context-sensitive assistance – such as coping strategies triggered by cravings – or by monitoring patient progress between in-person sessions.[54] This in-between care can help sustain motivation, enhance treatment adherence, and potentially improve treatment outcomes. By closing the gap between appointments and delivering timely nudges or feedback, these tools can lighten the burden on healthcare systems and increase treatment reach without compromising relational quality.[55] The experts' insistence on maintaining a 'human anchor' in cessation programs supports growing calls for blended care models that combine the scalability and convenience of mHealth with the authentic, relational quality of in-person therapy.[56,57]

This viewpoint dovetails with Morley & Floridi's argument,[10] which encourages moving beyond framing mHealth as a panacea that 'empowers' patients by simply shifting responsibilities onto them. Instead, they envision mHealth as integrative aids that work in harmony with established clinical practices. Our findings resonate with this viewpoint and even recommend further action. By offering curated digital resources, cessation experts and agencies can blend the flexibility and accessibility of

mHealth with the empathic, personalised care that remains essential to sustaining behaviour change. In practice, this could entail established therapists 'prescribing' evidence-based apps as adjuncts, for instance, integrating cessation chatbots that can flag high-risk periods for relapse, or including brief digital check-ins that facilitate ongoing patient engagement. Doing so not only helps meet the current unmet demand for digital tools – where patients seek tools but often find no official guidance – but also reinforces the role of professionals as knowledgeable partners. In this way, specialists can strengthen the therapeutic alliance by showing patients that their individual needs and preferences are understood and supported, both in-person and through carefully selected digital aids.

Still, these potential benefits come with important caveats. Experts warned that digital interventions may inadvertently exclude those who lack digital literacy, reliable internet access, or comfort using apps for sensitive health issues.[35,58] They also expressed concerns over privacy, data stewardship, and the 'privacy-personalization paradox', wherein patients may indicate that they are privacy conscious but are also willing to surrender their data in exchange for convenience and personalisation and may not fully appreciate the long-term implications.[59] Addressing these issues is critical, as robust data protection, accessible interfaces, and clear evaluation standards can build trust and thereby strengthen the experienced alliance with digital tools.

In using the therapeutic alliance as a pivotal lens through which we look at the challenges mHealth faces, this study offers a novel perspective. While previous research has critiqued the effectiveness and inclusivity of mHealth interventions,[35,55] our study foregrounds the relational dimension as equally significant. The success of digital smoking cessation interventions may hinge not only on their evidence-based content or technological sophistication but also on how well they imitate or support meaningful, trust-based interactions with healthcare professionals.

Limitations and future research

Our focus on accredited cessation experts in a specific regional context may limit the generalizability of our findings. Future studies would benefit from including end-users, both individuals who smoke and those who have quit, thereby capturing patient perspectives on how mHealth influences their experiences and outcomes. More targeted investigations could also determine which specific features (e.g., interactivity, personalisation, real-time responsiveness) of digital tools most effectively foster alliance-building and promote sustained behaviour change.

Although emerging research suggests that digital alliances can develop over time and may encourage trust and empathy,[51,60] our findings indicate that therapeutic alliance functions differently in digital environments and warrants further exploration. Researchers might, for example, examine the mechanisms and resilience of digital alliances or compare alliance formation and evolution in face-to-face versus digital settings. Moving toward more evidence-based mHealth integration, future work could experiment with blended care models – combining scheduled human contact with digital monitoring or nudges – to assess whether these approaches outperform either modality alone. Additionally, developing robust conceptual frameworks and further validating measures of digital therapeutic alliance will be essential to advancing the field.

Conclusion

As digital technologies become an integral part of the smoking cessation landscape, the path forward lies not in displacing human care but in complementing it. Our findings highlight an unmet need and a prime opportunity for cessation professionals to guide patients toward reliable digital tools, reinforcing trust and extending the therapeutic alliance beyond in-person sessions. By framing mHealth as an integral adjunct rather than a standalone solution, healthcare systems can capitalise on the flexibility, reach, and timeliness these tools offer while safeguarding the relational core that makes cessation support genuinely transformative. In sum, technology should not erode the human essence of care but enhance it.

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