Health Information Leaflet Co-Designed by People Experiencing Homelessness and ChatGPT for a Screening Program: A Mixed-Method Study

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Abstract

Background: It is well established in the literature that people experiencing homelessness have worse oral health outcomes and a huge health informational asymmetry compared to the general population. Screening programs present a viable option for this population, however, barriers to access, such as lower levels of health literacy, lack of information, and mistrust narrow their chances to participate.

Objective: For designing an adequate health information guide that presents the oral cancer screening program as acceptable, available, and effective for this vulnerable population, the applicability of the generative Artificial Intelligence (AI) tool, OpenAI's ChatGPT was investigated using co-design principles.

Methods: Six text variants of a health information leaflet were created by the open-access version of ChatGPT 3.5 for a future oral cancer screening program targeting people experiencing homelessness in Budapest, Hungary. Prompts were applied in English, while the results were expected to be in Hungarian. Clients of homeless social services (N=23) were invited to three semi-structured focus group discussions between May and July 2024. General opinions regarding generative Artificial Intelligence technology and direct feedback on the AI-generated text variants were obtained using qualitative and quantitative methods including a short questionnaire developed by the research team.

Results: Almost two-thirds of participants (N=17/23) stated that they had previously heard about AI, however, their self-assessment regarding the extent of their knowledge resulted in an average of 2.38 (N=16) on a 5-point Likert scale. Additionally, their answers concerning trust in medical applications of AI averaged 3.06 (N=16) on a similar scale. During the first focus group discussion with experts by experience, all six variants received a prominent score (between 4.63 and 4.92, N=6, on a 5-point Likert scale). In contrast, in the next two focus groups, when the pool was narrowed to four versions, participants remained positive, although scored the texts lower (between 3.77, N=13, and 3.50, N=12). During open discussions, text variants were considered understandable but, at the same time, certain difficulties with medical expressions, lengthiness of sentences, and stereotypical use of a subgroup among people experiencing homelessness (rough sleepers) were also reported.

Conclusions: The co-design process revealed that the participants in the focus groups wanted to actively shape the health information leaflet draft for the oral screening program. They shared their ideas and insights on how to finalize the draft so that it would appeal most to the target audience. Moreover, the involvement of generative AI technology in the co-design process revealed that the participants have heard about the concept of Artificial Intelligence and text generation as its potential function, and they have not rejected its use in healthcare settings. They actively suggested changes to the original text versions to reach the proper level of equitable use, targeting, understanding, and clarity.

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Abstract

Introduction: It is well established in the literature that people experiencing homelessness have worse oral health outcomes and a huge health informational asymmetry compared to the general population. Screening programs present a viable option for this population, however, barriers to access, such as lower levels of health literacy, lack of information, and mistrust narrow their chances to participate. For designing an adequate health information guide that presents the oral cancer screening program as acceptable, available, and effective for this vulnerable population, the applicability of the generative Artificial Intelligence (AI) tool, OpenAI's ChatGPT was investigated using co-design principles.

Methods: Six text variants of a health information leaflet were created by the open-access version of ChatGPT 3.5 for a future oral cancer screening program targeting people experiencing homelessness in Budapest, Hungary. Prompts were applied in English, while the results were expected to be in Hungarian. Clients of homeless social services (N=23) were invited to three semi-structured focus

group discussions between May and July 2024. General opinions regarding generative Artificial Intelligence technology and direct feedback on the AI-generated text variants were obtained using qualitative and quantitative methods including a short questionnaire developed by the research team.

Results: Almost two-thirds of participants (N=17/23) stated that they had previously heard about AI, however, their self-assessment regarding the extent of their knowledge resulted in an average of 2.38 (N=16) on a 5-point Likert scale. Additionally, their answers concerning trust in medical applications of AI averaged 3.06 (N=16) on a similar scale. During the first focus group discussion with experts by experience, all six variants received a prominent score (between 4.63 and 4.92, N=6, on a 5-point Likert scale). In contrast, in the next two focus groups, when the pool was narrowed to four versions, participants remained positive, although scored the texts lower (between 3.77, N=13, and 3.50, N=12). During open discussions, text variants were considered understandable but, at the same time, certain difficulties with medical expressions, lengthiness of sentences, and stereotypical use of a subgroup among people experiencing homelessness (rough sleepers) were also reported.

Conclusions: The co-design process revealed that the participants in the focus groups wanted to actively shape the health information leaflet draft for the oral screening program. They shared their ideas and insights on how to finalize the draft so that it would appeal most to the target audience. Moreover, the involvement of generative AI technology in the co-design process revealed that the participants have heard about the concept of Artificial Intelligence and text generation as its potential function, and they have not rejected its use in healthcare settings. They actively suggested changes to the original text versions to reach the proper level of equitable use, targeting, understanding, and clarity.

Keywords: homelessness, digital health, AI, ChatGPT, co-design, oral health, screening program, focus group, homeless, expert by experience

Introduction

Homelessness and Health

Homelessness is a complex social phenomenon, which leaves individuals for a shorter or longer time in an extremely vulnerable life situation. It comes with strong medical, psychological, mental, and social burdens, not to mention poor health outcomes, limited access to healthcare, and lower levels of health literacy. The COVID-19 pandemic has also increased the vulnerabilities and health risks of people living without adequate housing[1].

According to previous research, homelessness is associated with a significantly higher disease burden[2–4], which goes along with the phenomenon that people without adequate housing options have shorter life expectancy than the general population. In their systematic review, Aldridge et al. found that socially excluded populations have an eight times higher mortality rate for men and 12 times higher for women than the average population[5]. In Western, high-income countries, studies have also shown that homelessness is an independent risk factor for mortality, and life expectancy varies between 50-65 years on average[6].

Oral Health of People Experiencing Homelessness

Previous research on the oral health of people experiencing homelessness also found that this population has poor outcomes, they are in great need of restorative, oral hygiene, and periodontal treatment on one hand, and they have inadequate access to dental services with a reliance on

emergency treatment in parallel with unmet treatment needs on the other hand[7–9]. In the UK, dental health was identified as this group's largest unmet health need [10]. In the United States, a national study of homeless adults utilizing Health Care for the Homeless services found that approximately half of homeless adults had an unmet need for dental care as assessed by tooth or gum problems in the past year[11]. In Australia, Stormon et al. found that compared to the general population, people with socioeconomic disadvantage have higher rates of decayed, missing, and filled teeth and poorer oral health-related quality of life[12]. The latter means that as a further advantage being lost when experiencing homelessness, adequate oral health can bring an individual a greater sense of control, confidence, self-esteem, and social functioning while has been associated with chronic conditions, such as cardiovascular disease, diabetes, and kidney diseases, however, poor oral health is a serious public health issue in itself, too.

Reports of higher rates of substance use (alcohol, tobacco, drugs) further put the oral and general health of people experiencing homelessness at risk[13], which can mean cancerous malignancies and other serious health issues. Freitas et al. found strong associations between having lost half or more of their teeth and evidence of problem drinking, cocaine use, or having ever smoked[11]. In 1997, in Hungary, a screening study found that among 300 participants (230 men and 70 women) either experiencing homelessness or participating in alcohol withdrawal treatment, precancerous lesions were found in or around the oral cavity in 14% of this population, benign tumors in 2.33%, and malignancies in 2.66%[14]. Szabó et al. concluded that their assumption of the association between heavy drinking, smoking, and a higher risk of tumorous diseases of the oral cavity was confirmed[14].

Access to oral care also comes with serious barriers for this population: cost of care for private service providers, lengthy waiting lists for publicly funded institutions, competing priorities, which

might lead them to secure food and accommodation before healthcare, lack of information, mistrust of healthcare systems and experiences of discrimination in care settings all drive people experiencing homelessness away from dental care services, with a reliance on emergency treatment in cases of acute problems[1,12,15,16]. Moreover, psychosocial factors play a significant role: a systematic review found that higher levels of dental anxiety and dental phobia were found in the homeless adult population than in the general population and affected access to dental care[17]. In Toronto, homeless people were over twice as likely as people living on low incomes to attend an emergency department with a non-traumatic dental problem and almost half of those homeless people who did attend an emergency department for dental care made multiple visits[17].

Health Literacy and Information Asymmetry

Lack of information presents a serious problem when it comes to prevention and care in vulnerable populations, especially for people experiencing homelessness. One of the problems is an information asymmetry between general and dental care providers and people experiencing homelessness coupled with lower levels of (oral) health literacy. In our previous study in collaboration with the Digital Health Research Group at Semmelweis University, Budapest, Hungary, we found that difficulties in gaining reliable information from service providers might result in the phenomenon that people experiencing homelessness look up medical information online; they turn to alternative sources of information when not gaining access through institutional sources[15].

In their systematic review, Goode et al. found that in the US, over one-third of homeless adults did not know where to find dental care; and dental services were poorly advertised[17]. Via 25 qualitative interviews with people experiencing homelessness in Canada, Mago et al. found that they believe dentistry is frightening, humiliating, and expensive, and governments are neither sympathetic to their disability nor willing to provide helpful information about community dental clinics or

sufficient dental benefits for their needs[18].

Csikar et al. identified the level of (oral) health literacy as a barrier for people experiencing homelessness who had difficulties understanding letters sent to them. The authors concluded that it impacted their prioritization of oral health as individuals may have yet to understand the importance of oral care or their options for accessing it[13].

Oral Cancer Screening Program

To overcome the barriers to dental care for people experiencing homelessness in Hungary, the Charity Service of the Order of Malta in collaboration with Semmelweis University and Óbuda University has launched an oral cancer screening program with digital capabilities in 2024 in Budapest in one shelter. The initiative fits into the research and outreach agenda of the DocRoom Health Research Program of the Hungarian Charity Service of the Order of Malta, which previously completed a telemedicine pilot project, and integrated it into its care practices; and measured attitude and access characteristics of people experiencing homelessness to digital health technologies[19–23]. Following in the footsteps of the DocRoom Health Research Program and utilizing the advanced digital health solutions in this vulnerable community, the new digital platform Lesionwizard continues the spirit of this previous project, striving to achieve new goals and aims. Lesionwizard was designed to accomplish the oral cancer screening program for people experiencing homelessness using teledentistry.

As the literature shows the potential implications of health screening in dental practice are reductions in morbidity, mortality, and onward cost to healthcare systems by avoiding acute presentations of late-stage chronic disease[24]. Moreover, Nunez et al. found that in the United States, in VA homeless intervention programs during 2008 and 2009, veterans who received dental care were

found to stay in the program significantly longer than veterans who did not. They were significantly more likely to complete the program, obtain a residence, and secure financial stability. Their findings also indicated that the impact of the provision of dental care on outcomes among homeless veterans is equivalent to the impact of psychological treatments for depression[25].

Co-Design and the Use of Artificial Intelligence (AI)

To facilitate participation in the oral cancer screening program, the research team decided to aid the initiative with a health promotion guide. For designing an adequate information leaflet that presents the oral cancer screening program as acceptable, available, and effective for this vulnerable population[12], the research team decided to apply the principles of co-design and the technological assistance of the generative Artificial Intelligence tool, OpenAI's ChatGPT.

Co-design was previously defined as a participatory approach that brings individuals together to collaborate and combine their knowledge, skills, and resources to accomplish a design task[26]. It involves the meaningful engagement of end-users recognized as experts by experience[27]. Previous research has found that co-design, co-creation, or co-production can be empowering for socially marginalized or excluded groups, such as people experiencing homelessness as it acknowledges their views and experiences. Moreover, it is a pivotal approach to tackling stigmatization and promoting inclusivity. Co-design, co-creation, and co-production techniques have resulted in increased applicability and acceptance of research questions, outputs, participants' engagement, increased knowledge of different contexts, and an improved community network for the researcher[28].

Generative Artificial Intelligence software, such as ChatGPT, is a large language model (LLM) combined with a user-friendly interface that uses deep learning algorithms trained on vast amounts of data to generate humanlike responses to user prompts[29]. Its applicability in medicine is currently

under scrutiny but it has great promise in aiding doctor-patient communication. It has performed satisfactorily in answering physician-generated medical queries across 12 distinct specialties, including ophthalmology, dermatology, oncology, infectious disease, neurosurgery, gastroenterology, radiation oncology, trauma surgery, cardiology, anesthesiology, pulmonology, and surgical oncology[30]. It has been shown to generate dermatologic patient education materials according to specific reading levels[29].

Thus, in this research project, we aimed to co-design a health information leaflet for a future oral cancer screening program with people experiencing homelessness living in temporary shelters in Budapest, Hungary. Also, by using all available technological help including ChatGPT to present textual alternatives for this health information piece, we wanted to test the usability of ChatGPT in designing adequate alternatives serving the needs of people experiencing homelessness.

Methods

Participants

Three different focus group discussions were organized to provide feedback regarding patient information materials for a future oral cancer screening program. One of them was an already existing group of experts by experience, and additionally, two other ad hoc groups were formed from clients of social services (either homeless shelters or street outreach teams) operated by the Hungarian Charity Service of the Order of Malta (Budapest, Hungary). The experts by experience group was established in 2023 to assist in co-designing initiatives targeting relevant health issues of people experiencing homelessness. Expert group meetings were organized on a monthly schedule with the attendance of 6-9 experts. The number of participants in the three focus groups was six, ten, and seven, the demography characteristics are shown in Table 1. The focus group discussions took place on May 16, June 4, and July 4, 2024, their length varied between 40 and 55 minutes.

Table 1. Demography characteristics of the focus groups.

Group	Age (years)		Gender	
	Mean	SD	Female	Male
Experts by experience (N=6)	55.83	14.97	1	5
Focus group 2 (N=10)	61.50	7.11	2	8
Focus group 3 (N=7)	53.57	5.19	0	7

Text generation

Six text variants of basic patient information materials for oral cancer screening were generated by the open-access version of ChatGPT 3.5 (OpenAI, San Francisco, CA, USA) on May 13, 2024. The researchers chose OpenAI's freely available product as according to statistics, it is the most widely available[31]. Prompts were applied in English, while the results were required in Hungarian. Each text version was limited to a word count of 150. All prompts emphasized the target population (people experiencing homelessness), the main aim of the text (to raise the level of participation), and a reasoning or style/tonal requirement. These requirements were the following: (1) scientific evidence regarding oral cancer, (2) statistical evidence regarding oral cancer, (3) as motivating as possible, (4) based on an informal, familiar tone, using slang expressions, (5) formatted as a clickbait news article, and (6) structured in a bullet-point format. The prompts used in this study are listed as Supplementary Material S01.

Feedback questionnaires and semi-structured group discussions

A 2-part short feedback questionnaire developed by the research team was used to quantify different aspects of AI in general and AI-generated text variants, while it was also used to catalyze an open group discussion. The first part consisted of three items and asked about (1) whether the participants have heard about AI (in a Yes or No scheme), (2) self-assessment on the knowledge regarding AI

technology (on a 5-point Likert scale), (3) and trust in its use in healthcare settings (on a 5-point Likert scale). The second part included each text variant with seven items. Assessment of understandability and clarity, the quality of information content, the tone and style of the texts, as well as the convincing factor, was conducted on a 5-point Likert scale. Lastly, three open questions inquired about the strengths and weaknesses of the texts, any changes suggested, and the applicability of the texts in the screening program. The quantified values were obtained in paper and pencil form, while answers to open questions were discussed by the group members, and notes were taken by the research team.

Ethics

Participation in the focus group discussion was on a voluntary basis. After a verbal summary of the study tasks, oral consent was obtained from all members of the group and fill-out questionnaires were collected anonymously. During the focus group discussions, no drop-out occurred.

Results

General Acceptance of Artificial Intelligence

During the focus group discussions, participants were asked about AI technology as a starting point. 74 percent of participants (N=17/23) stated they had heard about AI in a Yes or No scheme. On a 5-point Likert scale asking about the extent of their knowledge of AI, they were more hesitant resulting in an average of 2.38 (N=16), where 1 was not familiar at all and 5 was totally familiar. As examples of the possible functions of AI, text or picture generation was mentioned the most (eight times), and in three cases, AI-generated content was attributed as “fake”, or “not real” (*“I know it can also generate fake photos”).*

After a general impression of AI, its application in healthcare was also discussed. For the question *Would you trust in AI-generated medical texts, documents, or tools?*, the answers averaged

3.06 (N=16) on a 5-point Likert scale (where 1 was no trust at all and 5 was complete trust). When participants were asked about the reasoning behind their answers, the need for human involvement was emphasized concerning decision-making regarding health issues. (*"Even if it was created by humans, machines can have errors, so I would have less confidence in it if my health would be at stake." / "I have no opposition regarding Artificial Intelligence if they use it as a helping tool but it would be frightening for me if it would make decisions without human oversight.").*

Applicability of Text Variants

In the following part of the focus group discussions, the AI-generated text variants were presented. As the first step before using these texts, two independent researchers reviewed the AI-generated draft text variants. Modifications were applied in only two cases due to severe grammatical errors in the Hungarian language that limited the integrity of these texts. Otherwise, all variants were intact and brought to the focus groups in their original form. The source of each piece was clarified for members of the groups only during the closure of group sessions.

First, participants were asked to provide general feedback on the applicability of each text variant in the context of a future oral cancer screening program. Scores measured on a 5-point Likert scale were detected in four dimensions (understandability and clarity, the quality of information content, the tone and style of the texts, and their convincing factor), and the results are shown as the average of these four items. During the first focus group discussion with experts by experience, all six variants were presented to the group.

Although the expert group members were highly positive regarding all variants, there were slight differences in the scoring of text versions. The ranking turned out to be the following: (1st) scientific reasoning (4.92, N=6), (2nd) informal, familiar tone (4.83, N=6), (3rd) focusing on motivation (4.75, N=6), (4th) clickbait news article style (4.71, N=6), (5th) statistical reasoning (4.67, N=6), (6th) bullet-point format (4.63, N=6). Participants were also asked to agree on the two

most promising text variants that represented the highest opportunity to raise the attendance rate according to their experience. Consensus was made after a short discussion resulting in the variant based on scientific reasoning as the first, and the informal, familiar version as the second without knowing the quantitative results. Participants were convinced that different text variants could address different subgroups of people experiencing homelessness (*"The familiar one will motivate the youth more. It sounds not so official."*).

After the first focus group discussion, two text variants (No. 2 with statistical reasoning and No. 6 with a bullet-point format) were removed from the pool as these were highly redundant according to the previous participants, and going through six texts challenged their attention, limiting the effectiveness of group discussions. All four other variants were presented to both remaining focus groups in the same form.

Participants of the latter two group discussions (N=17) were more critical in all aspects of the quantitative survey. The results of the 5-point Likert scale scoring were the following: (1st) informal, familiar tone (3.77, N=13), (2nd) focusing on motivation (3.69, N=15), (3rd) scientific reasoning (3.69, N=16), (4th) clickbait news article style (3.50, N=12).

Strengths and Weaknesses of AI-generated Content

After scoring all text versions, an open discussion took place. Although all group discussions concluded that the texts are almost fully understandable (*"I can totally get what they are speaking about." / "The main point is clear, even, if there are difficult words."*), there were suggestions for certain changes related to wording for the ease of reading. The replacement of a medical expression (from "oral cancer" to "mouth cavity tumor" as the latter is a more commonly used term by the general population in the Hungarian language) was mentioned seven times and affected all variants, while words with Latin roots ("informing" and "early staging") were advised to change to a more widely used expression one time each.

Also, the lengthiness of sentences as a factor of raising gaps in readability was mentioned two times in the context of the versions based on scientific and statistical reasoning. Furthermore, participants accommodated in night shelters and other temporary housing solutions mentioned that the phrasing in two-thirds of text variants (N=4/6) was not inclusive enough as the term “rough sleepers” was used as a synonym for the homeless population and this might result in alienation (*“They say people living on the streets only. That’s not very motivating for me who is living in a shelter.”*).

Based on the focus group discussions, the research group summarized the main strengths and weaknesses of text variants created by ChatGPT 3.5 in Table 2.

Table 2. Evaluation of strengths and weaknesses of ChatGPT-generated health information content.

Strengths	Weaknesses
It is easy to generate many text outputs with open-access tools quickly.	Text variants repeat the same problems (e.g., words difficult to understand for vulnerable populations).
The results are almost ready to use, with minimal modification needed from the textual coherence point of view (in the Hungarian language).	The motivational elements of text variants were stereotypical to a subgroup of people experiencing homelessness (rough sleepers) and lacking other prominent subgroups (e.g., people accommodated in community shelters or temporary hostels).
In most cases, participants were positive about whether the texts could fulfill their goal of motivating the target population to attend the program.	A level of disapproval appeared mostly regarding AI-based decision-making processes concerning health issues.
Text variants in various tones and styles can attract different age groups.	

No significant opposition was detected against AI-created content from people experiencing homelessness.	

Discussion

Applicability of Generative Softwares in Healthcare

Many fields of possible applications have been raised in using generative Artificial Intelligence in clinical settings, such as writing discharge summaries[32], medical notes based on transcripts of physician-patient encounters, summaries of laboratory test results[33], medical education[34], medical research[35], providing a communication platform for patients, or facilitating health information dissemination[36]. One of the most obvious applications is generating tailored patient information on a pre-determined topic, as collecting massive amounts of available scientific data on different topics and human-like reasoning is easily achievable with open-access versions of generative softwares. Moreover, ChatGPT and LLMs with a chatbot interface proved to be most useful not in churning out content as hallucinations might hinder their efficacy in that area, but in generating articulated texts with elaborated stylistic components in a predetermined topic[37]. That is the reason why they can be useful in patient information dissemination campaigns, such as a health promotion guide for a future oral cancer screening program for people experiencing homelessness.

However, vulnerable populations might have different contexts, motivations, challenges, and medical needs than the general population, and often require tailored medical treatment approaches to ensure the safety and efficacy of the treatment alongside potentially optimal health outcomes[38]. This consideration is currently highly underrepresented in generative AI usability studies. This paper aimed to investigate the viability of using AI-generated content for people experiencing homelessness as the target group.

Vulnerable Groups and their Knowledge and Trust around AI

In healthcare, underserved subgroups of people are known to have limited access to care pathways and possess altered demands in addition to an existing systematic information asymmetry as our previous studies also revealed[15]. As the results showed, anxiety, misunderstanding, discrimination, and negative experiences related to this information deficit could be compensated by using AI technology for patient information provision and later on, dissemination. Better usability of such services might play an important role in a more equitable management of health issues. Moreover, the usage of ChatGPT might unburden healthcare personnel tasked with the formulation of patient information as part of creating a screening program, as creating a health information leaflet with appropriate prompts takes significantly less time than building one from scratch. However, as a potential downside of relying on the technology, it is questionable whether and for how long the subscription-based model of OpenAI or any other generative software development companies allow vulnerable populations to benefit from the advantages of generative AI in the future.

Our study recruited people experiencing homelessness, one of the most underserved populations. The randomly invited study participants had a non-negligible prior knowledge of AI technology's existence, although they self-evaluated their knowledge as slightly below average. Interestingly, as examples of potential functions of AI, they mentioned text or picture generation the most, which might suggest that the knowledge about generative AI technology has already permeated Hungarian society, and also reached the most vulnerable population of Hungarian society associated with much slower technological uptake than in the case of the general population due to several accessibility barriers. Previous research shows that people with lower socioeconomic status are slower to adopt new technology, and the rates of smartphone and internet use of people experiencing homelessness were lower than for those with similarly low socioeconomic status but more stable housing[15,39]. An international, multicenter, cross-sectional study assessing the attitudes of hospital patients towards AI in healthcare across 43 countries, including Hungary, in 2023 found that patients

have a predominantly favorable general view of AI in healthcare, with 57.6% of respondents expressing a positive attitude[40]. In Hungary, a representative survey published in September 2024 found that 79 percent of the population believed they knew what Artificial Intelligence was, and 31 percent of respondents used chatbots and virtual customer service assistants[41].

In terms of positive or negative perceptions towards the medical use of Artificial Intelligence, the answers resulted slightly above average meaning that they might be hesitant or neutral to trust such services but do not reject them outright. However, for some individuals, AI-based decision-making was mainly acceptable only with human oversight in health-related issues. This is in line with the findings of the Digital Health Research Group at Semmelweis University which conducted a representative questionnaire survey in 2024 about the knowledge, attitudes, and potentials of digital health solutions in the Hungarian population[42]. In this survey, researchers asked respondents how would they feel if their family doctor or any of their medical specialists would partly rely on Artificial Intelligence during their care. 41.2 percent of the respondents said that they would be neutral, 27.5 percent said they would feel rather bad or very bad, while 31.3 percent said they would feel rather well or very well about it.

Text Quality Evaluation

The ChatGPT-generated draft text variants had to be modified by the researchers as these versions contained a minimal number of severe grammatical errors in the Hungarian language, however, after such modifications were made, the texts were presentable and positively accepted by the focus groups. This might be the result of generative AI software being most predominantly trained on Standard English language texts and that in the case of small languages, such as Hungarian, there is limited data available online for model training, and thus, large language models perform worse in such a “low resource” language compared to English, or “high resource” languages such as Spanish, Chinese, or Arabic[43].

This could also partly explain why the wording in such small languages might not be as sophisticated and considerate as in English language texts. This was expressed by focus group participants as they evaluated the tone and style of the generated text variants. They generally found that the various styles and tones might attract various subgroups and generations of people experiencing homelessness, however, they also noted that the motivational elements of text variants were stereotypical to a subgroup of people experiencing homelessness (rough sleepers) and lacking other prominent subgroups (e.g., people accommodated in community shelters or temporary hostels). This could partly stem from the generalization bias challenge of large language models, such as the one behind ChatGPT. These models are trained on large datasets that may contain biases, stereotypes, and prejudiced language[44]. As a result, the model may unintentionally learn these biases and produce responses that are offensive or perpetuate harmful stereotypes, such as the one about people experiencing homelessness represented as rough sleepers.

Co-design with Experts by Experience and Technology

In recent years, co-design, co-creation, co-production, or different forms of citizen engagement and collaboration of stakeholders have gained popularity in various fields, including social services for people experiencing homelessness [45], for different objectives: more efficient and customer-oriented services, activated and “empowered” clients, as well as more democratic legitimacy for the governance process and the decisions made[45]. All these terms have the underlying assumption that active involvement ensures that lay people have a voice in shaping work that affects them directly, creating respectful relationships across societal hierarchies[46]. Moreover, the involvement of individuals with lived experience has been shown to increase recruitment and follow-up rates in research projects, add to the validation of research findings, and generate more useful outputs[46,47]. This research project underpins these previous findings, as the involvement of the experts by experience group as well as two focus groups generated useful insights for the creation

of a health information leaflet for a planned oral screening program in terms of textual content, style, and tones.

This experimental mixed-method study was also a terrain to bring in generative Artificial Intelligence technology in the co-design process as a potential new tool for the consideration of personnel working in the social or health sectors dealing with vulnerable subgroups, who might not have the financial resources, time or energy to create finely tuned health information leaflets for health screening programs. It turned out that ChatGPT could produce usable material as a solid base for a health information leaflet draft, which was acceptable for the participants in the focus groups and the experts by experience group as well.

Limitations

Our study had some limitations. As a qualitative study relying on focus groups and feedback questionnaires, the methods themselves posed certain drawbacks. While focus groups encourage participation from vulnerable populations and do not rely on participant literacy, they offer a space where those individual perspectives that dissent from the majority opinion might remain hidden due to overriding behavioral or cultural norms, or a desire to be seen as conforming[48,49].

The study participants were selected from the urban homeless population from Budapest, Hungary, where socioeconomic conditions might differ from those in the countryside. Also, participants represented people experiencing homelessness who had a connection to the social infrastructure, thus others not in touch with the Hungarian social service architecture were not represented in the study sample. For a qualitative study using focus groups and feedback questionnaires, the sample size was small, and this should be taken into account when making conclusions.

Regarding technology, the researchers used OpenAI’s freely accessible technology, ChatGPT, while other generative AI software, such as Google’s Gemini (previously Bard), Claude, or Synthesia

were not utilized. This decision was made as ChatGPT has become perhaps the most widely known generative AI software[31], which also carried with it the understanding that vulnerable populations, for whom technologies are harder to access, could familiarize themselves with it[21].

The use of ChatGPT, or any other generative software for that matter, also raises the question of replicability: with the constant and rapid development of LLMs and their user interfaces, together called generative AI software, it might become uncertain whether this research could be replicated with the same technological conditions.

Conclusions

Our study revealed that health information materials generated by Artificial Intelligence can be used among people experiencing homelessness keeping in mind the objective of raising the attendance level in a future oral screening program. Although the realization of the latter we cannot investigate in the framework of the current research project, the co-design process revealed that the participants in the focus groups and the experts by experience group wanted to actively shape the draft for the screening program, shared their ideas and insights in how to finalize the text to avoid prevailing stereotypes about people experiencing homelessness and include more subgroups; and to frame it for various target audiences.

Moreover, the involvement of generative Artificial Intelligence software in the co-design process revealed that the participants have heard about the concept of Artificial Intelligence, as functions of AI, text, or image generation were mentioned, and they have not rejected its use in the design process of the health information leaflet. They actively suggested changes to the original text versions where it was needed to reach the proper level of understanding and clarity.

The group discussion also revealed some challenges of current LLM technology, specifically the production of suboptimal text in languages other than English, generalized language use not considering populations with various literacy and language skills, and stereotypical generalizations

about underrepresented socioeconomic groups such as people experiencing homelessness. Based on our results, the update of LLM technology considering the health literacy and general language skills of vulnerable populations and avoiding generalization bias for this underrepresented group would be beneficial for future applications.

In summary, our research project found that generative Artificial Intelligence technology, such as ChatGPT might be a useful tool in the future in the hands of personnel working in the social or health sectors dealing with vulnerable subgroups as it is widely available, easy to use, and the produced text is usable after minimal modifications are made. It might decrease the amount of time that the production of a health information leaflet would undertake, and via co-creation by the members of the target audience, the final product might be more appealing to the target group of a health screening program. As a recommendation for its efficient use, it would be worth considering the extension of the prompting experiences of personnel working in the social or health sectors to maximize the impact of AI in client care.

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Conflict of Interest

None declared.

Abbreviations

AI: Artificial Intelligence

HCSOM: Hungarian Charity Service of the Order of Malta

LLM: Large Language Model

References

1. Bedmar MA, Bennasar-Veny M, Artigas-Lelong B, Salvà-Mut F, Pou J, Capitán-Moyano L, García-Toro M, Yáñez AM. Health and access to healthcare in homeless people: Protocol for a mixed-methods study. Medicine (Baltimore) 2022 Feb 18;101(7):e28816. PMID:35363172
2. Schreiter S, Bermpohl F, Krausz M, Leucht S, Rössler W, Schouler-Ocak M, Gutwinski S. The Prevalence of Mental Illness in Homeless People in Germany. Dtsch Arzteblatt Int 2017 Oct 6;114(40):665–672. PMID:29070426
3. Zhang L, Norena M, Gadermann A, Hubley A, Russell L, Aubry T, To MJ, Farrell S, Hwang S, Palepu A. Concurrent Disorders and Health Care Utilization Among Homeless and Vulnerably Housed Persons in Canada. J Dual Diagn 2018;14(1):21–31. PMID:29494795
4. Graffy P, McKinnon S, Lee G, Remington P. Life Outside: A Narrative Ethnographic Inquiry into the Determinants of Homelessness. J Poverty 2018 Dec 13;23:1–27. doi: 10.1080/10875549.2018.1550133
5. Aldridge RW, Story A, Hwang SW, Nordentoft M, Luchenski SA, Hartwell G, Tweed EJ, Lewer D, Vittal Katikireddi S, Hayward AC. Morbidity and mortality in homeless individuals, prisoners, sex workers, and individuals with substance use disorders in high-income countries: a systematic review and meta-analysis. Lancet Lond Engl 2018;391(10117):241–250. PMID:29137869
6. van Dongen SI, van Straaten B, Wolf JRLM, Onwuteaka-Philipsen BD, van der Heide A, Rietjens JAC, van de Mheen D. Self-reported health, healthcare service use and health-related needs: A comparison of older and younger homeless people. Health Soc Care Community 2019 Jul;27(4):e379–e388. PMID:31020738
7. Beaton L, Coles E, Freeman R. Homeless in Scotland: An Oral Health and Psychosocial Needs Assessment. Dent J 2018;6(4):67. PMID:30513713
8. Daly B, Newton T, Batchelor P, Jones K. Oral health care needs and oral health-related quality of life (OHIP-14) in homeless people. Community Dent Oral Epidemiol 2010 Apr;38(2):136–144. PMID:20074294
9. Rl F, Sw H, C Q. Dental health of homeless adults in Toronto, Canada. J Public Health Dent J Public Health Dent; 2013 Winter;73(1). PMID:22881462
10. Simons D, Pearson N, Movasaghi Z. Developing dental services for homeless people in East London. Br Dent J 2012 Oct;213(7):E11. PMID:23059693
11. Freitas DJ, Kaplan LM, Tieu L, Ponath C, Guzman D, Kushel M. Oral health and access to dental care among older homeless adults: results from the HOPE HOME study. J Public Health Dent 2019;79(1):3–9. PMID:30295922
12. Stormon N, Pradhan A, McAuliffe A, Ford PJ. Does a facilitated pathway improve access to dental services for homeless and disadvantaged adults? Eval Program Plann 2018 Dec 1;71:46–50. doi: 10.1016/j.evalprogplan.2018.08.002
13. J C, K V-C, Jm R, J T, St S, Gva D. Identifying the barriers and facilitators for homeless people to achieve good oral health. Community Dent Health Community Dent Health; 2019 May 30;36(2). PMID:31070874
14. Szabó G, Klenk G, Veér A. [Correlation between the combination of alcohol consumption and smoking in oral cancer (screening of the population at risk)]. Orv Hetil 1997;138(52):3297–

3299. PMID:9463184
15. Radó N, Békási S, Győrffy Z. Health Technology Access and Peer Support Among Digitally Engaged People Experiencing Homelessness: Qualitative Study. JMIR Hum Factors 2024 May 14;11:e55415. PMID:38743937
16. Liu M, Hwang SW. Health care for homeless people. Nat Rev Dis Primer 2021;7(1):5. PMID:33446661
17. Goode J, Hoang H, Crocombe L. Homeless adults' access to dental services and strategies to improve their oral health: a systematic literature review. Aust J Prim Health 2018 Jul 9; PMID:29983138
18. Mago A, MacEntee MI, Brondani M, Frankish J. Anxiety and anger of homeless people coping with dental care. Community Dent Oral Epidemiol 2018 Jun;46(3):225–230. PMID:29446849
19. Békási S, Girasek E, Győrffy Z. Telemedicine in community shelters: possibilities to improve chronic care among people experiencing homelessness in Hungary. Int J Equity Health 2022 Dec 17;21:181. PMID:36528777
20. Győrffy Z, Békási S, Döbrössy B, Bognár VK, Radó N, Morva E, Zsigri S, Tari P, Girasek E. Exploratory attitude survey of homeless persons regarding telecare services in shelters providing mid- and long-term accommodation: The importance of trust. PloS One 2022;17(1):e0261145. PMID:34990458
21. Radó N, Girasek E, Békási S, Győrffy Z. Digital Technology Access and Health-Related Internet Use Among People Experiencing Homelessness in Hungary: Quantitative Survey. J Med Internet Res 2022 Oct 19;24(10):e38729. doi: 10.2196/38729
22. Uhrin E, Domokos Z, Czumbel LM, Kói T, Hegyi P, Hermann P, Borbély J, Cavalcante BGN, Németh O. Teledentistry: A Future Solution in the Diagnosis of Oral Lesions: Diagnostic Meta-Analysis and Systematic Review. Telemed J E Health 2023 0;29(11):1591. PMID:36976779
23. Németh O, Simon F, Benhamida A, Kivovics M, Gaál P. eHealth, teledentistry and health workforce challenges: results of a pilot project. BMC Oral Health 2022 Dec 1;22(1):552. doi: 10.1186/s12903-022-02603-6
24. Doughty J, M. Gallier S, Paisi M, Witton R, J. Daley A. Opportunistic health screening for cardiovascular and diabetes risk factors in primary care dental practices: experiences from a service evaluation and a call to action. Br Dent J Nature Publishing Group; 2023 Nov;235(9):727–733. doi: 10.1038/s41415-023-6449-6
25. Nunez E, Gibson G, Jones JA, Schinka JA. Evaluating the Impact of Dental Care on Housing Intervention Program Outcomes Among Homeless Veterans. Am J Public Health American Public Health Association; 2013 Dec;103(S2):S368–S373. doi: 10.2105/AJPH.2012.301064
26. Sanders E. From user-centered to participatory design approaches. Des Soc Sci Mak Connect 2002. p. 1–7. doi: 10.1201/9780203301302.ch1ISBN:978-0-415-27376-3
27. Visser FS, Stappers PJ, van der Lugt R, Sanders EB-N. Contextmapping: experiences from practice. CoDesign Taylor & Francis; 2005 Apr 1;1(2):119–149. doi: 10.1080/15710880500135987
28. Rodriguez A, Shambhunath S, Wijesiri TID, Biazus-Dalcin C, Mc Goldrick N. Co-design of health educational materials with people experiencing homelessness and support workers: a scoping review. Front Oral Health 2024 Jun 11;5:1355349. PMID:38919732
29. Lambert R, Choo Z-Y, Gradwohl K, Schroedl L, Ruiz De Luzuriaga A. Assessing the Application of Large Language Models in Generating Dermatologic Patient Education Materials According to Reading Level: Qualitative Study. JMIR Dermatol 2024 May 16;7:e55898. PMID:38754096
30. Jl J, B N, Ky S. Assessment of readability and content of patient-initiated google search results for epidermolysis bullosa. Pediatr Dermatol Pediatr Dermatol; 2019 Nov;36(6). PMID:31468562
31. Liu Y, Wang H. Who on Earth Is Using Generative AI ? Washington, DC: World Bank; 2024. doi: 10.1596/1813-9450-10870
32. Patel SB, Lam K. ChatGPT: the future of discharge summaries? Lancet Digit Health Elsevier;

2023 Mar 1;5(3):e107–e108. PMID:36754724
33. Benefits, Limits, and Risks of GPT-4 as an AI Chatbot for Medicine | New England Journal of Medicine. Available from: https://www.nejm.org/doi/full/10.1056/NEJMsr2214184 [accessed Oct 11, 2024]
34. Preiksaitis C, Rose C. Opportunities, Challenges, and Future Directions of Generative Artificial Intelligence in Medical Education: Scoping Review. JMIR Med Educ 2023 Oct 20;9(1):e48785. doi: 10.2196/48785
35. Keykha A, Behravesh S, Ghaemi F. ChatGPT and Medical Research: A Meta-Synthesis of Opportunities and Challenges. J Adv Med Educ Prof 2024 Jul;12(3):135–147. PMID:39175584
36. Fatima A, Shafique MA, Alam K, Fadlalla Ahmed TK, Mustafa MS. ChatGPT in medicine: A cross-disciplinary systematic review of ChatGPT's (artificial intelligence) role in research, clinical practice, education, and patient interaction. Medicine (Baltimore) 2024 Aug 9;103(32):e39250. PMID:39121303
37. Azamfirei R, Kudchadkar SR, Fackler J. Large language models and the perils of their hallucinations. Crit Care 2023 Mar 21;27(1):120. doi: 10.1186/s13054-023-04393-x
38. Tao H, Liu L, Cui J, Wang K, Peng L, Nahata MC. Potential Use of ChatGPT for the Treatment of Infectious Diseases in Vulnerable Populations. Ann Biomed Eng 2024 Aug 12; doi: 10.1007/s10439-024-03600-2
39. Raven MC, Kaplan LM, Rosenberg M, Tieu L, Guzman D, Kushel M. Mobile Phone, Computer, and Internet Use Among Older Homeless Adults: Results from the HOPE HOME Cohort Study. JMIR MHealth UHealth 2018;6(12):e10049. PMID:30530464
40. Busch F, Hoffmann L, Xu L, Zhang L, Hu B, García-Juárez I, Toapanta-Yanchapaxi L, Gorelik N, Gorelik V, Rodriguez-Granillo G, Ferrarotti C, Thi C, Tuncel M, Kaya G, Solís-Barquero S, Avila M, Ivanova N, Kitamura F, Kader R. Multinational attitudes towards AI in healthcare and diagnostics among hospital patients. 2024. doi: 10.1101/2024.09.01.24312016
41. Broadest Ever Research on AI Readiness in Hungary Published - ITBUSINESS. 2024. Available from: https://itbusiness.hu/english/research-on-ai-awareness-in-hungary/ [accessed Oct 21, 2024]
42. Győrffy Z, Girasek E. E-páciensek Magyarországon, 2024. Reprezentatív felmérés a digitális egészségügyi megoldásokkal kapcsolatos tudásról, attitűdökről, lehetőségekről a magyar lakosság körében. 2024.
43. Nicholas G, Bhatia A. Lost in Translation: Large Language Models in Non-English Content Analysis. arXiv; 2023. doi: 10.48550/arXiv.2306.07377
44. Ray PP. ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope. Internet Things Cyber-Phys Syst 2023 Jan 1;3:121–154. doi: 10.1016/j.iotcps.2023.04.003
45. Meriluoto T. Between Expertise and Authenticity : Co-creation in Finnish Housing First Initiatives from the Perspective of Experts-by-experience. Eur J HOMELESSNESS 2018;12(1):61–83.
46. Crooks J, Flemming K, Shulman C, Casey E, Hudson B. Involving people with lived experience of homelessness in palliative and end of life care research: key considerations from experts in the field. Res Involv Engagem 2024 Jan 30;10(1):16. doi: 10.1186/s40900-024-00549-3
47. Staley K. 'Is it worth doing?' Measuring the impact of patient and public involvement in research. Res Involv Engagem 2015 Jul 31;1(1):6. doi: 10.1186/s40900-015-0008-5
48. Kitzinger J. Qualitative Research: Introducing focus groups. BMJ British Medical Journal Publishing Group; 1995 Jul 29;311(7000):299–302. PMID:7633241
49. Rice PL, Ezzy D. Qualitative Research Methods: A Health Focus. South Melbourne, Australia: Oxford University Press;

Supplementary Files

Multimedia Appendixes

Supplementary Material S01.
URL: http://asset.jmir.pub/assets/3d342f2d296f85b3b60f2a592b4b48b0.docx

TOC/Feature image for homepages

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