



Digital solutions for adolescent homelessness: a review of health and technological interventions

Yang C.¹, Karabanow J.²

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Abstract

Homelessness has profound and far-reaching effects on youth, often resulting in severe physical and mental health challenges. While there is substantial research on the mental health consequences of homelessness among youth, there is a notable gap in the literature concerning the efficacy and availability of current interventions designed to support this vulnerable population. This study aimed to address this gap by providing a comprehensive overview of existing digital interventions for homeless youth, given the rapid evolution of technology. Through a meticulous synthesis of quantitative and qualitative data, the study examined user behaviors, engagement patterns, and attitudinal surveys. Key aspects analyzed included sample sizes, technological solutions, study durations, dropout rates, features of the interventions, their aims, and the resulting outcomes. The analysis indicated that, although the implementation of Technology-Based Interventions (TBI) is a relatively new concept, it is both feasible and promising for future development. As part of this broad TBI, we propose the adoption and implementation of an app that funds the bail of first time homeless youth offenders. The funding is incentivized by providing tax credits to the donors.

Keywords

Psychology, Adolescent mental health, Youth intervention, Homelessness, Technology, Adolescent homelessness, Youth incarceration, Substance abuse, Digital intervention for homeless youth, Youth drop-in shelters

¹Congjia Yang, Collingwood School, 70 Morven Drive, West Vancouver, British Columbia, V7S 3H4, Canada.
chloeyang.wv@gmail.com

²Jeff Karabanow, Dalhousie University, 6299 South Street, Halifax, Nova Scotia, B3H 4R2, Canada.
jeff.karabanow@dal.ca

1 Introduction

Homelessness, particularly among adolescents, is a pressing issue that is escalating rapidly across North America. There has been a 12% increase in the overall number of individuals in homeless shelters, with a 15% rise in homeless unaccompanied youth over the past year alone (1). Similar research indicates that over 4.2 million young people aged 13-25 experience homelessness annually, with 41,000 unaccompanied youth under 25 homeless on any given night (2). Additionally, U.S national survey data shows that homelessness affects youth living in rural, suburban and urban communities at similar rates and that the number of homeless youth across North America is significantly underestimated (3). Youth aged 16 to 24 make up approximately one-fifth of shelter users in Canada, and in a given year, there are at least 35,000-40,000 youth experiencing homelessness (4). Clearly, the urgent issue of adolescent homelessness requires immediate attention and action.

Although there are some studies that highlight current intervention methods for homeless youth and their mental health (5-7), the impact of digital media and technology specific interventions remains unclear; hence, this paper aims to compile and address current technological interventions for homeless youth. First, the review will conceptualize homeless youth and examine the primary physical and mental health characteristics of this group. Second, it will examine youth's access to technology, current online interventions, and the benefits and challenges of digitalization as a form of support. Finally, the review will propose an additional digital solution for an existing disparity alongside adolescent homelessness and discuss the core findings, limitations, and future directions of current research.

Methods

The systematic review followed a clear and structured approach to ensure a rigorous and transparent process. First, a comprehensive search strategy was established, using databases such as PubMed, PsycINFO, and Google Scholar. Key search terms included "homeless youth," "digital media interventions," "mental health," and "technology". Once the relevant studies were identified, their quality was assessed using the Critical Appraisal Skills Program (CASP) checklist. This included examining the methodology, sample size, and the relevance of each study. Next, the findings were grouped by themes such as access to technology, forms of intervention, and the pros and cons of digitalization. Finally, the review clearly reported findings on methodological choices to enhance the comprehensibility, quality assessment, replicability, and the impact of future studies.

2 An overview of homeless youth health

2.1 The definition of youth homelessness

As we overview technology as a means of intervention for homeless youth, one question immediately surfaces: how do we conceptualize homeless youth? Early conceptualizations of homeless youth were often connected with wrongdoing, misconduct, and juvenile delinquency. However, as of recent, the definition of homeless youth has become more focused on the familial, behavioral, and systematic (8). The McKinney-Vento Act defines homeless individuals as those who do not have a stable, regular, and sufficient nighttime residence. This includes individuals whose primary nighttime residence is: a) a supervised shelter, whether publicly or privately operated, that provides temporary living arrangements; b) an institution offering temporary housing for individuals awaiting institutionalization; or c) a public or private

location not intended for or commonly used as a regular sleeping place for people (9). For the purposes of this study, homeless youth will be defined as individuals who are not more than 25 years of age.

It is crucial to clarify the criteria for identifying homeless youth beyond the previously mentioned definitions by providing specific examples. Runaway youth, defined as individuals who leave their place of legal residence without their guardians' consent, are classified as homeless youth (10). Additionally, youth who have been removed from their homes by either legal guardians or authorities and subsequently run away are also considered homeless youth (11). On the contrary, youth within homeless families do not fall under the category of homeless youth. Instead, they are regarded as unhoused individuals who, despite lacking a stable, permanent residence, remain under the care of their legal guardians (12).

2.2 The physical health of homeless youth

Homelessness is associated with various health implications across multiple domains, making it imperative to identify these implications. While this paper focuses on the mental health of homeless adolescents, it is also essential to recognize the detrimental physical outcomes that accompany homelessness. Moreover, we know that physical health challenges can impact psychological well-being, and vice versa. A review of physical morbidities affecting homeless children under the age of 18, published between 1999 and 2019, found several issues such as respiratory problems (e.g., asthma), skin conditions (e.g., scabies), and poor dental and ocular health (13). Among the various physical consequences identified, one particularly significant and detrimental category emerged; that of malnutrition (14).

A cross-sectional study conducted on homeless youth in Toronto examined homeless youth nutrition through interviews, dietary intake recalls, and measurements of height, weight, and thickness of various body parts. The study found that 7% of tested youth were underweight and 22% were overweight or obese. Over half of the youth had “inadequate intakes of folate, vitamin A, vitamin C, magnesium, and zinc” and most youth obtained food from more than one source a day, most of which comprised of meal programs, receiving food from strangers, and by stealing (15). Additionally, an observational study conducted of homeless youth recruited from a drop-in center in Ohio revealed that 41% of males were either overweight or obese and over half of females were obese. Over 90% of males had inadequate intakes of vitamin A and vitamin D₃, along with calcium and magnesium. For females, 100% had inadequate intakes of vitamin A, C, and D₃, with greater than 90% lacking adequate vitamin E and calcium, leading to increased cardiometabolic risk (16).

2.3 The mental health of homeless youth

Many studies have reported high levels of psychiatric disorders among homeless youth including depression, anxiety, and posttraumatic stress disorder (PTSD) (17-19). A longitudinal diagnostic study that regularly interviewed 428 individuals found that homeless youth were six times more likely to suffer from a mental disorder compared to youth in the National Comorbidity Study (18). Similarly, a study of 182 homeless youth in Denver, Colorado, found that nearly all participants (98.4%) met the DSM-IV-TR criteria for one or more mental disorders (20). A particularly alarming aspect of mental health among homeless youth was that despite the high prevalence of mental disorders, only about one-

third of those affected had accessed mental health services in the past six months (21).

Childhood homelessness is associated with persistently elevated internalizing and externalizing symptoms throughout early adolescence compared to their consistently housed peers. The risk is especially pronounced for children who first experienced homelessness during middle childhood and for those who faced recurrent homelessness (22). Therefore, it is crucial to identify both internal and external disorders in the context of homelessness and adolescent mental health.

Among homeless youth, there were high levels of psychiatric disorders, including depression, anxiety, substance use, posttraumatic stress disorder, and psychosis (23). A 2008 study conducted on 95 homeless youth found that 41% of participants met the criteria for Major Depressive Disorder and 41% met the criteria for Bipolar Disorder (24). Depression was another important internalizing disorder. In a survey of 205 Arizonian youth, about 60% of the participants were diagnosed with depression, and nearly 70% of the participants' depression scores indicated probable depression (i.e., showed mild severity of depression or worse) (25). A study examining 157 homeless children found that the cognitive abilities of homeless children were much lower and their disruptive behavioral disorders were much higher compared to their housed counterparts (26). Furthermore, 364 homeless adolescents in Seattle (mean age 16.4 years) were tested under the Diagnostic and Statistical Manual-III-Revised version (DSM-III-R) and similar indexes of anxiety, depression, and self-esteem. Results showed that "53% met the criteria for Conduct Disorder or Oppositional Defiant Disorder, 32% for Attention Deficit Hyperactivity Disorder, 21% for mood

disorders, 21% for mania or hypomania, and 10% for Schizophrenia (23)."

2.4 The impact of diminished health among homeless youth

It is important to recognize the interplay between poor physical and mental health among homeless adolescents and the consequences of their diminished health. Research identifies two main categories: substance abuse and suicide (27).

Substance abuse and Sexually Transmitted Infections (STI)

In a sample of homeless youth in the United Kingdom where 82% indicated a mental health diagnosis, 71% of those reported using drugs as a coping mechanism (28). Studies consistently show that substance use is more prevalent among homeless youth compared to their housed counterparts (29-31). A 2008 study conducted on homeless youth in California found that levels of substance abuse were double than those of housed students, and an interview with 42 youth found that 88% of participants used at least one substance (32). Similarly, research on 1,426 young adults experiencing homelessness across seven U.S. cities found that the most commonly used substances were ecstasy, cocaine, crack, methamphetamine, and injection drugs, all of which led to severe suicidal ideation (33). Consequently, substance disorders tend to develop in homeless youth. In another study, 86.1% of a sample of 197 homeless youth met the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) criteria for dependence or abuse of at least one substance, such as alcohol, in the past year. Specifically, 57.8% met the criteria for alcohol abuse, 56.1% for marijuana abuse, 38.1% for amphetamine abuse, and 18% for heroin abuse (34). Additionally, youth under the influence of

substances are more likely to engage in risky sexual behaviors, such as having unprotected sex or being intimate with individuals who were more likely to carry a sexually transmitted disease, leading to an increased risk of STIs (35).

Suicide

Suicide is one of the leading causes of death among the homeless population, (36) and the risk is even higher among homeless youth (37). Historical research shows that suicide is most often associated with internalizing disorders such as depression; however, evidence suggests that externalizing psychopathology, including substance dependence disorders and antisocial personality disorder, may have an independent relationship with suicidal behavior (38). Additional factors that lead to suicidal behavior include a history of family abuse, loneliness, low self-esteem, and having friends who are also suicidal (39). A study involving 150 youth from the only homeless youth drop-in center in a large Midwestern city found that 80% of the participants had previously attempted suicide (40). Similarly, a study of 208 homeless youth in New York City and Toronto found that 46% had made at least one suicide attempt either at home or on the streets, and 78% had attempted suicide more than once (39). It is evident that the high prevalence of suicidal behavior among homeless youth is influenced by a complex interplay of internalizing and externalizing disorders, as well as various socio-environmental factors. The following sections will present and discuss the technological interventions available to support these youth.

3 Technological intervention

3.1 Means of accessibility

Many homeless youth face significant barriers to accessing basic care, including limited financial resources, difficulties maintaining stable contact information, and negative

attitudes and perceptions from healthcare professionals toward the homeless population (41). This highlights the critical need for interventions and services for homeless youth, particularly from a technological standpoint, due to physical trust issues. Hence, it is important to analyze the accessibility of technology for homeless youth.

A perusal of 19 separate articles, that do not form a part this paper, reporting on homeless youth found that more than half of the youth population owned smartphones, used social media, and accessed the internet weekly to search for housing, employment, health information, and to communicate with family, peers, and health workers (42). Additionally, among a survey of 201 homeless adolescents in Hollywood, California, 84% used the Internet at least once a week, with 24% using it for more than an hour a day and 27% using it almost every day. Specifically, 50% of youth accessed the internet at public libraries, 31% at youth service agencies, 23% at their home or current place of residence, 22% at Internet cafés, and 22% at friends' or associates' homes. Other locations included schools (12%), and workplaces (5%) (43). Hence, homeless youth have access to and can easily use online technology.

3.2 The definition of technological intervention

There are several types of interventions for homeless youth, explored across a variety of articles (44-45). A 2009 study found that the main forms of intervention included youth drop-in shelters, vocational training, substance abuse treatment, and counseling. Specific examples of these interventions are the Family and Youth Services Bureau's (FYSB) Basic Center, Transitional Living, and Street Outreach programs (46). Similarly, family-focused interventions, where programs target the family

to identify the cause of crisis, exist alongside school-based interventions. There are also more specialized types of interventions, such as on-site and online interventions (47). This review will focus on online interventions, or ICTs.

ICTs refer to the use of electronic tools and resources such as e-health platforms, virtual reality, information and communication technologies, and smartphone applications to provide various forms of treatment and support “for health-related issues such as substance use disorders, eating disorders, obesity, and mental health conditions (48).” In the context of homeless youth, ICTs primarily include mobile apps, phone calls, video and SMS texts, and daily trackers. These tools are used to deliver interventions and instructions aimed at reducing risky behaviors, addressing cognitive functioning, providing emotional support, offering vital resources, and alleviating anxiety (49).

3.3 An overview of technological interventions

3.3.1 Selection process

A comprehensive literature search was conducted using databases such as APA PsycInfo, Google Scholar, and PubMed. This search identified 16 relevant articles. Additionally, the references of these articles were examined to compile a list of relevant studies. The selection was further refined based on four inclusion criteria: a) The article must be relevant to and/or discuss the use of ICTs (Information and Communication Technologies) for homeless youth, b) The article must be written in English, c) The article must have been published no earlier than 2005, d) There must be a variety of study types (e.g., qualitative,

quantitative, mixed methods). Articles focusing on ICTs exclusively available to healthcare professionals were excluded. Articles with unclear relevance or context were also excluded. The selected publications were then read, annotated, and entered into Google Sheets for further review.

3.3.2 Results

Short-term interventions, as defined in this study, are those executed within a timeframe of 0-12 months. Table 1 summarizes all evaluated studies, which were conducted in preliminary phases. Two studies aimed to improve the mental health of homeless youth, two aimed to reduce substance use and sexual behaviors, two aimed to increase youth access to services, and one aimed to regulate emotion. The intervention lengths varied from 6 days to 8 months, with two studies focusing on one-time interventions. Participants were aged 16-25 and all studies had a relatively small sample size (total mean sample size of $n=50.3$). A wide range of ICTs were utilized, including smartphones, mobile apps, and virtual reality. The findings from Table 1 indicate a broad acceptance of technological interventions among participants. 6/8 (75%) of studies reported high ratings for the acceptability of these interventions, and all evaluated studies (100%) reported that their respective approaches were feasible. Specifically, one study found that participants were very enthusiastic about the overall quality, approach, and content of the pilot app (51). Another study revealed that youth reported a high likelihood of using the pilot app if given access, indicating its adoption among homeless youth (53). However, 3/8 studies did not find changes in clinical outcomes (54, 55-57).

Table 1. Summary of interventions, including Sample Population Size, Technology, Study Duration, Dropout Percentage, Features, Intervention Aim, and Findings.

	Sample Population Size	Technology	Study Duration	Dropout (%)	Features	Intervention Aim	Findings/Feasibility
Glover et al., 2019 (50)	16-25 years old (n=100), Chicago Metropolitan Area	Smartphone and mobile apps	6 months	81%	Several apps promoting mental health, daily surveys, automated self-help system with brief cognitive behavioral interventions	Improve mental health	High: Participants benefited from daily tips, surveys, and the automated self-help system, while interactive features were less used and rated as less beneficial.
Thompson et al., 2020 (51)	18-21 years old (n=60)	Smartphone and mobile apps	28 days	33%	Daily Tracker, Motivational Intervention (BMI)	Reduce substance use and sexual risk behaviors	High: OnTrack+BMI was feasible and effective in reducing past 2-week alcohol use and unprotected sex among homeless young adults.
Chavez et al., 2020 (52)	n=30	Virtual Reality Headset	1 time	3%	Virtual reality meditation, audio meditation, and virtual reality imagery of historical pictures and text	Improve mental health	High: Anxiety scores decreased in all groups. Virtual Reality mediation was most effective.
Sheoran et al., 2016 (53)	18-25 years, n=6, Santa Clara, USA	Smartphone and mobile app	1 time	N/A	Condensed list of Resources	Increase engagement and help youth access services	Moderate; Participants thought YTH StreetConnect was a good blend of current social media and app functions.
Greeson et al., 2019 (54)	18-25 years, n=10, Philadelphia	Smartphone and mobile app	2 weeks	N/A	Condensed list of Resources	Increase engagement and help youth access services	Moderate: For all questions, at minimum, all participants "somewhat agreed."
Leonard et al., 2018 (55)	Mean age=18.54, n=49	Smartphone and mobile apps and wrist-worn sensor band	6-8 months	18%	Daily tracker, push-in tips, and self-report alert	Regulate Emotion	High: A high degree of acceptability among homeless adolescent mothers for the technology components of a blended intervention designed to increase emotional regulation.
Maria et al., 2021 (56)	18-25 years, n=97	Smartphone and mobile app	6 weeks	20%	Mobile text-messaging intervention	HIV prevention	High: The intervention was effective at reducing (1) the odds of substance use, (2) the urge for sex, and (3) stress among homeless youth.
Schueller et al., 2019 (57)	18-24 years, n=35	Smartphone and mobile apps	1 month	43%	Phone data and service, support from mental health coach	Improve mental health	High: High rates of satisfaction, with 100% of remaining participants indicating that they would recommend participation to someone else.

3.5 Benefits of online intervention

Many homeless youths have had poor interactions with healthcare providers in the past or may have not thought they needed support, leading to mistrust in the healthcare system (58). For example, a focus group study found that substance use was a barrier to using drop-in centers; youth often felt they did not need services post substance-use or feared that they might disappoint staff by showing up under the influence (59). In contrast, technology-based interventions could build trust through a novel system, making homeless youth more willing to use them (60). The concept of online interventions respects the boundaries of adolescents and healthcare workers, which can foster greater trust (61).

Additionally, Homeless youths tend to be more mobile and less likely to obtain care at a single location or medical home (62). This mobility often leads to difficulties in locating drop-in shelters. In a sample of 83 homeless youth, very few youth who had not used a drop-in center before reported that they knew how to find one (63). Mobile mental health interventions, however, can leverage the widespread ownership of smartphones to deliver support that can reach individuals wherever they are, including at the times and places they need it most (64). Homeless youth are therefore able to access the support they need, increasing accessibility and therefore the scope of support they receive.

Finally, some homeless youth may not be able to address their healthcare needs immediately. Homeless youth often face competing demands, such as securing stable housing, which conflict with their ability to access traditional outpatient care (65). This is contrary to the immediate and on-demand nature of technological

interventions, where homeless youth can prioritize their urgent needs without the need for scheduled appointments or in-person visits. Telehealth interventions, for instance, provide "OnDemand" treatment options, removing barriers such as transportation issues and overwhelmed facilities, and reducing costs for both providers and patients (66).

4 Recommendations for addressing pretrial detention

While ICT methods may prove effective for homeless youth, it is also crucial to address the population of homeless youth that have been detained for both minor and major infractions, including loitering, trespassing, and theft of essentials like food. A study conducted on homeless youth from 11 U.S cities found that ~44% had been incarcerated in a jail, prison, or juvenile detention center; 78% had experienced at least one encounter with the police; and nearly 62% had faced arrest at least once (67). Arrested youth are set a bail, and if they are unable to pay, they are held in pretrial detention until their scheduled trial date (68).

Influenced by the challenges of trial processes and homeless detention, youth often develop significant barriers to seeking help, particularly from adults. There are various risks associated with incarceration. Incarceration often leads to severe physical and mental health consequences, including chronic conditions caused by poor ventilation, overcrowding, and stress; an increased risk of HIV infection and viral hepatitis; and mood disorders such as major depressive disorder and bipolar disorder. It may even result in a form of PTSD specific to the trauma of incarceration (69). Therefore, establishing effective intervention methods is crucial. We propose the integration and implementation of a digital app that these homeless youth can access as a means of

support. The app will allow for youth to request funds for bail. The bail money is anticipated to originate from donors provided with tax credits dependent on how many individuals they are able to provide bail support for. Obviously, adoption of this credit into the Tax code at the Federal and local level will boost funding to keep these vulnerable first-time offenders out of detention facilities or jails.

The app could be introduced in collaboration with <https://bailproject.org>, a nonprofit organization that provides bail assistance to low-income individuals through a volunteer-based system while helping them navigate voluntary support services as they await trial. Donors to this organization will receive tax credits for their contributions. As a result, youth have the opportunity to receive the support they deserve throughout the legal process and will have a second opportunity to re-integrate into society.

5 Conclusion

5.1 Core findings

This literature synthesis covered the overall health of homeless youth along with current digital interventions for this population. Seven main papers were identified and analyzed, supplemented by additional studies to support the claims and knowledge presented. These seven studies utilized various research designs and small-scale testing, finding that the implementation of technological-based interventions was a beneficial option.

Many key findings are presented in the paper. First, the implementation of technology as an intervention resource is relatively new, with all research conducted so far involving pilot programs. This indicates that a) there is a significant need for more extensive and longitudinal studies to understand the long-term

effects and efficacy of technological interventions for homeless youth, and b) there is an opportunity to refine and improve these interventions based on feedback and outcomes from these initial pilot programs to better meet the unique needs of this vulnerable population.

Second, there was a dearth of longitudinal research in this area. While technological interventions were deemed feasible and "useful" by most participants, clinical evidence to support these improvements was scarce. This scarcity may be attributed to the fact that most studies were cross-sectional and short-term pilot programs; the fluid and unstable living situations of homeless youth make it challenging to track this population over extended periods. Consequently, these studies may not capture the long-term benefits or challenges of technological interventions. Additionally, clinical outcomes might have overlooked other improvements in well-being, such as a sense of connection or validation, which could be valuable areas for future research.

Finally, the findings indicate that access to and use of technology supported the maintenance of positive and healthy social contacts, which was associated with fewer depressive symptoms, a decrease in unusual sexual behaviors, and a reduction in substance-use. This suggests that greater accessibility to technological intervention can help homeless youth maintain good social relationships that are desirable and necessary for mental well-being. It is crucial to encourage the use of ICTs to maintain positive social contacts, monitoring the nature of these online connections. It is equally important to develop support systems for homeless youth who are detained, ensuring they can maintain positive connections, safeguard their mental and

physical well-being, and have opportunities for successful reintegration into society.

5.2 Limitations

A limitation of this review is the lack of a quality assessment of the selected papers, caused by the scope of the study. Additionally, the review exclusively included articles written in English, potentially introducing language bias and limiting the generalizability of the findings to English-speaking populations.

Moreover, the level of intervention varied significantly across the studies, meaning that comparisons between different interventions were not straightforward and may not have accurately reflected their relative effectiveness. The preceding observation also complicates the synthesis of findings and the drawing of general conclusions.

The data for this review was drawn from convenience samples, which are inherently biased. Specifically, adolescents who have more connections outside of street life and are actively seeking opportunities (e.g., employment) or who are motivated to improve their situation may be more likely to volunteer for surveys. Consequently, the results may be less representative of isolated youth who may experience more severe situations, underrepresenting the experiences and needs of the most vulnerable segments of the homeless youth population.

Finally, the results regarding the acceptability and success of the interventions may be overestimated. If the recorded dropout percentages were mostly due to participant dissatisfaction with interventions, the analyzed success rates could be false. High dropout rates

can indicate underlying issues with the intervention's design, implementation, or relevance to the participants' needs, which are crucial factors to consider in future research and program development.

5.3 Future perspectives

A future direction for research is to explore the combination of online interventions with physical interventions while involving health professionals to monitor progress. Interventions can be implemented at the personal, societal, community, and institutional levels to achieve multiple outcomes, including general health, accessibility to services, and healthy interpersonal relationships. Research has found that combining different treatment approaches that vary in techniques and therapeutic methods can result in cumulative benefits. This concept is widely recognized in other areas of human behavior, where repetition or reinforcement using various methods can significantly alter thinking and behaviors across a wide range of activities (70). Additionally, integrating traditional face-to-face approaches with internet- and mobile-based elements enhance the effects of psychological interventions and reduced the costs of mental health treatments (71). These findings align with previous literature, revealing the importance of implementing ICTs as co-interventions, bridging the gap in access to care and support.

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