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Ethics, effectiveness and population health information interventions: a Canadian analysis

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Ethics, Effectiveness, and Population Health Information Interventions: A Canadian Analysis

BACKGROUND: Population health information interventions (PHIIs) use information in efforts to promote health. PHIIs may push information to a target audience (communication), pull information from the public (surveillance), or combine both in a bidirectional intervention. While PHIIs have often been framed as non-invasive and ethically innocuous, in reality they may be intrusive into people's lives, affecting not only their health but their senses of security, respect, and self-determination. Ethical acceptability of PHIIs may have impacts on intervention effectiveness, potentially giving rise to unintended consequences. OBJECTIVE: This article examines push, pull, and bidirectional PHIIs using empirical data from an ethnographic study of young mothers in Greater Vancouver, Canada. METHODS: Data was collected from October 2013 to December 2014 via naturalistic observation and individual interviews with 37 young mothers ages 16-22. Transcribed interviews and field notes were analyzed inductively using inductive qualitative thematic analysis. RESULTS: Both push and pull interventions were experienced as non-neutral by the target population, and implementation factors on a structural and individual scale affected intervention ethics and effectiveness. CONCLUSION: Based on our findings, we suggest that careful ethical consideration be applied to use of PHIIs as health promotion tools. Advancing the 'ethics of PHIIs' will benefit from empirical data that is informed by information and computer science theory and methods. Information technologies, digital health promotion services, and integrated surveillance programs reflect important areas for investigation in terms of their effects and ethics. Health promotion researchers, practitioners, and ethicists should explore these across contexts and populations.

Introduction

Within health promotion there is a subset of interventions that use information in efforts to improve the health of a population, which we might call Population Health Information Interventions (PHIIs). Most PHIIs can be classified with the language of information "push" and "pull." Many information interventions push information (e.g., community education campaigns) to a target audience, others pull information (e.g.,

population surveillance efforts) from populations, and some interventions combine the two by pushing and pulling information at the same time (e.g., an education intervention that also collects data on participants).

PHIIs may be active or passive in nature. Passive surveillance relies on reports by the public or health care providers, rather than actively monitoring the population through regular surveying or collection of administrative data. Push PHIIs may also be passive, as in the case of information resources such as websites and hotlines that are made available to the public with the intention of promoting health, but which require active information seeking on the part of the public in order to engage.

Evidence on the effectiveness of various types of push PHIIs is mixed (Noar, 2006; Snyder et al., 2004). Techniques used to improve relevance of health information push interventions include: message framing (positive versus negative) (Akl et al., 2011), targeting (to a subgroup) (Schmid et al., 2008), and tailoring (to an individual) (Kreuter et al., 2000). Most studies of push strategies focus on changes in attitudes or other psycho-social outcomes such as self-efficacy (Akl et al., 2011). Current research on pull PHIIs centres on harnessing digital health surveillance methods, such as syndromic surveillance (Henning, 2004), public health infoveillance (Eysenbach, 2009), and dataveillance (Clarke, 1988), which frequently integrate non-medical data with traditional forms of health surveillance.

Push and pull PHIIs interact with and inform each other. Surveillance findings spur and shape communication efforts, for example by measuring the need for intervention and evaluating intervention success (Nsubuga et al., 2006). Bidirectional PHIIs intertwine push and pull; for example via coordinated face-to-face programming (Hill, et al., 2007) or through digital and mobile health applications (Lupton, 2012). In

bidirectional PHIIs, coordinating surveillance and communication agendas is important in order to ensure intervention effectiveness as well as ethical acceptability.

Ethical Considerations Related to the Use of Population Health Information Interventions

The Nuffield Council on Bioethics' prominent report on ethical issues in public health (Nuffield Council on Bioethics, 2007) introduced the metaphor of an "intervention ladder" framework that ranks public health interventions by level of invasiveness, and thus, ethical concern. This framework placed interventions that "provide information" below all other interventions in terms of their invasiveness, and considered surveillance not even to be an intervention at all, equating "monitor the situation" with "do nothing" at base of the ladder. This framework, while influential, has been subject to a great deal of discussion and critique, ranging from the liberal philosophical underpinnings of the model (Coggon, 2008) and the lack of appropriateness of the very metaphor of the ladder (Dawson, 2016).

Dawson critiques the framing of PHIIs within the ladder, pointing out that doing nothing is indeed *not* equivalent to monitoring a situation, the latter of which "may require substantive public health activity such as surveillance work," and that providing information (the second step on the ladder framework) is often an essential part of enabling choice (the third step) (Dawson, 2016, p.511). Public health surveillance (an information pulling PHII), is defined by the World Health Organization as "the continuous, systematic collection, analysis and interpretation of health-related data" (World Health Organization, 2015) for use in public health practices ranging from planning through to evaluation. Although considered by many to be the "cornerstone" of modern public health (Lee & Thacker, 2011), surveillance practices have given rise to privacy concerns regarding the collection and use of personally-identifiable data,

including the privacy and confidentiality of research data use and of data sharing between health and other entities such as law enforcement, as well as the potential effect on identity and stigma of surveillance of individuals and populations (Fairchild and Bayer, 2004; Fairchild and Johns, 2013). A small body of research has also emerged considering the ethical challenges inherent in information pushing interventions, including the risks of promoting misinformation and increasing stigma with communication campaigns (Guttman, 1997; Guttman & Salmon, 2004).

We concur with Dawson, Fairchild, and Guttman, in asserting that information provision and surveillance activities in health promotion are *not* in fact non-intrusive and, instead, warrant more serious consideration from an ethical perspective. The recent proliferation, and rapid uptake within health systems, of information technologies, digital health services, and surveillance data sources adds impetus to the need for empirical ethical work on PHIIs, in order to understand the impacts of such technological advances on health, equity and justice. Despite important initial work into ethical challenges of public health surveillance and communication, the ethics of PHIIs—and particularly the interconnections between information push and information pull within health promotion interventions—remain under-theorized and under-empiricised (Lee, 2012; Petrini, 2010). In the current analysis, we examine the ethics and effectiveness of a set of push, pull, and bidirectional PHIIs, using qualitative empirical data from an ethnographic study of young mothers in Greater Vancouver, Canada.

Study Setting

Within Greater Vancouver, PHIIs targeting the health and welfare of young mothers and their children are planned and implemented by regional Health Authorities that

administer hospital and health services in the province, a variety of religious and secular community and family support non-profit organizations, and secondary school based Young Parent Programs (YPPs), which offer high school completion for student parents, with alternative schooling options and integrated daycare.

Methodology

In recent years, bioethicists have debated the merits of incorporating empirical research into ethical thinking in health (Molewijk & Frith, 2009), with some arguing that empirical and normative approaches are fundamentally complementary (De Vries & Gordijn, 2009) and their integration can lead to a richer and more productive ethics (Hoffmaster & Hooker, 2009). Although ethical reasoning may be extended to new health promotion issues prior to the emergence of empirical evidence, integrating empirical research into public health and health promotion ethics can, as in bioethics (Ives and Draper, 2009), provide the contextual understanding of the "on the ground" effects of ethical positions that allow for development of robust normative ethics oriented toward "real-world" health promotion policy and practice (Tannahill, 2008). Drawing on a social justice approach (Knight et al., 2014; Powers & Faden, 2006), we integrate naturalistic empirical investigation and normative ethical exploration of population health information interventions targeting and affecting the stigmatized population of young parents.

Data were collected from October 2013 to December 2014 via naturalistic observation at YPPs and in-depth individual interviews with expectant and parenting young women. Interview participants were purposively sampled from the observation sites, and theoretically sampled through return visits and other community organizations that served young parents. Interviews took place at schools, community organizations, and at participants' homes. Initial interviews were approximately 90 minutes long, with

follow-up interviews typically lasting 45-60 minutes. Interviews were semi-structured in nature and covered topics such as young mothers' experiences with health services and health information, education, housing, childcare, education, finances. Interviews were audio recorded with participant consent, and transcribed for analysis. In the transcription process, identifying information was anonymized and participant-selected pseudonyms were used. Transcripts were member-checked by participants whenever follow-up was possible.

Transcribed field notes and interviews were analyzed inductively using qualitative thematic analysis (Braun & Clarke, 2006) influenced by constructivist grounded theory principles and procedures (Charmaz, 2007). Initial open coding identified PHIIs that were observed and described in field work. Subsequent constant comparative coding, conducted iteratively with ongoing data collection, led to groupings of codes into themes identifying attributes of PHIIs and young mothers' experiences with them. Analytic and reflexive memo-writing assisted in refining themes and drew on Powers and Faden's (2006) social justice model to guide normative ethical analysis of the observed and described PHIIs.

Findings

Over 15 months of data collection, we conducted 50 days of observation and 60 interviews with 37 young mothers aged 16-22 years. In addition to young parents, during observations the researcher had the opportunity to speak with and observe a variety of service providers. The following sections contain descriptions of push, pull, and bidirectional PHIIs affecting young mothers in this study, followed by emergent ethical considerations regarding use of PHIIs.

Push Information Interventions

Most of the push interventions in this study focused on maternal-child health, and were delivered via public health nurse visits, lessons from childcare providers, health education by teachers, and guest presentations from a variety of non-profit outreach workers. The acceptability and perceived effectiveness of push PHIIs were strongly related to the implementation of the interventions, with important factors including the provider's individual style and social location, and the relationship of the organization to young mothers (e.g., whether it had authority to threaten child apprehension, whether it was promoting a specific religious/moral agenda, etc.), in addition to the content and timing of the interventions. Competing interests among those implementing different push PHIIs, as well as between information providers and young parents, resulted in complex relationships.

For example, seventeen year old young mother Sarah expressed frustration at receiving compulsory instruction in basic parenting skills, often by non-parents, at the expense of time to complete her academic work.

> I've been sitting through this for the past four years and it's—like, this is boring to me and there's nothing new and I'd rather be doing my school work, which I cannot because I have to listen to these nurses and waste a day listening to [mockingly] "How do you take care of yourself after you have a baby?" Well, I dunno, my kids are two and three years older. "How do you breastfeed?" and I don't want to listen to this. I don't want to listen to baby's gums getting brushed. My babies eat food, they brush their teeth, you know? It's, you know, what to check for in your newborn's poop. I don't have newborns in the house, you know? I know all these things. I don't want to hear it. You know, I'd rather do my school work.

The competing priorities to educate young mothers on health and parenting issues as well as assist them in completing secondary school resulted in pressures that potentially

decreased the effectiveness of interventions while increasing the stress on the target audience.

Push interventions ranging from passive wall posters to active public health nurse visits concentrated heavily on topics aligned with public health priorities, emphasizing nutrition and contraceptive use, with additional attention paid to healthy relationships, child dental health, and preventing online predation of girls. These priorities did not always align with mothers' own self-defined information needs, and the information received from multiple sources was observed to be sometimes contradictory or inaccurate. For example, reduction of sugar in the diet, and increased intake of fresh fruit and vegetables were promoted, but how to access and afford fresh food appeared to be rarely discussed.

In the current study, the young mothers reported feeling inundated with contraceptive information, but critical that the information they received often emphasized contraceptive options that were neither most desired nor highly-effective (e.g., a focus on "the pill" rather than IUDs) and typically concentrated on avoiding (rather than planning for) future pregnancies. Many young mothers expressed surprise when, following our interview guide, we inquired about their future family planning priorities, with remarks such as Sarah's, "Wow! I've never been asked that question. […]I've never – I haven't been asked that question. Maybe [I plan to have another baby in] six years or more. Yeah probably that." Others described having to do their own research on contraception despite receiving birth control education at school, because they preferred a method that was not promoted to them by public health nurses. One of these young mothers, Rey, explained,

> I wanted to get an IUD. So I didn't know anything about that so I went on the Internet
>
> and, like, I asked a question and I got, like, a whole bunch of answers and, like, what

people...recommend and use better and stuff. […]Yeah, like, what's better for...it's, like,

you know, like, 'cause there's two types, Mirena and...copper.

Although Rey was provided with contraceptive education through her YPP, it

did not meet her needs or answer her specific questions, decreasing the value of

that health education intervention substantially and leaving her on her own to

"Google" for answers.

Pull Information Interventions

Surveillance by health and social welfare professionals was the norm in the lives of

young mothers in this study. While they sometimes resented this surveillance, most

expressed resignation, exemplified in Linda's comment regarding her expectations for

motherhood:

> I knew it was going to be hard. I knew it would be hard because the ministry would be
>
> on – on my butt all the time. I knew it would be hard but I didn't care about that. I just
>
> cared about how much I love my kids and how happy I would be after all that.

Sometimes student mothers were incentivized to provide information in

exchange for academic credit or other benefits. This was observed during fieldwork in

the classroom and social service settings, for example at one YPP a teacher told an

expectant mother to keep a record of when her baby ate, telling her that the community

health nurse would want to see it, and if she brought the record back to school she could

get parenting class credit for it. Both teachers and daycare staff were observed giving

instructions on how to record and monitor infant feeding and elimination, offering as

incentive the opportunity to provide evidence of good mothering, academic reward, and

a keepsake for future memories.

Most mothers in the study expressed a willingness to comply with forms of

surveillance that they saw as meeting their needs. For example, we observed students

willingly providing personal information to public health nurses in order to update, access, and complete their vaccination records. In one YPP, we observed visiting health professionals requesting that student parents complete screening questionnaires regarding their children's development. While the young mothers in the room expressed some initial hesitation, when their teachers assured them that this screening was beneficial and that early intervention was better than discovering developmental issues later on, not only did the young mothers complete the questionnaires, but one also requested to do one for a younger sibling about whom she was concerned.

However, in order to evade surveillance that they found unhelpful or insulting, (e.g., monitoring of their contraceptive use, which was observed during fieldwork) some young mothers used strategies, including subterfuge, to minimize or obscure surveillance. Riley described disliking a mental health professional who came to a mother-baby drop-in group she frequented, explaining that she "always tries to…I don't know, ask me questions or give me advice when I don't need it." Riley explained her strategy of managing this intrusion, stating, "I just usually just shrug her off or just tell her what she wants to hear."

Mothers who reported to social workers (i.e., were wards of the State) were required to submit to surveillance of their sexual or romantic relationships in order to maintain benefits such as housing – for instance through the so-called "no spouse in the house" rules for subsidized housing. In contradiction to push PHIIs that encouraged involved fatherhood, such pull interventions appeared to put young parents in positions where they were compelled to hide cohabitation (or late night visits). As Sarah explained, hiding overnight visits was commonplace, but if one was caught breaking these rules, there could be consequences from the social worker.

[A]lmost 100%--not 100%, [but] like, 90% for sure--*everybody* on youth agreements

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has at least someone sleeping over and it's not… it's not really a big deal[…]. But it's

not a good thing 'cause if they catch you and you have all your boyfriends' clothes

everywhere and everything, they might be like, "What the hell?"

While the mothers in this study acknowledged that social workers needed to do

their jobs, they also described feeling insulted when social workers would call or visit.

Twenty-year old mother of one Darkat described feeling disrespected when a

government worker called to investigate a report alleging that her child might be

neglected.

I had some girl call me and she was like, "Oh," she's like, [affects voice] "Oh,

someone said you don't know how to hold your baby properly and thinks you're an

idiot." I'm like, "How can someone even report me for such a trivial thing?" Like, it's

like, not even a concern. Like [affects voice] "Oh I don't know how to hold the baby."

And then my nurse was like, "That's ridiculous." And then she called and she was

like, "I've seen her and she can hold her baby fine. She is a fine parent." So then she

just cancelled.

Many young mothers in the current study described having been raised in

families where they had experienced abuse and they expressed frustration that the State

had failed to provide sufficient support to have prevented that past abuse, or was still

failing to help them recover from it, while overly intensely focusing on surveillance of

their current parenting practices. As an eighteen year old mother of two, Linda, said, "I

was a drug addict before. The ministry never helped me. I was on the streets instead."

Although Linda stopped using when she became a parent, her children were removed

from her care shortly before our intake interview. She expressed a great deal of anger

that the same government that failed to help her when she was younger had, from her

perspective, judged her as being an unfit parent, rather than providing support.

I'm hurt because [crying] the ministry took my kids away, the only things that have

kept me alive all these years. I gave them—I gave them life and they gave me a reason

to live. And it hurts me a lot because they're not with me right now. But I'm not giving up at all, I'm not gonna give up until—I'm not gonna give up.... until I get them. That's the only way I give up, I'm not giving up any other way [sobbing]. And I'm very, very, very hurt from the ministry. I'm very angry with the ministry. They judge people.

Bidirectional Information Interventions

At the time of this study, the most significant example of bidirectional information intervention was the nurse visitor program in British Columbia. During data collection for the current study, the program was in the process of shifting from a whole-population postpartum nurse visitor program to a targeted approach that provides intensive information interventions via home visits for young mothers. The program emphasizes the knowledge support the nurse can provide a vulnerable first-time mother, and the nurse visitor collects information during home visits to monitor mother and child well-being, which is also used to evaluate the intervention. Young mothers' descriptions of their experiences with this new PHII were varied. For example, Jane, a 16 year old expectant mother, enjoyed the visits, in part because she was interested in participating in research, and in part because she had a great deal of trust in nurses in general. Twenty year old mother of one Mary, on the other hand, was vocally dismissive of the program, from which she had recently withdrawn. Mary felt that the educational content was information she already knew, and that the nurse's surveillance was causing her needless stress and fear.

> I felt like she was putting too much pressure on me to be the perfect mom. And that's not what any young mom needs. Even, like, an old mom who's a young mom, if that makes sense. A new mom, no new mom needs that kind of pressure, and I think that it was—it was too much pressure and it was geared at women—for women who didn't know *anything*. Like, stupid, stupid people. And I don't think that treating people like

they're stupid is going to help them improve.

The contrast between Jane and Mary's perceptions of this bidirectional intervention is striking, and may reflect implementation factors, such as cultural awareness of the information provider, or the personality compatibility between the nurse and mother.

Discussion

This study of PHIIs affecting young mothers in Greater Vancouver found that both push and pull interventions were experienced as non-neutral by the target population, and that implementation factors on a structural and individual scale affected intervention ethics and effectiveness. Within the examples presented above, surveillance and education objectives sometimes conflicted with each other, even when conceptualized as synergistic components of a bidirectional PHII. Although PHIIs might on the surface appear non-intrusive and ethically uncomplicated or appropriate, this analysis found that both education and surveillance interventions involve a variety of ethical complexities, including questions about intervention effectiveness (e.g., of education aiming to modify behavior) and accuracy (e.g., validity of surveillance data), the occurrence of various unintended consequences and, ultimately, concerns about social justice and health equity. These findings demonstrate that some PHIIs have the potential to dramatically influence the distribution of fair and unjust experiences and outcomes within and across populations of young mothers (e.g., along a social gradient). For example, the most socially marginalized young mothers were the least insulated from these competing priorities, as they were often the most heavily targeted by multiple interventions. The same teenage mother might, for example, be receiving education and be the subject of surveillance by the nurse home visitor program, immigrant settlement workers, youth workers from secondary school programs, social workers monitoring their housing and their children's well-being, daycare workers monitoring their

children's welfare, and mental health or addictions clinicians or peer mentors, in addition to clinicians at any point of interaction with the formal health care system. This is in keeping with Swift's (1995) assertion that "categories of deviance" (p.12) produce societal scapegoats, subjecting marginalized mothers to surveillance, scrutiny, and evaluation.

Young mothers in this study were willing to provide information to surveillance efforts, and were receptive to health education interventions, which they perceived as originating in trustworthy organizations and delivered by individuals with whom they could relate. On the contrary, a lack of trust generated by PHII implementation—even within an intervention planned with great respect for the target population—could lead to unanticipated (and undesirable) outcomes such as subterfuge and avoidance by the target population. Our findings illustrate how implementation factors affect both the effectiveness of education interventions on changing attitudes or behaviour and the accuracy of information pulled from a target population, who may at times engage in defensive practices of disinformation (Karlova & Lee, 2011), deception (Chatman, 1996), and information withholding.

Based on our analysis, we suggest that information interventions ought not to be considered as innately non-invasive *nor* ethically neutral. Rather, rigorous consideration should be given to the ways in which conceptualizing and implementing information interventions relate to justice concerns, such as autonomy, self-determination, and respect. As such, we argue our findings behove those working in this area to continue advancing an ethics of PHIIs that has the capacity to clearly identify both the intended and unintended consequences of intervention implementation. Below, we offer insights into where we think scholarship should be advanced in this area, including philosophically, empirically and methodologically.

Implications

The philosophical implications of this analysis should not be understated. The dominant ethical discussions within population and public health ethics range from being fairly dismissive of ethical implications of information interventions to focused on the multiple privacy and stigma-related issues involved with personally-identifiable surveillance data (Bayer and Fairchild, 2000; Fairchild and Bayer, 2004; Fairchild and Johns, 2013; Kass, 2001) and unintended effects of health communication (Guttman, 1997; Guttman and Ressler, 2001; Guttman and Salmon, 2004). Compared with surveillance, relatively less attention has been paid to the ethics of health communication interventions (Guttman and Salmon, 2004), although dilemmas related to health communication include concerns over misinformation, potentially-manipulative marketing (despite a potentially beneficent intent), and issues associated with targeting already stigmatized groups (Guttman, 1997). Based on our findings, we suggest that practitioners and theorists alike should assume that PHIIs will not be experienced as "neutral" by targeted populations, and the ethics of surveillance and communication interventions should be assessed in the context of each other's existence.

In particular, we urge special attention be paid to implementation factors, as implementation of a PHII may be more important than informational content when examining the justice-related outcomes of an intervention. Tailored approaches, such as interventions designed and implemented by trusted cultural insiders who are able to obtain consent and mutual respect within the context of PHII implementation, hold great potential to improve acceptance and effectiveness of PHIIs. While Rose (Rose, 2008) advocates targeting the general population in order to improve the whole-population health most efficiently, Frohlich and Potvin (2008) argue that such approaches may

reduce distributive justice. The relative merits of targeted, tailored, and whole-population interventions is an active area of ethical debate and uncertainty in population health intervention research (Allebeck, 2008; Frohlich and Potvin, 2008, 2008; Semenza et al., 2008)—and this study's findings underscore some of the contextualized and philosophical complexities that need to be further advanced within this debate. General population PHIIs in some cases supported young parents' sense of personal security and respect relative to being targeted as "high risk" parents, but in other cases were inaccessible to members of this marginalized group. Targeted and tailored interventions had the potential to affect positive *o*r negative influence over young parents' sense of security, respect and self-determination.

Emerging Issues

Certain public health information issues have been rising in prominence, and while neither "nudges" nor digital health technologies figured largely in this study, our findings may carry implications for understanding ethical dimensions of both trends. There is active debate regarding the extent to which responding to nudges is a free choice (Ménard, 2010; Sunstein and Thaler, 2003), and what collateral effects nudges might carry (Conly, 2013; Eyal, 2014), We suggest that information-pushing nudges (e.g., providing information on risks or benefits of health behaviours), which today use a variety of communication methods including social marketing, should be subject to the same stigma-related concerns as structural or policy nudges, including the risks of exacerbating stigma among the non-compliant and of causing ethical conflict and shame among those who do comply.

Emerging digital health technologies, increased self-surveillance (often through mobile technologies), use and reuse of "big data" for public health and policy purposes, and increasingly sophisticated and multiplatform/multimedia health education

campaigns are on the rise. Using information and communications technology as a tool to improve the health of populations is complex and may benefit from integration of information and computer science research methods, as well as empirical insights into human information interaction from digital sociology. Information ethics, rooted in information science and with values and perspectives that differ, sometimes dramatically, from those held in healthcare, should be brought into consideration when analyzing the ethics of information-based health interventions, particularly when considering the often conflicting values that arise within interactions between surveillance and culture. While public health tends to take the goodness and necessity of population surveillance for granted, questioning perhaps the handling of sensitive data but not the general undertaking of surveillance, information ethicists are frequently concerned with the psychological and democratic effects of a "surveillance society" (Lyon, 1994, 2007) (drawing theoretically on Foucault's panopticon (Foucault, 1995)), and considering inequities that can arise as a result of the gendered, sexed, and racialized effects of surveillance upon specific populations.

Following the success of digital fertility and pregnancy information support and tracking, the "quantified baby" movement (Heussner, 2013; Lagorio-Chafkin, 2015) comprises an emerging area of ethical concern particular to new parents and maternal-child health. In this study, push interventions aimed to teach young parents to track and chart their infants' bodily functions and activity, and report back to teachers, public health nurses, and health care providers. It may be that in the future, electronic tracking will replace paper records for this purpose, even going so far as to automatically report metrics on the parenting of "high risk" populations, and comparing this to some standard. Similar to many other types of personal data tracking, the evidence on the effects of such quantified tracking on actual health and social outcomes are relatively

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unknown, although experts caution against reliance on data that is of such questionable accuracy, as well the possibility of such technological solutions increasing a culture of fear and anxiety regarding child development (Gaunt, et al., 2014). Ideally, future investigations into the effectiveness and ethics of PHIIs will move beyond the tendency to position PHIIs as ethically innocuous. As our findings illustrate, combining theory with empirical data can provide meaningful opportunities to thoughtfully consider how health and social outcomes are distributed within and across the population.

Conclusion

Population health information interventions that push information to or pull information from the public in efforts to improve the health of a population are used in multiple, sometimes overlapping ways. Young mothers' health, personal security, respect, and self-determination were affected both positively and negatively by PHIIs in this study. Using information as a tool to improve the health of populations is complex and may benefit from integration of information and computer science research methods. Information ethics, drawing on different values and perspectives from those held in healthcare, should be brought into consideration when analyzing the ethics of PHIIs, particularly when considering interactions between surveillance and culture, including the psychological and democratic effects of an increasing surveillance society.

This small, qualitative study of a group of young mothers in one metropolitan area in British Columbia cannot claim to generate results that are generalizable to other populations. However, we suggest that the themes and concerns relating to the ethics of the PHIIs that targeted and affected this population should be taken up and tested in other contexts. As population health interventions increasingly incorporate sophisticated digital information technologies, and as the use of surveillance data continues to grow with unprecedented scale, scope, and reach, it is imperative to thoroughly and

thoughtfully consider the ethics and effectiveness of population health information interventions. As the findings of the current study demonstrate, information 'push' (i.e., communication) and 'pull' (i.e., surveillance) are themselves powerful, non-neutral forces (i.e., they are not on par with doing nothing) and their unintended effects may ripple far beyond health.

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