



## **The Use of Mobile Applications to Support Indigenous Youth Wellbeing in Canada**

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Volume 8, numéro 1, 2021

URI : <https://id.erudit.org/iderudit/1077724ar>

DOI : <https://doi.org/10.7202/1077724ar>

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### Éditeur(s)

Canada Research Chair in Interpersonal Traumas and Resilience/Chaire de recherche du Canada sur les traumatismes interpersonnels et la résilience

ISSN

2292-1761 (numérique)

[Découvrir la revue](#)

### Citer cet article

Noronha, N., Smith, S., Martin Hill, D., Davis Hill, L., Smith, S., General, A., McQueen, C., Looking Horse, M., Drossos, A., Lokker, C., Bilodeau, N. & Wekerle, C. (2021). The Use of Mobile Applications to Support Indigenous Youth Wellbeing in Canada. *International Journal of Child and Adolescent Resilience / Revue internationale de la résilience des enfants et des adolescents*, 8(1), 124–134. <https://doi.org/10.7202/1077724ar>

### Résumé de l'article

In Canada, Indigenous youth have remained resilient despite being confronted with a wide range of structural and systemic risks, such as long-lasting boil water advisories, over-representation in the child welfare system, and injustices related to land treaties. As people of the land, all disruptions to ecological health are a disruption to personal and community holistic health. Land-based activities and cultural continuity strengthen pathways of perseverance for Indigenous youth (Toombs et al., 2016). For youth, cultural self-expression and personal agency are enhanced with digital platforms, which are well-suited to Indigenous people's strengths in art, music, and oral forms of passing on knowledge. The field of mental health has turned to e-supports such as mobile applications (apps) that can provide easy-to-access intervention, when needed. To date, resilience interventions have received comparatively less attention than the study of resilience factors and processes. It is timely to review the extant literature on mental health apps with Indigenous youth as, currently, Indigenous apps are in early research stages. Critically reviewing work to date, it is argued that an inclusive and expansive concept of resilience, coherent with Indigenous holistic health views, is well-positioned as a foundation for collaborative resilience app development. To date, few mental health apps have been researched with Indigenous youth, and fewer have been co-constructed with Indigenous youth and their community members. The current literature points to feasibility in terms of readiness or potential usage, and functionality for promoting an integrated cultural and holistic health lens. As this effort may be specific to a particular Indigenous nation's values, stories, and practices, we highlight the Haudenosaunee conceptual wellness model as one example to guide Indigenous and non-Indigenous science integration, with a current project underway with the JoyPop™ mHealth app for promoting positive mental health and resilience.

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## The Use of Mobile Applications to Support Indigenous Youth Wellbeing in Canada

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### Abstract

In Canada, Indigenous youth have remained resilient despite being confronted with a wide range of structural and systemic risks, such as long-lasting boil water advisories, over-representation in the child welfare system, and injustices related to land treaties. As people of the land, all disruptions to ecological health are a disruption to personal and community holistic health. Land-based activities and cultural continuity strengthen pathways of perseverance for Indigenous youth (Toombs et al., 2016). For youth, cultural self-expression and personal agency are enhanced with digital platforms, which are well-suited to Indigenous people's strengths in art, music, and oral forms of passing on knowledge. The field of mental health has turned to e-supports such as mobile applications (apps) that can provide easy-to-access intervention, when needed. To date, resilience interventions have received comparatively less attention than the study of resilience factors and processes. It is timely to review the extant literature on mental health apps with Indigenous youth as, currently, Indigenous apps are in early research stages. Critically reviewing work to date, it is argued that an inclusive and expansive concept of resilience, coherent with Indigenous holistic health views, is well-positioned as a foundation for collaborative resilience app development. To date, few mental health apps have been researched with Indigenous youth, and fewer have been co-constructed with Indigenous youth and their community members. The current literature points to feasibility in terms of readiness or potential usage, and functionality for promoting an integrated cultural and holistic health lens. As this effort may be specific to a particular Indigenous nation's values, stories, and practices, we highlight the Haudenosaunee conceptual wellness model as one example to guide Indigenous and non-Indigenous science integration, with a current project underway with the JoyPop™ mHealth app for promoting positive mental health and resilience.

**Keywords:** Mobile applications; wellness; resilience; Indigenous; youth.

## Introduction

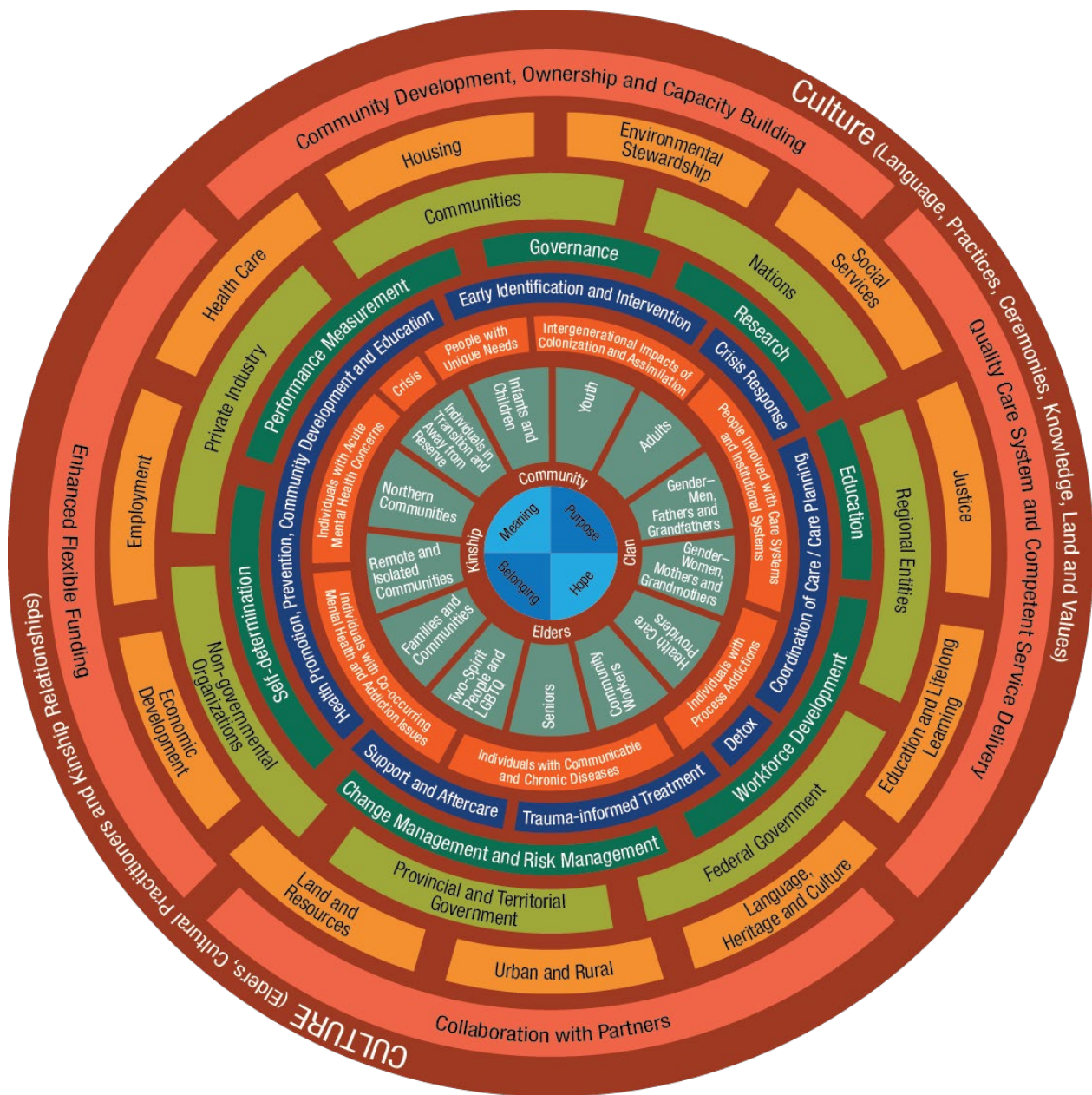
Structural determinants of health can negatively impact the health and wellness of Indigenous communities. The determinants include proximal determinants (i.e., determinants that have an immediate or direct impact on an individual's health – for example, gender norms), distal determinants (i.e., deep-rooted systemic or structural patterns that indirectly impact an individual's health), and intermediate determinants (i.e., those that link proximal and distal determinants to either promote positive health outcomes or contribute to negative health outcomes – for example, the loss of land) (Reading, 2015). Mental wellness continues to be a priority for many First Nations communities. First Nation communities define mental wellness as a daily state in which the individual renews their potential to “walk a good path” in life, in harmony with all their relations, animate and inanimate. Resilience reflects the resistance to, recovery from, and cultural persistence in the face of colonial oppressions and genocide of Indigenous peoples (Starblanket, 2018). Given the critical support of community, community resilience is a collective and collaborative concept, supported by kin, clan, Elders, and/or the community. Mental wellness is considered to be a fine balance of the mental, physical, spiritual, and emotional components of an individual. A general framework of this mental wellness is seen in the First Nations Mental Wellness Continuum Framework (Figure 1). This framework was built with an advisory committee formed by Indigenous Elders, community members, representatives, and chair members. It is rooted in culture and comprises several layers of elements that support First Nations mental wellness. The center of the model refers to the interconnection between mental, physical, spiritual, and emotional behavior – purpose, hope, meaning, and belonging. A balance between all of these elements lead to optimal mental wellness (Health Canada, 2015). As shown, culture is the key route to resilience with all elements (e.g., governance, environmental stewardship, self-determination, trauma-informed treatment, social services, research) contained within. In alignment, healing and wellness are nurtured when physical, mental, emotional, and spiritual needs of a person and their families are the focus of our attention and take priority over system needs (Health Canada, 2015). While federal, provincial, and territorial mental wellness programs and services seek to support wellness in First Nation communities, there are gaps as services and support are not always provided in a culturally safe manner. As a result, the development of a coordinated, comprehensive approach to mental health programming is required; mHealth apps may be a useful contribution.

Research has shown that creating, maintaining, and reinforcing resilience pathways promotes mental wellness for Indigenous youth (Toombs et al., 2016). As resilience is, in part, the availability of resources (Ungar & Liebenberg, 2011), Indigenous resilience tools need to be directed by relevance to youth. Indigenous youth have shown a quick adoption of mobile phone technology applications (apps) to promote cultural identity, quickly mastering newer apps such as TikTok, where the hashtag #Indigenous has over one billion associated views and is a tool for Indigenous youth advocacy and leadership (Loyer, 2020). The understanding of the mobile phone technology landscape for youth resilience is an opportunity to consider the differing streams of work in the areas of mental health app development, Indigenous youth resilience research, and the nascent Indigenous-developed resilience app area.

Mobile phone technology has been adopted by Indigenous peoples for accessing basic social and emergency services, with uptake of usage being both rapid and prevalent (Du, 2017). In reviewing the literature on information and communication technology among Indigenous peoples, Du (2017) found that in Western Australia, most Indigenous mobile phone users had a prepaid phone service. The mobile aspect provided a means of maintaining private communication in over-crowded housing, as well as supporting outdoors movement, as compared to a household computer. Du (2017) recommended federal government endorsement of universal access to telecommunications as a key means to reducing health disparities. However, research into the technology-based behaviour of Indigenous peoples is in its infancy, with little empirical-based understanding of the fit to culture and values.

Within the following sections, we describe the collaborative process and knowledge exchange of a McMaster University- Six Nations of the Grand River youth mental wellness committee, using a Haudenosaunee model, to co-create a research project on mHealth. Specifically, we consider the conceptualization of resilience, the Indigenous resilience components of culture, language, and personal agency. This paper will highlight the current landscape of mHealth available to support Indigenous youth and, further, demonstrate how an existing application, JoyPop™ will be adapted to be the first mobile application created specifically with and for Indigenous youth, integrating clinical psychology science strategies for the promotion of their resilience. To date, JoyPop™ has shown promising results in doing no harm, reducing depression scores, and increasing emotion regulation skills (MacIsaac et al., 2021).

Figure 1. First Nations Mental Wellness Continuum Framework (Health Canada, 2015)

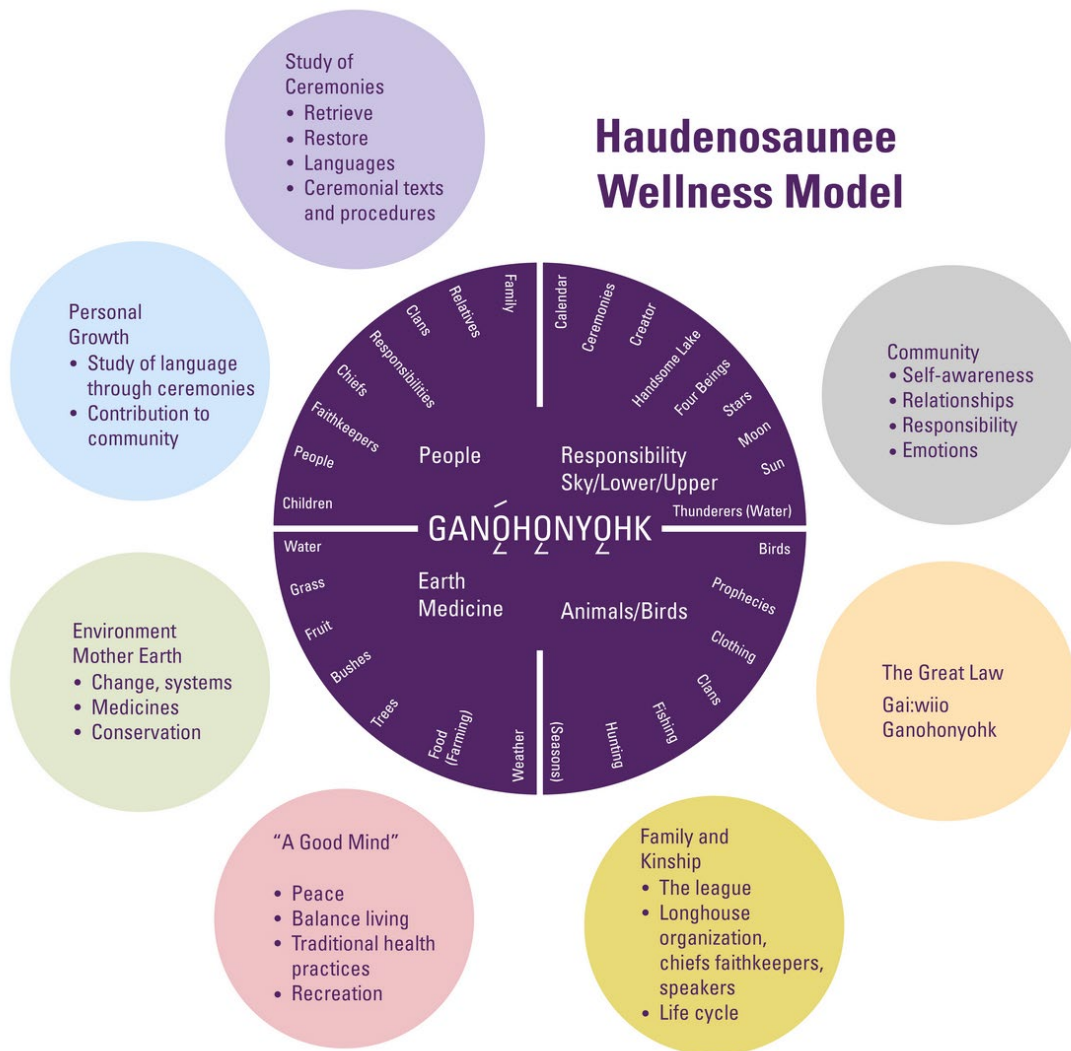


### Resilience: Haudenosaunee Perspective

Non-Indigenous views of psychology defined resilience as an individual characteristic or process, in line with the known developmental processes of accommodation and adaptation to challenge (Bernard, 2004). However, resilience can be extended to groups, as the capacity of individuals, their communities, their ecosystems, and their governance systems to survive, adapt, and grow in the face of adversity or transformation. While resilience has been associated with individual factors such as grit, emotional and cognitive flexibility, creative problem-solving, humor, and social skillfulness (Feder et al., 2009; Oshio et al., 2018), it may also derive from social connectedness with a ‘belonging’ group. Recent resilience research suggests that it is valuable to have social networks that can be responsive to an individual’s bid for support (Hamby et al., 2018; Hamby et al., 2020; Wekerle, 2020). Indigenous peoples hold a holistic view of health and resilience, placing emphasis on distinctive features for Indigenous groups such as history, social and

geographical settings. One Haudenosaunee model of wellness is depicted in Figure 2. This holistic view of health can be expressed through the phrase “we come together to have a good mind.” Stories that are built around culturally-informed notions of personhood that link the individual to the community (both past and present), and to the land and broader environment (Berkes & Ross, 2013; Blackstock et al., 2020; Kirmayer et al., 2012; Martin Hill, 2009) can further support this holistic view of health. Key resilience components can include culture (Kirmayer et al., 2012; Kirmayer & Valaskakis, 2009), language (Aguilera & LeCompte, 2007), personal agency (Blackstock et al., 2020; Kirmayer et al., 2012), and personal practices such as daily recital of the Thanksgiving address (Onhenton Kariwahtekwen), attending Longhouse and other ceremonies, respecting reciprocal relationships (e.g., carbon dioxide and oxygen exchange between trees and individuals), and community as relational where responsibilities are understood to the self and the others. It is important to consider these different key resilience components in the co-creation of an mHealth app for Indigenous youth, in order to encourage ‘coming together to have a good mind’ as when we help current youth, we are assisting the next seven generations of youth. Below we further describe culture and language, and personal agency and view of self as it relates to Indigenous resilience for integration into mHealth apps.

**Figure 2.** Haudenosaunee Wellness Model used with permission from Kawenni:io/Gaweni:yo Private School from Six Nations of the Grand River.



**Kawenni:io/Gaweni:yo Private School**

## Culture and Language

A person's connection to the land and environment reflects working with forces both within and outside the individual (Kirmayer et al., 2012; Raftopoulos & Bates, 2011). There is a recognition of the inter-relatedness of traditional ecological knowledge with traditional medicines from the land and holistic healing (Martin Hill, 2009). The natural environment can support emotional regulation, guidance, and healing (Kirmayer et al., 2012; Raftopoulos & Bates, 2011). Haudenosaunee culture invites the recital of the Thanksgiving Address at the start and end of the day to acknowledge all gifts from the Creator and the natural way of living in harmony, peace, and respect. Known as Ohèn:ton Karihwatéhkwen, it is a spiritual practice of bringing all into alignment, acknowledging and greeting the natural world (e.g., Mother Earth, animals, food, medicines). As a daily resilience practice dating back to pre-colonization, it is much earlier science on the valuing of the practice of gratitude for mental health, as compared to its recent advancement by positive psychology frameworks (e.g., Kong et al., 2020; Scott et al., 2020). Within the Ohèn:ton Karihwatéhkwen, the individual is said to bring their mind together with the minds of the community, to become one and align themselves with the natural world (i.e., "all one"). A literal translation may be "what we say before we do anything important" (Mohawks of the Bay of Quinte, n.d.). Thus, rather than "Indigenizing" resilience, conceptually, resilience needs to recognize earlier Indigenous understandings of wellness. Pride in cultural heritage, language-based cultural knowledge and practices, and spirituality all support the community resilience goals of decolonization and healing. Research has demonstrated that Indigenous youth enjoy using mobile technologies such as apps and believe that apps can contribute to supporting processes such as language revitalization, learning, and cultural understanding (Dyson et al., 2015). A Canadian Arctic study found that stable and secure relationships across one's friends, family, and community allowed youth to feel more resilience in the face of adversity, specifically related to social change (Kral et al., 2014).

## Personal Agency and View of Self

*"Odagahódeş is a Cayuga word that makes us more compassionate. It means that you know of the way of life, so that you can move into someone else's space, with the highest integrity and the deepest connectedness. It is just so understood as a sacred space. It is a participation in someone's life and honoring the way of life, without interference, so decision-making stays with the individual who has been gifted with the powerfulness and richness of the language and the coming together of two people in respect"* (Six Nations Elder, Jacobs, 2020 p.5).

Indigenous worldview is expansive through space and time, reflecting a humble view of self in the evolution of the universe, where children are the most sacred members (Blackstock et al., 2020). With the view of becoming ancestors to future generations, there is an investment in children and youth acquiring 'knowledge credentials' in regard to culture. A youth is considered someone who is being taken care of. Once they transition to someone who is taking care of someone else (e.g., becoming a parent), they no longer hold youth status (L. Davis Hill, personal communication, November 18, 2020). Collective efficacy can strengthen the individual efficacy and make individuals feel capable of addressing their own needs. Resilience is a descriptor for a person with agency, who is capable, skillful, and knowledgeable on how to survive in the world (Isbister-Bear et al., 2017). Practically, land-based experiences (e.g., knowing when and how to harvest food as taught by Elders) build a sense of reciprocity and respect for the land that is carried back and forth in interactions with people. For example, in a Northern Norway study, researchers found that the use of recreational and natural resources, and traditional land/ecological knowledge (such as reindeer husbandry) could strengthen adolescents' ethnic identity and pride. Cultural connectedness, thus, acts as a potential resilience mechanism (Nystand et al., 2014). Ulturgasheva et al. (2015) highlight the importance of Indigenous youth being given the opportunity to negotiate resources, including them as members of a participatory research process. From children to youth, opportunities to practice self-agency are supported and guided by Elders and the community. Self-determination, as a concept, is foundational to achieving respectful relations (Blackstock et al., 2020). The trajectory of research on mobile apps for mental health can be described as focusing on non-Indigenous apps as applied to Indigenous youth populations with specific psychological symptomatology (e.g., suicidality, anxiety, substance misuse) to co-creation of apps to focus on resilience. However, research to date has not examined personal agency issues. For example, for youth seeking support in building their resiliency, privacy issues arising from "free" apps (i.e., in-app purchases, in-app advertising) is a concern given the third-party selling of app data, which may put individuals at risk for exploitation. Given the historical betrayal of Indigenous peoples in preference for financial gain, these ethics issues are paramount for transparency in mental health and resilience apps targeted to Indigenous youth.

## Mobile Apps for Indigenous Youth Resilience

### Current Literature on Mobile Apps x Indigenous Communities

To our knowledge, no literature currently exists around resilience mobile applications for Indigenous communities. However, other literature has explored the use of mobile apps for Indigenous communities. Qualitative work by Tonkin et al. (2017) found young Indigenous Australians (18-35 years of age) were most interested in apps that included games, audio features, and socialization. A summary of the mobile applications that can be found currently for Indigenous communities is found in Table 1 below.

**Table 1.** Mobile mental health apps available for Indigenous Communities around the world.

Mobile Application	Region of Use	Purpose	Current status	Features	Co-Creation with community?
iBobbly™	Aboriginal and Torres Strait Islander Peoples of Australia	To target suicidal ideation, however not specific to youth	Available on Market Research conducted	Self-assessment on how you're feeling Demonstrates ways to manage thoughts and feelings, and how to decide what is important in your life Resources to support users	Yes
HABITS	New Zealand youth (Indigenous and non-Indigenous)	To teach mental health skills with a focus on Maori and Pacific Communities (InGame, n.d.)	Available on Market Research upcoming	Evidence-based gamified cognitive behaviour therapy that encourages positive mental health skills	Unknown

Despite the examples we have provided, e-Health psychological interventions for Indigenous youth seem to have very little progression beyond feasibility or acceptability, with little to no research done in the areas of community preferences, current resilience practices, cost-effectiveness, and outcome measures that reflect culturally relevant measurements of resilience and direct measurements of youth service recipients, as compared to service providers (Toombs et al., 2020). Specific to mental health apps for Indigenous communities in Canada, a recent scoping review by Noronha et al. (2020) examined existing Indigenous mental health mobile apps available for download in Canada. This review identified only three Indigenous mobile apps (i.e., IndigenousFriends™, 2018; FirstResponse™, 2019; It's My Life™, 2017) within the peer-reviewed and grey literature and one conference abstract (Kristman & Gilbeau, 2018), which described an app in development. None of these apps were youth-specific, and their primary focus was to provide mental health information and connection to resources and local services, rather than providing culturally specific tools for mental health and resilience promotion. The authors concluded that research on Indigenous mental health apps is extremely limited and non-existent as it pertains to youth co-creation. Literature supporting how technology research with Indigenous communities should be conducted is available. In a critical review of Indigenous technology for physical health, Jones et al. (2017) reported that community advisory councils are central to the research development process and a key means of ensuring cultural appropriateness. These are best considered as long-term relationships that operate within a cyclical model of knowledge exchange and co-creation. iBobbly™ (Table 1) utilized a co-design approach, involving the community in app development. As a process of community leadership and consultation, co-creation was identified as a key part of building trust with Indigenous communities in regard to research relationships and also a best practice in software design. While a collaborative approach was utilized to develop the features of the app, the same process did not seek to specify the measurement model, community-driven targets of improvement beyond symptomatology of interest, or existing adaptive practices. The app development aligned with acceptability of presentation and 'translation' into a visual format consistent with visual cultural metaphors. Indigenous language was not incorporated, and the non-Indigenous science-based therapeutic model was limited in inclusivity in terms of a holistic health model (Shand et al., 2019). Similar co-creation practices have been used in developing Indigenous mHealth tools (video games), such as I-SPARX, and future developers can draw on these examples when supporting Indigenous co-creation in the future (Bohr et al., 2019; Litwin, 2020). Practical strategies to encourage co-creation include incorporating storytelling in providing feedback, the use of visuals (e.g., storyboards, conceptual model diagrams, research timelines and targets), meeting in community locations, and meal-sharing when application development is ongoing.

### Next Steps: Resilience Mobile Apps x Indigenous Communities

Within this authorship team, the Six Nations-McMaster Youth Mental Wellness Research Development and Advisory Committee was initiated in 2018 to explore youth resilience app development and research aligning with the previously mentioned literature on how technology research should be conducted. This committee, on average, met monthly and established a partnership among non-Indigenous researchers, youth and Elder community members, health service leaders, and traditional ecological knowledge researchers in order to understand a Haudenosaunee approach to resilience. Sharing digital stories initiated a process of amplifying youth voices.<sup>1</sup> Holding consultation groups with youth cultural knowledge leaders provided opportunity for learning current means for resilience (e.g., singing traditional songs, participating in lacrosse, environmental advocacy, participating in rites of passage programming). With committee meetings occurring over a shared meal, Non-Indigenous resilience measurement was reviewed as a background to creating a committee-developed survey for studying youth resilience. This process enabled a mutual valuing of epidemiological measurement that allows for standardization of knowledge; knowledge of cultural practice engagement, with a recognition of youth variation in exposure to cultural knowledge; current ecological knowledge and the related advocacy of its youth; and non-Indigenous researchers recognizing that environmental wellness is inseparable from mental wellness. Based on Global Water Futures-funded research, Six Nations of the Grand River waterways have been identified as having significant toxicities, potentially impacting human, wildlife, and medicinal plant health (Lookinghorse, 2020). Only a minority of its inhabitants have access to running water, despite being Canada's most popular reserve (Shimo, 2018). Youth leadership organized a podcast series to have presentations by water and ecological scientists, traditional and Non-Indigenous mental health experts, and traditional knowledge leaders, to bridge this research discussion to the broader community.

As per community directives, investigating ecological grief and water anxiety is to be integrated with health interventions in a way that honours youth creativity and Haudenosaunee values. At the invitation of the community, the adaptation of the JoyPop™ resilience app forms the basis for engaging on the topic of youth resilience app interventions (see [youthresilience.net](http://youthresilience.net)), and in the co-creation process of an Indigenous app.

### JoyPop™

JoyPop™ is a mobile application created based on research suggesting that mental health and resilience can be fostered by helping youth gain coping skills, especially those related to managing difficult emotions and increasing engagement in positive activities. The app includes a host of features designed to foster resilience, including mood ratings and helpful corresponding activities depending on their ratings. Activities can focus on relaxing the body, helping to organize the thoughts, and providing a fun or distracting outlet. JoyPop™ is based on the theory that emotion regulation is a key mechanism for resilience and positive psychology intervention is a primary method to enhance regulation. Emotion regulation involves multiple processes for understanding, monitoring, evaluating, and modifying emotional reactions (Thompson, 1994; for JoyPop™ development history, see [youthresilience.net](http://youthresilience.net)). This app seeks to support the formation of a daily resilience routine for youth, where youth can start and end their day checking in with the app, as well as utilize the app as a supportive tool throughout the day. Features of the app include emotion ratings, breathing exercises, reflective resilience journaling, a visual-spatial game shown to reduce trauma symptoms, a doodling pad, connection to safe, and social resources. The JoyPop™ app can also link youth directly to their support system or established telephone helplines when further assistance is required. JoyPop™ will serve as a prototype that will be modified to create a holistic wellness tool for Indigenous youth in the form of a mobile app.

The modified version of JoyPop™ is will be researched and supported by a project led by a research team at McMaster University (Ohneganos Ohnegahdę:gyo - Water is Life Project; Principal Investigator: D. Martin Hill; Co-Leads: C. Wekerle & L. Davis Hill) which aims to operationalize the principles of participatory action research and co-creation to create a holistic wellness tool for Indigenous youth in the form of a mobile app. It is recognized that adaptation research is required in order to tailor JoyPop™ to meet the needs and interests of Haudenosaunee youth. Six Nations community members identified the social connectedness features to be especially consistent with Haudenosaunee values. Culturally safe and supportive resources, such as connecting with Elders and Clan Mothers, is available in the safe social connecting "Circle of Trust" feature, where the youth inputs up to six contact persons for quick connecting (Wekerle & Smith, 2018). Furthermore, Haudenosaunee youth identified that 24/7 helplines tailored to Indigenous youth and gender diverse youth would be helpful. Thus, many of the app features have face validity with the Haudenosaunee concept of "good mind". Many of the app features have face validity with the Haudenosaunee concept

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<sup>1</sup>See Ohneganos Ohnegahdę:gyo YouTube channel for youth digital water stories: <https://www.youtube.com/channel/UC95POu2D6fnd4QtCbz07BIQ/>



of “good mind.” For example, in the Mohawk language, *iah teio’nikonhriihston* literally translates to “it does not cause the mind to be good” and *siako’nikonhriihstáhkwa* translates to “it is used to make the mind good again” (J. Green, personal communication, November 19, 2020). The app features are consistent with the Haudenosaunee values of personal agency in skill development and help-seeking, as well as a daily thankfulness of and coming together to be of a good mind. Preliminary consultation with Indigenous youth living on-reserve, Elders, and community health personnel has generated the following suggestions for app features: recital of the Thanksgiving address, use of Six Nation languages, health-promoting daily activity suggestions, reliance of visuals (e.g., emojis) rather than text, cultural teaching resources, and environment-related information. For example, water is the first medicine for people (from the creation story of Sky Woman falling into a water world, it is taught that human gestation is in a “water world” and the human body is primarily composed of water). Other water-related information (such as mapping of water bodies and water knowledge) was suggested to be beneficial to include in the app as well.

**Table 2.** Key Resilient Components for Haudenosaunee Populations

Key Resilience Components for Haudenosaunee Populations	Proposed Application Modifications
Personal Agency	Recital of Thanksgiving Address
Culture	Reliance on visuals rather than text Cultural teaching resources Environment-related information (e.g., water teachings, water mapping, water knowledge)
Language	Use of Six Nation languages

Future work with JoyPop™ will involve a qualitative pilot study of technology use and acceptability of the JoyPop™ app with Six Nations youth enrolled in language immersion programming, to be able to comment on ways to include culture and language. “A good mind” is a primary conceptual model within this immersion program. An exploratory study of feasibility involves daily JoyPop™ app use over one month and youth reporting on app acceptability, their frequency of use, their use of specific app features, and ideas for app development will be conducted. The goal of this formative work is to hold a series of meetings with the app development team in order to co-create a resilience tool that will provide Haudenosaunee youth with an easy-to-access wellness tool that does not require internet connectivity, and where no “back end” data needs to be collected and, therefore, no third-party commercialization is possible. Self-determination in terms of control of what data is or is not collected, and how it is or is not used, is a strong message from the community and reflective of research ethics practices (i.e., [OCAP principles](#): information ownership; control; access; possession).

## Conclusions

Mobile apps for Indigenous communities may be a channel to remove barriers to services for those in need of support and may be an effective tool for promoting resilience skill sets. However, few mental health apps have been implemented in Indigenous communities or created with them in a community-based manner. To date, non-Indigenous psychological interventions, specifically CBT and mindfulness approaches, dominate existing mental health promotion and resilience apps. There is minimal cultural integration and utilization of traditional land-based experiential learning, cultural teachings (e.g., creation story), or language development. Targeting personal agency is present in existing apps; however, the interdependence between individual and communal or broader resilience is missing. Indigenous youth engagement and consultation is emergent in current app development. Tailoring mobile apps to fit the needs of Indigenous youth requires special consideration and appropriate research techniques that allow Indigenous communities to be actively involved in the development of mobile apps for their community in meaningful ways. Co-creation of Indigenous mobile apps with Indigenous communities is in the very early stages. Work to date indicates that Indigenous youth have a readiness for mobile apps, prefer information delivery that relies on visuals, including gaming elements, as well as help foster cultural identity and connectedness. More research is encouraged to ensure that youth-centric, culturally relevant tools are created to facilitate Indigenous youth resilience. The adapted version of JoyPop™ may be the first mobile resilience app developed through co-creation and consultation with Indigenous community partners.

## Limitations

This discussion piece is not exhaustive, but rather intended to highlight current literature in the field to identify current research and gaps. It is likely that other publications, mobile applications, or poster/poster abstracts may be available, but are not included in this discussion. It should be noted that this article describes only a subset of all mental health and wellness apps that are broadly available in the main app stores. All articles and information discussed herein were only selected if available in English, due to limited language fluency of authors, which may have excluded relevant articles in other languages. Given the target population, any articles in an Indigenous language, if available, would have strengthened this summary. Given that there is currently no pan-Indigenous concept of resilience, it is possible that some articles or apps that may be relevant to some communities were not identified as applicable or relevant by the authors given the lack of a central understanding of the concept. Also, Indigenous youth vary on their identification with and exposure to culture. Maintaining the space for agency remains important to provide in resilience development.

## Future Directions for Research

Indigenous traditional knowledge offers a long-standing perspective on resilience, where children and youth are placed at the centre as responsibility is taken for the present and future generations. From the Haudenosaunee perspective, it is noteworthy that there is no word for “trauma” (J. Green, personal communication, November 19, 2020). The concepts that are central are expressed in terms of a “good mind,” set in motion daily with the Ohèn:ton Karihwatéhkwén Thanksgiving Address. One on-going challenge evident in the app research discussed herein is the implementation of a decolonizing research approach: “Indigenous users of technology for health were not concerned with enhancing independence but rather interdependence. This includes recognizing that Indigenous perceptions of health may differ greatly from non-Indigenous perceptions” (Jones, 2017, p. 15). The Indigenous relationship-based view of holistic health needs to inform technology for youth resilience. A trajectory of research projects and sustained community-based relationships are needed to form an on-going conversational relationship of end-users, community service providers, health professionals, and Elders, with reflective knowledge checking and integration. Importantly, app research needs to assess the potential for unintended negative consequences of utilizing apps with Indigenous youth (Tighe et al., 2017). While in current environments, Indigenous youth resilience is a primary concern for communities, resilience needs and efforts are dictated, in part, by the social determinants of health. Social justice and health equity are important primary goals that may reflect lower extraordinary, on-going resilience strivings for Indigenous youth (Isbister-Bear et al., 2017).

## Acknowledgements

The authors wish to acknowledge Ms. Katherine Kim for her assistance in organizing meetings for writing, reviewing and editing this manuscript.

## Funding

This work was supported in part by the Canadian Institute for Health Research (TE3-138302, 2014 & TE3-171382, 2020) and Global Water Futures, Canada First Research Excellence Fund (20011361).

## Conflict of Interest

The author has no conflict of interest to disclose.

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