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Barriers and Facilitators to Healthy Active Living in South Asian Families Living in Canada: A Thematic Analysis

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Title Page

Barriers and Facilitators to Healthy Active Living in South Asian Families in Canada: A Thematic Analysis

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Abstract

Objectives: The study objective was to understand the barriers and facilitators to healthy active living in South Asian families living in Canada.

Design: Semi-structured interviews of 30-60 minutes duration with South Asian women with young families, and analyzed using a thematic analytic approach

Setting: Community-dwelling South Asian women interviewed in the home environment or by phone.

Participants: Fifteen married South Asian women (mean age = 34.2 y) living in the Peel region of Ontario, Canada with at least 1 child under the age of 5 years. The majority of women had immigrated to Canada (13/15), during a 5 – 10-year interval preceding interviews.

Results: 57 different codes derived from 18 interview hours, and further evaluated through member checking. The top three barriers to healthy eating were: 1) not having enough time for healthy food preparation; 2) lack of knowledge about what is healthy eating; and 3) viewing healthy eating as a matter of engaging in time-limited dieting. These barriers were addressed with: 1) knowledge and awareness

of healthy eating; 2) clear goal setting; 3) access to fresh vegetables and fruits; and 4) better arrangements and more time for food preparation. The top five barriers to physical activity were: 1) not enough time and energy; 2) competing priorities; 3) lack of childcare; 4) lack of family-engaging exercise and; 5) limited access to interesting exercise programming. These barriers were addressed by: 1) experiencing exercise as enjoyable and stress-releasing; 2) commitments to walking exercise; 3) use of an electronic exercise-tracking device; 4) offspring exercise supported by spouse and family; 5) success stories about exercise from others.

Conclusions: Barriers to healthy active living in South Asian women with young families can be addressed with facilitators that stimulate clear goal setting and healthy food preparation skills, and exercise formats that engage mothers and offspring, with or without exercise tracking.

Strengths and limitations of this study

- Candid disclosures by participants were supported by the interviewer being of South Asian background and fluent in Urdu, Punjabi and Hindi [languages frequently used by participants to complement English disclosures]
- Key theme selection was aided by a careful member checking process.
- More than two-thirds of n = 15 participants endorsed each key theme
- Minimal participation by marital partners and offspring.

Introduction [Word count – 3443 words]

Excess weight and obesity are highly consequential for children and adults [1]. Children with obesity are increasingly diagnosed with clinical conditions once limited to adults, including type 2 diabetes, hypertension, hypercholesterolemia, fatty liver, asthma, disrupted sleep, early puberty, disordered eating and chronic fatigue [1]. The additional mental health consequences for adults and children include teasing, bullying, reduced self-esteem, isolation, depression, social skill deficits, learning difficulties, and excess stress and anxiety [1].

In studies of individual behaviours, high-energy intake and increased screen time are associated with weight gain, while healthy physical activity (PA) levels and longer sleep durations are associated with normal weight [2]. As healthy lifestyle behaviours are shaped in early childhood [3], healthy active living (HAL) behaviours during childhood can contribute to the lifelong maintenance of healthy weight [3]. HAL behaviours in children are affected by family environments, with specific familial impacts reported in multiple studies. For example, children without siblings are less physically active than children with siblings, and children in single-parent homes have more screen exposure (e.g. TV watching hours) than those living with both parents. [3,4,5]

Amongst the ethnic groups with a high prevalence of overweight and obesity and related complications are South Asians (SA) who have become Canada's largest non-

white ethnic group [6-9]. SA in Canada confront elevated risks for type 2 diabetes and for cardio-metabolic disorders that contribute to the onset of coronary artery disease [10-12]. Immigration is stressful, disrupting old social networks and requiring new networks to be initiated. Efforts in network building can affect HAL behaviours [13]. Furthermore, HAL role-modeling by parents, whether present or absent, can influence the offspring [14,15].

The understanding of barriers and facilitators in the adoption of HAL behaviours is instructive, both within intra-familial and multi-generational contexts. This explains our focus on SA women who, after immigration from the Indian subcontinent, confront elevated cardio-metabolic risks on an individual and familial basis. Understanding their perceptions of HAL barriers and facilitators is an important step in designing efficacious interventions.

The study goal was to utilize semi-structured interviews with SA mothers of child-bearing age from Ontario, Canada to understand their views of HAL (including barriers and facilitators), especially in relation to nutrition and physical activity.

Research Ethics Approval

The study was approved by the Hamilton Integrated Research and Ethics Board (HIREB)#10-640 at McMaster University on May 23, 2017 [16].

Methods

Patient and Public Involvement

No patient involved.

Study design

This is a qualitative descriptive study, undertaken in accord with an interpretivist perspective.

Setting and participants

Interview participants were recruited from the South Asian Birth Cohort (START), a cohort study of SA women living in Ontario's Peel Region [17,18]. Between 2011 and the present, over 1,000 mother-child dyads have been recruited and followed 1, 2, 3 and 5 years later (with 90% follow-up rates).

Sampling strategy

All participants who attended their scheduled START study visits were eligible for qualitative study enrolment. We approached participants consecutively until the n=15 study goal was reached. All interested participants were contacted by the study coordinator who undertook consents at visits and provided information on how study interviews could be scheduled by phone with the interviewer. The interviewer and participants met most often in the identified participant's home

environment (N = 10) although N = 5 interviews were undertaken by phone. [Table 1]

Interview schedule and process

Semi-structured interviews of 30-60 minutes duration elicited verbal responses from participants about recent and past experiences. A guiding assumption was that SA mothers of child-bearing age might be more candid in describing unique obstacles when subjects and the interviewer were matched for ethnicity and age-range. Therefore, a South Asian female interviewer (SM) conducted the interviews. The semi-structured interview schedule (SSIS) addressed barriers to and facilitators of healthy exercise and diet and was developed by an investigator (PR) in accord with prior diabetes intervention research [19, 20]. The original draft was reviewed, and modified by team members (SM, SA, SK, Rjds, GW, DD, SA) and pilot-tested with participants. Since English was a second language for most participants, several frequently employed linguistic idioms from Urdu, Punjabi and Hindi. The interviewer's ability to speak these languages and understand these multilingual idioms assisted the interview process.

Data processing

To maintain confidentiality, personal information was removed from digitally-represented transcripts and audio interview recordings were stored in a locked cabinet in locked research offices.

All interviews were digitally recorded and fully-transcribed verbatim. Transcripts were then checked for accuracy and reviewed word-by-word by the interviewer (SM) and three additional members of the research team (SK, GW, PR), two of whom were also females of SA background. All reviews focused on ensuring an unbiased approach to information elicitation and analyses. Interviews conducted in other South Asian languages were first translated into English prior to verbatim transcription.

Researcher characteristics

The research team was multi-disciplinary and comprised of physicians (SA, GW), a dietitian and nutritional epidemiologist (RD), PhD-level graduate students in Education and Health Research Methods, Evidence and Impact (SM, SK) a program manager who oversees multiple epidemiologic studies (DD) and a clinical research psychologist (PR). Of the 7 team members, a South Asian ethnic background was shared by 6 members (5 female, 1 male) while one member was of North American-European background (1 male).

Patient and Public Involvement

No patient involved.

Data Analysis

Coding and analyses were performed using NVivo (v. 10; QSR International) and employed a thematic analytic approach [21,22] to thoroughly explore the relevant

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2
3 themes that surfaced during interviews. [Table 2]. Thematic analysis provides a
4 systematic identification of emergent patterns through the logical organization of
5 the qualitative data into broader (representative) themes [21-23]. Our analytic
6 strategy of constant comparison included code development (SM and SK) as the
7 basic analytic unit and then, with code use, the derivation of broader themes
8 (through team discussions) that illustrated coherent views of the data. Participant
9 perspectives and self-management experiences were explored in the context of
10 individual, offspring and family-based efforts to adopt and sustain positive HAL
11 changes. Saturation, or the point where novel information is not
12 detectable with additional interviews, was evaluated by all research team members,
13 in accord with study goals. [23] Member checking was undertaken with all
14 interviewees (15 of 15), and included reviews of both group and individualized
15 findings (each interviewee responded to carefully constructed summaries of her
16 interview) [24] [Table 3]. The member checking was undertaken by the original
17 interviewer (SM) by telephone, using detailed notes describing subject perceptions
18 of convergences and divergences of the findings assumed to be representative.
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23 In summary, the thematic analysis process included: (a) code development as the
24 basic unit of analyses capturing relevant aspects of data, (b) code summaries into
25 broader themes, and (c) creation of an organized, coherent picture to illustrate
26 major themes within the data.
27
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29 Results

30
31 The average age of the 15 interviewees was 34.2 years (SD=2.1). Thirteen of the 15
32 women immigrated to Canada in the 5 – 10 year interval preceding interviews.
33 [Table 1] All participants were married, spoke English as a second language and
34 had one or more children. Participants co-inhabited households with a mean of 2
35 residents other than spouse and offspring (household members who were
36 often extended family members) and while 46.2% (7/15) of participants
37 were employed. their spouses were 100% employed. The spousal work patterns
38 identified in interviews involved long hours of inflexible but shifting
39 engagements with a high prevalence of evening and night-time shift work.
40
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42

43 All of the 57 codes derived from 18 interview hours with 15 mothers, were re-
44 evaluated during member checking. Our thematic analysis identified **four themes**:
45 1) barriers related to healthy diet; 2) facilitators related to healthy diet; 3) barriers
46 related to physical exercise and 4) facilitators related to physical exercise. Table 3
47 presents the full set of barriers and facilitators identified.
48
49

50 De-motivating Barriers and Motivating Facilitators for Healthy Eating

51
52 Three barriers, according to member-checking, were the most convergently
53 endorsed in importance. Each barrier or facilitator theme identified is followed by a
54 representative quote.
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1) not enough time for healthy food preparation;

“...we are making fresh food and it’s very time consuming because you have to cut everything.... a lot of chopping in our food... and then [doing] the dishes.” [Interviewee # 4]

2) lack of knowledge about what is and how to implement healthy eating;

“...Someone told me once to drink water with a spoon of this or that...and then I’ll lose weight....I tried many, many times to do this but I never noticed a difference.”

[Interviewee # 8]

3) viewing healthy eating as a matter of engaging in time-limited dieting.

“...I start something but I don’t know what happens with the busyness ... I just lose momentum and eventually stop.

[Interviewee # 4]

Two additional barriers were frequently mentioned but less convergently endorsed:

1) spouse or children’s unhealthy eating habits;

“Trying to eat healthier.... like trying to stop with the white bread and white rice....”

[Interviewee # 14]

2) pressures to personally eat unhealthy foods.

“...sometimes they want to order pizza....I don’t want to eat any, you know... but you see the pizza and you’re like, okay, I can have one slice...”

[Interviewee # 3]

All barriers were seen as mutually reinforcing as insufficient time for food preparation left mothers vulnerable to serving quickly prepared and unhealthy foods, particularly when these latter foods were aligned with spouse and offspring preferences. The intention to solely engage in a time-limited healthy eating plan rather than commit to longer-term plans seemed to decrease the strength of intentions to prepare healthy foods; healthy eating was dominantly seen as a brief, time-limited exception to status quo consumptions.

These barriers were experienced as addressed by facilitators that included;

1) knowledge about and awareness of what healthy eating entails;

“... trying to eat more ... boiled or baked stuff. Trying to eat healthier.”

[Interviewee # 14]

2) setting clear goals for eating 'healthier';

"...when I pack their snacks....I always tell them that before they can have ... snacks they have to finish all their health food..."

[Interviewee # 15]

3) better access to fresh vegetables and fruits;

"Suppose if we are eating ... kale and cucumber ... but when it's finished, it's finished...I don't know when the next time will be that I'll go get groceries. I'm so busy that I just make sure the main things are at home ..."

[Interviewee # 4]

4) clear arrangements (including apportioning adequate time) for healthy food preparation.

"My friend... gave me a diet chart... about which diet is best ... they didn't have the flour we use, there were ... replacements ... like soy ..."

[Interviewee # 8]

Another frequently mentioned facilitator was:

5) becoming a vegan or vegetarian, although it was less convergently endorsed during member checking.

"I couldn't figure out what was going on, but ... I cut those two (meat and dairy) out of my diet....I figured out...afterwards...I wasn't digesting properly...so I went vegan... completely one day...."

[Interviewee # 6]

De-motivating Barriers and Motivating Facilitators for Healthy Exercise

Five barriers were the most convergently endorsed, according to member checking, as important for healthy exercise. Each barrier or facilitator theme identified will again be followed by a representative quote.

1) not enough time and energy to engage in exercise;

"Sleep. When I have lack of sleep, I'm already tired and ... I don't really feel like doing more exercise or anything, ...I'm so tired of watching my baby at night and then he's all cranky in the morning too. So I'm like, you know what, let's just put him to sleep and I will take a nap while he's sleeping. "

[Interviewee # 1]

2) competing priorities;

"I used to do running, walking a lot. Now I get tired just doing the housework and I don't have that much energy."

[Interviewee # 4]

3) lack of childcare (while exercising);

"...sometimes they have day care in the gym and sometimes they don't Sometimes he [my son] doesn't want to go, even if I want to go... and then nobody is at my home to watch him, so I can't go...."

[Interviewee # 4]

4) lack of family-engaging exercise and

"... a world gym...near my house.... for 3 weeks, I didn't go ... because my kids are... busy, busy, busy..."

[Interviewee # 8]

5) limited access to exercise programming viewed as interesting and beneficial.

"I'm going to my sister's in Edmonton. She is training at the gym. She is joining Zumba classes.... she wanted me to join ... for one month so I can learn"

[Interviewee # 11]

These barriers were also seen as mutually reinforcing as insufficient time and energy were reinforced by conflicts with offspring priorities, supported by the lack of high quality childcare (during exercise) and family- engaging exercise programs.

The above barriers were viewed as addressed by facilitators that included:

1) experiencing exercise as enjoyable and stress releasing;

"... I love to do exercise. ...beforeI got married, I used to ... exercise. ... I would love to continue ... Like, every day for ... two hours..."

[Interviewee # 1]

2) commitments to walking forms of exercise, especially with use of fitbits or other electronic exercise tracking devices;

" I wear the Fitbit. ...I keep track of calories... But ... I don't have ... to lose ...weight. ...I just want to track how...how much I ran today, how many steps I took...."

[Interviewee # 13]

3) a high priority on offspring exercise supported by spouse and family;

" After ... prayer, she takes the group of kids ... for a walk..."

[Interviewee # 5]

4) hearing success stories from others who adopt healthy exercise;

"Yesterday my friend was telling me that.... there's a track... a 400 metre track and she's been going there for 3 or 4 days ... ashe'll do 400 metres, 10 times."

[Interviewee # 8]

5) being able to exercise with others (including family members):

".... my sister ... motivated me because she's going to the gym.many people are going on my street... I saw them and ... I realized I had to go too."

[Interviewee # 11]

In all the codes developed during analyses of verbatim transcripts, there was a strong role for multiple elements of 'culture' that influence the family, with 'mother' occupying a central role. Cultural elements, combined with the community environments, appeared to aid or reduce motivation and behavioural adoption.

Data Sharing

No additional data available

Discussion [1050 words]

Disclosures about and descriptions of the barriers-facilitators of HAL behaviours were derived from interviews with South Asian mothers of children. The interviews were mainly conducted in home environments, by an interviewer of similar ethnic background and fluent in English, Punjabi, and Hindi. The facilitators and barriers to healthy active living identified in this study were unique in some important ways but shared commonalities with other studies in the general population (25), Indigenous communities (26), specific ethnic groups (27), pregnant South Asian women (28), and women post-gestational diabetes (29).

Negative 'barriers' to healthy eating were compensated for by facilitators that revolved around knowledge and awareness of healthy eating, cooking, meal preparation and goal setting skills. Limited exploration and contemplation could therefore be compensated for by clear, 'how-to' messaging.

The ambiguities about 'what is healthy eating?' could be addressed by support in thinking beyond the status quo to apply clear goal-setting for healthier eating. Another facilitator emphasis was access to high quality (fresh) fruits and vegetables. There was ambivalence as to whether vegetarian or 'vegan' lifestyles facilitated healthy eating, evident in the member checking, where only 7 of 15 participants endorsed non-meat eating as advantageous. There were specific mentions that people, although highly devoted to vegan or vegetarian lifestyles, could engage in high carbohydrate and sugar consumption. Whereas vegan-vegetarian choices were linked to religious beliefs and not health beliefs, a lack of knowledge about healthy vegetarian or vegan eating presented a barrier to healthy choices, resulting in unhealthy (although plant-based) diets that increase risks of diabetes and other metabolic disordered conditions [30-32].

The perceived exercise barriers included insufficient time and energy (to exercise) amidst understandable resistances to utilizing inadequate childcare (while exercising), due to concerns about the safety, and level of stimulation/engagement, provided, and ongoing conflicting priorities. The barriers specifically related to a lack of family-engaging exercise combined with the availability of limited exercise programs that did not arouse engagement interest nor confidence (in benefits).

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3 These barriers were counterbalanced by facilitators that included preferred family-
4 engaging exercise options, with spousal/family support aided by high priorities on
5 offspring exercise [33]. The final perceived facilitator was an already adopted
6 regular exercise program that provided enjoyment and momentum for
7 maintenance.
8
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10 In themes that cross the barrier/facilitator and healthy eating/exercising
11 boundaries, a lack of time and energy seemed primary, and linked to conflicting
12 priorities and the lack of high quality information. The prioritization dilemma
13 indicated low confidence levels in the information used, with 'not enough time and
14 energy' reflecting indecision on what priorities merited investment. For example,
15 the majority of most participants had not formulated specific health goals.
16 Furthermore, a significant number noted that healthy eating and exercise were not
17 emphasized in SA culture, and that this lack of emphasis influenced their offspring.
18 As a result, changes in the direction of improved physical fitness and healthier
19 eating were temporary and fleeting. The absence of family engaging exercise and/or
20 childcare during exercise sessions were major pragmatic obstacles as few mothers
21 would tolerate the conflict of values whereby inadequate childcare was tolerable in
22 order to fit exercise into regular scheduling.
23
24
25

26 Most women had husbands who worked long day, evening and night hours
27 resulting in the mothers being responsible for cooking, cleaning and primary child
28 care. Some of the mothers additionally worked outside the home and felt
29 overwhelmed with 'juggling' multiple caretaking tasks.
30
31

32 Culture is a multiply relevant construct here because it refers to the adopted culture
33 that impinged on eating and exercise prioritization; quickly prepared pre-processed
34 foods often dominated diets and exercise was considered non-essential by most
35 mothers [30]. Furthermore, perceptions of SA culture also indicated a lack of
36 perceived support for healthy exercise and eating.
37
38

39 In theoretical terms, the inattention and restricted cognitions of mothers reflect a
40 pre-contemplative stage of change (where status quo behaviours are not debated)
41 or early contemplation (where debates are limited, as in considering substituting
42 temporary calorie-reducing diets for full status quo acceptance) [34].
43
44

45 The remainder of healthy eating barriers could be categorized as physical and socio-
46 cultural. The physical factors revolved around general fatigue related to disturbed
47 sleep (a frequent cause of excess, unselective eating) and were differentiated from
48 cultural factors that ranged from social pressures to eat traditional and unhealthy
49 foods (e.g. during holiday celebrations) to the TV advertisements that influence
50 offspring to resist maternal efforts to introduce healthier, less-advertised foods.
51 These influences, in turn, are differentiated from social factors that are not
52 specifically cultural, such as catering to spouse's unhealthy eating habits, that
53 reinforce the deficits for healthy eating from family members and peers (including
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3 the influence of extended family household members in combined family systems)
4 and susceptibility to unhealthy fast-food consumption inside and outside the home.
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7 **Strengths and Limitations**

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9 The selection of key themes was substantially aided by a careful member checking
10 process where each interviewee (15 of 15) was contacted by phone and during
11 follow up interviews given the opportunity to judge whether the communicated
12 findings affirmed what was conveyed. The themes emphasized yielded the most
13 confirmations and the least disconfirmations. Altogether, more than two-thirds of
14 participants endorsed each theme although for most key themes
15 >73% provided endorsement (e.g. 73%, 87%, 93%, 100%).
16
17

18 In terms of limitations, we note the sparseness of participation by marital partners
19 and offspring. Strong efforts were made during in-home interviews and in
20 attempts at follow up phone interviews with spouses. However, the offspring
21 present during interviews were hesitant to speak and spouses were not inclined to
22 accept and follow up with the invited phone interviews. Finally, we acknowledge
23 that our guide may have been too structured. We made the deliberate choice to
24 specifically interrogate barriers and facilitators and allow for the greatest degree of
25 flexibility in the participants' description of these. This approach likely limited our
26 flexibility to explore themes beyond this focus more fully.
27
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29

30 **Conclusion**

31
32 The SA women interviewed reported being busy attending to family matters
33 (including long hours of spousal work) with insufficient scheduled time to
34 emphasize healthy active living (HAL) behaviours. This is of particular concern
35 because SA-ethnicity families confront elevated risks for diabetes and metabolic
36 syndrome disorders. Fortunately, there are applicable facilitators that can stimulate
37 clearer goal setting and healthy food preparation skills (based on more
38 attentiveness and devoted time) and immediate exercise formats (e.g. walking) that
39 engage mothers, fathers and offspring (together). A family-based prioritization of
40 HAL behaviours can be rewarded by and sustained by observable and shared health
41 improvements.
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Tables

Table 1. Characteristics of Participants (N = 15*)

Characteristic	Participants N = 15	START Cohort N= 787
Age Years [1]	34.2 (2.4)	36.2 (4.0)
Born in Canada [2]	2 (13.3 %)	40 (5.1%)
Born outside of Canada [2]	13 (86.7%)	747 (94.9%)
Ancestral Country of Origin [2]		
India	12 (80%)	567 (72%)
Pakistan	3 (20%)	184 (23.4%)
Mother Tongue		
Punjabi	9 (60%)	410 (52.1%)
Urdu	4 (26.7%)	177 (22.5%)
Religious Practice		
Sikh	9 (60%)	379 (48.2%)
Muslim	4 (26.7%)	207 (26.3%)
Vegetarian [2]	6 (40%)	291/782 (37.2%)
Years living in Canada (if immigrant)[1]	10.9 (2.2)	13.1 (5.9)
Married [1]	15 (100%)	786/786 (100%)
Number of children in household [3]	2 (1,4)	2 (1,7)
Offspring children in household (excluding Index Child) [3]	1 (0, 2)	1 (0,4)
Number of people in household [3]	6 (3, 11)	5 (2,18)
Language spoken at home – Punjabi	6 (40%)	131/526 (24.9%)
Language spoken at home – Urdu	4 (26.7%)	32/526 (6.1%)
Language spoken at home - English	13 (86.7%)	233/524 (44.5%)
Education – High School or less[2]	2 (13.3%)	125/786 (15.9%)
Education – College [2]	4 (26.7%)	103/786 (13.1%)
Education – Undergraduate [2]	4 (26.7%)	309/786 (39.3%)
Education - Graduate [2]	1 (6.7%)	178/786 (22.6%)
Education - Other [2]	4 (26.7%)	71/786 (9%)

Currently employed outside the home [2]	7/14 (50%)	211/396 (53.3%)
Gestational Diabetes Diagnosis [2]	2 (13.3%)	283/784 (36.1%)
Total Physical Activity [1] hours/day	3.1 (1.4)	3.1 (1.8)
Exercise (to get out of breath/sweaty) [1] hours/day	0.3 (0.4)	0.2 (0.3)
Physical labour [1] hours/day	1.6 (0.8)	1.7 (1.4)
Physically taxing household chores (hours/day) [1]	1.3 (0.7)	1.2 (0.8)
Screen Time [1] of mother (hours/day)	2.4 (1.4)	3.0 (2.6)

[1] Presented as mean (SD)

[2] Presented as count (%)

[3] Presented as median (min/max)

Data Statement Section: data can be accessed at the Population Health Research Institute (secure portal), McMaster University

Table 2. Cumulative Codes Segmented by Barrier/Facilitator Clusters**Barriers to Healthy Eating**

1. Dislike of healthy foods (e.g. boredom with the tastes of healthy foods)
2. Not wanting to devote too much time to cooking (i.e. devaluing cooking); serving 'minimal-prep' 'fast', comfort foods instead
3. Not having healthy ingredients to cook with (resulting from non-informed shopping)
4. Not knowing how to healthfully cook with the ingredients obtained
5. Lack of knowledge about what is healthy eating
6. Viewing healthy eating as a time-limited challenge, resolvable in several wks. or mths. of dieting
7. Preparing unhealthy foods preferred by children
8. Eating unhealthy foods with children
9. Difficulties in preparing healthy school lunches and snacks
10. Perceptions that healthier eating is expensive and not affordable
11. Culturally related dietary restrictions that conflict with healthy eating
12. Social pressure to eat traditional, unhealthy foods
13. Holiday celebrations that involve unhealthy eating
14. Being outside the home (and susceptible to unhealthy fast-food consumption)
15. Feeling fatigued and eating too much in attempts to become energetic
16. Late night eating (when fatigued and susceptible to eating comfort foods)
17. TV /screen watching and eating unhealthy foods while watching
18. Catering to spouse's unhealthy eating habits
19. Lack of support for healthy eating from family members and peers
20. Tea and coffee drinking with too much added sugar
21. Inconsistency in eating healthy (when one can do it)
22. Living with in-laws in a combined family system
23. Marital separation leading to extra responsibility and caretaking
24. Sports team involvement (leaving no time for healthy eating).
25. Not knowing how to use online resources to learn about healthy nutrition and meal preparation
26. Disturbed sleep
27. General fatigue
28. Scheduling routines that leave minimal time for healthy food preparation. Conflicting priorities with: a) Housework; b) Offspring schedules (including transport); c) Religious practices; d) Demanding study schedule and/or demanding job; e) Work schedules that diverge from those of spouse and children.

Facilitators to Healthy Eating

1. Ability to think 'outside the box' [ability to think beyond the influence of daily routines]
2. Setting clear goals for eating in a healthier way
3. Access to fresh produce fruit and vegetables and/or the ability to grow them
4. Becoming a vegan or vegetarian
5. Having a calorie counting 'app'
6. Access to healthy 'take out' food
7. Portion control awareness
8. Access to smoothies and juicing methods
9. "Batch" cooking – cooking healthy foods in batches
10. Reading and understanding nutrition labels
11. Curiosity about healthy eating (what it is? how to do it?)
12. Identification of weight gain – and interest in weight loss
13. Judgment that healthy foods are worth the calories consumed

Barriers to Healthy Exercise

1. Injury, pain and disturbing sensations (e.g. soreness) after exercise; perceived injury that functionally prevents or limits exercise
2. Not enough time/energy to exercise amidst competing personal priorities
3. Too busy providing child-care to exercise
4. Gym memberships are too expensive
5. Impossibility of making everyone happy when the family jointly exercises
6. Not enough exercise programming that's interesting, fun and beneficial
7. Not enough exercise programming that engages my whole family

Facilitators of Healthy Exercise

1. A walking destination
2. Having a fitbit or other 'wearable' device
3. Needing stress release/relief and viewing exercise as a helpful stress releaser
4. Being able to 'work out' with others (e.g. neighbors)
5. Hearing success stories from others about sustaining healthy exercise
6. Getting good results from exercise
7. Access to good health information
8. Seeing housework as potentially healthy physical activity
9. Sports team involvement

Table 3 – Member Checking Results
Summary of General Member Checking N = 15

Healthy Eating Barriers		
Not devoting enough time to food preparation	10 agree	5 disagree
Lack of knowledge about what <u>is</u> healthy eating	10 agree	5 disagree
Viewing healthy eating as a time-limited challenge, solvable in a few weeks or months	10 agree	5 disagree
Spouse or children's unhealthy eating habits	6 agree	9 disagree
Social pressure to eat traditional, unhealthy foods	6 agree	9 disagree
Healthy Eating Facilitators		
More knowledge about & reminders of what healthy eating is	14 agree	1 disagree
Setting clear goals for eating in a healthier way	14 agree	1 disagree
Better access to fresh vegetables & fruit	14 agree	1 disagree
Clearer arrangements & better tools for healthy food preparation	13 agree	2 disagree
Becoming a vegan or vegetarian	7 agree	8 disagree
Healthy Exercise Barriers		
Not enough time/energy to exercise as other personal priorities are more important	14 agree	1 disagree
Lack of having good childcare (while exercising)	10 agree	5 disagree
Not enough exercise programming that engages my whole family	13 agree	2 disagree
Not enough exercise programming that's interesting, fun and beneficial	7 agree	8 disagree
Healthy Exercise Facilitators		
Experiencing exercise as enjoyable and/or stress releasing	15 agree	0 disagree
Making a commitment to walk 'somewhere'	14 agree	1 disagree
Hearing success stories from others who adopt healthy exercise	14 agree	1 disagree
Having a fitbit or other wearable device	13 agree	2 disagree
Being able to exercise with others (including family members)	11 agree	4 disagree

Statements

A. Conflict of Interest

Paul Ritvo is currently funded by the Canadian Institutes of Health (CIHR) (2021–2025). He coordinates research with NexJ Health, Inc., which provides a software platform to convey the psychosocial and psychiatric programming he develops and assesses. Ritvo receives no personal compensations for studies coordinated with NexJ but does receive free-of-charge platform support. **All other authors declare no conflicts of interest.**

B. Contributorship Statement

Mirza, Sabina [sabina27@yorku.ca]: substantial contributions to the conception or design of the work; subject interviewing; interview transcribing; interview coding; article draft; table construction; final approval of the version to be published; AND Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Kandasamy, Sujane [kandas3@mcmaster.ca]: substantial contributions to the conception or design of the work interview coding; article draft; table construction; final approval of the version to be published; AND agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

de Souza, Russell Jude [desouzrj@mcmaster.ca]: substantial contributions to the conception or design of the work article draft; final approval of the version to be published; AND agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Wahi, Gita [wahig@mcmaster.ca]: substantial contributions to the conception or design of the work interview coding; article draft; final approval of the version to be published; AND agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Desai, Dipika [Dipika.Desai@phri.ca]: substantial contributions to the conception or design of the work article draft; table construction; final approval of the version to be published; AND agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Anand, Sonia Savitri [anands@mcmaster.ca]: substantial contributions to the conception or design of the work article draft; table construction; final approval of the version to be published; AND agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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C. Competing Interests

Paul Ritvo is currently funded by the Canadian Institutes of Health (CIHR) (2021–2025). He coordinates research with NexJ Health, Inc., which provides a software platform to convey the psychosocial and psychiatric programming he develops and assesses. Ritvo receives no personal compensations for studies coordinated with NexJ but does receive free-of-charge platform support. All other authors declare no conflicts of interest.

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E. Data Sharing Statement

No additional data available

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12 **Authors Statement**

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14
15 **Conflicts of Interest:** Paul Ritvo is currently funded by the Canadian Institutes of
16 Health (CIHR) (2021–2025). He coordinates research with NexJ Health, Inc., which
17 provides a software platform to convey the psychosocial and psychiatric
18 programming he develops and assesses. Ritvo receives no personal compensations
19 for studies coordinated with NexJ but does receive free-of-charge platform support.
20 All other authors declare no conflicts of interest.
21

22 **Patient and Public Involvement:** It was not appropriate or possible to involve
23 patients or the public in the design, or conduct, or reporting of our research. We
24 will engage patients and the public in the dissemination of this research, once there
25 is acceptance of and publication of the submitted manuscript.
26

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COREQ: 32-item checklist (necessary for BMJ Open qualitative research submissions)

	Research Checklist (32 items)	Response
1	Which author conducted the interviews?	Sabina Mirza, Ph.D.
2	What were this researcher's credentials?	Ms. Mirza has a Ph.D. from the Department of Education, York University and is currently in the last stages of a PhD dissertation study based on interviews and qualitative analyses of n = 40 youth, currently 'homeless' residents of Toronto.
3	What was their occupation at the time of the study?	Ms. Mirza was employed as a health coach in a randomized controlled trial of an online cognitive behavioural therapy intervention for youth (18 – 35 years) diagnosed with major depressive disorder: An Online Mindfulness-Based Cognitive Behavioral Therapy Intervention for Youth Diagnosed With Major Depressive Disorders: Protocol for a Randomized Controlled Trial ; JMIR Res Protoc 2019;8(7):e11591 DOI: 10.2196/11591 PMID: 31359869 PMCID: 6690226
4	Was the researcher male or female?	Female
5	What experience or training did the researcher have?	Courses and activities related to interview competency at within York University, Department of Education EDUC 5222 – Seminar in in-depth interviewing EDUC 5100 – Research and Issues in Language, Culture and Teaching Research Intern: United Way, York Region -York University Knowledge Mobilization Unit – Study Title: <i>Turning Research into Action</i> Granting Agency: Social Science and Humanities Research Council, Canada
6	Was a relationship established prior to study commencement?	There was no relationship established prior to study commencement.
7	What did participants know about the researcher? e.g. personal goals, reasons for doing the research	Participants were informed that the team interviewer would be contacting them by phone. They were communicated her full name and university degree.
8	What characteristics were reported about the interviewer? e.g. Bias, assumptions,	Ph.D. in Education. South Asian ethnic background; Linguistically fluent in Urdu and Hindi and able to understand the interviewee's use of idioms during the interview process.

	reasons and interests in the research topic	
9	What methodological orientation underpinned the study?	This was a qualitative descriptive study, undertaken in accord with an interpretivist perspective. Thematic analysis was undertaken.
10	How were participants selected?	Interview participants were recruited from the South Asian Birth Cohort (START), a cohort investigation of SA women living in Ontario's Peel Region [17, 18]. Between 2011 and the present, over 1,000 mother-child dyads were recruited and followed 1, 2, 3 and 5 years later (with 90% follow-up rates). Convenience sampling was undertaken
11	How were participants approached?	During regularly scheduled START cohort appointments, candidate participants were informed about the interview study. If interested in participation, they were contacted by the study coordinator who undertook consents at visits and provided information on how study interviews could be scheduled by phone with the interviewer.
12	How many participants were in the study?	N = 15
13	How many people refused to participate or dropped out? Reasons?	There were no dropouts. n = ? refused to participate
14	Where was the data collected?	Semi-structured interviews were undertaken in participants' home environments (n = 10) or by phone (n = 5)
15	Was anyone else present besides the participants and researchers?	For the interviews undertaken in the home environment (n = 10), spouse (n = 1), offspring (n = 3) and extended family members (n = 1) were present, as was preferred by the interviewee.
16	What are the important characteristics of the sample? e.g. demographic data, date	Interview participants were recruited from the South Asian Birth Cohort (START), a cohort investigation of SA women living in Ontario's Peel Region [17, 18]. They were all of SA ethnic background. Below are other key characteristics Participants N=15 Age-in- years = Mean of 34.2 (2.4) Born in Canada = 2 (13.3 %) Born outside of Canada = 13 (86.7%) Years living in Canada (if immigrant) = 10.9 (2.2) Married = 15 (100%) Number of children in household = 2 (1, 4) [mean] Non-offspring children in household = 1 (0, 2) [mean] Number of people in household = 6 (3, 11) [mean] English as spoken as second language = 15 Education - High School or less = 2 (15.4%) Education - College = 4 (30.8%)

		<p>Education – Undergraduate = 3 (23.1%)</p> <p>Education – Graduate = 1 (7.7%)</p> <p>Education – Other = 3 (23.1%)</p> <p>Currently Employed outside the home = 6 (46.2%)</p> <p>Gestational Diabetes Diagnosis = 2 (13.3%)</p> <p>Total Physical Activity = 3.1 hrs/day (1.4) [mean]</p> <p>Exercise (to get out of breath/sweaty) = 0.3 hrs/day (0.4) [mean]</p> <p>Physical labour = 1.5 hrs/day (0.9) [mean]</p> <p>Physically taxing household chores = 1.3 hrs/day (0.7) [mean]</p> <p>Screen Time of mother = 2.3 hrs/day (1.3) [mean]</p>
17	Interview guide: Were questions, prompts, guides provided by the authors? Was it pilot tested?	Interview guide is provided and the guide was pilot tested
18	Were repeat interviews carried out? If yes, how many?	Yes – n = 15 follow up, member checking interviews were carried out
19	Audio/visual recording: Did the research use audio or visual recording to collect the data?	Audio recording
20	Were field notes made during or after interviews ?	Field notes were made during and after interviews
21	Duration: What was the duration of the interviews ?	Average interview duration was 1 hr
22	Was data saturation discussed?	Saturation was discussed and agreed on by all investigators
23	Were transcripts returned to participants for comment and/or correction?	No
24	How many data coders coded the data?	N = 2 data coders
25	Did authors provide a description of the coding tree?	Yes
26	Were themes identified in advance or derived from the data?	Themes were derived from the data.
27	What software was used to manage the data?	NVivo (v. 10; QSR International)
28	Did participants provide feedback on the findings?	Yes, during the follow up, member-checking interviews
29	Were participant quotations presented to	Quotations are presented and each quotation is identified.

	illustrate the themes / findings? Was each quotation identified?	
30	Was there consistency between the data presented and the findings?	Yes, there was consistency between data presented and findings
31	Were major themes clearly presented in the findings?	Yes
32	Is there a description of diverse cases or discussion of minor themes?	Yes

SRQR COMPLETION

<p>TITLE AND ABSTRACT</p> <p>S1 - Title</p>	<p>Barriers and Facilitators to Healthy Active Living in South Asian Families in Canada: A Thematic Analysis</p>
<p>S2 - Abstract</p>	<p>Objectives: The study objective was to understand the barriers and facilitators to healthy active living in South Asian families living in Canada.</p> <p>Design: Semi-structured interviews of 30-60 minutes duration with South Asian women with young families, and analyzed using a thematic analytic approach</p> <p>Setting: Community-dwelling South Asian women interviewed in the home environment or by phone.</p> <p>Participants: Fifteen married South Asian women (mean age = 34.2 y) living in the Peel region of Ontario, Canada with at least 1 child under the age of 5 years. The majority of women had immigrated to Canada (13/15), during a 5 – 10-year interval preceding interviews.</p> <p>Results: 57 different codes derived from 18 interview hours, and further evaluated through member checking. The top three barriers to healthy eating were: 1) not having enough time for healthy food preparation; 2) lack of knowledge about what is healthy eating; and 3) viewing healthy eating as a matter of engaging in time-limited dieting. These barriers were addressed with: 1) knowledge and awareness of healthy eating; 2) clear goal setting; 3) access to fresh vegetables and fruits; and 4) better arrangements and more time for food preparation. The top five barriers to physical activity were: 1) not enough time and energy; 2) competing priorities; 3) lack of childcare; 4) lack of family-engaging exercise and; 5) limited access to interesting exercise programming. These barriers were addressed by: 1) experiencing exercise as enjoyable and stress-releasing; 2) commitments to walking exercise; 3) use of an electronic exercise-tracking device; 4) offspring exercise supported by spouse and family; 5) success stories about exercise from others.</p> <p>Conclusions: Barriers to healthy active living in South Asian women with young families can be addressed with facilitators that stimulate clear goal setting and healthy food preparation skills, and exercise formats that engage mothers and offspring, with or without exercise tracking.</p>
<p>INTRODUCTION</p>	<p>Amongst the ethnic groups with high prevalence of overweight</p>

<p>S3 - Problem formulation</p>	<p>and obesity and related complications are South Asians (SA) who have become Canada's largest non-white ethnic group [6-9]. SA in Canada confront elevated risks for type 2 diabetes and for cardio-metabolic disorders that contribute to the onset of coronary artery disease [10-12]. Immigration is stressful, disrupting old social networks and requiring new networks to be initiated. Efforts in network building can affect HAL behaviours [13]. Furthermore, HAL role-modeling by parents, whether present or absent, can influence the offspring [14, 15].</p> <p>The understanding of barriers and facilitators in the adoption of HAL behaviours is instructive, both within intra-familial and multi-generational contexts. This explains our focus on SA women who, after immigration from the Indian subcontinent, confront elevated cardio-metabolic risks on an individual and familial basis.</p> <p>Understanding their perceptions of HAL barriers and facilitators is an important step in designing efficacious interventions.</p>
<p>S4 - Purpose or research question</p>	<p>The study goal was to utilize semi-structured interviews with SA mothers of child-bearing age from Ontario, Canada to understand their views of HAL (including barriers and facilitators), especially in relation to nutrition and physical activity.</p>
<p>METHODS</p> <p>S5 - Qualitative approach and research paradigm</p>	<p>This is a qualitative descriptive study, undertaken in accord with an interpretivist perspective.</p> <p>Interpretivism (interpretivist) Research Philosophy</p> <p>Interpretivism, also known as interpretivist involves researchers to interpret elements of the study, thus interpretivism integrates human interest into a study. Accordingly, "interpretive researchers assume that access to reality (given or socially constructed) is only through social constructions such as language, consciousness, shared meanings, and instruments".[1] Development of interpretivist philosophy is based on the critique of positivism in social sciences. Accordingly, this philosophy emphasizes qualitative analysis over quantitative analysis.</p> <p>Interpretivism is "associated with the philosophical position of idealism, and is used to group together diverse approaches, including social constructivism, phenomenology and hermeneutics; approaches that reject the objectivist view that meaning resides within the world independently of consciousness"[2]. According to interpretivist approach, it is important for the researcher as a social actor to appreciate</p>

	differences between people.[3] Moreover, interpretivism studies usually focus on meaning and may employ multiple methods in order to reflect different aspects of the issue.
S6 - Researcher characteristics and reflexivity	The research team was multi-disciplinary and comprised of physicians (SA, GW), a dietitian and nutritional epidemiologist (RD), PhD-level graduate students in Education and Health Research Methods, Evidence and Impact (SM, SK) a program manager who oversees multiple epidemiologic studies (DD) and a clinical research psychologist (PR). Of the 7 team members, a South Asian ethnic background was shared by 6 members (5 female, 1 male) while one member was of North American-European background (1 male).
S7 - Context	The study was approved by the Hamilton Integrated Research and Ethics Board (HIREB)#10-640 at McMaster University on May 23, 2017 [16].
S8 - Sampling strategy	Interview participants were recruited from the South Asian Birth Cohort (START), a cohort study of SA women living in Ontario's Peel Region [17, 18]. Between 2011 and the present, over 1,000 mother-child dyads have been recruited and followed 1, 2, 3 and 5 years later (with 90% follow-up rates). All participants who attended their scheduled START study visits were eligible for qualitative study enrolment. We approached participants consecutively until the n=15 study goal was reached. All interested participants were contacted by the study coordinator who undertook consents at visits and provided information on how study interviews could be scheduled by phone with the interviewer. The interviewer and participants met most often in the identified participant's home environment (N = 10) although N = 5 interviews were undertaken by phone.
S9 - Ethical issues pertaining to human subjects	The study was approved by the Hamilton Integrated Research and Ethics Board (HIREB)#10-640 at McMaster University on May 23, 2017 [16].
S10 - Data collection methods	Semi-structured interviews of 30-60 minutes duration elicited verbal responses from participants about recent and past experiences. A guiding assumption was that SA mothers of child-bearing age might be more candid in describing unique obstacles when subjects and the interviewer were matched for ethnicity and age-range. Therefore, a South Asian female interviewer (SM) conducted the interviews. The semi-structured interview schedule (SSIS) addressed barriers to and facilitators of healthy exercise and diet and was developed by

	<p>an investigator (PR) in accord with prior diabetes intervention research [19, 20]. The original draft was reviewed and modified by team members (SM, SA, SK, RJdS, GW, DD, SA) (see Table 2) [Table 2] and pilot-tested with participants. Since English was a second language for most participants, several frequently employed linguistic idioms from Urdu, Punjabi and Hindi. The interviewer's ability to speak these languages and understand these multilingual idioms assisted the interview process.</p>
S11 - Data collection instruments and technologies	<p>The semi-structured interview schedule (SSIS) addressed barriers to and facilitators of healthy exercise and diet and was developed by an investigator (PR) in accord with prior diabetes intervention research [19, 20]. The original draft was reviewed, and modified by team members (SM, SA, SK, RJdS, GW, DD, SA) (see Table 2) [Table 2] and pilot-tested with participants.</p>
S12 - Units of study	<p>To maintain confidentiality, personal information was removed from digitally- represented transcripts and audio interview recordings were stored in a locked cabinet in locked research offices.</p>
S13 - Data processing	<p>All interviews were digitally recorded and fully-transcribed verbatim. Transcripts were then checked for accuracy and reviewed word-by-word by the interviewer (SM) and three additional members of the research team (SK, GW, PR), two of whom were also females of SA background. All reviews focused on ensuring an unbiased approach to information elicitation and analyses. Interviews conducted in other South Asian languages were first translated into English prior to verbatim transcription.</p>
S14 - Data analysis	<p>Coding and analyses were performed using NVivo (v. 10; QSR International) and employed a thematic analytic approach [21,22] to thoroughly explore the relevant themes that surfaced during interviews. [Table 3]. Thematic analysis provides a systematic identification of emergent patterns through the logical organization of the qualitative data into broader (representative) themes [21-23]. Our analytic strategy of constant comparison included code development (SM and SK) as the basic analytic unit and then, with code use, the derivation of broader themes (through team discussions)that illustrated coherent views of the data. Participant perspectives and self-management experiences were explored in the context of individual, offspring and family-based efforts to adopt and sustain positive HAL changes [Table 3]. Saturation, or the point where novel information is not detectable with additional</p>

	<p>interviews, was evaluated by all research team members, in accord with study goals. [23] Member checking was undertaken with all interviewees (15 of 15), and included reviews of both group and individualized findings (each interviewee responded to carefully constructed summaries of her interview) [24] [Table 4]. The member checking was undertaken by the original interviewer (SM) by telephone, using detailed notes describing subject perceptions of convergences and divergences of the findings assumed to be representative.</p> <p>In summary, the thematic analysis process included: (a) code development as the basic unit of analyses capturing relevant aspects of data, (b) code summaries into broader themes, and (c) creation of an organized, coherent picture to illustrate major themes within the data.</p>
S15 - Techniques to enhance trustworthiness	<p>Member checking was undertaken with all interviewees (15 of 15), and included reviews of both group and individualized findings (each interviewee responded to carefully constructed summaries of her interview) [24] [Table 4]. The member checking was undertaken by the original interviewer (SM) by telephone, using detailed notes describing subject perceptions of convergences and divergences of the findings assumed to be representative.</p>
<p>RESULTS AND FINDINGS</p> <p>S16 - Synthesis and interpretation</p>	<p>All of the 57 codes derived from 18 interview hours with 15 mothers, were re-evaluated during member checking. Our thematic analysis identified four themes: 1) barriers related to healthy diet; 2) facilitators related to healthy diet; 3) barriers related to physical exercise and 4) facilitators related to physical exercise. Table 3 presents the full set of barriers and facilitators identified.</p>
S17 - Links to empirical data	<p>Direct quotes related to identified themes are linked to participants transcribed interviews in the paper and can be found in the <i>results</i> section of the paper.</p>
<p>DISCUSSION</p> <p>S18 - Integration with prior work, implications, transferability, and contribution(s) to the field</p>	<p>The selection of key themes was substantially aided by a careful member checking process where each interviewee (15 of 15) was contacted by phone and during follow up interviews given the opportunity to judge whether the communicated findings affirmed what was conveyed. The themes emphasized yielded the most confirmations and the least disconfirmations. Altogether, more than two-thirds of participants endorsed each theme although for most key themes >73% provided</p>

	endorsement (e.g. 73%, 87%, 93%, 100%).
S19 - Limitations	In terms of limitations, we note the sparseness of participation by marital partners and offspring. Strong efforts were made during in-home interviews and in attempts at follow up phone interviews with spouses. However, the offspring present during interviews were hesitant to speak and spouses were not inclined to accept and follow up with the invited phone interviews. Finally, we acknowledge that our guide may have been too structured. We made the deliberate choice to specifically interrogate barriers and facilitators and allow for the greatest degree of flexibility in the participants' description of these. This approach likely limited our flexibility to explore themes beyond this focus more fully.
S20 - Conflicts of interest	No conflicts to report
S21 - Funding	This work was supported by the CIHR research grant No. 359907
Acknowledgements	The authors acknowledge the subjects who volunteered their time and home environments during interviews while sharing their valuable, personal perspectives. We acknowledge ample research support from the Canadian Institutes for Health Research (No. 359907)

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Title Page

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Barriers and Facilitators to Healthy Active Living in South Asian Families in Canada: A Thematic Analysis

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Abstract

Objectives: The study objective was to understand the barriers and facilitators to healthy active living in South Asian families living in Canada.

Design: Semi-structured interviews of 30-60 minutes duration with South Asian women with young families, and analyzed using a thematic analytic approach

Setting: Community-dwelling South Asian women interviewed in the home environment or by phone.

Participants: Fifteen married South Asian women (mean age = 34.2 y) living in the Peel region of Ontario, Canada with at least 1 child under the age of 5 years. The majority of women had immigrated to Canada (13/15), during a 5 – 10-year interval preceding interviews.

Results: 57 different codes derived from 18 interview hours, and further evaluated through member checking. The top three barriers to healthy eating were: 1) not having enough time for healthy food preparation; 2) lack of knowledge about what is healthy eating; and 3) viewing healthy eating as a matter of engaging in time limited dieting. These barriers were addressed with: 1) knowledge and awareness of healthy eating; 2) clear goal setting; 3) access to fresh vegetables and fruits; and 4) better arrangements and more time for food preparation. The top five barriers to physical activity were: 1) not enough time and energy; 2) competing priorities; 3)

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3 lack of childcare; 4) lack of family-engaging exercise and; 5) limited access to interesting
4 exercise programming. These barriers were addressed by: 1) experiencing exercise as
5 enjoyable and stress-releasing; 2) commitments to walking exercise; 3) use of an electronic
6 exercise-tracking device; 4) offspring exercise supported by spouse and family; 5) success
7 stories about exercise from others.
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10 **Conclusions:** Barriers to healthy active living in South Asian women with young families
11 can be addressed with facilitators that stimulate clear goal setting and healthy food
12 preparation skills, and exercise formats that engage mothers and offspring, with or without
13 exercise tracking.
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15

16 **Strengths and limitations of this study**

- 17 • Candid disclosures by participants supported by an interviewer of South Asian
18 background who was fluent in Urdu, Punjabi and Hindi [languages frequently used
19 by participants to complement English disclosures].
- 20 • Key theme selection aided by a careful member checking process.
- 21 • More than two-thirds of n = 15 participants endorsed each key theme.
- 22 • Minimal participation by marital partners and offspring.
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27 **Introduction**

28
29 Excess weight and obesity, and related complications, pose a significant burden to the
30 health of children and adults [1]. Children and youth with obesity are increasingly
31 diagnosed with clinical conditions including type 2 diabetes, hypertension,
32 hypercholesterolemia, and fatty liver. Furthermore, obesity may impact other health
33 conditions for children and adults including asthma, disrupted sleep, early puberty,
34 disordered eating and chronic fatigue, smoking and gestational diabetes mellitus [1-3]. The
35 mental health consequences of overweight and obesity for adults and children include
36 teasing, bullying, reduced self-esteem, isolation, depression, social skill deficits, learning
37 difficulties, and excess stress and anxiety [1].
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40

41 In studies of individual health behaviours, high-energy intake and increased screen time
42 are associated with weight gain, while healthy physical activity (PA) levels and longer sleep
43 durations are associated with normal healthy weight [4]. As lifestyle behaviours are shaped
44 in early childhood [5], healthy active living (HAL) behaviours can contribute to the lifelong
45 maintenance of healthy weight [5]. The Diabetes Canada Clinical Practice Guidelines Expert
46 Committee strongly argues for HAL, emphasizing the efficacy of physical exercise in
47 minimizing risks for diabetes and cardiovascular disease. They suggest that physical
48 activity improves glycemic control in type 2 diabetes, lowering morbidity-mortality and
49 weight [6]. HAL behaviours in children are affected by family environments, with specific
50 familial impacts reported in multiple studies [7]. For example, children without siblings are
51 less physically active than children with siblings, and children in single parent homes have
52 more screen exposure (e.g., TV watching hours) than those living with both parents [1-6]
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3 Previous qualitative studies emphasize the needs for social support for adults and children
4 in relation to diet and exercise, especially in populations affected by gestational diabetes
5 [8]. Barriers to diet and exercise for parents are related to work and childcare
6 responsibilities which could be reduced with more support for childcare [8]. Kandasamy et
7 al., (2021) studied the barriers and facilitators to diet and exercise activity among South
8 Asian women of childbearing age, emphasizing the importance of cultural and contextual
9 factors that influence knowledge, attitudes and dietary-exercise practices [9]. Similarly,
10 understandings of South Asian cultural influences are emphasized in several studies
11 related to health behaviour change, especially in preventing diabetes and hypertension in
12 this high-risk group [8, 9].
13
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16 South Asians (SA), now Canada's largest non-white ethnic group, are amongst the ethnic
17 groups with health complications associated with excess adiposity [10-14]. SA in Canada
18 confront elevated risks for gestational diabetes, central adiposity, type 2 diabetes and
19 associated cardio-metabolic disorders that contribute to the premature onset of coronary
20 artery disease [9-14]. Immigration is stressful, disrupting old social networks and requiring
21 new network initiations. Efforts in social network building and maintenance can also affect
22 HAL behaviours [15, 16]. Furthermore, HAL role-modeling by parents has a strong
23 influence on HAL behaviours in offspring [16, 17]. SA living in Canada possess a unique
24 risk profile for diabetes and cardio-metabolic disorders [9, 17, 18], explored in this paper.
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28 The understanding of barriers and facilitators in the adoption of HAL behaviours is
29 instructive, both within intra-familial and multi-generational contexts. This explains
30 our focus on SA women who, after immigration from the Indian subcontinent, confront
31 elevated cardio-metabolic risks on an individual and familial basis. Understanding their
32 perceptions of HAL (barriers and facilitators) is an important step in designing efficacious
33 interventions [9, 10, 19]. Previous qualitative studies have focused on prevention
34 interventions for diabetes, with a focus on SA women [8, 9, 11] have informed our study
35 and interventions for this group.
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38 The study goal was to utilize semi-structured interviews with SA mothers of childbearing
39 age from Ontario, Canada to understand their views of HAL (including barriers and
40 facilitators), especially in relation to nutrition and physical activity.
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42

43 **Methods**

44 **Study design**

45 This is a qualitative descriptive study, undertaken in accord with an interpretivist
46 perspective.
47

48 **Setting and participants**

49 The study was approved by the Hamilton Integrated Research and Ethics Board
50 (HIREB)#10-640 at McMaster University on May 23, 2017 [20]. Interview participants
51 were recruited from the South Asian Birth Cohort (START), a cohort study of SA women
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3 living in Ontario's Peel Region [21, 22]. Between 2011 and the present, over 1,000 mother-
4 child dyads have been recruited and followed 1, 2, 3 and 5 years later (with 90% follow-up
5 rates).
6

7
8 **Patient and Public Involvement:** It was not appropriate or possible to involve patients or
9 the public in the design, or conduct, or reporting of our research. We will engage patients
10 and the public in the dissemination of this research, once there is acceptance of and
11 publication of the submitted manuscript.
12

13 **Sampling strategy**

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16 All participants who attended their scheduled START study visits were eligible for
17 qualitative study enrolment. We approached participants consecutively until the N=15
18 study goal was reached. All interested participants were contacted by the study
19 coordinator who undertook consents at visits and provided information on how study
20 interviews could be scheduled by phone with the interviewer. The interviewer and
21 participants often met in the identified participant's home environment (N = 10) although
22 N = 5 interviews were undertaken by phone [See Supplementary Table 1].
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26 Twenty-three people who were eligible for this study were approached, 16 agreed to
27 participate and 15 completed the interview. Seven of the approached participants were not
28 included in the analysis. One person's interview was not recorded, as requested by the
29 participant herself. Of the 6 who declined, 1 declined because she was moving residences, 2
30 were not interested, 1 initially agreed, but later declined, 1 could not commit sufficient
31 time, and 1 was expecting a second child and therefore too busy to participate (See
32 Supplementary Table 1). Comparisons of those who accepted participation versus those
33 who declined indicated that participation was associated with a higher education level, and
34 those who accepted had more people living in the household (See Figure 1 for Participant
35 Flow Chart).
36
37

38 **Interview schedule and process**

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40
41 Semi-structured interviews of 30-60 minutes duration elicited verbal responses
42 from participants about recent and past experiences. A guiding assumption was that SA
43 mothers of child-bearing age might be more candid in describing unique obstacles when
44 subjects and the interviewer were matched for ethnicity and age-range. Therefore, a South
45 Asian female interviewer (SM) conducted the interviews. The semi-structured interview
46 schedule (SSIS) addressed barriers to and facilitators of healthy exercise and diet and was
47 developed by an investigator (PR) in accord with prior diabetes intervention research [23-
48 27]. The original draft was reviewed, and modified by team members (SM, SA, SK, Rjds,
49 GW, DD, SA) [See Supplementary Table 2]) and pilot-tested with participants. Since English
50 was a second language for most participants, several frequently employed linguistic idioms
51 from Urdu, Punjabi and Hindi. The interviewer's ability to speak these languages and
52 understand these multilingual idioms assisted the interview process.
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3 The interview structure thoroughly emphasized different types, frequencies and durations
4 of exercise in order to capture at meaningful levels the physical exercise that was regularly
5 undertaken. With respect to dietary alternatives, the aim was to describe dietary
6 orientations in sufficient detail to assist individuals in considering their dietary patterns
7 carefully. Care was taken during each interview to help participants carefully consider
8 every category in the course of responding to interview questions. The linguistic diversity
9 of participants was significant, requiring the interviewer to clarify different levels and
10 types of orientations in the participant's native language (See Supplementary Table 3).
11
12

13 **Data processing**

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16 To maintain confidentiality, personal information was removed from digitally-represented
17 transcripts and audio interview recordings were stored in a locked cabinet in locked
18 research offices.
19

20
21 All interviews were digitally recorded and fully transcribed verbatim. Transcripts were
22 then checked for accuracy and reviewed word-by-word by the interviewer (SM) and three
23 additional members of the research team (SK, GW, PR), two of whom were also females of
24 SA background. Altogether, there were 4 reviewers per transcript, who met weekly at a
25 consistent day and time for 4 months to conduct the analyses. The transcripts were read,
26 re-read and coded individually and then jointly, in group meetings, to explore similar,
27 repeated or new insights. In qualitative research, it is important for reviewers to reach
28 consensus and continually revise coding and analysis to ensure an in-depth analysis [8].
29 The analytic developments were then shared with the rest of the research team (SA, RD,
30 DD) every week at a scheduled team meeting. All reviews focused on ensuring an unbiased
31 approach to information elicitation and analyses. Interviews conducted in other South
32 Asian languages were first translated into English prior to verbatim transcription.
33
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35

36 **Researcher characteristics**

37
38 The research team was multi-disciplinary and comprised of physicians (SA, GW), a dietitian
39 and nutritional epidemiologist (RD), PhD-level graduate students in Education and Health
40 Research Methods, Evidence and Impact (SM, SK) a program manager who oversees
41 multiple epidemiologic studies (DD) and a clinical research psychologist (PR). Of the 7
42 team members, a South Asian ethnic background was shared by 6 members (5 female, 1
43 male) while one member was of North American-European background (1 male).
44
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46 **Data Analysis**

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49 Coding and analyses were performed using NVivo (v. 10; QSR International) and employed
50 a thematic analytic approach [28, 29] to thoroughly explore the relevant themes that
51 surfaced during interviews [See Supplementary Table 2]. Thematic analysis provides a
52 systematic identification of emergent patterns through the logical organization of the
53 qualitative data into broader (representative) themes [28, 29]. Our analytic strategy of
54 constant comparison included code development (SM and SK) as the basic analytic unit and
55 then, with code use, the derivation of broader themes (through team discussions) that
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3 illustrated coherent views of the data. 'Code development' refers to how we labeled and
4 organized the qualitative data when conducting analysis of transcripts, to identify varying
5 themes and relationships between themes [28, 29]. Participant perspectives and self-
6 management experiences were explored in the context of individual, offspring and family-
7 based efforts to adopt and sustain positive HAL changes [See Supplementary Table 2].
8 Saturation, or the point where novel information is not detectable with additional
9 interviews, was evaluated by all research team members, in accord with study goals [30].
10 Member checking was undertaken with all interviewees (15 of 15), and included reviews of
11 both group and individualized findings (each interviewee responded to carefully
12 constructed summaries of her interview) [29, 31] [See Supplementary Table 4]. The
13 member checking was undertaken by the original interviewer (SM) by telephone, using
14 detailed notes describing subject perceptions of convergences and divergences of the
15 findings assumed to be representative.
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20 In summary, the thematic analysis process included: (a) code development as the basic unit
21 of analyses capturing relevant aspects of data, (b) code summaries into broader themes,
22 and (c) creation of an organized, coherent picture to illustrate major themes within the
23 data.
24

25 Results

26
27
28 The average age of the 15 interviewees was 34.2 years (SD=2.1). Thirteen of the 15 women
29 immigrated to Canada in the 5 – 10-year interval preceding interviews. [See Supplementary
30 Table 1] All participants were married, spoke English as a second language and had one or
31 more children. Participants co-inhabited households with a mean of 2 residents other than
32 spouse and offspring (household members who were often extended family members) and
33 while 46.2% (7/15) of participants were employed; their spouses were 100% employed.
34 The spousal work patterns identified in interviews involved long hours of inflexible but
35 shifting engagements with a high prevalence of evening and night-time shift work (See
36 Supplementary Table 5).
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40 All of the 57 codes derived from 18 interview hours with 15 mothers, were re-evaluated
41 during member checking. Our thematic analysis identified **four themes**: 1) barriers related
42 to healthy diet; 2) facilitators related to healthy diet; 3) barriers related to physical exercise
43 and 4) facilitators related to physical exercise. Table 3 presents the full set of barriers and
44 facilitators identified.
45

46
47 Barriers, in the study, are defined as obstacles to positive behaviour changes. Facilitators,
48 on the other hand, are defined as behaviours, cognitions and environments that result in a
49 higher likelihood of positive behaviour change [6]. Often, barriers can be confronted with
50 the purposeful use of facilitators. For example, a mother who does not want to leave a child
51 in a childcare situation with paid staff, can be directed to leave her children with relatives
52 and the success in arranging this situation, would facilitate more frequent exercise.
53 Representative quotes and themes can be found in supplementary Table 6 and 7 (See
54 Figure 2 for Integrated Graphic of Study Results).
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De-motivating Barriers and Motivating Facilitators for Healthy Eating

Three barriers, according to member-checking, were the most frequently endorsed in importance. Each barrier or facilitator theme identified is followed by a representative quote.

1)not enough time for healthy food preparation;

“...we are making fresh food and it’s very time consuming because you have to cut everything.... a lot of chopping in our food... and then [doing] the dishes.” [Interviewee # 4]

2)lack of knowledge about what is and how to implement healthy eating; “...Someone told me once to drink water with a spoon of this or that...and then I’ll lose weight.... I tried many, many times to do this but I never noticed a difference.” [Interviewee # 8]

3)viewing healthy eating as a matter of engaging in time-limited dieting.

“...I start something, but I don’t know what happens with the busyness ... I just lose momentum and eventually stop. [Interviewee # 4]

Two additional barriers were frequently mentioned but less frequently endorsed:

1) spouse or children’s unhealthy eating habits;

“Trying to eat healthier.... like trying to stop with the white bread and white rice....” [Interviewee # 14]

2) pressures to personally eat unhealthy foods.

“...sometimes they want to order pizza.... I don’t want to eat any, you know... but you see the pizza and you’re like, okay, I can have one slice...” [Interviewee # 3]

All barriers were seen as mutually reinforcing as insufficient time for food preparation left mothers vulnerable to serving quickly prepared and unhealthy foods, particularly when these latter foods were aligned with spouse and offspring preferences. The intention to solely engage in a time-limited healthy eating plan rather than commit to longer-term plans seemed to decrease the strength of intentions to prepare healthy foods; healthy eating was most frequently seen as a brief, time-limited exception to status quo consumptions.

These barriers were experienced as addressed by facilitators that included;

1) knowledge about and awareness of what healthy eating entails;

“... trying to eat more ... boiled or baked stuff. Trying to eat healthier.” [Interviewee # 14]

2) setting clear goals for eating ‘healthier’;

“.... when I pack their snacks....I always tell them that before they can have ... snacks they have to finish all their health food...” [Interviewee # 15]

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3 **3) better access to fresh vegetables and fruits;**

4 “Suppose if we are eating ... kale and cucumber ... but when it’s finished, it’s finished...I
5 don’t know when the next time will be that I’ll go get groceries. I’m so busy that I just make
6 sure the main things are at home ...” [Interviewee # 4]
7

8
9 **4) clear arrangements (including apportioning adequate time) for healthy food
10 preparation.**

11 “My friend... gave me a diet chart... about which diet is best ... they didn’t have the flour we
12 use, there were ... replacements ... like soy” [Interviewee # 8]
13

14
15 **Another frequently mentioned facilitator was:**

16
17 **5) becoming a vegan or vegetarian, although it was less frequently endorsed
18 during member checking.**

19 “I couldn’t figure out what was going on, but ... I cut those two (meat and dairy) out of my
20 diet.... I figured out...afterwards...I wasn’t digesting properly...so I went vegan... completely
21 one day....” [Interviewee # 6]
22
23

24 **De-motivating Barriers and Motivating Facilitators for Healthy Exercise**

25
26 Five barriers were the most frequently endorsed, according to member checking as
27 important for healthy exercise. Each barrier or facilitator theme identified will again be
28 followed by a representative quote.
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30

31 **1)not enough time and energy to engage in exercise;**

32 “Sleep. When I have lack of sleep, I’m already tired and ... I don’t really feel like doing more
33 exercise or anything, ...I’m so tired of watching my baby at night and then he’s all cranky in
34 the morning too. So, I’m like, you know what, let’s just put him to sleep and I will take a
35 nap while he’s sleeping.” [Interviewee # 1]
36
37

38 **2) competing priorities;**

39 “I used to do running, walking a lot. Now I get tired just doing the housework and I don’t
40 have that much energy.” [Interviewee # 4]
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42

43 **3) lack of childcare (while exercising);**

44 “...sometimes they have day care in the gym and sometimes they don’t Sometimes he
45 [my son] doesn’t want to go, even if I want to go... and then nobody is at my home to watch
46 him, so I can’t go....” [Interviewee # 4]
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49 **4) lack of family-engaging exercise and**

50 “... a world gym...near my house.... for 3 weeks, I didn’t go ... because my kids are.... busy,
51 busy, busy...” [Interviewee # 8]
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53 **5) limited access to exercise programming viewed as interesting and beneficial.**

54 “I’m going to my sister’s in Edmonton. She is training at the gym. She is joining Zumba
55 classes.... she wanted me to join ... for one month so I can learn” [Interviewee # 11]
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These barriers were also seen as mutually reinforcing as insufficient time and energy were reinforced by conflicts with offspring priorities, supported by the lack of high-quality childcare (during exercise) and family- engaging exercise programs.

The above barriers were viewed as addressed by facilitators that included:

1) experiencing exercise as enjoyable and stress releasing;

“... I love to do exercise. ...beforeI got married, I used to ... exercise. ... I would love to continue ... Like, every day for ... two hours...” [Interviewee # 1]

2) commitments to walking forms of exercise, especially with use of fitbits or other electronic exercise tracking devices;

“ I wear the Fitbit. ...I keep track of calories... But ... I don't have ... to lose ...weight. ...I just want to track how...how much I ran today, how many steps I took...” [Interviewee # 13]

3) a high priority on offspring exercise supported by spouse and family;

“After ... prayer, she takes the group of kids ... for a walk...” [Interviewee # 5]

4) hearing success stories from others who adopt healthy exercise;

“Yesterday my friend was telling me that.... there's a track... a 400-metre track and she's been going there for 3 or 4 days ... ashe'll do 400 metres, 10 times.” [Interviewee # 8]

5) being able to exercise with others (including family members):

“.... my sister ... motivated me because she's going to the gym.many people are going on my street... I saw them and ... I realized I had to go too.” [Interviewee # 11]

In all the codes developed during analyses of verbatim transcripts, there was a strong role for multiple elements of ‘culture’ that influence the family, with ‘mother’ occupying a central role. Cultural elements, combined with the community environments, appeared to aid or reduce motivation and behavioural adoption.

Discussion

Disclosures about, and descriptions of, the barriers-facilitators of HAL behaviours were derived from interviews with South Asian mothers (mean age of 34.2 years) of children below the age of 10 years. The interviews were mainly conducted in home environments, by an interviewer of similar ethnic background who was fluent in English, Urdu, Punjabi, and Hindi. The facilitators and barriers to HAL identified were unique in important ways but shared commonalities with other studies in the general population (26, 32, 33), in Indigenous communities (32, 34), in other specific ethnic groups (35-37), in pregnant South Asian women (34), and in women with post-gestational diabetes (30).

Negative ‘barriers’ to healthy eating were compensated for by facilitators that revolved around knowledge and awareness of healthy eating, cooking, meal preparation and

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3 consumption goal setting. Limited exploration and contemplation could therefore be
4 compensated for by clear, 'how-to' messaging. For example, the ambiguities about 'what is
5 healthy eating?' could be addressed by support in thinking beyond status quo to an
6 application of goal setting for healthier eating. Another facilitator emphasis was access to
7 high quality (fresh) fruits and vegetables. Despite the emphasis on vegetables and fruits,
8 there was ambivalence as to whether vegetarian or 'vegan' lifestyles facilitated healthy
9 eating, evident in the member checking, where only 7 of 15 participants endorsed non-
10 meat eating as advantageous. Specific mentions referred to mothers who were highly
11 devoted to vegan or vegetarian lifestyles, but still engaged in excess carbohydrate and
12 sugar consumption. When vegan-vegetarian choices were linked to religious beliefs and not
13 health judgments, a lack of knowledge about healthy vegetarian or vegan eating presented
14 a barrier to healthy choices, resulting in unhealthy (though plant-based) diets that
15 increased diabetes risks and the risks of other metabolic disorders [38, 39].
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20 The perceived exercise barriers included insufficient time and energy amidst resistances to
21 utilizing inadequate childcare (while exercising), due to concerns about safety and the
22 engagement of childcare workers, and ongoing conflicting priorities. The barriers
23 specifically related to a lack of family-engaging exercise combined with the availability of
24 limited exercise programs that neither aroused interest nor confidence. These barriers
25 were counterbalanced by facilitators that included preferred family-based exercise options,
26 with spousal/family support aided by priorities on offspring exercise [40, 9]. The final
27 perceived facilitator was a consistently adopted exercise program that provided enjoyment
28 and momentum towards health-related goals.
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31 In themes that cross the barrier/facilitator and healthy eating/exercising boundaries, a
32 lack of time and energy was primary, and linked to conflicting priorities and the lack of
33 high-quality information. The prioritization dilemma indicated low confidence in the
34 information accessed, with 'not enough time and energy' reflecting indecision about which
35 priorities merited investment. For example, most participants had not formulated specific
36 health goals [35]. Furthermore, a significant number noted that healthy eating and exercise
37 were not emphasized in SA culture, and that this absence of emphasis influenced their
38 offspring. As a result, changes in the direction of improved physical fitness and healthier
39 eating were frequently temporary and fragmented. The absence of family engaging exercise
40 and/or childcare during exercise sessions were major pragmatic obstacles as few mothers
41 would tolerate inadequate childcare to exercise on a regular basis. Other maternal studies
42 point to similar barriers, asserting that altering diet and exercise requires social support
43 from friends, family, spouse and specifically, childcare support, to allow for attendance in
44 exercise programs [8].
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49 Most women had husbands who worked long day, evening and night hours resulting in the
50 mothers being primarily responsible for cooking, cleaning and childcare. Some of the
51 mothers additionally worked professionally outside the home and felt overwhelmed with
52 'juggling' many caretaking tasks.
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55 Culture is a multiply relevant construct here. First, it refers to the adopted North American
56 culture that impinges on healthy eating and exercise priorities. Quickly prepared pre-
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3 processed foods dominated diets and exercise was considered non-essential by most
4 mothers [40-42]. Furthermore, our subjects' perceptions of SA culture also indicated a lack
5 of perceived support for healthy exercise and eating. This may contribute to the unique
6 cardiovascular risk profile of South Asian people living in Canada [10]. Therefore, there is
7 an emerging cultural awareness that South Asian women and mothers require additional
8 support. Thus, it is important to consider the cultural influences in relation to how
9 knowledge about healthy eating and exercise is obtained, shared and valued [9, 42-44].
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12 In psychological terms, the inattention and restricted cognitions of mothers reflect a pre-
13 contemplative stage of change (where status quo behaviours are not internally debated) or
14 early contemplation (where debates are limited to considering temporary calorie-reducing
15 diets in place of previous dietary patterns) [35].
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18 The remainder of healthy eating barriers could be categorized as both psychological and
19 sociocultural. There was acknowledgment of a general fatigue related to disturbed sleep
20 (also a frequent cause of excess, unselective eating) and a range of cultural factors that
21 ranged from social pressures to eat traditional but unhealthy foods (e.g., during holiday
22 celebrations and extended family gatherings) to the TV advertisements that influence
23 offspring to resist introductions of healthier, minimally-advertised foods. These influences,
24 in turn, were differentiated from social factors that are partly cultural and partly
25 psychological, such as catering to spouse's unhealthy eating habits that reinforce the
26 deficits for healthy eating from family members and peers (including the influence of
27 extended family household members in joint family systems). Altogether, there is an
28 identified susceptibility to unhealthy fast-food consumption that operates inside and
29 outside the household.
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34 In terms of intervention strategies, based on the findings of this study, equal emphasis
35 would be placed on exercise promotion and dietary modification. As mothers were
36 reluctant to leave offspring at daycare centres to exercise individually, emphasis would
37 focus on family-based exercise (i.e. what parents and children can do jointly). This is
38 inherently more complex than individual exercise, as parental care taking is merged with
39 individual exercise. What the literature indicates is the simpler exercise alternatives, for
40 example, going for walks, are more easily transformed into family-based exercise [44-46].
41 However, the complexity of ensuring a positive experience for offspring might warrant
42 training in specific skills where exercise is made palatable for children accompanying their
43 parents [44-46]. For example, the Diabetes Canada Clinical Practice Guidelines Expert
44 Committee emphasize strategies to improve motivation and self-efficacy related to physical
45 activity through goal setting and use of monitoring tools such as pedometers [6]. As
46 gleaned from our interview participants, Fit Bits and smartphone applications that track
47 steps, exercise, and diet were perceived as motivating and helpful. In terms of diet, the
48 tendency to adopt frequently advertised foods by offspring (that influence family choices)
49 would be addressed with specific health behaviour change strategies. Although dietary
50 changes in immigrant family interventions have been more successful in adult family
51 members, the role modeling of adults can have a positive impact on offspring [47].
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56 **Strengths and Limitations**

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4 The selection of key themes was substantially aided by a careful member checking process
5 where each interviewee (15 of 15) was contacted by phone and during follow-up
6 interviews given the opportunity to judge whether the communicated findings affirmed
7 what was conveyed. The themes emphasized yielded the most confirmations and the least
8 disconfirmations. Altogether, more than two-thirds of participants endorsed each theme
9 although for most key themes >73% provided endorsement (e.g., 73%, 87%, 93%, 100%).
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12 In terms of limitations, we note the sparseness of participation by marital partners and
13 offspring. Strong efforts were made during in-home interviews and in attempts at follow up
14 phone interviews with spouses. However, the offspring present during interviews were
15 hesitant to speak and spouses were not inclined to accept and follow up with the invited
16 phone interviews. Finally, we acknowledge that our guide may have been too structured,
17 but we made the deliberate choice to specifically interrogate barriers and facilitators, while
18 allowing for the greatest degree of flexibility in the participants' descriptions.
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22 Conclusion

23
24 The SA women interviewed reported being busy attending to family matters (including
25 supporting the long hours of spousal work) with insufficient scheduled time to emphasize
26 healthy active living (HAL) behaviours. This is of particular concern because SA-ethnicity
27 families confront elevated risks for diabetes and metabolic syndrome disorders.
28 Fortunately, there are applicable facilitators that can stimulate clearer goal setting and
29 healthy food preparation skills (based on more attentiveness and devoted time) and
30 immediate exercise formats (e.g., walking) that engage mothers, fathers and offspring
31 (together). A family-based prioritization of HAL behaviours can be rewarded by and
32 sustained by observable and shared health improvements.
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36 Figure Captions:

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38 Figure 1. Participant Flow Chart

39 Figure 2. Integrated Graphic of Study Results
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42 **Data Sharing Statement:** No additional data are available.
43
44

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54 Author Statements

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4 design of the work subject interviewing; interview transcribing; interview coding; article
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49 work are appropriately investigated and resolved
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51

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55 and assesses. Ritvo receives no personal compensations for studies coordinated with NexJ
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5

6
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For peer review only

Figure 1. Participant Flow Chart

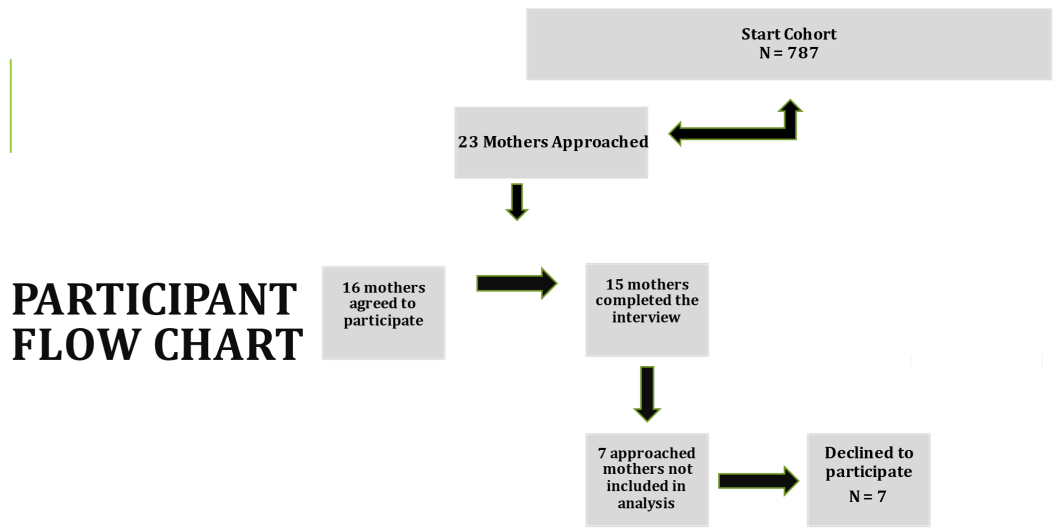


Figure 1 is a PRISMA diagram showing participant recruitment and final sample.

START Cohort = South Asian Birth Cohort Study

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Figure 2. Integrated Graphic of Study Results

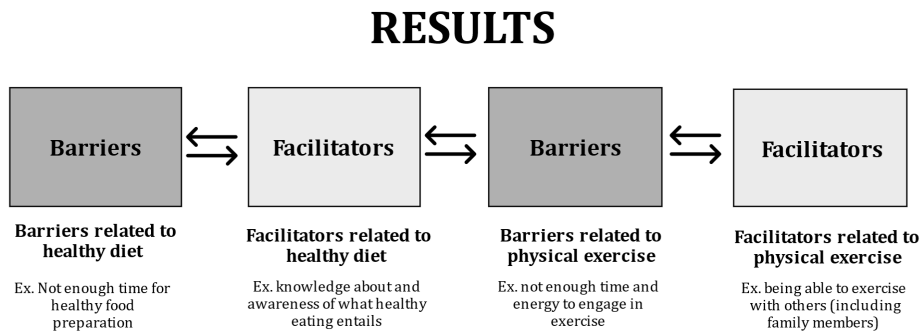


Figure 2: Summary of codes related to barriers and facilitators

review only

Supplementary Table 1. Characteristics of Participants (N = 15*)

Characteristic	Participants N = 15	Participants who declined to participate N = 7	START Cohort N = 787
Age Years [1]	34.2 (2.4)	35.2 (3.4)	36.2 (4.0)
Born in Canada [2]	2 (13.3 %)	0 (0.0%)	40 (5.1%)
Born outside of Canada [2]	13 (86.7%)	7 (100%)	747 (94.9%)
Ancestral Country of Origin [2]			
India	12 (80%)	6 (85.7%)	567 (72%)
Pakistan	3 (20%)	1 (14.3%)	184 (23.4%)
Mother Tongue			
Punjabi	9 (60%)	5 (71.4%)	410 (52.1%)
Urdu	4 (26.7%)	1 (14.3%)	177 (22.5%)
Religious Practice			
Sikh	9 (60%)	5 (71.4%)	379 (48.2%)
Muslim	4 (26.7%)	1 (14.3%)	207 (26.3%)
Vegetarian [2]	6 (40%)	3 (42.9%)	291/782 (37.2%)
Years living in Canada (if immigrant)[1]	10.9 (2.2)	11.8 (3.8)	13.1 (5.9)
Married [1]	15 (100%)	7 (100%)	786/786 (100%)
Number of children in household [3]	2 (1,4)	2 (2, 4)	2 (1,7)
Offspring children in household (excluding Index Child) [3]	1 (0, 2)	1 (1, 3)	1 (0,4)
Number of people in household [3]	6 (3, 11)	4 (4, 10)	5 (2,18)
Language spoken at home – Punjabi	6 (40%)	4 (57.1%)	131/526 (24.9%)
Language spoken at home – Urdu	4 (26.7%)	1 (14.3%)	32/526 (6.1%)
Language spoken at home - English	13 (86.7%)	7 (100%)	233/524 (44.5%)
Education – High School or less[2]	2 (13.3%)	4 (57.1%)	125/786 (15.9%)
Education – College [2]	4 (26.7%)	0 (0.0%)	103/786 (13.1%)
Education – Undergraduate [2]	4 (26.7%)	2 (28.56%)	309/786 (39.3%)
Education - Graduate [2]	1 (6.7%)	1 (14.3%)	178/786 (22.6%)
Education - Other [2]	4 (26.7%)	0 (0.0%)	71/786 (9%)

Currently employed outside the home [2]	7/14 (50%)	5 (71.4%)	211/396 (53.3%)
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[1] Presented as mean (SD)

[2] Presented as count (%)

[3] Presented as median (min/max)

Data Statement Section: data can be accessed at the Population Health Research Institute (secure portal), McMaster University

For peer review only

Supplementary Table 2. Cumulative Codes Segmented by Barrier/Facilitator Clusters

Barriers to Healthy Eating	
1.	Dislike of healthy foods (e.g. <i>boredom</i> with the tastes of healthy foods)
2.	Not wanting to devote too much time to cooking (i.e. <i>devaluing</i> cooking); serving 'minimal-prep' 'fast', comfort foods instead
3.	Not having healthy ingredients to cook with (resulting from non-informed shopping)
4.	Not knowing how to healthfully cook with the ingredients obtained
5.	Lack of knowledge about what is healthy eating
6.	Viewing healthy eating as a time-limited challenge, resolvable in several weeks or months of dieting
7.	Preparing unhealthy foods preferred by children
8.	Eating unhealthy foods with children
9.	Difficulties in preparing healthy school lunches and snacks
10.	Perceptions that healthier eating is expensive and not affordable
11.	Culturally related dietary restrictions that conflict with healthy eating
12.	Social pressure to eat traditional, unhealthy foods
13.	Holiday celebrations that involve unhealthy eating
14.	Being outside the home (and susceptible to unhealthy fast-food consumption)
15.	Feeling fatigued and eating too much in attempts to become energetic
16.	Late night eating (when fatigued and susceptible to eating comfort foods)
17.	TV /screen watching and eating unhealthy foods while watching
18.	Catering to spouse's unhealthy eating habits
19.	Lack of support for healthy eating from family members and peers
20.	Tea and coffee drinking with too much added sugar
21.	Inconsistency in eating healthy (when one can do it)
22.	Living with in-laws in a combined family system
23.	Marital separation leading to extra responsibility and caretaking
24.	Sports team involvement (leaving no time for healthy eating).
25.	Not knowing how to use online resources (e.g. You Tube) to learn about healthy nutrition and meal preparation
26.	Disturbed sleep
27.	General fatigue
28.	Scheduling routines that leave minimal time for healthy food preparation. Conflicting priorities with: a) Housework; b) Offspring schedules (including transport); c) Religious practices; d) Demanding study schedule and/or demanding job; e) Work schedules that diverge from those of spouse and children.
Facilitators to Healthy Eating	
1.	Ability to think 'outside the box' [ability to think beyond the influence of daily routines]
2.	Setting clear goals for eating in a healthier way
3.	Access to fresh produce fruit and vegetables and/or the ability to grow them
4.	Becoming a vegan or vegetarian
5.	Having a calorie counting 'app'
6.	Access to healthy 'take out' food
7.	Portion control awareness
8.	Access to smoothies and juicing methods
9.	"Batch' cooking - cooking healthy foods in batches
10.	Reading and understanding nutrition labels
11.	Curiosity about healthy eating (what it is? how to do it?)
12.	Identification of weight gain - and interest in weight loss
13.	Judgment that healthy foods are worth the calories consumed
Barriers to Healthy Exercise	
1.	Injury, pain and disturbing sensations (e.g. soreness) after exercise; perceived injury that

functionally prevents or limits exercise
2. Not enough time/energy to exercise amidst competing personal priorities
3. Too busy providing child-care to exercise
4. Gym memberships are too expensive
5. Impossibility of making everyone happy when the family jointly exercises
6. Not enough exercise programming that's interesting, fun and beneficial
7. Not enough exercise programming that engages my whole family
Facilitators of Healthy Exercise
1. A walking destination
2. Having a fitbit or other 'wearable' device
3. Needing stress release/relief and viewing exercise as a helpful stress releaser
4. Being able to 'work out' with others (e.g. neighbors)
5. Hearing success stories from others about sustaining healthy exercise
6. Getting good results from exercise
7. Access to good health information
8. Seeing housework as potentially healthy physical activity
9. Sports team involvement

Supplementary Table 3: RA Script for Participant Interaction & Interview Guide

START RA, when introducing the study to participant: Note – please ask the participant of their interest in participating after they have completed the START study visit.

Introduction: Thank you so much <<name of the participant>> for your and your child's time in the START study. All of the data we collect will help use learn more about the risk factors of overweight, obesity and risk for diabetes and heart disease among the South Asian population. At this time, we are also conducting a small study with a few families in START to understand the factors that influence healthy lifestyle behaviours among young children and their families. This study is called HAPPY (Health Attitudes, Perceptions, and Practice among Young families). We will be asking you more details about your physical activity and diet, and barriers and facilitators for healthy eating and adequate exercise. This study will help us determine the perceptions, attitudes, and practices of families with young children (i.e. infants, toddlers, and young children) using qualitative interviews and analyses to identify levers and/or opportunities for future health-behavior interventions, aimed at preventing the development of the obesity, diabetes and related problems in adult family members, as well as girl and boy offspring.

If you agree to participate in this study, you will:

- 1) Review and sign a separate Informed Consent Form (I have a copy here for your review and to keep)
- 2) Meet with a research assistant (either by phone or in-person), named Sabina Mirza, from the START team at a convenient location and time for you
- 3) Discuss your and your family's beliefs, attitudes and practices about healthy lifestyle, including physical activity, diet and other related behaviours.

"Would you be interested in learning more about the study?" **OR** "If consent to be obtained by study staff before contacted by Sabina (START). Would you be willing to participate in a 1 hour interview session?"

Yes – Thank you for your support. I will provide your name, phone number and email address to Sabina so she can contact you directly to set up a time for the interview.

No – Thank you for your consideration. We appreciate your time with START. I keep in touch with you for our next appointment.

Interviewer, when calling the participant: Introduction: Hello, my name is Sabina Mirza. May I please speak with <name of the participant>. Hello, <name of the participant> my name is Sabina Mirza and I am the research interviewer that <<name of the START RA>> Is this a good time to speak to schedule our interview?

Yes: great. What is your availability over the next 2 weeks when I can come and do the interview with you either at your home or by phone?

No: when can I call you back.

Interviewer during the interview: Hello << name of the participant>> thank you for speaking with me. I will begin by getting you to sign this consent. (hand over 2 copies of the consent, allow the participant time to review and ask questions). Please ask me if you have any questions.

Inform the participant that you are going to record the interview so that you can go back to the exact words and are not introducing your bias in taking the notes.

Once ready proceed with the interview.

Once done. Thank the participant for their time and inform them that they will be contacted by the START study RA for any future study related information.

START Semi-Structured Interview Protocol

Physical Activity: Please consider the forms of physical activity you have been able to *do* in the past that were helpful to your health and, at times, enjoyable and/or invigorating. Can you identify a form or forms of physical activity of this kind? _____

When able to do this form or these forms (of physical activity), can you specify how often this is typically possible ? (For each form of physical activity noted above, aim to elicit specific information)

Check one for frequency:	1 time/ week	2 times/ week	3 times/ week	4 times/ week	5 times/ week	6 times/ week	7 times/ week
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When able to do this form or forms (of physical activity), can you specify how long you could do them for? (i.e. for what mean duration, e.g. in min. / activity period ?)

Check one for average duration/time:	10 minutes/time	20 minutes/time	30 Minutes/ time	40 minutes/time	50 minutes/time	60 minutes/time or more (specify how much more)
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Can you specify your average duration of physical activity (of this kind) per week?

Check one for average duration/time:	10 minutes/time	20 minutes/time	30 Minutes/ time	40 minutes/time	50 minutes/time	60 minutes/time or more (specify how much more)
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If you had difficulty identifying a preferred mode of physical activity, or believe that you might want to engage in different approaches (other than those mentioned) please review the options below and indicate your preference for doing them.

	Most Preferred	Moderately Preferred	Not Preferred
Walking			
Jogging			
Hiking			
Running			
Swimming			
Bicycling			
X-Country Skiing			
Downhill Skiing			
Skate-boarding			
Soccer			
Softball			
Badminton			
Tennis			
Squash			
Bowling			
Exer-cycling			
Step-climbing			
Treadmill exercise			
Resistance exercise using elastic band			
Fixed-Weight Training			
Free-Weight Training			
Tai Chi			
Hatha Yoga			
Bangra Dance			
Yoga (any type)			
Pilates			
Other – Print in			

If there was a more convenient way of doing your most preferred mode or modes of physical activity (as indicated above), how often do you feel you could do them?

Check one for frequency:	1 time/week	2 times/wk	3 times/wk	4 times/wk	5 times/wk	6 times/wk or more (specify how much more)
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Can you define what 'more convenient way' would mean in this context?
If able to do this form or forms, can you specify what average duration you could foresee?

Check one for average duration:	10 mins	20 mins	30 mins	40 mins	50 mins	60 mins or more (specify how much more)
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Related Semi-Structured Interview Questions

- Do you think you could follow through on the activity plan you identified above over the next 12 months, i.e. during all four seasons (including winter)? If you anticipate difficulties following through, can you help us understand what those difficulties might be? For example, would it be more difficult following through during winter or summer, fall or spring?
- Is the activity plan for yourself linked to activity plans that might involve one or more offspring? (e.g. would you consider attending or have you been attending a gym, community activity program or YMCA where multiple family members effectively exercise during a certain period of day or evening?)
- Is there an activity plan for one or more offspring that makes it more difficult for you to follow through on the plan for yourself? (e.g. watching your offspring's soccer game or his/her gymnastics practice requires you to be sedentary while watching). How much impact does this difficulty have on carrying out your plan? Is there an alternative plan that might result in both you and your offspring engaging in common, shared activities (e.g. biking together)? How difficult is it to carry out such plans? Are there community resources that (you feel) address these needs? Can you envision a community-type program that could help you and your offspring jointly engage in vigorous physical activity (together)?
- Does your spouse engage in a physical activity program? If so, is his/her program linked in any way to your program? Do you sometimes engage in vigorous physical activity together or in some 'linked way' where you encourage or support each other in engaging in moderate-to-vigorous physical activity (MVPA)?
- Are there some activities where all family members engage in MVPA together (i.e. spouse, self, offspring)?
- Now, in referring to the current plan and/or the most typical activity pattern engaged in, what about this plan or pattern 'works effectively' for you?
- What about this plan or pattern is most challenging to keep up or maintain, or sufficiently and consistently do? Are there particular times of the calendar year, or school year, or month that makes that especially difficult? What could be done to address those particular difficult times? How long do they last and how much do they reduce the quantities of your overall activity output?
- If you do **not** think you can follow this activity plan, generally (although following it would be ideal), why not?
- What changes would you make to the plan to better fit with your current lifestyle and available time?
- What challenges do you anticipate confronting in being able to reach your exercise goals? and those you have for your offspring? Do you have goals for your spouse's exercise? If so what are they and what difficulties do you see him/her confronting in achieving them? Altogether, can you provide a summary of the difficulties and/or challenge in supporting yourself and your family in obtaining healthy amounts of moderate to vigorous physical activity.
- What resources do you think you would need to overcome these barriers?

Semi-Structured Interview Protocol

Dietary Activity: Please consider the following forms of healthy eating that you *may* have been able to adopt in the past, that were helpful (even temporarily) and, at times, enjoyable. These approaches to healthy eating would apply to you, individually, and to your offspring and spouse (if currently living with a spouse). Can you identify the most relevant forms of healthy eating to you? Please check all that apply.

Check one:	Increasing my intake of vegetable protein	Increasing my intake of animal protein (e.g. eating more chicken, fish, beef, etc.)	Increasing my intake of fresh vegetables and fruit (e.g. broccoli, carrots, apples, oranges, etc.)	Reducing my total intake of calories (e.g. eating less sweet or low nutritional value - calorie rich foods including pastries, ice cream, muffins, etc.)	Reducing my total intake of sugar (e.g. eating less sweet or low nutritional value foods and adding less sugar to foods - including pastries, ice cream, muffins, etc.)	Reducing my total intake of animal protein (e.g. eating less chicken, fish, beef, etc.)
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Please now identify any other forms of healthy eating that are relevant to you?

Check one:	1) Dictated description:	2) Dictated description:	3) Dictated description:	4) Dictated description:	5) Dictated description:	6) Dictated description:
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When able to do this form or forms of healthy eating, can you specify how consistently you were able to work towards your personal goals?

Check one for consistency:	Very consistently - about 80 to 100% of the time	Moderately consistently - about 60% to 75 % of the time	About 50% or half of the time I am able, and half of the time I am unable	About 25% consistency: a quarter of time able, and most of the time unable	Less than 25% consistency
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When able to do this form or forms of healthy eating, can you specify what duration you were able to work towards your personal goals?

Check one for duration:	For about 1 year (or more) - and I'm still working on it	For about 1 year (or more) - but I'm not currently working on it	For about 9 months - and I'm currently working on it	For about 9 months - but I'm not currently working on it	For about 6 months - and I'm currently working on it	For about 6 months - but I'm not currently working on it	For about 3 months - and I'm currently working on it	For about 3 months - but I'm not currently working on it
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- Consider how frequently you prepare meals for the family? For the most part, are you the **only meal preparer** in the family (i.e. nearly 100% of the time)? Or the **most frequent meal preparer** in the family (sharing 10% or less of these responsibilities with another relative or spouse or older offspring)? Or do you **significantly share the meal preparer role** in your family (sharing 10 - 25% of these responsibilities with another relative, or spouse or older offspring)? Or, at least, **equally sharing the meal preparer role** in your family (sharing 50% or more of these responsibilities with another relative, or spouse or older offspring)?
- How frequently do you, or the person with whom you share a meal preparer role, opt to 'take-in' food from a nearby restaurant? Is the nearby restaurant 'food quality' as healthy as that which you usually prepare or not as healthy as that which you usually prepare? Is any of the food you and your family members eat outside the home conventionally considered 'fast food' (e.g. McDonalds, Wendy's, Burger King, Tim Hortons, etc.)? When fast food is eaten, are the foods eaten particularly related to the most healthy (fast-food) menu options? What proportion of the foods eaten by your family qualify as 'fast foods'?
- Do you think you and your family are currently able to follow a healthy eating plan to reach the goals you have identified?
- If so, what foods would you most want to emphasize in your plan?
- What foods would you not emphasize or eliminate in your healthy eating plan?
- If not able to follow a healthy eating plan of your choosing, why do you think you could *not* do it? Can you be as specific as possible? (e.g. my family members all prefer different meals and it's difficult to prepare them healthy versions of their preferences, we attend family and multi-family celebrations where unhealthy foods are freely available and eaten, and we consume leftovers from celebrative eating that undermine our healthy eating goals)
- What changes would you make to your current plan to make it fit your lifestyle and time available?
- What are the major obstacles and challenges you see in being able to follow healthy eating suggestions?
- What resources do you think health promotion professionals could make available to help you overcome these barriers?

Physical Activity and Dietary Activity (in combination)

- Considering both healthy physical activity and eating, would you be more willing to change *either* your physical activity or eating habits to achieve your health goals?
- If so, why would one be easier to change than the other?
- What challenges do you see in being able to change both eating and physical activity patterns?
- What resources do you think you will need to overcome these barriers?

Online Applications Assistance

- Do you or members of your family currently use any online resource to assist the tracking and undertaking of healthy diet and/or exercise? If so, can you name the ones used?

If so, can you describe the 'apps' used and how often they are used by whom? Are they deemed helpful? Can you imagine an online set of contacts that would be most helpful in your aiming to reach fitness and dietary goals related to yourself and members of your family.

Supplementary Table 4 – Member Checking Results
Summary of General Member Checking N = 15

Healthy Eating Barriers		
Not devoting enough time to food preparation	10 agree	5 disagree
Lack of knowledge about what <i>is</i> healthy eating	10 agree	5 disagree
Viewing healthy eating as a time-limited challenge, solvable in a few weeks or months	10 agree	5 disagree
Spouse or children's unhealthy eating habits	6 agree	9 disagree
Social pressure to eat traditional, unhealthy foods	6 agree	9 disagree
Healthy Eating Facilitators		
More knowledge about & reminders of what healthy eating is	14 agree	1 disagree
Setting clear goals for eating in a healthier way	14 agree	1 disagree
Better access to fresh vegetables & fruit	14 agree	1 disagree
Clearer arrangements & better tools for healthy food preparation	13 agree	2 disagree
Becoming a vegan or vegetarian	7 agree	8 disagree
Healthy Exercise Barriers		
Not enough time/energy to exercise as other personal priorities are more important	14 agree	1 disagree
Lack of having good childcare (while exercising)	10 agree	5 disagree
Not enough exercise programming that engages my whole family	13 agree	2 disagree
Not enough exercise programming that's interesting, fun and beneficial	7 agree	8 disagree
Healthy Exercise Facilitators		
Experiencing exercise as enjoyable and/or stress releasing	15 agree	0 disagree
Making a commitment to walk 'somewhere'	14 agree	1 disagree
Hearing success stories from others who adopt healthy exercise	14 agree	1 disagree
Having a fitbit or other wearable device	13 agree	2 disagree
Being able to exercise with others (including family members)	11 agree	4 disagree

Supplementary Table 5: Spouse Work Patterns (described by participants)

Interview 1	Because he [my husband] works at ____ Motor Company, as general manager, you don't know when he's leaving and when he's coming back. Sometimes 13 hours a day.
Interview 2	He [my husband] is a truck driver....working (between) Canada to the U.S. [He works a 2-day stint] and comes back after the second day about 7:30 pm
Interview 3	[My] husband is a cab driver; he works throughout the night and sleeps all day.
Interview 4	[My] husband does home renovations and has his own business. His schedule is 'crazy busy'; he leaves in the morning and comes home at 8 or 9 PM.
Interview 5	[My] husband works in delivery management for at least 10 hours a day.
Interview 6	[My] husband is a truck mechanic. ... So busy.
Interview 7	[My] husband works 9-10 hours [per day] for Toronto Transit.
Interview 8	[My] husband...makes chairs for hotels and motels. He is a self-employed contract worker works his own hours.
Interview 9	[My] husband is a truck driver. He's gone for a few days at a time.
Interview 10	[My] husband is a truck driver and works 11-12 hours a day
Interview 11	[My] husband has his own trucking business and drives a truck
Interview 12	[My] husband is a truck driver, who works long hours, starts at 4-5 am and gets home by 5-6 PM - after 12-hour shifts.
Interview 13	[My] husband is a senior financial advisor [at a bank]. [His hours are] from 9:00 to when he leaves at 5:00
Interview 14	[My] husband wakes up earlier than me. He has a long commute, 1 hour and 45 minutes...he works in the supply chain business...He never gets time for exercise.
Interview 15	[My] husband is a project manager for a consulting company... Brings work home [to finish], after work hours.

Supplementary Table 6: Key Themes and Quotes (Full Quote Related to Brief Quote in Paper)**De-motivating barriers & Motivating Facilitators for Healthy Eating****Theme 1: barriers related to healthy diet**

Interviewee #4 Full Quote: "Yeah, groceries and bills and kids appointment, and our own appointments, right and uh, sometimes [Hindi Translation>] at my school, there are some kinds of activities that are ongoing, for my son, and then you have to attend that and yeah mostly anything, and other, we are making fresh food and it takes some time, it's very time consuming because you have to cut everything, chopping, a lot of chopping in our food, so yeah, and then the dishes"

Interviewee #8 Full Quote: "Like this morning, I took hot water, a lemon, not a full one, just half a lemon, I put apple cider vinegar, two spoons of that and I also put a spoon of honey. So this morning, I drank that. Someone told me once to drink water with a spoon of this or that, honey and then I'll lose weight and I tried many, many times to do this but I never noticed a difference. I am always trying different things."

Interviewee 8 Full Quote: "Like my husband is always telling me to lose weight but I have, and am, trying so many different things and nothing is working."

Interviewee #4 Full Quote: "I think make more consistency to help me, I don't know how but in any ways. [Hindi Translation>] If they, even if I start and they make sure like I am on that track, something, right? Like I was telling you before, I start something but I don't know what happens with the busyness or something, I just lose momentum and eventually stop."

Interviewee #14 Full Quote: "So, yeah. And, just trying, the only thing is like changing our diet. Our food, everything is too, it's got way too much. So trying to eat more of like boiled or baked stuff. [oh, okay] Trying to eat healthier. And then because of my kids conditions the other thing is making sure, like trying to stop with the white bread and white rice [Yeap] and make sure we added quinoa to our diet."

Interviewee #3: Full quote: "No. It's just us. So, sometimes they want to order pizza. Like pizza is coming and you're like today, I don't want to eat any, you know, pizza and you see the pizza and you're like, okay, I can have one slice."

Theme 2: facilitators related to healthy diet

Interviewee #14 Full Quote: "So, yeah. And, just trying, the only thing is like changing our diet. Our food, everything is too, it's got way too much. So trying to eat more of like boiled or baked stuff. [oh, okay] Trying to eat healthier. And then because of my kids conditions the other thing is making sure, like trying to stop with the white bread and white rice [Yeap] and make sure we added quinoa to our diet."

Interviewee # 15 Full Quote: "Yeah. So, we definitely talk about healthy eating and we talk about you know what are healthy things to eat. And if I give them some treats we'll say, "this is only one time and that it's not healthy". So they do understand what's healthy and not healthy [Okay]. And then even when I pack their snacks, they're like, I always tell them that before they can have all their snacks they have to finish all their health food first [Okay, okay]. So, they do know the difference of what's healthy and unhealthy and they do understand."

Interviewee # 4 Full Quote: "Actually, I always [Hindi Translation>] I start but then by the time busyness and other things and sometimes the things I eat on a regular basis, suppose yogurt, and the yogurt runs out, so these things they take you back and make you regress because then you have to go do the groceries, extra, like and you can't get anything in bulk, right? Suppose if we are eating, or I was drinking actually, uh, maybe a week ago, Kale and uhhhhh cucumber, but when it's finished, it's finished, right? I don't know when the next time will be that I'll go get groceries. I'm so busy that I just make sure the main things are at home, and if they are, I don't need to go grocery shopping just yet."

Interviewee #8 Full Quote: "Yeah, that thing like it made a big difference. My friend, she gave me a diet chart, you know how they have those guides about which diet is best, so that particular plan my friend gave me, they didn't have the flour we use, there were some replacement one's mentioned like soy and different names that I can't even remember. Sometimes ...I don't know what it's called but you can put it like with bread...I don't know."

Interviewee # 6 Full Quote: "Yeah, so and then I figured it out; I couldn't figure out what was going on, but once I cut those two out of my diet [Yeah] I figured out that afterwards when I felt even more crappy in the day was because I was eating these foods that I wasn't digesting properly. [Hmm, hmm] Right, and I would just become so sick...stomach felt knotted and I was throwing up, and I couldn't understand. [Hmm,

hmm] So, I took that out and then I found out...so I went vegan, like completely one day just woke up, "I'm going vegan!" My mom's like, "What?""

De-motivating Barriers and Motivating Facilitators for Healthy Exercise

Theme 3: barriers related to physical exercise

Interviewee # 1 Full Quote: "Sleep. When I have lack of sleep, I'm already tired and then I don't really feel like doing more exercise or anything, Because I'm so tired of watching my baby at night and then he's all cranky in the morning too. So I'm like, you know what, let's just put him to sleep and I will take a nap while he's sleeping. And then I will just do my daily chores and then you know, what should I make for dinner? And, then just the day goes by. Every day like that."

Interviewee # 4 Full quote: "I used to do running, walking a lot [Hindi Translation>] Now I get tired just doing the house work and I don't have that much energy so I'm kind of lazy, you can say, now."

Interviewee # 4 Full Quote: "If anyone watch my son because if I have to take him with me, sometimes they have day care in the gym and sometimes they don't have. Sometimes he doesn't want to go, even if I want to go, he doesn't want to go and then nobody is at my home to watch him, so I can't go, so this is another problem."

Interviewee # 8 Full quote: "It's a world gym, like near my house. Like from 3 weeks, I didn't went there because of my kids are, this week was busy, busy, busy, so...yeah. Most of the time, everyday I went there because like now like from 3 week my kids, they're not well, so I didn't went there."

Interviewee # 11 Full quote: "Well cause' I told you I'm busy, so that's a problem on me. [Hmm, okay] To find free, like I can do anything I want for me. Because right now I'm planning my vacation. [Hmm, hmm] I'm going to my sister's in Edmonton. She is training the gym. She is joining Zumba classes and she told me many thing like Zumba class or dance class. And, she wanted me to join the gym for one month [Yeah] so I can learn some things. That thing I can do at home too. So that's why she said if I come there, and I like go for whole month, like if I stay there every day I go with her to the gym and yeah, I'm making plans like that."

Theme 4: facilitators related to physical exercise

Interviewee # 1 Full Quote: "Yeah. Yoga. Like, I love to do exercise. Because before even when I got married, I used to do exercise. I wouldn't even touch butter, cream or cheese or anything that could make me fat. That's why I was very skinny back then. But, then...yeah. I would love to continue exercising or anything. I don't know the trainer name. It's like 30 days with, I don't know her name now. So, I tried that too, on the TV. Like all of these instructors, like I would love to follow them. Like, every day for like two hours..."

Interviewee # 13 Full Quote: "I wear the Fitbit. [Oh, yeah] Yeah. So, I keep track of calories. But then, I say I don't have that goal to burn like, to lose some weight. [Hmm, hmm] So, I just want to track how much I have, how much I ran today, how many steps I took. And that's it. Nothing much. But, my husband he just got into this thing. He's been doing. He was watching this documentary about keto diet. [Keto diet?]"

Interviewee # 5 Full quote: "At their Sikh prayer, she takes the group of kids at the Gurdwara for a walk"

Interviewee # 8 Full quote: "Yesterday my friend was telling me that at the Brampton Soccer Centre, there's a track, it's a 400-metre track and she's been going there for 3 or 4 days now and she'll cover that ground 10 times."

Interviewee # 11 Full quote: "Well, my sister had motivated me because she's going to the gym [Hmm, hmm]. Yeah. And, she said like you are gaining weight. You are ____ [00:08:04] now when I saw you last time. So, you have to start some exercise. She motivated a lot. Like, she said you have go, you have to take care of yourself too [Okay]. You do so much for the home and we have to start it, right? So, many people are going on my street. So, I saw them and then I realized I had to go too. Yeah."

*Numerical ID/Pseudonyms have been used to ensure confidentiality

Supplementary Table 7. Key Themes and Additional Qualitative Quotes

De-Motivating Barriers & Motivating Facilitators for Healthy Eating

Theme 1: Barriers related to healthy diet

Interviewee #4: "Yeah, groceries and bills and kids appointment, and our own appointments, right and uh, sometimes [Hindi Translation>] at my school, there are some kinds of activities that are ongoing, for my son, and then you have to attend that and yeah mostly anything, and other, we are making fresh food and it takes some time, it's very time consuming because you have to cut everything, chopping, a lot of chopping in our food, so yeah, and then the dishes."

Interviewee #5: "When there are traditional sweets, it's difficult to let go of that, she loved gulab jamans and rasgoolas, its tradition and difficult to give up."

Interviewee #8: "Yeah my father in law, he doesn't do anything and my mother in law, she doesn't do anything either. Since I joined their family, it's just me who does everything."

Theme 2: Facilitators related to healthy diet

Interviewee #7: "Yes, I did. Yes, I do some of the times. I did one time really hardly, strictly diet. Low-carb diet ... Okay. So in 2010 I did low-carb diet. In which I used to take salad and only proteins."

Interviewee #4: "I think make more consistency to help me, I don't know how but in any ways. [Hindi Translation>] If they, even if I start and they make sure like I am on that track, something, right? Like I was telling you before, I start something but I don't know what happens with the busyness or something. I just lose momentum and eventually stop."

Interviewee #15: "Yeah. So, we definitely talk about healthy eating and we talk about, you know, what are healthy things to eat. And if I give them some treats we'll say, "this is only one time and that it's not healthy". So they do understand what's healthy and not healthy [Okay]. And then even when I pack their snacks, they're like, I always tell them that before they can have all their snacks they have to finish all their health food first [Okay, okay]. So, they do know the difference of what's healthy and unhealthy and they do understand."

De-Motivating Barriers and Motivating Facilitators for Healthy Exercise

Theme 3: Barriers related to physical exercise

Interviewee #1: "Twenty-25 push-ups everyday. In every two days, I would say. Whenever my baby cooperates with me. In the morning, I'm like, okay, let's do it. Sometimes he (the baby) doesn't let me. So, that's the thing and some leg exercises. Some other, like instructors, they do on TV, or YouTube, I just copy."

Interviewee #2: "Just shortage of time. If maybe, sometimes I don't wake up on time. I don't know. Maybe I can follow that, if I want I can do it. Yeah, so it's up to me."

Interviewee #7: "Energy level was high that time, yeah. Yeah I used to do more running and all that kind of stuff. But nowadays my energy level is low. If I do one song, then I get little tired."

Theme 4: Facilitators related to physical exercise

Interviewee #3: "Yeah. It's just like you need motivation, you know. Sometimes, I do have time, but I get so lazy I don't want to do it. And, I need a partner to do it too. Alone, it's hard I think. So, sometimes I tell my sister, she's like okay, yeah, we'll go. So, she goes to the gym, but sometimes she tells me; let's go run outside. At night, I'm so tired, I don't want to go outside. My kids are sleeping. I just want to relax. So, sometimes it's just you don't want to do it."

Interviewee #15: "No. I have this app on my phone that does, it kind of every day you do a certain amount of like I guess, the amount of floor exercises."

Interviewee #7: "And I have no reason to lose weight, right? So I said, "Let's try this one". And then I have my, what do you call?, cousin, and she and me we did it together. So it was encouraging for me. So I did that. I take croutons and spinach in the salad. I take baked fish, baked chicken and green tea both the time (for dinner)."

*Numerical ID/Pseudonyms have been used to ensure confidentiality

COREQ: 32-item checklist (necessary for BMJ Open qualitative research submissions)

	Research Checklist (32 items)	Response	Page #s re: Reviewers
1	Which author conducted the interviews?	Sabina Mirza, Ph.D.	Page 4
2	What were this researcher's credentials?	Ms. Mirza has a Ph.D. from the Department of Education, York University and is currently in the last stages of a PhD dissertation study based on interviews and qualitative analyses of n = 40 youth, currently 'homeless' residents of Toronto.	Page 4
3	What was their occupation at the time of the study?	Ms. Mirza was employed as a health coach in a randomized controlled trial of an online cognitive behavioural therapy intervention for youth (18 – 35 years) diagnosed with major depressive disorder: An Online Mindfulness-Based Cognitive Behavioral Therapy Intervention for Youth Diagnosed With Major Depressive Disorders: Protocol for a Randomized Controlled Trial ; JMIR Res Protoc 2019;8(7):e11591 DOI: 10.2196/11591 PMID: 31359869 PMCID: 6690226	Page 4
4	Was the researcher male or female?	Female	Page 4
5	What experience or training did the researcher have?	Courses and activities related to interview competency at within York University, Department of Education EDUC 5222 – Seminar in in-depth interviewing EDUC 5100 – Research and Issues in Language, Culture and Teaching Research Intern: United Way, York Region - York University Knowledge Mobilization Unit – Study Title: <i>Turning Research into Action</i> Granting Agency: Social Science and Humanities Research Council, Canada	Page 4
6	Was a relationship established prior to study commencement?	There was no relationship established prior to study commencement.	Page 2
7	What did participants know about the researcher? e.g. personal goals, reasons for doing the	Participants were informed that the team interviewer would be contacting them by phone. They were communicated her full name and university degree.	Page 2

	research		
8	What characteristics were reported about the interviewer? e.g. Bias, assumptions, reasons and interests in the research topic	Ph.D. in Education. South Asian ethnic background; Linguistically fluent in Urdu and Hindi and able to understand the interviewee's use of idioms during the interview process.	Page 4
9	What methodological orientation underpinned the study?	This was a qualitative descriptive study, undertaken in accord with an interpretivist perspective. Thematic analysis was undertaken.	Page 2
10	How were participants selected?	Interview participants were recruited from the South Asian Birth Cohort (START), a cohort investigation of SA women living in Ontario's Peel Region [17, 18]. Between 2011 and the present, over 1,000 mother-child dyads were recruited and followed 1, 2, 3 and 5 years later (with 90% follow-up rates). Convenience sampling was undertaken	Page 3
11	How were participants approached?	During regularly scheduled START cohort appointments, candidate participants were informed about the interview study. If interested in participation, they were contacted by the study coordinator who undertook consents at visits and provided information on how study interviews could be scheduled by phone with the interviewer.	Page 3
12	How many participants were in the study?	N = 15	Page 3
13	How many people refused to participate or dropped out? Reasons?	16 agreed to participate and 15 completed the interview. 1 person declined due to lack of time.	Page 3
14	Where was the data collected?	Semi-structured interviews were undertaken in participants' home environments (n = 10) or by phone (n = 5)	Page 3 Page 4
15	Was anyone else present besides the participants and researchers?	For the interviews undertaken in the home environment (n = 10), spouse (n = 1), offspring (n = 3) and extended family members (n = 1) were present, as was preferred by the interviewee.	Page 3 Page 4
16	What are the important characteristics of the sample? e.g. demographic data,	Interview participants were recruited from the South Asian Birth Cohort (START), a cohort investigation of SA women living in Ontario's Peel Region [17, 18]. They were all of SA ethnic background. Below are other key	Page 5 Page 12

	date	<p>characteristics</p> <p>Participants N=15</p> <p>Age-in- years = Mean of 34.2 (2.4)</p> <p>Born in Canada = 2 (13.3 %)</p> <p>Born outside of Canada = 13 (86.7%)</p> <p>Years living in Canada (if immigrant) = 10.9 (2.2)</p> <p>Married = 15 (100%)</p> <p>Number of children in household = 2 (1, 4) [mean]</p> <p>Non-offspring children in household = 1 (0, 2) [mean]</p> <p>Number of people in household = 6 (3, 11) [mean]</p> <p>English as spoken as second language = 15</p> <p>Education – High School or less = 2 (15.4%)</p> <p>Education – College = 4 (30.8%)</p> <p>Education – Undergraduate = 3 (23.1%)</p> <p>Education – Graduate = 1 (7.7%)</p> <p>Education – Other = 3 (23.1%)</p> <p>Currently Employed outside the home = 6 (46.2%)</p> <p>Gestational Diabetes Diagnosis = 2 (13.3%)</p> <p>Total Physical Activity = 3.1 hrs/day (1.4) [mean]</p> <p>Exercise (to get out of breath/sweaty) = 0.3 hrs/day (0.4) [mean]</p> <p>Physical labour = 1.5 hrs/day (0.9) [mean]</p> <p>Physically taxing household chores = 1.3 hrs/day (0.7) [mean]</p> <p>Screen Time of mother = 2.3 hrs/day (1.3) [mean]</p>	
17	Interview guide: Were questions, prompts, guides provided by the authors? Was it pilot tested?	Interview guide is provided and the guide was pilot tested	Page 13
18	Were repeat interviews carried out? If yes, how many?	Yes – n = 15 follow up, member checking interviews were carried out	Page 5 Table 4
19	Audio/visual recording: Did the research use audio or visual recording to collect the data?	Audio recording	Page 4
20	Were field notes made during or after interviews ?	Field notes were made during and after interviews	Page 5

21	Duration: What was the duration of the interviews ?	Average interview duration was 1 hr	Page 3
22	Was data saturation discussed?	Saturation was discussed and agreed on by all investigators	Page 5
23	Were transcripts returned to participants for comment and/or correction?	No	Page 4
24	How many data coders coded the data?	N = 2 data coders	Page 5
25	Did authors provide a description of the coding tree?	Yes	Page 5
26	Were themes identified in advance or derived from the data?	Themes were derived from the data.	Page 5
27	What software was used to manage the data?	NVivo (v. 10; QSR International)	Page 5
28	Did participants provide feedback on the findings?	Yes, during the follow up, member-checking interviews	Page 5
29	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified?	Quotations are presented and each quotation is identified.	Page 6
30	Was there consistency between the data presented and the findings?	Yes, there was consistency between data presented and findings	Page 5 Page 6
31	Were major themes clearly presented in the findings?	Yes	Page 5 Page 6 Page 11 Page 12 Page 26 Page 27 Page 28 Page 31
32	Is there a description of diverse cases or discussion of minor themes?	Yes	Page 5 Page 6 Page 11 Page 12 Page 26

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			Page 28
			Page 31

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