Trauma-Informed Digital Health Interventions: A Scoping Review

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Trauma-informed digital health interventions: A scoping review

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6. Yale University, School of Medicine, New Haven CT, United States

Abstract

Background: Trauma exposure is a pervasive issue around the world and the impacts of trauma can be long lasting and detrimental to individual and population health outcomes. Trauma responses can influence and determine an individual or community’s approach in seeking supportive resources. Given the critical role of supportive resources and the prevalent use of technology and internet use, it is essential to understand how digital health interventions contribute to addressing trauma explicitly. This scoping review aims to explore the landscape of trauma-informed digital health interventions for adults, assess their outcomes, and identify their measurable impacts across various settings.

Methods: A scoping review was conducted, guided by objectives to map out the current landscape of trauma-informed digital health interventions. The review protocol adhered to PRISMA-ScR guidelines and involved a comprehensive search across multiple databases. Inclusion criteria focused on studies utilizing the phrase ‘trauma-informed’ in digital interventions published from 2012 to 2023. A total of 10,807 articles were screened, resulting in 12 studies being selected for inclusion.

Results: The findings reveal a predominance of interventions targeting interpersonal trauma and utilizing primarily behavioral approaches, with most studies employing platforms through telecommunication and the internet. Notably, only a fraction of studies provided a clear definition of ‘trauma-informed,’ and outcome measures varied widely.

Discussion: While all studies state a trauma-informed approach, few adhere to a standardized definition, which complicates their ability to be compared and replicated. A third of the studies highlighted the complexities of trauma highlighting overlapping and emphasizing the need for multi-pronged strategies to address. The predominance of such studies in the U.S. suggests an opportunity for expanded research and resource allocation to address trauma globally.

Conclusions: Given the widespread use of technology today, it is critical to balance its potential harms and benefits, especially when used with vulnerable populations. The development of trauma-informed digital health interventions represents a growing area of opportunity for innovative collaborations across multiple disciplines.

Funding: This scoping review was supported by initiatives reflecting an ongoing need to integrate trauma-informed principles in technology-supported interactions, particularly for marginalized populations. The study was funded by the National Institutes of Health and National Library of Medicine, through a Diversity Supplement grant (3R01LM013477-03S2). The funding agency had no role in the design, analysis, or interpretation of the data in the study.

Introduction

As outlined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), a traumatic event (TE) includes “exposure to threatened death, serious injury or sexual violence” (Benjet et al., 2016). These events are not limited to the individual directly involved, but can permeate to
observers, close community members who hear about the event, or continual exposure to such events (“Trauma and its aftermath,” 2024). A 2016 survey conducted across 24 countries found that exposure to traumatic events could widely vary, with over 70% of participants sharing they had experienced at least one traumatic event and approximately 31% had experienced multiple, four or more events (Benjet et al., 2016). The United States (82.7%) falls among the countries with the most frequent exposure to traumatic events, Bulgaria had the lowest exposure (28.6%), while Ukraine reported the highest (84.6%) (“Trauma and its aftermath,” 2024). Therefore, indicating that traumatic events are unfortunately an ordinary occurrence of the human experience and for some communities, traumatic events are ongoing and continuous.

Trauma exposure significantly escalates the risk of an immense range of health and behavioral vulnerabilities, including mental health challenges like PTSD, severe depression, excessive rage, and anxiety; substance use; and various physical health hurdles such as systolic blood pressure, immunosuppression, irritable bowel syndrome and chronic pelvic pain (DeVeaux, 2013). The Substance Abuse and Mental Health Services Administration (SAMHSA) characterizes trauma as “an event or circumstance resulting in, physical, emotional, and/or life-threatening harm,” adversely affecting overall health and well-being through multiple dimensions, including but not limited to, mental, physical, emotional, social, and spiritual (“Trauma and violence,” 2022). These impacts penetrate through economic productivity concerns, as the World Health Organization (WHO) approximates that depression and anxiety is tied to a loss of $1 trillion USD and is projected to rise to $16 trillion USD by 2030 (Chodavadia et al., 2023). Furthermore, trauma influences the way individuals interact with potentially supportive relationships and programs (DeVeaux, 2013). From a public health and healthcare access lens this is concerning because individuals who have experienced abuse are frequently hesitant to engage in health services (Elumn et al., 2021). One of the groups most impacted by abuse and trauma exposure, are youth in the justice system (Dierkhising et al., 2013). The prevalence of trauma is stark among youth in the justice system, with 90% reporting exposure to a traumatic event (Dierkhising et al., 2013), illustrating the impact of trauma throughout society and the need for thoughtful interventions.

Trauma-informed care is an method that seeks to integrate an understanding of how trauma impacts human health and considers the widespread impact of trauma when assisting those who have been exposed to traumatic events. This approach aims to mitigate avenues that could cause further trauma, known as re-traumatization, and the Center for Disease Control and Prevention (CDC) pinpoints six guiding principles for a trauma-informed approach. They include: ensuring safety, building trustworthiness and transparency, offering peer support, fostering collaboration and mutuality, empowering individuals with voice and choice, and respecting cultural, historical, and gender considerations (“Infographic: 6 Guiding Principles to a Trauma-Informed Approach,” CDC, n.d.). By incorporating these principles, trauma-informed care addresses the complex effects of trauma and adapts the services offered to help individuals develop healthier coping mechanisms. Such interventions have been successfully implemented across a scope of services, including mental health, substance abuse treatment, criminal justice systems, and education (Amaro et al., 2007; Amaro et al., 2007; Bassuk et al., 2017; Brown et al., 2013; Dion et al., 2019; Wilson et al., 2013). They have been particularly effective among Black and Hispanic communities (Amaro et al., 2007; Amaro et al., 2007; Bassuk et al., 2017; Brown et al., 2013; Dion et al., 2019; Wilson et al., 2013).
Trauma-informed approaches, aiming to treat the entire person rather than narrowly on their symptoms, emerged in medical settings during the 1970s (Brake, 2020). Initially, these approaches were developed to treat war veterans by addressing both their physical and psychological needs (Brake, 2020). In 2001, recognizing the value of these approaches, the U.S. Congress and SAMHSA started initiatives that expanded trauma-informed care into other areas like pediatrics and education (Brake, 2020). Current literature recognizes the need to integrate trauma-informed principles across various disciplines, including technology-supported interactions, in alignment with SAMHSA’s previously defined six key principles (Chen et. al., 2022). While health technologies have historically been deployed to enhance patient engagement and improve medication adherence, there is a growing need for trauma-informed technologies to be broadened with caution (Chen et. al., 2022). Unfortunately, they are not avenues to solve trauma, however there’s an opportunity to reduce technology related harms, particularly in vulnerable populations (Chen et. al., 2022). Pew Research Center data from 2022-2023 indicates smartphone ownership around the globe varies from as high as 98% in some countries, and as low as 50% in others (Beshay, 2024). This wide range speaks to how integrating caution is crucial for digital interventions that are accessible in a variety of settings and cater to diverse populations. Therefore, this scoping review was conducted to gather insights that will inform the design and development of the 'Welcome Home' mobile application (Foumakoye, 2023). Specifically, this app aims to support individuals with a history of incarceration as they reintegrate into their communities, incorporating the principles of trauma-informed care in its core development and functionality (Foumakoye, 2023).

**Objectives**
The following question guided this scoping review:

1. What is currently the landscape of trauma-informed digital interventions (characteristics, barriers, facilitators, and effectiveness) for all populations, across all settings?

We chose to conduct a scoping review in order to examine this exploratory research question and describe the relevant evidence.

**Methods**
The scoping review took place from July 2023 to February 2024. The research team included KD, JE, TY, TM, KW and AL. We developed a protocol, that outlined the scoping review to assess the landscape of trauma-informed digital health interventions, focusing on how these interventions incorporate trauma-informed principles into their design and subsequent outcome measurements. The following section summarizes our methodological approach.

**Eligibility Criteria**
We only included studies that specifically used the phrase ‘trauma-informed’ in discussing the design and implementation of the digital intervention. Originally, if this phrase was missing from the titles and abstracts of papers, the reviewers looked for words that described trauma-informed principles, such as: choice, collaboration, empowerment, enablement, intersectionality, peer support, safety, trust, and/or trustworthiness. However, early on in the title/abstract review process, the review team removed the trauma-informed principles within the inclusion criteria.
but kept this criterion for the full text review. In addition, reviewers identified words that could indicate a past or ongoing relationship with trauma or traumatic experience(s). Reviewers identified these connections when a mental health diagnosis (e.g., PTSD, CPTSD, and substance use), or violence related words were used. We included peer reviewed journal articles that were: published between 2012 to 2023, written in English, and involved human participants for all populations within any setting. We decided to review literature dating back to 2012 so that we could review the most current literature on trauma-informed digital interventions of the last decade or so. For this scoping review, the focus was narrowed to digital interventions and therefore we did not use the phrase digital technology but used associated keywords more broadly to encompass as many results as possible. All study designs were eligible for inclusion in our review, but we will not include review papers. We did not restrict studies to any particular country or region of the world.

**Information Sources**

The literature search strategies were developed with a medical librarian (KD) in accordance with the recommendations made by the JBI Manual for Evidence Synthesis: Scoping Reviews (Brown, 2013) and were peer-reviewed by another library professional using the Peer Review of Electronic Search Strategies (PRESS) guidelines (McGowan et al., 2016). The search included a mixture of keywords and subject headings about digital interventions that were trauma-informed for all populations in all settings. The search results were filtered to only include those published between 2012 – 2023 per the inclusion criteria. The search was executed in the following databases in July 2023 to identify potentially relevant scholarly literature: Embase (Ovid platform), ERIC (ProQuest), Google Scholar, MEDLINE (Ovid), PsycINFO (Ovid), and Web of Science (Clarivate). These databases were chosen because the librarian and review team thought they would collectively cover a wide range of literature on trauma and digital interventions, from the perspective of the health sciences, social sciences, as well as educational settings. PsycINFO was especially fitting because this review question deals with trauma and mental health and searching in Web of Science allowed some grey literature to be retrieved.
Table 1 Keywords and Boolean operators used in the Ovid database search

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<tr>
<th>PCC</th>
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<th>MEDLINE search Terms</th>
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<td>concept = digital interventions</td>
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<td>(digital health intervention* or &quot;DHI&quot; or DHI's or digital intervention* or digital mental health intervention* or &quot;DMHI&quot; or DMHIs).tw,kw</td>
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<td>((app based or application based or computer* or e-mental or e-therap* or media or mhealth or mobile health app* or mobile or online or smart phone* or smartphone* or social media or tablet* or technolog* or virtual* or web*).adj5 (approach* or education* or intervention* or prevent*).)tw,kw</td>
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<td></td>
<td>3</td>
<td>mobile applications/</td>
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<td></td>
<td>4</td>
<td>1 OR 2 OR 3</td>
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<tr>
<td>context = trauma-informed, and/or for those with PTSD</td>
<td>5</td>
<td>trauma*.tw,kw</td>
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<td></td>
<td>6</td>
<td>(abus* or assault* or distress* or &quot;IPV&quot; or &quot;PTSD&quot; or posttrauma* or psychological stress* or violen*).tw,kw</td>
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<td></td>
<td>7</td>
<td>exp violence/</td>
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<td></td>
<td>8</td>
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<td></td>
<td>10</td>
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<td>4 AND 10</td>
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<td>12</td>
<td>limit 11 to yr=&quot;2012-current&quot;</td>
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<td></td>
<td>13</td>
<td>12 NOT ((exp animal/ or nonhuman/) not exp human/)</td>
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<tr>
<td>Total Results (7/17/23)</td>
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</table>

Selection of Sources of Evidence
We performed all study screening on Covidence, in a two-staged process using a team of two reviewers (AL and TY). During the first stage, we reviewed the titles and abstracts of all 10,807 studies to assess them for meeting inclusion criteria; the work was divided such that each study was independently reviewed by both reviewers, and any discrepancies were resolved by a third reviewer (JE). The team of reviewers met before screening was initiated to develop a standardized study inclusion form, and also met weekly during the screening process to discuss and resolve any concerns. The form was iteratively updated throughout the first stage of the screening process to refine the criteria for inclusion, based on abstracts that presented uncertainty. A total of 43 articles were selected for full-text screening during this first phase. During the second phase of screening, we reviewed the full text of all studies that were included in the first phase; each text was reviewed by two reviewers independently, and any discrepancies between the two reviewers were resolved by full group discussion. A total of 12 studies were selected for inclusion in the review during the second stage.

Data Charting Process
After we finalized the list of 12 studies that met our inclusion criteria, we distilled pertinent data from full text articles using a Qualtrics questionnaire. The questionnaire was developed by four authors to examine studies for relevance and draw out relevant variables. Each study was charted by two reviewers (AL and TY) independently, one of whom then reviewed the charting to note any variances. For studies with qualitative output, each reviewer summarized applicable and notable findings and then one reviewer combined the two summaries to ensure all details were included. Any differences in charting were resolved through discussion between the two
reviewers who had charted the paper, and any final discrepancies were resolved by a third reviewer (JE). Regular team meetings were utilized to discuss the process and address any concerns or resolve any persistent discrepancies.

Figure 1. Flow diagram of search strategy used during the scoping review of trauma-informed digital health interventions.

Data Items
The data extracted from all articles included authors’ department and field of study, general study characteristics and methodology, study participant characteristics (e.g., sample size,
demographics, trauma history), amount and access to technology, and any health information collected.

**Critical Appraisal of Individual Sources of Evidence**
We used a standardized extraction process to collect information such as: title of study, first and last author information and year published; study setting; study design; description of study population; type of trauma-informed approach and principles; main findings. While our search strategy covered all types of trauma experiences we primarily focused on the following occurrences: accidents and injuries (e.g., natural disasters, car accidents), collective trauma (e.g., war, genocide, ongoing effects of colonialism), interpersonal trauma (e.g., intimate partner violence, child maltreatment), and structural trauma (e.g., racism, poverty). However, some studies did not specify which type of trauma, but instead primarily focused on the symptomatic manifestations.

**Synthesis**
Data from customized Qualtrics form was exported to Microsoft Excel, and descriptive statistics were performed using Microsoft Excel and summarized.

**Results**

**Sample and Study Characteristics**
Our search produced 10,963 results, with 156 duplicates, resulting in 10,807 articles that were reviewed during the title and abstract segment. Of those, 10,764 were excluded at the title and abstract screening phase as they did not meet our inclusion criteria; most excluded did not include a trauma-informed focus. Forty-three full-text articles were then screened and 31 were removed because they were not peer reviewed (n = 6), did not have the appropriate intervention (n = 4), had an incorrect study design (n = 6), was not a study (n = 1), focused on the incorrect patient population (n = 11) and were not locatable to determine (n = 3). The remaining 12 articles included in the final data analysis phase were included in the final scoping review (Fig. 1). Studies were published between 2017 and 2023. Sixty-seven percent (n = 8) of the studies were conducted in the United States, 25% (n = 3) in Canada, and 8% (n = 1) unknown. Of the studies included, 42% (n = 5) were quantitative studies, 33% (n = 4) were qualitative studies, and 25% (n = 3) were mixed methods. We looked at interventions that aimed to mitigate the effects of defined trauma and opted against including interventions solely focused on enhancing trauma response education for healthcare providers working with patient populations. This decision stemmed from our primary goal of determining the characteristics, barriers, facilitators, and effectiveness of trauma-informed interventions for all populations experiencing trauma, rather than assessing the adaptability and receptiveness of increasing trauma-informed skills in healthcare settings. The sample sizes varied between 3 and 314 intervention participants, of the studies 67% of included up to 50 participants, 0% included between 51 and 100 participants, 17% included between 101 to 200 participants, and 175 included over 201 participants, highlighting a possible difference in quality of results.

**Trauma Types and Prevalence**
Among the twelve reviewed studies, 58% (n = 7) focused on interpersonal trauma (e.g., intimate partner violence, child maltreatment), 25% (n = 3) on collective trauma (e.g., war, genocide), 8%
(n = 1) did not specify the trauma type, and 8% (n = 1) alluded to “health-related" trauma, that we categorized as other. Notably, 33% (n = 4) of studies included a secondary trauma experience (COVID-19, structural trauma, mental health, military). The majority of the studies took a behavioral only intervention approach 92% (n = 11) and one took a multi-intervention approach, combining behavioral and pharmacological 8% (n = 1).

**Trauma-Informed Definition, Measurements, and Outcomes**

Within the sample of studies we examined, only 17% (n = 2) clearly defined ‘trauma-informed’ in the scope of their digital health interventions. Evans et al. (2023) identified choice and control as fundamental to their approach, whereas Abdulai et al. (2022) included the following five principles, emotional safety, choice, collaboration, trustworthiness, and empowerment. The remaining 83% (n = 10) mentioned the term 'trauma-informed' but did not provide a follow up on which principles would be utilized to guide the intervention design.

The studies used a variety of approaches to measure and assess trauma informed interventions. The identified approaches utilized can be broadly categorized as standardized instruments 50% (n = 6) (e.g., ABC Medication Scale, BSI-18, Mobile App Rating Scale), multi-source assessments 25% (n = 3) (e.g., electronic screening tools, surveys, and medical records), intervention-specific measures 17% (n = 2) (e.g., "safe decision making", "trauma-informed strategies"), and not specified 8% (n = 1).

The studies utilized a variety of outcome measures that could be broadly categorized as mental health symptoms 25% (n = 3) (e.g., traditional mental health assessments like depression and PTSD scores, parent psychological health), intervention specific outcomes 50% (n = 6) (e.g., changes in self-regulation, app usability, relatability of characters, fidelity to trauma-informed principles), program acceptability and user experience 25% (n = 3), societal impact 17% (n = 2) (e.g., increasing access to mental health resources, reducing intimate partner violence), and not specified 8% (n = 1). About one-quarter (n = 3) of the studies employed multiple methods of measuring outcomes (e.g., mental health symptoms and program acceptability and user experience, intervention specific outcomes and societal impact, program acceptability and user experience and societal impact). Some studies used a combination of methods to measure outcomes, the primary measurements included intervention specific outcomes 50% (n = 6), mental health symptoms 25% (n = 3), program acceptability and user experience 25% (n = 2), and not specified 8% (n = 1). While secondary measurements included program acceptability and user experience 25% (n = 1) and societal impact 17% (n = 2).

**Mode of Intervention**

Of the twelve studies reviewed, telecommunication-based interventions, including telehealth and video conferencing platforms, were used in 33% (n = 4) of cases. Similarly, another 33% (n = 4) of studies relied on web and internet-based platforms such as webpages, websites, web-based curricula, and online workbooks. Mobile and tablet-based applications were used in 25% (n = 3) of the studies, and health information technology was utilized in 8% (n = 1) of the cases.
<table>
<thead>
<tr>
<th>Title</th>
<th>Authors &amp; Affiliations</th>
<th>Population, Location &amp; Setting</th>
<th>Trauma-informed approach &amp; Mode of intervention</th>
<th>Definition of trauma informed</th>
<th>Type of Trauma</th>
<th>Study Design</th>
<th>Assessment Scale</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>A Trauma-Informed, Family-Centered, Virtual Home Visiting Program for Young Children: One-Year Outcomes</td>
<td>Catherine Mogil, University of California Los Angeles, Jane and Terry Semel Institute for Neuroscience and Human Behavior Patricia Lester, University of California Los Angeles, Jane and Terry Semel Institute for Neuroscience and Human Behavior</td>
<td>Adults, Southern California, USA Hospital and University</td>
<td>Trauma-informed design and preventive intervention</td>
<td>Telehealth</td>
<td>Undefined</td>
<td>Quantitative Randomized control trial</td>
<td>Brief Symptom Inventory–18 (BSI), Anxiety and depression scores, Posttraumatic Diagnostic Scale (PDS), Parenting Stress Index–Short Form (PSI-SF)</td>
<td>Parent psychological health, Parent–Child relationships and Child behavior</td>
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<td>At-risk adolescents as experts in a new requirements elicitation procedure for the development of a smart phone psychoeducational trauma-informed care application</td>
<td>Paulina Sockolow, Drexel University, Philadelphia, PA, College of Nursing and Health Professions Sandra Bloom, Drexel University, Philadelphia, PA, College of Nursing and Health Professions</td>
<td>Adolescents (13 to 17 years old), Albany, New York, USA Community</td>
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<td>Qualitative</td>
<td>Safe decision making</td>
<td>How likable the game was, character relatability, and personal experience relatability; mental health care access and quality of care among vulnerable and marginalized populations by making actionable resources available</td>
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<td>Title</td>
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<td>Population, Location &amp; Setting</td>
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<td>Creating Safe Spaces for Those Who Have Lived through Intimate Partner Violence</td>
<td>Katie Evans; Veterans Affairs Puget Sound Health Care System; Mental Health Service Line</td>
<td>Adults</td>
<td>Trauma-informed care</td>
<td>Two important principles of trauma-informed care are integrating the input of those who have experienced trauma into the delivery of services as well as maximizing choice and control in formulating the treatment plan</td>
<td>Interpersonal trauma (e.g., intimate partner violence, child maltreatment)</td>
<td>Quantitative</td>
<td>Cohort study</td>
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<td>Laura Marie LaPlante; Veterans Affairs Puget Sound Health Care System; Mental Health Service Line</td>
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<td>Developing an Educational Website for Women With Endometriosis-Associated Dyspareunia: Usability and Stigma Analysis</td>
<td>Abdul-Fatawu Abdulai, University of British Columbia, The School of Nursing</td>
<td>Adults (30 to 63 years old)</td>
<td>Trauma-informed care</td>
<td>The 5 principles of trauma-informed care (Fallot and Harris)</td>
<td>Medical Health</td>
<td>Qualitative</td>
<td>Secondary analysis</td>
<td>PSSUQ Post-Study System Usability Questionnaire</td>
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<td>Leanne M Currie, University of British Columbia, The School of Nursing</td>
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<td>Surgery</td>
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<td>Development, acceptability, and perceived effectiveness of a trauma-informed adolescent self-regulation intervention</td>
<td>Aaron Plant, Sentient Research</td>
<td>Adolescents</td>
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<td>Randomized control trial</td>
<td>e-PS-R acceptability and perceived effectiveness among youth with juvenile justice involvement</td>
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<td>Jorge Montoya, Sentient Research</td>
<td>New Mexico, USA Juvenile justice facility</td>
<td>Online workbook</td>
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<td>Program acceptability, perceived effectiveness on self-regulation and sexual health outcomes; race/ethnicity, gender, age, state, and ACE scores</td>
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<td>Population, Location &amp; Setting</td>
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<td>eConnect: implementation and preliminary evaluation of a virtually delivered attachment-based parenting intervention during COVID-19</td>
<td>Lin Bao, Simon Fraser University, Burnaby, Canada, Department of Psychology Marlene M. Moretti, Simon Fraser University, Burnaby, Canada, Department of Psychology</td>
<td>Adults Canada Community, Hospital, and University</td>
<td>Trauma-informed parenting group intervention Video conferencing platform</td>
<td>Undefined</td>
<td>Collective trauma (e.g., war, genocide, ongoing effects of colonialism) COVID-19</td>
<td>Quantitative Randomized control trial</td>
<td>Brief Child and Family Phone Interview (BCFPI), Caregiver Strain Questionnaire (CGSQ), Revised Conflict Tactic Scale (CTS2), Adolescent Attachment Anxiety and Avoidance Inventory (AAAAI), Technical Challenge Questionnaire – Parent Version (TCQ-P), Videoconferencing Experience Questionnaire – Parent Version (VEQ-P), and Parental Program Acceptability Questionnaire (PPAQ)</td>
<td>Changes in youth functioning, changes in parental mental health, changes in parent-child interactions and program acceptability</td>
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<td>Engaging African American Youth in the Development of a Serious Mobile Game for Sexual Health Education: Mixed Methods Study</td>
<td>Loral Patchen, MedStar Washington Hospital Center, Washington, DC Robin Gaines Lanzi, University of Alabama at Birmingham</td>
<td>Adolescents and young adults (15 to 21 years old) District of Columbia, USA and Birmingham, Alabama, USA University</td>
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<td>Maintaining Safety While Discussing Suicide: Trauma Informed Research in an Online Focus Groups</td>
<td>Donna Epp, Brandon University, Brandon, MB, Canada, Health Studies&lt;br&gt; Doug Ramsey, Brandon University, Brandon, MB, Canada, Department of Geography and Environment</td>
<td>Adults (25 to 74 years old)&lt;br&gt; Canada (British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, and Newfoundland)&lt;br&gt; Community and University</td>
<td>Trauma-informed research approach&lt;br&gt; Video conferencing platform</td>
<td>Undefined</td>
<td>Interpersonal trauma (e.g., intimate partner violence, child maltreatment)</td>
<td>Qualitative</td>
<td>Trauma informed strategies</td>
<td>How well trauma informed approach was employed in focus group setting</td>
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<td>Minding the complexities of psychotropic medication management for children and youth in the foster care system Paper 2: Levels of trauma responsiveness among child welfare staff</td>
<td>Julie E. Bertram, University of Missouri-St. Louis, College of Nursing&lt;br&gt; Jennifer McManus, University of Missouri-St. Louis</td>
<td>Adults&lt;br&gt; St. Louis, Missouri, USA</td>
<td>Trauma-informed medication management&lt;br&gt; Web-based curriculum</td>
<td>Undefined</td>
<td>Interpersonal trauma (e.g., intimate partner violence, child maltreatment)</td>
<td>Mixed methods&lt;br&gt; Secondary analysis</td>
<td>19-item ABC Medication Scale and continuum of the Missouri Model</td>
<td>Trauma responsiveness and psychosocial facets of resilience</td>
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<td>Novel Health Information Technology to Aid Provider Recognition and Treatment of Major Depressive Disorder and Posttraumatic Stress Disorder in Primary Care</td>
<td>Dara H. Sorkin, PhD, University of California Irvine, Irvine, Department of Medicine&lt;br&gt; Richard Mollica, MD, MAR, Harvard Medical School, Boston, MA, Department of Psychiatry</td>
<td>Adults&lt;br&gt; Long Beach, California, USA</td>
<td>Trauma-informed mental health care&lt;br&gt; Health information technology</td>
<td>Undefined</td>
<td>Collective trauma (e.g., war, genocide, ongoing effects of colonialism)</td>
<td>Quantitative</td>
<td>Randomized control trial</td>
<td>Depression and PTSD Scores</td>
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<tr>
<td>Title</td>
<td>Authors &amp; Affiliations</td>
<td>Population, Location &amp; Setting</td>
<td>Trauma-informed approach &amp; Mode of intervention</td>
<td>Definition of trauma informed</td>
<td>Type of Trauma</td>
<td>Study Design</td>
<td>Assessment Scale</td>
<td>Outcomes</td>
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<td>Thrive: A Novel Health Education Mobile Application for Mothers Who Have Experienced Intimate Partner Violence</td>
<td>Maya I. Ragavan, Division of General Academic Pediatrics, Boston Medical Center, Boston, MA, USA Megan Bair-Merritt, Boston University, Boston, MA, USA</td>
<td>Adults Pittsburgh, PA, Boston, MA Hospital and University</td>
<td>Trauma-informed design and health education Mobile application</td>
<td>Undefined</td>
<td>Interpersonal trauma (e.g., intimate partner violence, child maltreatment)</td>
<td>Mixed methods</td>
<td>Mobile App Rating Scale</td>
<td>App usefulness</td>
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<tr>
<td>Trauma-Informed Personalized Scripts to Address Partner Violence and Reproductive Coercion: Preliminary Findings from an Implementation Randomized Controlled Trial</td>
<td>Amber L. Hill, Division of Adolescent and Young Adult Medicine, Children's Hospital of Pittsburgh of UPMC &amp; University of Pittsburgh School of Medicine Elizabeth Miller, Division of Adolescent and Young Adult Medicine, Children's Hospital of Pittsburgh of UPMC &amp; University of Pittsburgh School of Medicine</td>
<td>Adolescents and adults (16 to 29 years old) Pennsylvania, USA Community</td>
<td>Trauma-informed personalized scripts Tablet-based application</td>
<td>Undefined</td>
<td>Interpersonal trauma (e.g., intimate partner violence, child maltreatment)</td>
<td>Quantitative Randomized control trial</td>
<td>Discussion of IPV, RC and safety cards</td>
<td>Summary score that captured any discussion of IPV, RC, and a wallet-sized safety card during the clinic visit</td>
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Discussion
Principal Findings
In this scoping review, we provide a synthesis of the published literature related to trauma-informed digital health interventions, focusing on how research has incorporated trauma-informed principles, how outcomes are measured, and how the measurable impacts contribute to whole person healing.

Most studies in the review labeled their interventions as trauma-informed, however, they often did not specify how these interventions met trauma-informed criteria, such as the six guiding principles outlined by the CDC (2020). For these interventions to be effectively replicated, it is essential to establish an operationalized definition that enables the usage of scientific standardization practices. The absence of a standardized definition hinders both the development process of these interventions and the establishment of clear objectives and measurable impact.

Approximately one-third of the studies reviewed reported participants as having experienced both primary and secondary trauma (Bao & Moretti, 2023; Epp et. al., 2022; Mogil et. al., 2021; Sockolow et. al., 2017). This finding indicates that trauma frequently does not occur in isolation and is often complex. This underscores the importance of examining the root causes of trauma and the role of oppressive systems play in creating and exacerbating traumatic experiences, especially within historically marginalized populations. These insights are valuable for shaping future treatment and intervention strategies, including advocating for a comprehensive cumulative impact and multi-pronged approaches to address the nuanced needs of those affected by overlapping traumas.

The studies under review utilized a diverse array of methodologies to measure and assess trauma-informed interventions. This variation demonstrates a lack of standardization, which complicates efforts to compare the effectiveness of different interventions systematically. Such inconsistency also raises questions regarding the existence of a predominant replicable model within the field. Within the realm of digital interventions, establishing a gold standard for trauma-informed practice and measurement is critical to facilitate the transition of these practices to digital platforms effectively.

Two-thirds of the studies included in this review were conducted in the United States (Bertram & McKanry, 2022; Hill et. al., 2019; Mogil et. al., 2021; Patchen et. al., 2020; Plant et. al., 2023; Ragavan et. al., 2020; Sockolow et. al., 2017; Sorkin et. al., 2019), which correlates with data positioning the U.S. as a country with a high prevalence of traumatic events. This prominence suggests a huge strain on the U.S. economy due to an abundance of strain on the population’s mental and physical well-being. And therefore presents an opportunity for public health policymakers to strategically allocate resources toward trauma-related interventions both structurally, and through health programs and social services. This observation suggests the need for further investigation beyond the U.S. context, considering that high rates of trauma are not exclusive to the U.S. but also prevalent in regions affected by war, conflict zones, and natural and human-driven disasters. This highlights an opportunity to explore digital interventions, especially in locations where physical infrastructure has been compromised (Phuong et. al. 2023). Therefore, grant funding mechanisms that are flexible enough to support interventions, addressing a wide spectrum of traumatic experiences, yet tailored enough to effectively target
and address individual trauma experiences. The landscape of existing digital interventions remained limited, underscoring the significance and timely development of the previously mentioned ‘Welcome Home’ mobile application.

**Future Research**

Future research should prioritize the evaluation of intervention effectiveness across various trauma types, with a particular focus on the co-occurrence of multiple traumatic events. Attention should also be given to persistent traumas that have been strategically engrained in the day-to-day experiences of historically marginalized groups (e.g., ethnic and racial minorities, LGBTQ+ individuals, immigrants and refugees, women and girls, housing insecure individuals). Moreover, the field would benefit from developing and validating of standardized definitions and metrics to assess the impact of trauma-informed interventions. This would enhance the ability to compare and replicate studies within the field. Addressing trauma in research is inherently complex due to the quantity of variables influencing individual responses and resilience. Nonetheless, the inextricable link between trauma and mental health underscores the potential of relational models in conceiving effective approaches to treatment and support. While technology significantly expands the capacity to connect with individuals and communities, it simultaneously introduces potential vulnerabilities, such as concerns related to privacy and security. These issues are critical and must be meticulously addressed at all stages within the research process to ethically engage with individuals and communities through digital means. It is essential for digital interventions to incorporate vigorous protective measures to safeguard sensitive information and ensure the trust and safety of all participants.

**Strengths and Limitations**

The primary strengths of this review are in its methodological rigor, highlighted by a systematic search strategy and the robust assessment of articles. Quality assessment evaluations were conducted independently by two reviewers, ensuring a comprehensive and unbiased review process. An adjudicator was involved as necessary to resolve any discrepancies, further reinforcing the integrity and reliability of our findings. This rigorous process is important for validating future study in this area, specific for digital interventions. To the research team’s knowledge this is also the first scoping review of its kind to assess the range of trauma-informed digital health interventions.

The search strategy and results of this review present several notable limitations. Due to the lack of a standardized approach for integrating trauma-informed frameworks into research, the search criteria were deliberately narrowed to only include exact verbiage, leaving out the potential to capture studies that utilized principles but did not specifically call their approach “trauma-informed”. The review was confined to several specific databases, excluding grey literature due to constraints of time and resources. Only articles published in English were considered, reflecting the linguistic capabilities of our research team. We did not contact authors to inquire about potentially relevant unpublished work.

Despite limitations, this review identifies significant discrepancies in how trauma-informed digital health interventions are defined, measured, and replicated. These inconsistencies pose
substantial challenges in summarizing and comparing findings across studies effectively, and by shedding light on this gap this study can serve as a guide for future research.

**Conclusion**

Traumatic events are a prevalent aspect of the human experience, necessitating comprehensive public health approaches to both prevent trauma and its aftermath responses. These approaches is crucial not only for individual health but also for societal well-being. In today's society, where technology use is pervasive, it is important to recognize both the potential harms and benefits of such accessibility. While technology offers substantial reach for addressing trauma, its application must be handled with particular care, especially when engaging vulnerable populations. The development of trauma-informed digital health interventions presents significant area of opportunity for innovative collaboration between multiple fields to tackle the complexities of trauma production. However, these interventions must also include approaches to structural change that address the root causes of trauma, rather than solely focusing on post-trauma healing modalities and behavior change. This dynamic focus will ensure a more holistic and effective response to trauma within the public health framework.

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**Author contributions**

Amelea Lowery: Conceptualization, Methodology, Writing – review & editing.
Toni-Ann Yapp: Conceptualization, Methodology, Writing – review & editing.
Terika McCall: Mentor, Conceptualization, Methodology, Writing – review & editing.
Kayla Del Biondo: Conceptualization, Methodology, Writing – review & editing.
Karen Wang: Mentor, Secondary Advisor, Conceptualization, Methodology, Writing – review & editing.
Chelsey R. Carter: Primary Advisor, Writing – review & editing.
Johanna Elumn: Mentor, Conceptualization, Methodology, Writing – review & editing.

**Declaration of Competing Interest**

TM is a member of the Advisory Board at RACE Space Inc. The aforementioned company was not involved in the writing of this paper or in the decision to submit it for publication. All other authors declare no other conflicts of interest.
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