Evaluating User's Perception and Impact of Neighborhood Smart Tiny Homes for Equity and Engagement

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Abstract

Smart Tiny Homes (STHs) are micro-infrastructure-based digital equity centers in a local community with privacy enhancing technology, internet access, loaner devices, and in-person digital support within a short walk of disadvantaged areas. While internet infrastructure is widely accessible, residents still lack access to digital devices, digital skills, privacy protection, and technical support. This research assesses STH user perceptions and effective telehealth and digital learning readiness. We will use a quasi-experimental design with mixed-methods across three communities where STHs have been implemented and surrounding areas. A sample of about 300 adults (users and potential non-users) will be identified and recruited through community and partner outreach, posters, and invitations. Quantitative data will be collected using validated instruments measuring digital access, telehealth readiness, digital self-efficacy, perceived usefulness, trust, privacy confidence, and usability. In-depth interviews with residents, digital navigators, and community partners will elicit barriers, facilitators, and user experiences.

Fidelity will be measured via checklists on staffing, hours of operation, device availability, uptime, and utilization. Analysis will comprise ANCOVA, independent t-tests, and regression models adjusted for socioeconomic status and pre-intervention digital literacy, as well as qualitative data analysis. The primary outcomes will be telehealth readiness and digital self-efficacy; secondary outcomes will be portal use self-efficacy, intention to reuse, and community participation. This will inform the capacity of STHs to offer a sustainable, community oriented approach to improving digital health and community computer services.

Keywords: Smart Tiny Homes, Telehealth Readiness, Digital Literacy, Digital equity, Neighborhood micro-infrastructure.

1. Introduction

Digital technologies are having a growing influence on access to healthcare, education, and social services, with telehealth being a key driver to extend the delivery of healthcare access beyond traditional care settings. Telehealth has shown the possible benefit of reducing geographical, transportation, and time related barriers to care, especially during the Covid-19 pandemic, during which remote healthcare delivery became a requirement rather than an option [1, 2]. Despite this booming expansion of telehealth use, there are inequalities in both adoption and persistence along socioeconomic, demographic, and geographic barriers.

A growing amount of research suggests that digital inequity goes beyond the availability of broadband infrastructure. There are barriers shown to access, such as a lack of appropriate devices, a lack of digital confidence, privacy issues, a lack of trust, and a lack of support that will have a significant impact on whether individuals can engage meaningfully with digital health technologies [3, 4]. These challenges are particularly acute in underserved neighborhoods, where there may be limitations in the household environment to support the levels of privacy and reliable connectivity and technical support around video based care and digital learning [5]. As a result, communities that need telehealth services the most have some of the lowest levels of sustained use.

Smart home technologies have been suggested as one of the ways to support access to health and independent living by incorporating smart devices for connectivity, monitoring, and assistive systems into the built environment. Prior research has shown that smart homes can increase the ability of people to age in place, cope with chronic illness, and monitor their health when usability and privacy are appropriately addressed [6, 7]. However, most smart home implementations target individual households and always assume baseline digital skills, stable internet access, and individual technology ownership - which limit their application in marginalized communities [8]. As such, such approaches can result in a de facto confirmation of existing inequities, instead of reducing them.

Community-based digital inclusion efforts have come to recognize the importance of combining a technological infrastructure with human centered support. Evidence has consistently shown that programs using digital skills training, trusted intermediaries, and personalized help are more effective than technology only inclusive interventions [9, 10]. Nevertheless, community access points commonly used, such as libraries or public Wi-Fi locations, are often of concern in that they are associated with privacy, reliability, and comfort constraints, especially for sensitive healthcare interactions [11]. These limitations point out the need for other models that integrate privacy, accessibility, and engagement on the neighborhood level.

Neighborhood Smart Tiny Homes (STHs) are a new model of micro-infrastructure that envisions housing as a community resource (rather than a residential unit in isolation). Positioned within walking distance of residents, STHs can serve as neighborhood hubs offering spaces for privacy, connectivity, device lending, and on-site digital support. This localised approach is in line with social and digital determinants of health frameworks, which prioritize multi-level interventions that address the ability of individuals, local community contexts, and structural barriers at the same time [3, 12]. By projecting caretaking of technology in trusted neighbourhood locations, Smart Tiny Homes might improve equity and create long lasting community engagement. Despite the growing interest in smart housing and digital equity interventions, there is little empirical evidence assessing Smart Tiny Homes from a user centered point of view. In particular, limited knowledge is available on how residents themselves perceive such hubs, how perceptions of usefulness, trust, and privacy affect engagement, and whether Smart Tiny Homes play an important role in improving telehealth readiness and digital self-efficacy. Existing studies tend to focus on the feasibility of technology or accessibility of services and leave loopholes in the understanding of user experiences and engagement mechanisms through which real-world impact occurs.

This study addresses these gaps by assessing user perceptions as well as the effect of Neighborhood Smart Tiny Homes on equity and engagement. Specifically, it focuses on the effect of Smart Tiny Homes on telehealth readiness, digital self-efficacy, and community participation, comparing the perceptions and outcomes between users and eligible non-users. The scope of the study is localized to areas that host Smart Tiny Homes and deals with perception-based and engagement outcomes, and not clinical health outcomes. While findings may not be generalizable to the entire community, the work really does offer important insights regarding the ways in which neighborhood scale digital infrastructure may enable equitable and meaningful digital engagement.

2.0 Conceptual Framework

To examine these relationships systematically, this study is guided by an Equity-Engagement-Technology conceptual framework that describes the effect that Neighborhood Smart Tiny Homes (STHs) have on digital equity and community engagement by user centered mechanisms (Figure 1). The framework posts Smart Tiny Homes as neighborhood scale micro-infrastructure interventions whose impact depends not merely upon access to technology but additionally upon the way residents see the technology and how they work with these resources.

At the base of the framework lies technology and infrastructure (privacy-ready technology spaces for telehealth, reliable broadband connectivity, device lending, and smart/home tires/connections being the key technology embedded within smart tiny homes). While these resources are a necessary input for digital participation, previous studies indicate that access is not usually enough to contribute to long-term adoption and use, especially in underserved communities [3, 9].

The framework therefore, focuses on mechanisms for engagement, with a particular focus on human-centered support, by, for example, navigator-led coaching, on-site support, and digital skills training. These supports act as a bridge between infrastructure and use by helping residents to build confidence, overcome technical barriers, and build trust in digital services [10, 13].

Closely related are user perceptions, such as perceived usefulness, ease of use, trust (privacy and security), comfort, and perceived relevancy of the community. These perceptions affect motivation and willingness to engage and strongly influence adoption and sustained participation in digital health tools [7, 14]. All relationships in the framework exist in the context of equity, characterized by elements such as socioeconomic status, baseline digital literacy, prior technology exposure, cultural relevance, and neighborhood trust. Drawing on the frameworks of social and digital determinants of health, the concept of equity is discussed as a moderating context of the opportunities and distribution of health benefits across individuals and communities by Smart Tiny Homes [3, 12].

Primary outcomes are telehealth readiness and digital self-efficacy, and secondary outcomes are utilization, sustained engagement, and perceived community benefit.

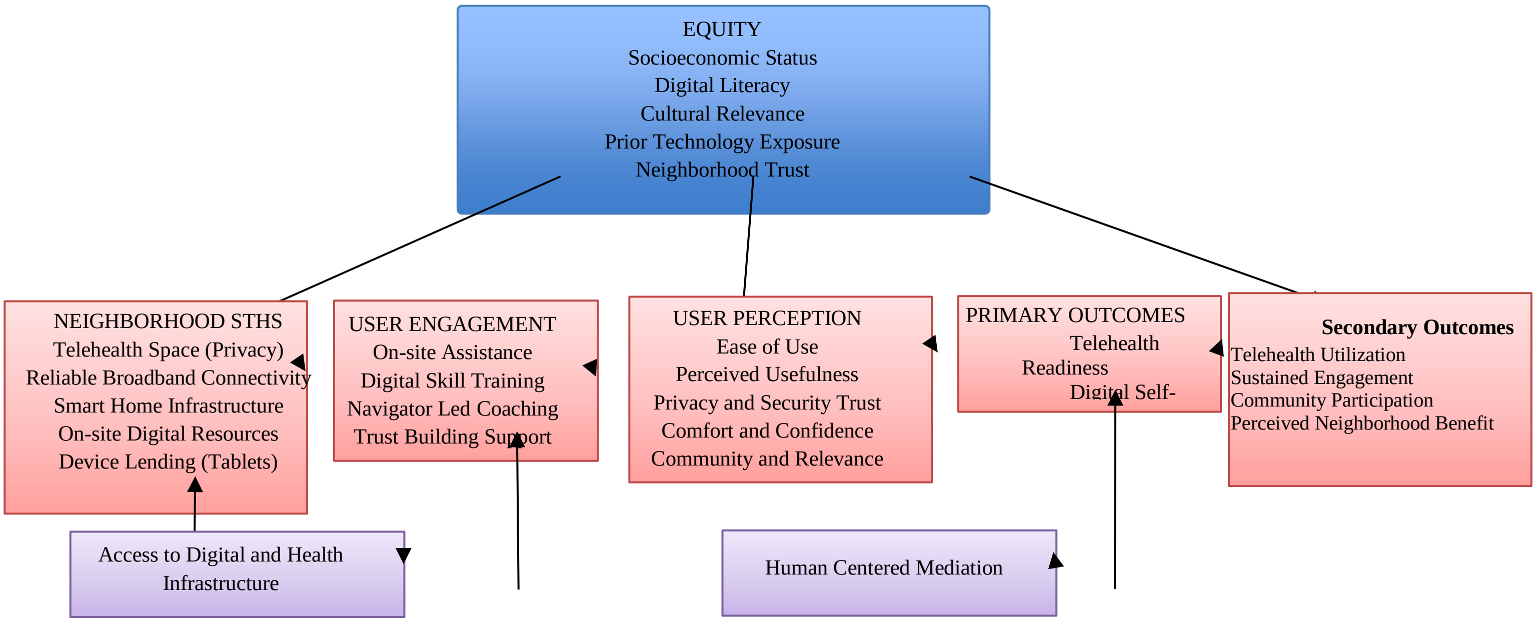

Figure 1. Conceptual Framework of STHs

3.0 Materials and Methods

A. Study Design

This study adopts a mixed-methods, quasi-experimental evaluation design to assess user perceptions and engagement outcomes across three neighborhoods over a 6-month data collection period. The design compares STH users with eligible non-users residing in the same neighborhoods to isolate perception-based and engagement-related differences attributable to STH exposure rather than broader neighborhood conditions [1,9].

B. Study Setting and Participants

The study is conducted in neighborhoods hosting operational Smart Tiny Homes that function as community micro-infrastructure hubs. Approximately 300 participants include adult residents

(≥18 years) who actively use STH services and eligible non-users living within walking distance of the STHs. Participants will be recruited through community outreach, flyers, door to door invitations, etc., and small appreciation incentives may be offered. This approach aligns with community-based digital equity research emphasizing localized, place-based interventions [5]. The study will be conducted in three urban neighborhoods where operational tiny smart hmes are installed.

C. Data Collection

(A) Quantitative Surveys

Structured surveys using validated questionnaires are administered to both users and non-users. Survey domains include digital access barriers, telehealth readiness, digital self-efficacy, perceived usefulness, ease of use, privacy, and trust. These constructs are grounded in prior telehealth equity and digital literacy research. Surveys will adapt validated measures from the Technology Acceptance Model, eHealth Literacy Scale, and telehealth readiness instruments.

(B) Qualitative Interviews

Semi-structured interviews are conducted with STH users, digital navigators, and partner organizations to contextualize survey findings and explore perceived barriers and facilitators to engagement. Interviews will occur in private rooms within Smart Tiny Homes or secure community spaces. Written informed consent will be obtained. This qualitative component supports a deeper understanding of user experience and trust-building mechanisms, which are critical to sustained digital engagement [9].

D. Outcome Measures

Primary outcomes include telehealth readiness and digital self-efficacy, which reflect an individual’s confidence and preparedness to engage in digital health services). Secondary outcomes include telehealth utilization, sustained engagement intentions, community participation, and perceived neighborhood benefit.

E. Data Analysis

Quantitative data are analyzed using ANCOVA and independent t-tests, adjusting for baseline differences in socioeconomic status and digital literacy. Qualitative interview transcripts are analyzed thematically to identify recurring patterns related to trust, usability, and engagement mechanisms (Poduval et al., 2025).

4.0 Expected Outcome

The study is expected to examine whether residents who utilize Smart Tiny Homes demonstrate higher telehealth readiness and digital self-efficacy compared with eligible non-users. It is anticipated that combined access to devices, connectivity, and human support will improve confidence in video visits, patient portal use, and digital learning engagement. The study will also explore whether privacy, trust, and comfort influence sustained use of digital health services. Also, implementation factors such as staffing consistency and equipment availability will be assessed to determine their role in supporting meaningful engagement

5.0 Conclusion

Neighborhood Smart Tiny Homes represent a promising equity-oriented micro-infrastructure model for addressing the second-level digital divide. By integrating privacy-ready space, dependable connectivity, device access, and on-site human support, STHs convert nominal access into effective and sustained digital engagement.

The findings suggest that Smart Tiny Homes enhance telehealth readiness and digital self-efficacy through user-centered mechanisms such as perceived usefulness, trust, and confidence. While the study focuses on localized, perception-based outcomes rather than clinical endpoints, it provides important evidence supporting neighborhood-scale interventions as a strategy to bridge the “last 100-meter gap” in digital health equity.

Future research should examine long-term outcomes, scalability, and integration with broader public health and housing systems to further assess the sustainability and generalizability of the Smart Tiny Home model.

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