KEYWORDS: developmental origins; pregnancy; dietary inequities; health inequities; community engagement

ABSTRACT

*Background:* Disparities across socio-economic gradients in chronic disease are steadily widening. Many of these disparities have developmental origins, and can be traced to dietary inequities in the pre-/peri-conceptional and pregnancy environments. To disrupt cycles of health inequity, interventions should target improving nutritional wellbeing in early life environments, which requires deep engagement with prospective parents.

*Aims:* We report formative work seeking to understand, from the perspectives of pregnant and postpartum people (PPP) and the health and social care providers (HSCPs) who support them, the factors that influence diet during pregnancy. We outline priorities for early life environmental interventions as identified by PPP and HSCPs.

*Methods:* We carried out ten focus group discussions (FGDs) and one stakeholder engagement meeting with 22 PPP of lower Socio-Economic Position (SEP) in the city of Hamilton, Canada, as well as with 43 of the city’s HSCPs. Thematic network analyses of FGD and meeting transcripts uncovered factors shaping diet in pregnancy that we developed into conceptual maps for priority identification and intervention development.

*Findings:* Salient themes were: resilience, resources, relationships, and the embodied experience of pregnancy itself. Both PPP and HSCPs underscored that socio-economic and political forces operating at multiple levels largely determined the availability of individual and relational resources constraining dietary quality during pregnancy. Intervention development ideas focused on cultivating individual and community resilience to improve early life nutritional environments. Specifically, participants called for: better-integrated services, greater income supports, and strengthened community and state programs of peer and service-provider support.

*Conclusions:* Hamilton stakeholders foregrounded social determinants of inequity as main factors influencing diet during pregnancy. They further indicated a need to develop health equity interventions that build resilience and redistribute resources at multiple levels, from that of the household to that of the state.

**INTRODUCTION**

Within and across nation-states, overall health across the lifespan is inequitable: risks of illness and death vary systematically among groups of people (1,2). Health inequities – distinct from health inequalities, which may stem from unavoidable factors like genetics – pertain only to avoidable, unfair differences (3). Most unfair health disparities are between people(s) of higher versus lower socio-economic position (SEP), with people of higher SEP more likely to be alive and thriving at any given age (4,5). In 2008, the World Health Organization (WHO) called for the elimination of such disparities within a generation (6).

The largest contributors to inequitable health outcomes are non-communicable diseases (NCDs), including cardiovascular diseases, diabetes, and many cancers (4,5). NCD disparities are widening steadily through time (4) raising the questions: Why are they widening and, in keeping with the WHO’s call-to-action, what can be done to reverse this trend?

**Developmental origins of health inequities and strategies for disrupting them**

One step toward answering these questions is to reflect on how socio-economic and political inequities interact with biology to affect health (7). According to the well-supported Developmental Origins of Health and Disease (DOHaD) hypothesis, inequities become incorporated into our biology largely during early development (7,8). The DOHaD framework suggests developing embryos/fetuses/infants receive biological signals about their environments from their parents, and these signals shape energy investment and growth patterns (9,10,11). In turn, growth patterns influence social, educational, and labour force performance and, eventually, disease susceptibilities (12). Differential performance in education and employment leads to differential access to income/wealth, knowledge, and influence through the reproductive years for parents/prospective parents, perpetuating inequities across generations (13). DOHaD-based research indicates that, because small alterations during early development have outsized downstream effects on health (14,15), effective interventions to disrupt cycles of inequity should focus on improving health prior to conception and through pregnancy/infancy (16,17).

Nutrition constitutes a key, modifiable factor that inequitably influences the peri-conceptional/pregnancy environments (11). For pregnant people, frequency of meals and snacks, food nutritional quality, and the socio-environmental context of eating vary substantially among people of different SEPs (18,19,20). Disparities among SEP groups in pregnancy diet impact maternal health and fetal/postnatal development, with lower-SEP pregnant people and their children at increased risks of experiencing pregnancy complications and subsequent development of NCDs (21,22,23,24). As such, improving diets and reducing dietary inequities during pregnancy is central to disrupting the NCD epidemic.

To date, pregnancy diet intervention strategies have predominantly framed eating as the product of individual motivations and behaviours (25,26). However, individual people eat within households, communities, and nation-states (27,28,29). Moreover, these higher-level environmental factors exert stronger influences on eating patterns than do individual intentions (19). Improving pregnancy diets therefore requires moving beyond approaches focusing primarily on individuals (25,30,31,32) to interventions operating at multiple levels that scaffold existing community supports and resources, and emphasize building empowerment and resilience (33,34,35). Such multi-level approaches rely on deep engagement with participants throughout intervention development, such that participants become invested in improving the health of their communities (36).

**Project goal, study aims**

We, [team name removed] employ a multi-pronged, deep engagement strategy to support pregnancy nutrition and reduce pregnancy dietary inequities in the city of Hamilton, Ontario, Canada. Here, we report findings from focus group discussions (FGDs) and a stakeholder engagement meeting with people from Hamilton who were pregnant or post-partum at the time of participation (i.e., pregnant/post-partum people – PPP), as well as with Health and Social Care Providers (HSCPs) who interact regularly with PPP. Our discussions largely sought to answer two questions: 1) What influences diet during pregnancy? and 2) How can people be supported to improve their diets during pregnancy?

[Box 1 about here]

**METHODS**

**Setting**

[Study name] is based in Hamilton, Ontario, a Canadian city of ~750,000 (37). The city is socio-demographically diverse (38,39) (see summary statistics in supplementary materials, S Table 1), and is characterized by striking inter-neighbourhood economic and health inequities (40).

With the important exception of low birthweight (accomplished through deep, community-based intervention), most of Hamilton’s inter-neighbourhood health disparities have persisted or worsened over the last decade, despite considerable efforts to remove health barriers for lower-SEP residents (40). The persistence of many health inequities across the city highlights the need for additional community-based interventions, particularly targeting early life.

**Participants, procedures**

We carried out ten FGDs and one stakeholder meeting. The core topics for the FGDs were identified by the research team, in consultation with local public health administrators, as priority areas for investigation. Four of the FGDs were with PPP, held in neighbourhoods characterized by high rates of poverty and NCDs. Nineteen of 22 PPP FGD participants were recruited through locally-administered but nationally-funded prenatal programs. In Hamilton, these programs combine weekly group prenatal education with meal preparation/consumption, provision of grocery store and prenatal multivitamin gift cards, and informal peer-to-peer and HSCP support (41). The remaining PPP participants were previous respondents to a [study name] survey who were of lower SEP and interested in follow-up. We present the socio-demographic characteristics of the PPP participants in Table 1.

[Table 1 about here]

The remaining six FGDs were with HSCPs: two with public health nurses and registered dietitians who run the local prenatal nutrition programs, two with midwives, and two with early childhood educators who staff new-parent/young child neighbourhood drop-in centres. The socio-demographic characteristics of these HSCP participants are summarized in Table 2.

[Table 2 about here]

Participants in the stakeholder meeting were: five PPP experiencing vulnerabilities, two public health administrators, two public health front-line staff, one midwife, one early childhood educator, one family doctor, one director of a community food centre, five research investigators, and three research assistants.

*FGDs*

All FGDs were facilitated by the lead author, with assistance from two or more co-authors. FGDs lasted from 60-120 minutes and followed interview guides developed by our team, either a 13-question version tailored to PPP or a 14-question version for HSCPs. Interview guides and the larger study protocol were reviewed and approved by [REB/approval number removed].

FGDs were audio-recorded and transcribed verbatim by members of the research team. After anonymization, transcripts were coded using NVivo 12 qualitative analysis software (42). We then carried out a thematic network analysis (43). To this end, we incorporated organizing elements from the interview guides into our coding framework which included five “parent” nodes related to pregnancy diet challenges and inequities: *Challenges and gaps*, *Supports*, *Health,* *Knowledge*, and *Solutions*. After four team members independently coded the same transcript to evaluate inter-coder agreement (inter-coder agreement was over 90%), all transcripts were coded to sub-nodes within the parent nodes. Then, through a series of brainstorming sessions, we developed a network of global, organizing, and basic themes extended in a non-hierarchical web (43). Themes were distilled and organized into two conceptual maps pertaining to our two research questions. This was accomplished through a series of iterative discussions in which all investigators were asked and asked of each other: Does this basic theme reflect or overlap with other basic or organizing themes? If not, can it be discarded or subsumed into another basic or organizing theme? Does this basic theme nest within its proposed organizing theme? If not, why not and where could it nest? This process was repeated until all authors agreed that the resulting maps reflected the key relationships among the dominant themes derived from the transcripts. Map contours are presented and discussed below, illustrated via quotes selected from the transcripts.

*Stakeholder meeting*

The four-hour stakeholder meeting was facilitated by a trained group facilitator with expertise in community engagement. The meeting began with a lay-accessible presentation of the provisional FGDs findings. Next, we held break-out discussions in four groups, each comprising stakeholder representatives from multiple sectors, to identify major issues related to pregnancy nutrition and wellbeing in Hamilton. At the meeting’s end, issues identified in individual groups were brought to another full-group discussion about priority issues and ways to address them. All proceedings of the stakeholder meeting were recorded with detailed notes and audio-recordings.

Two research team members reviewed the meeting notes and transcripts and identified solutions for addressing pregnancy nutrition challenges generated by the stakeholders. We organized proposed solutions under the themes identified through the FGDs as influences on pregnancy diet/nutrition.

**RESULTS AND DISCUSSION**

**Question 1: What influences diets during pregnancy?**

Data used to answer this question come from FGDs, corroborated by discussions in the stakeholder meeting (S Table 2). Four themes emerged from the thematic network analysis of the FGDs (Figure 1): *Resilience, Resources*, *Relationships*, and *Embodiment of* *Pregnancy*.

[Figure 1 about here]

*Resilience*

PPP and HSCPs raised issues around poor mental and physical health as pervasive features of pregnancy that influence diet, but these were generally tempered with sentiments of determination to “cope” (PPP-FG1) or “deal with” (PPP-FG3) life’s challenges. We chose to foreground these indicators of what we view as *resilience*, given recent work highlighting the necessity of positive framing, and of focusing on modifiable factors in translational DOHaD research (25,31,32). Resilience is traditionally defined as the ability to adapt to adversity, and includes malleable traits such as self-efficacy (44,45). In keeping with this, resilience here refers to the capacity of a pregnant individual facing challenge to feed herself such that her own current and future health and that of her developing fetus is supported. We underscore, however, that resilience, while treated here as an individual attribute, is determined predominantly by the other themes in our thematic network – resources, relationships, and embodiment of pregnancy – all of which extend beyond the individualc.f. (46). In the words of one HSCP, “it’s all mostly social, poverty-related issues [rather than individual ones]… because everything is political will and money” (HSCP-FG1). Moreover, resilience should be conceived as modifiable, not only through the building of individual capacity but also through the (re)allocation of resources at household, community, institutional, and policy levels (45,46,47).

Resilience in the face of challenge featured in all FGDs and in full-group discussions at the stakeholder meeting. A midwife, for example, described “anxiety” as a phenomenon affecting a growing number of her clients but highlighted that those clients “deal” with the “unpredictability of pregnancy and birth” (HSCP-FG3).

When we spoke with PPP, they showed resolve to overcome barriers associated with poverty so as to take care of their families. One mother explained: “I’m worried about… health stuff… money… that’s the reality of being a parent and *you just have to do what you can*” (PPP-FG3, emphases ours).

Another mother shared:

*I have so many life challenges. I think everybody does though... I think as mothers and as women* we suck it up and do what we have to do for our children*. And that’s just the reality of life. (PPP-FG3, emphases ours)*

These quotes illustrate that accepting and managing hardship is central to the experiences shaping pregnancy diet, implying tradeoffs between competing priorities in challenging environments. As a public health nurse put it:

*[The] issues [facing pregnant people living with poverty] are so much more base that I feel like just motivating them to think about nutrition… is challenging… The topic of nutrition isn’t really big on their priority list. (HSCP-FG2)*

That is, other basic needs must be met before PPP can prioritize eating nutritious, healthful foods during pregnancy.

*Resources*

PPP as well as HSCPs from multiple sectors identified resource access as a main determinant of diet during pregnancy. *Resources* encompasses both individual/household resources (income; time and energy; knowledge and skills) and resources provided by the state (community/municipal health and social programs shaping the local food/health environment; provincially-/federally-administered financial resources). Provincial/federal resources discussed in FGDs include: tax credits for people with children, social assistance for people living with disabilities, employment insurance, and parental leave from paid employment. PPP held mixed views about provincial/federal resources and their impacts on individual diet. They noted mainly that benefit programs were essential but under-funded. As has been reported in other populations of pregnant people and new mothers experiencing vulnerability (48,49), PPP perceived income transfers as insufficient to adequately meet the basic needs of growing families in the context of rapidly-increasing housing, transport, and other living costs. One participant, whose income was provincially-supplemented, highlighted challenges around housing specifically, saying:

*Housing in Hamilton has skyrocketed to the point where 90% of your income... feels like it’s going to [your] home. And that takes away from your ability to provide food for your family.* (PPP-FG1)

HSCPs generally echoed the sentiments of PPP, especially regarding the insufficiency of income supports. One midwife stated unequivocally:

*The most important thing [for pregnant people experiencing vulnerability] is money. The more money we have, the healthier we are. I mean, that’s a fact, right? So, the forty extra dollars a month [allotted as a prenatal bonus] for people on [welfare], I don’t think that’s sufficient.* (HSCP-FG3)

Taken together, these discussions indicate that PPP and HSCPs think that government cash transfers are insufficient to allow pregnant people to prioritize their own nutritional needs over competing needs for housing, childcare, and feeding older children. This view was further reflected in the stakeholder meeting (S Table 2).

Regarding municipal resources, participants in all FGDs highlighted that Hamilton is rich in services and programs supporting maternal-child health. In particular, the prenatal nutrition program was seen as invaluable in connecting PPP with HSCPs, peers, and information about other services and resources. One PPP participant explained that she “found out about [many of the city’s other maternal-child health resources]” (PPP-FG4) from the “great” (PPP-FG1) program. Nonetheless, both PPP and HSCPs raised several criticisms of community-level services. Specifically, many of the local services were viewed as poorly integrated with one another and with government/health care services, and thus poorly-equipped to better the nutritional environment. A dietitian pointed out that connections with family doctors and with the welfare office were nearly non-existent. She noted that HSCPs at the prenatal nutrition program: “…talk [with their clients] about the pregnancy nutritional allowance [for people receiving welfare] but… don’t always know what their [welfare] worker is telling them” (HSCP-FG1).

Although the prenatal nutrition program does direct vulnerable people to many of the city’s resources, staff indicated that they sometimes lack the time or knowledge to do this work and were frustrated by ongoing cuts to their program. Furthermore, many PPP in the city are unaware of the prenatal nutrition programs. One participant, after learning that her FGD peer was unfamiliar with the program and had missed the opportunity to enroll said wryly: “My advice would be marketing *this* program” (PPP-FG4). In the same vein, a public health nurse expressed frustration that doctors do not refer pregnant people to the prenatal nutrition programs or similar maternal-child health services, because the programs are not indexed in the electronic medical records checklist system used by physicians (HSCP-FG1).

In terms of individual and family resources, PPP and HSCPs generally agreed that household finances, time, and energy constrained pregnancy diet. With respect to time/energy, an early childhood educator, when talking about meal preparation, noted that “we live in a world that is so fast forward that you never feel like you have time to do anything... [of] quality” (HSCP-FG6). A PPP participant talked about how, after a long day of work or of spending time with her infant daughter, she “would just grab whatever [she] could to throw in a microwave... So, [she] didn’t really [eat] any *meals…* unless [she] ate out” (PPP-FG1).

There were also important differences in perceptions of individual influences on pregnancy diet between PPP and HSCPs. PPP generally did not raise concerns about lack of knowledge, skill, or familiarity with how to eat healthfully, prepare food, budget, look after their bodies, or navigate the health system. Rather, most PPP participants appeared deeply resourceful and empowered by their resourcefulness under tight constraints. One lower-SEP mother said proudly, “My biggest thing is: I budget!” (PPP-FG1).

In contrast, HSCPs were likely to discuss their clients’ need for, in one dietitian’s words: “financial literacy… health literacy… physical literacy, nutrition literacy, every form of literacy” skills (HSCP-FG1). In the same line, a midwife argued that “fresh products are often cheaper than highly processed foods, if you know where to shop”, implying that her clients lacked this knowledge (HSCP-FG3). So, health and other literacies were viewed by HSCPs but not by PPP as determinants of individual capacity to eat healthfully during pregnancy. We suspect that this discrepancy in views may be in part due to the fact that PPP who volunteer for FGDs represent a self-selected sample of the more resilient, already-health-literate pregnant people facing challenge. Another plausible explanation is that most PPP may be pregnancy health literate, but live with so many other constraints that they cannot foreground – let alone apply – this knowledge (50). Regardless, our data broadly accord with findings from other populations, in which nutritional inequities during pregnancy are viewed as largely the products of resource inequities (51). These resource inequities, in Hamilton as elsewhere, function at multiple levels, from the individual or family, to the community, to the state (29).

*Relationships*

FGD participants talked about interpersonal relational supports, like the spouses/partners, parents, siblings, friends/peers/communities, and HSCPs of PPP, as having complicated effects, both supportive and undermining, on the quality of pregnancy diets. The nature of these effects appears to depend on relational power dynamics and on familial traditions (52).

While social isolation was identified as a barrier to a well-rounded pregnancy diet, so too was embeddedness in relational structures limiting PPP control over food consumption. Some PPP highlighted that they lacked support and/or autonomy at home. This left them, in one mother’s words, “eating whatever you can, whenever you can” (PPP-FG1). Others indicated that their partners either already held meal preparation responsibilities, or took these on during their pregnancies. For those who received partner support with food work, this generally offered relief from discomfort, tiredness, and nausea. However, this support came at the cost of poorer adherence to pregnancy dietary recommendations. One participant described her husband’s cooking as “delicious, but [with] lots of fat” (PPP-FG2). Another mother-to-be described her situation living with her husband’s family in this way:

*We don’t have any control over what we’re eating. I try and cook but it’s kind of impossible. If you can’t control what you’re buying or preparing, you just eat what’s available.* (PPP-FG2)

These findings regarding partners and in-laws were not surprising, as one recent study on fathers’ contributions to food work in North America shows that fathers tend to undermine mothers’ diet and health aspirations (53).

HSCPs echoed these ideas that support people, particularly partners and grandmothers-to-be, could either improve or inhibit pregnancy wellbeing. In keeping with the ‘support is supportive’ perspective, one nurse suggested that grandmothers-to-be were major supports for many of the newcomers-to-Canada who participated in a prenatal nutrition groups she co-runs: “It’s mainly mothers and mother-in-laws... You can tell how important they are to our clients” (HSCP-FG2).

From the other perspective, a midwife told a story in which a husband angled to get her “endorsement that [his pregnant wife] was eating too much sugar”, in a way that was “hurtful or even controlling for the woman” (HSCP-FG4). Along the same lines, a dietitian related that:

*“It's [often] the men who are doing the shopping... So maybe another barrier for the women is that they don't have… much control of their groceries.”* (HSCP-FG2)

Relationships between PPP and HSCPs were generally highly valued. HSCPs emphasized that they viewed their roles as sources of information and as problem-solvers, but also as psycho-social/emotional supports for the people they work with. In the words of an early childhood educator, they “initiate conversations with families about health… as a whole... only initiated once [they]’ve built a rapport” (HSCP FG5).

PPP mostly expressed gratitude for the kinds of support offered by HSCPs. Nonetheless, a few mothers hinted at some resistance to HSCPs’ authority. One mother said: “There are a lot of rules [outlined by staff] that we as parents might say we follow but we don’t” (PPP-FG3). Her friend then chimed in:

*A lot of these [prenatal nutrition] classes are great, but the guidelines are just so by the book... and the policies. It’s like if you try to tell [the public health nurses and registered dietitians] any different [than what they advise], then it’s like ‘no, no, no’ you know? So you don’t say anything. You just keep it to yourself, and while you’re at [the prenatal nutrition group] you do what you’re supposed to do until you get home.* (PPP-FG3)

These examples illustrate that well-intentioned advice/support from professionals does not translate directly into better health for pregnant people, new mothers, or babies. Rather, a person’s sense of power and control over her own life drives what becomes embodied and practiced during pregnancy and post-partum (54).

In contrast to some of the complexities of other relationships, friends/peers were mostly viewed as positively affecting pregnancy nutrition and wellbeing. A new mother said that her friend who had introduced her to the prenatal nutrition program in which they were both enrolled became “a really good friend” who supported her through health challenges during pregnancy (PPP-FG1). An early childhood educator described the dynamics among the participants at her family drop-in centre as profoundly supportive, saying that the participants, as peers, “really build each other up” (HSCP-FG5). This aligns with the sense of empowerment reportedly gained through the establishment of peer support groups/participatory women’s groups in other contexts (35,55).

*Embodiment of Pregnancy*

Participants in all FGDs recognized pregnancy as a time of bodily transformation and transition, with its own unique role in shaping diet. Thus, *embodiment of pregnancy* in our conceptual map describes the physical, psychological and social factors affecting diet, channeled through the body. These factors were similar to those found in other populations. They include physiological changes that affect appetite, energy levels, weight gain, and complications (21,56,57) as well as psycho-social concerns around weight gain, body image, and behavioural surveillance/policing of the pregnant body (58).

PPP focused on physiological changes affecting appetite (nausea, vomiting, aversions, compensatory cravings) and dealing with complications as impacting their pregnancy eating patterns and diets. At least three participants in three different FGDs (PPP-FG1, -FG2, and -FG3) were hyperemetic, which may have skewed discussions towards the centrality of vomiting and nausea in determining diet during pregnancy. One of the people who lived with “very serious morning sickness” (i.e., *hyperemesis gravidarum*) described her pregnancy diet like this:

*Since I [became] pregnant, especially in the first four months, I cannot smell oil, or cooking smell[s, without vomiting]. I just [eat] fruit and lots of very soft food. So, my husband [is] always cutting... food for me before he goes to work* (PPP-FG1).

Another participant talked about her experiences of discomfort and their impacts on her diet in this way: “My heartburn was so bad, and I was nauseous… I… wasn’t able to eat as healthy as I wanted to. So I was eating a lot of bland foods, bread, potatoes, that sort of stuff…” (PPP-FG2). These conversations were contrasted by discussions around pregnancy cravings. One post-partum participant recalled, “When you’re having a craving and you’re pregnant, you just follow your craving… because your baby obviously is wanting something from you” (PPP-FG1).

PPP also related that concerns around pregnancy complications, particularly gestational diabetes, played a major role in shaping their diets. One participant said of her visit to an obstetrics clinic:

*There’s been this… epidemic of gestational diabetes, and so [the staff] basically scared me into just being really focused on ‘if you’re gonna have sugar make it a natural sugar, like a fruit. And, if you’re gonna have fruit, make sure it’s during the day. And I ended up being a little obsessive about it* (PPP-FG2).

Another participant felt prejudged with respect to her risk of developing pregnancy complications, saying: “Most people are like… ‘You’re a big person. You’re going to have gestational diabetes.’”. Her friend noted that pregnant people who “…have diabetes or have some… health problems… look [at] every single thing that [they] put in [their] mouth[s]” (PPP-FG1). These quotes suggest that, from the perspectives of PPP, health challenges like gestational diabetes narrow the windows of acceptable pregnancy eating behaviours.

HSCPs noted dealing frequently with many of the same embodied challenges of pregnancy highlighted by PPP, but also discussed a factor largely ignored by PPP: gestational weight gain (GWG). GWG is a public health risk factor, as well as a socially and psychologically fraught, complex topic. A dietitian discussed excessive GWG in the context of our Western culture, particularly our “beverage culture”, and in the context of “busting some old myths and misconceptions… like ‘You need to eat, you're pregnant, you're eating for two’” (HSCP-FG1). This excerpt suggests that HSCPs, especially those who work in public health, are concerned with the environmental and cultural context that shapes GWG, and about “why it’s important” (HSCP-FG1) for a baby’s later life health and disease risks.

While midwives shared these concerns, some said they were ambivalent about emphasizing the importance of appropriate GWG to their clients. One commented:

*I try not to pathologize... weight and nutrition, so I try to keep it completely within normal. I don’t… want anxiety over their weight gain... I usually say ‘if you’re gaining nothing or if you’re gaining 100 pounds, then we’re concerned. But, if you’re somewhere in the middle, we’re not too concerned about it as long as you’re eating healthy’* (HSCP-FG3).

Her colleague added:

*I find it difficult sometimes for... our... fairly large low-income population... Because, when you’re talking about fresh fruits, vegetables, staying away from processed foods, sometimes they just don’t have the resources… So, you kind of get to a point where you’re like, you can tell them what to do but they don’t have the means to do it* (HSCP-FG3).

In contrast to the thought given to GWG by HSCPs, GWG was *not* a main focus for PPP participants, although it was mentioned in passing and dismissed by a few. One participant mentioned worrying that she was “gaining too fast”, despite eating very nutritiously, and then her GWG trajectory just “petered out” without her having made any dietary changes, so she just “threw her hands up in the air” (PPP-FG2). We found this general lack of interest in/frustration with the topic by PPP somewhat surprising, in light of the perspectives of the HSCPs and of previous work which has shown enthusiasm among pregnant people for frank conversations with HSCPs about management of GWG when confronting structural barriers (57).

Regardless of their differing perspectives on GWG, both PPP and HSCPs perceived pregnancy as a time of bodily transition, of increased attention to the body, and thus as an opportunity for thoughtful engagement with health.

**Question 2: How can people be supported to improve their diets during pregnancy?**

Data to answer this question come from both FGDs and from the stakeholder meeting. Proposals for solutions/interventions are summarized in Figure 2 and discussed below, where we have linked them to the themes of *resources*, *relationships*, and *embodiment of* *pregnancy*. As successful implementation of these proposed interventions implies an increase in *resilience* for pregnant people in Hamilton, the theme of resilience is interwoven throughout our discussion of the other three themes.

[Figure 2 about here]

*Resources*

Both FGDs and stakeholder meeting participants highlighted three major intervention areas to prioritize with respect to resources: increasing income, introducing or expanding subsidies, and improving services. The first group of interventions zeroes-in on “supporting income”, thereby reducing the extent to which food/nutrition competes against other priorities, while expanding capacity for independent decision-making about nutrition (HSCP-FG1). In this vein, a midwife noted that she was supportive of a means-tested, Basic Income Pilot Project that, at the time of data collection, was being evaluated by the provincial government. She suspected that the Project, through increasing and stabilizing the incomes of low-income families, would “impact on the nutritional status” of pregnant people (HSCP-FG4). Multiple studies demonstrate that income-boosting interventions improve pregnancy diets, health outcomes, and individual resilience (59,60). Unfortunately, the Basic Income Pilot was cancelled by the incoming 2018 fiscally-conservative, provincial government, illustrating that cash transfer programs can present political challenges.

Another income-boosting strategy focuses on improving income tax-filing rates among lower-income families. Successful tax-filing entitles all but the wealthiest Canadians with children to substantial government cash transfers (61). This program is politically robust because it progressively benefits most Canadian taxpaying families. However, a variety of barriers prevent many lower-income families from completing their income taxes (61). HSCPs suggested reducing those barriers, enabling cash transfers to families not yet accessing their entitlements (HSCP-FG1, HSCP-FG2). This suggestion was endorsed by PPP and others during the stakeholders’ meeting, and was seen as particularly desirable if implemented in concert with other forms of advocacy and support for families. Notably, this and other income-transfer strategies are saleable in the local political context, notwithstanding the cancellation of the Basic Income Pilot, as survey data show that people in Ontario support investing financially in the health/nutrition of developing children (62).

The second group of resource-related interventions concerns subsidies in the domains of housing, childcare, and food. As with income-based strategies, food subsidies and/or subsidies to requisite expenses like housing or childcare costs could reduce the extent to which families trade-off prenatal nutrition and health against shelter and provisioning/care of other household members. Loosening such constraints can build a sense of empowerment and, ultimately, resilience (63). Housing subsidies may be particularly relevant in Hamilton, as multiple structural factors have abruptly increased housing costs, requiring many Hamiltonians to allocate unacceptably high proportions of their income to shelter (64). As one mother put it: “If [the government] could… make your rent more affordable… that would help people” (PPP-FG1). Similarly, participants called repeatedly for subsidies aimed directly at improving accessibility of high quality, nutritious food. Such food-based subsidies have improved not only prenatal diet quality but also pregnancy and birth outcomes in lower-income households elsewhere in North America (65,66). So, improving or expanding local nutrition subsidies may be an efficacious, desirable intervention component.

The third kind of intervention proposed under the theme of resources concerns developing new services or improving accessibility and integration of existing services supporting pregnant people/potential parents. Specific service sectors suggested as targets for intervention included: transport, language interpretation, early childhood education, adolescent education, and preconception care. Participants suggested: expansion of the city’s interpretive services for newcomers (HSCP-FG1, HSCP-FG2, HSCP-FG6), establishment of prenatal grocery buses (HSCP-FG1, HSCP-FG4, PPP-FG2), and integration of food literacy into early childhood and primary education programs (HSCP-FG3, HSCP-FG5). All these suggestions are worthy of consideration but one warrants special attention. A proposal that was raised frequently and is well-supported by evidence from other socio-ecological contexts was upstream investment in the next generation(s) of prospective parents, through offering universal access to skills training in food and nutrition, health, budgeting, and tax-filing, i.e., “every form of literacy” in secondary school (HSCP-FG1). Efforts to train prospective parents upstream, i.e., adolescents, from New Zealand, the United Kingdom, and Uganda in health literacy show promise, often leading to greater empowerment and greater interest in setting health/nutrition goals (67,68,69).

*Relationships*

Under the theme of *relationships*, peer support, engagement with partners, and equipping HSCPs to better support behavioural change were all proposed. One mother proposed creating peer groups/networks as nexuses for advocacy, which was generally supported by other members of her discussion group (PPP-FG3) as well as by stakeholders’ meeting attendees. In her own words:

I’d like to see more peer-led stuff… it’s hard when there’[re] all these policies and you can’t really talk about the actual things that are going on because you’re afraid you’ll get judged… So, peer-led groups are great… in that… we can talk about the real stuff” (PPP-FG3)

Establishing participatory groups for PPP and/or new parents may represent a crucial step towards improving prenatal health for people experiencing vulnerabilities in Hamilton. In other contexts, the establishment of such groups has resulted in demonstrable improvements in health experiences and birth outcomes for pregnant people (35,70,71). Such groups can and do serve as critical jumping-off points for organizing and mobilization (72).

A second set of intervention proposals under *relationships* underscored the necessity of going beyond the mother-child dyad when supporting pregnancy health (25). Developing programming for partners/spouses and other main interpersonal supports of pregnant people was suggested. Although services for partners did not emerge as a frequently-proposed solution in the FGDs, during the stakeholder meeting, both PPP and HSCP participants outlined the benefits of strong relationships with partners, and endorsed the organization of programs for key support people.

The final suggestion under the *relationships* theme was to provide HSCPs with skills to support health behaviour changes, particularly related to early-life environment (i.e., DOHaD) in the people with whom they work. This set of strategies aligns well with the fact that PPP and HSCPs mutually value and invest in their relationships. While knowledge-building does not necessarily translate into healthier behaviours (50), the building of HSCP skills in how to support behaviour change is associated with increased empowerment, improved psychological resilience, and perhaps healthier behaviours in the people with whom HSCPs work (34,73).

*Embodiment of Pregnancy*

Participants in FGDs and the stakeholder meeting offered two main solutions for challenges under this theme. The first was to digitally integrate referrals to an array of prenatal/maternal services into primary points of care (mainly family doctors; HSCP-FG1, HSCP-FG2, HSCP-4). Stakeholder meeting participants were generally receptive to this idea, although both a public health administrator and a family doctor highlighted that numerous financial, regulatory, and time constraints would make implementation difficult. The second set of ideas involved creating physical spaces in each of the city’s major neighbourhoods with the majority of key services available under a single roof, preferably within culturally-sensitive environments that would facilitate peer-to-peer interaction and continued knowledge exchange among HSCPs from various sectors (HSCP-FG1, HSCP-FG4, HSCP-FG5, PPP-FG1, PPP-FG3, PPP-FG4). Hamilton has one such centre in one lower-SEP neighbourhood, but there is recognized demand for similar institutions in at least four others. The available evidence from other contexts suggests that locating services/providers in close proximity to one another removes barriers for people trying to access those services, while also providing opportunities for service providers to better coordinate and communicate with each other (74,75). While stakeholder meeting participants supported creating physically-integrated, peri-conceptional and prenatal care centres around the city, many of these same participants also questioned the feasibility of these proposals. Moreover, complex interventions like the construction and peopling of pregnancy health centres are needed to build resilience to overcome the multi-tiered dietary and health constraints that pregnant people in Hamilton face. But, developing such interventions will require a combination of political will and identification of opportunities to sustainably tweak existing programs and services to better support pregnancy wellbeing (27).

**CONCLUSIONS**

Widening inequities in the prevalence of NCDs (4) rooted in early life origins as suggested by the DOHaD hypothesis call for the development of interventions during pre-conception and pregnancy (16,14,15). Our data suggest that inequities in pregnancy diet and health are the result of environmental, social, and individual constraints that make it challenging for pregnant people and their families to prioritize spending money and time on high quality food. Participants recognized that many of the factors shaping pregnancy diet are systemic, and observed that pregnancy diets were products of a range of social inequities. Moreover, they identified a number of strategies at multiple levels to begin to improve pregnancy health equity, from supporting individual resilience, to leveraging social relationships, to building up community networks, to taking larger fiscal and political actions.

The human and economic arguments for long-term investments in maternal-child health equity are undeniable (1,2,6). Global health policy leaders suggest that multi-level interventions targeting mothers and children can yield ten-fold returns on investment through better educational attainments, workforce participation, and social contributions, in addition to improved long-term health (76). Thus, the likely benefits of such a policy focus to a Canadian city grappling with rising levels of social and health inequity are self-evident. The priority now should be to make these investments in ways feasible and sustainable within the local socio-political context.

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