



# Proximal and distal influences on dietary change among a diverse group with prediabetes participating in a pragmatic, primary care nurse-led intervention: a qualitative study

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## Abstract

**Objective:** To understand motivators, facilitators and challenges to dietary change amongst a diverse sample of New Zealanders with prediabetes participating in a primary care nurse-led individualised dietary intervention.

**Design:** A qualitative study involving semi-structured, face-to-face interviews with a stratified sample of adults with prediabetes and BMI  $\geq 25$  kg/m<sup>2</sup>, purposefully selected from a larger 2-year primary care-based prediabetes dietary intervention study. Thematic analysis was undertaken. A socio-ecological model guided interpretation.

**Setting:** Hawke's Bay, Aotearoa/New Zealand, April 2018–March 2020.

**Participants:** Fifty-eight people aged 28–69 years, with similar numbers of men and women, indigenous Māori and non-Māori, and those who had and had not regressed to normoglycaemia at 6 months.

**Results:** Motivators for wanting to make dietary changes were determination not to progress to diabetes; wanting to be healthy and contribute to others and encouragement by others. Facilitators for adopting and maintaining changes were a strong desire to be healthy; personal determination and feeling supported. Challenges were compromised control over life and environmental factors; feeling unsupported by others; social occasions; financial constraints and living with other health conditions. Developing their own strategies to overcome challenges was empowering, enabling a sense of control. These factors were similar across demographic and glycaemic outcome groups.

**Conclusions:** Influences on dietary change involved personal, interpersonal, organisational, environmental and policy factors. Although findings appeared similar across groups, dietary interventions need to address the specific ways motivators, facilitators and challenges manifest for individuals and social groups and be tailored accordingly within the context of the wider obesogenic and socio-economic environment.

**Keywords**  
Dietary habits  
Indigenous peoples  
Prediabetes  
Primary care nursing  
Qualitative research  
New Zealand  
Socio-ecological model

Prediabetes affects as many as 25–50% of some adult populations including in New Zealand, where the prevalence in the adult population is 26%, with higher rates in indigenous populations such as New Zealand Māori<sup>(1,2)</sup>. Prediabetes is a risk factor for the development of type 2 diabetes, CVD and the microvascular complications associated with diabetes<sup>(3–6)</sup>. Lifestyle modification and weight loss in those who are overweight can prevent or delay progression to type 2 diabetes<sup>(7–9)</sup>. In the landmark US-based

Diabetes Prevention Program study<sup>(7)</sup> and the Finnish Diabetes Prevention Study<sup>(9)</sup>, incidence of type 2 diabetes was reduced by 58% over 3 years. This reduction was achieved through individualised dietary and physical activity advice and supervised physical activity programmes, which sought to reduce body weight by 5–7% and increase physical activity of moderate intensity to 150 min/week.

While there is good clinical trial evidence from landmark studies<sup>(7–9)</sup>, the successful translation of diabetes

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prevention lifestyle programmes into real-world settings is challenging<sup>(10)</sup>, particularly in community primary care settings<sup>(11)</sup>. The cost of similarly intensive programmes employing specialist lifestyle intervention staff is a significant barrier<sup>(12)</sup>, and those with prediabetes in community clinical settings are typically a more heterogeneous group than those enrolled in diabetes prevention lifestyle clinical trials. Further, the challenges of making lifestyle changes from the perspective of the person with prediabetes are often complex<sup>(13–15)</sup>.

While weight loss and diabetes prevention dietary guidelines have traditionally focused on recommending particular macronutrient proportions with an emphasis on broad food groups, promoting healthful foods and eating patterns, rather than nutrients, and avoiding processed foods are increasingly common practice<sup>(16–18)</sup>. Further, it is now considered that dietary advice should be individually tailored and take into account personal, cultural and socio-economic factors<sup>(16–18)</sup>.

Behaviour change models and theories that focus on psycho-social influences have often informed lifestyle change interventions, but the influence of wider social determinants of health on the development of prediabetes and diabetes has been less acknowledged<sup>(19,20)</sup>. However, there is increasing interest in models that also take into account the influence of these wider cultural, social and environmental factors<sup>(21)</sup>, such as the socio-ecological model (SEM)<sup>(22)</sup>. The SEM recognises five levels of influence: personal, interpersonal, organisational, community and policy<sup>(22)</sup> and is underpinned by a public health perspective consistent with the Ottawa Charter for Health Promotion<sup>(23)</sup>.

Community-based diabetes prevention programmes that take this wider holistic approach have met with some success<sup>(24)</sup>, including a New Zealand community intervention undertaken in partnership with local indigenous Māori<sup>(25)</sup>. Dietary interventions undertaken in primary care clinical settings that recognise wider public health domains of influence on dietary behaviours, and prediabetes and diabetes risk also have the potential to reduce the incidence and impact of diabetes, but are uncommon<sup>(26)</sup>.

The Prediabetes Intervention Package (PIP) in primary care study was designed to be a pragmatic primary care nurse delivered approach to dietary advice for overweight and obese patients with prediabetes that could be adapted to each individual's circumstances<sup>(27,28)</sup>. A preventive healthcare approach based on public health principles informed the easy-to-implement intervention within the constraints of a primary health service environment. The cost of training primary care nurses was low, and there was no health service cost for participants<sup>(29)</sup>. While the primary focus of the intervention is diet, an understanding of participants' socio-economic and cultural context, and goal setting are key components. A pragmatic mixed-methods non-randomised 6-month pilot study conducted in the Hawke's Bay region, New Zealand, demonstrated that

intervention implementation fidelity was high and, after adjustment, the intervention group lost a mean 1.3 kg more than the control group ( $P < 0.001$ )<sup>(27)</sup>. The subsequent cohort study, which is using the same dietary intervention approach in the primary care setting with the addition of two extra visits in the first 6 months and review visits at 3-monthly intervals for 18 months, aims to determine if there are clinically relevant differences between those with prediabetes who regress to normoglycaemia, those who have persistent prediabetes and those who progress to type 2 diabetes<sup>(28)</sup>.

The aim of this qualitative study was to explore and examine motivators, facilitators and challenges to making clinically meaningful dietary changes among a demographically diverse sample of those who had, and had not, regressed to normoglycaemia following 6 months of the primary care nurse delivered prediabetes intervention package. For the purposes of this study, motivators were defined as those factors that prompted people to want to make dietary changes and to engage with the PIP programme, facilitators were those factors that helped people adopt and maintain their healthful dietary changes and challenges were those factors that inhibited the adoption and maintenance of these healthful changes. In this paper, we report on these findings which are discussed using the socio-ecological model<sup>(22)</sup>.

## Methods

### Setting

This qualitative interview study was undertaken as an adjunct to the main PIP study. In brief, the main study recruited participants from eight primary care practices in two neighbouring cities (Napier and Hastings) in the Hawke's Bay region, New Zealand. In 2018, more than one-fifth (22.2%) of the Napier city population (62 241) and more than one-quarter (27.3%) of the Hastings district population (81 537) were indigenous Māori, which is higher than that for the overall New Zealand population (16.5%)<sup>(30)</sup>.

The participating practices implemented the PIP intervention following a successful pilot undertaken in the same region<sup>(27)</sup>. Participants were adults aged 18–69 years with prediabetes defined according to the New Zealand diagnostic criteria (glycated Hb (HbA1c) 41–49 mmol/mol)<sup>(31)</sup>, and a BMI  $\geq 25$  kg/m<sup>2</sup>. They were diagnosed with prediabetes following screening as part of a recommended cardiovascular risk assessment or because they were deemed to be at risk of diabetes<sup>(31)</sup>.

The PIP intervention was pragmatic, low cost and simple to implement. It consisted of six components<sup>(27,28)</sup>: (1) primary care nurse training and support from a local dietitian; (2) individualised dietary assessment, goal setting and dietary advice taking into account socio-economic and cultural influences; (3) key messages and consistent



opportunistic reminders; (4) nutritionally supportive primary care environment; (5) community-based group education for participants and their family and (6) written patient resources.

In the main study, participants were assessed at baseline with follow-up intervention appointments at 2–3 weeks, 6 weeks, 3 months, 4 months and 6 months, followed by reviews at 3-monthly intervals for 18 months. Demographic, clinical (including weight and HbA1c) and study data (including self-monitoring activities, social support systems, sleep patterns, physical activity and health-related quality of life) were collected at baseline and at 6 months, 12 months and 24 months.

### Participants

Participants in this qualitative study comprised a subsample of those who participated in the main study. Inclusion criteria were completion of the 6-month intervention and, at enrolment into the main study, consent to take part in further research. Eligible participants ( $n$  197) were identified in the main study database ( $n$  359) iteratively, as the study progressed. Participants were then purposefully selected to ensure a stratified sample with a balance by gender, indigenous Māori and non-Māori, and those who had regressed to normoglycaemia after completion of the 6-month intervention and those who had not. Although Māori comprise 16.5% of the New Zealand population, 22% and 27%, respectively, of the two Hawke's Bay cities where the intervention took place<sup>(30)</sup>, and 34% of the main study sample, we sought a sample of 50% Māori to enable meaningful understanding of their experiences in recognition of the high rates of prediabetes and diabetes in this ethnic group<sup>(1)</sup>.

### Interviews

Data collection involved single face-to-face interviews. Explanation of the qualitative study, checking participation willingness, obtaining written consent and the setting up and conduct of interviews for those agreeing to participate were undertaken by SA, a local female independent researcher with 30 years of qualitative research and interviewing experience, including research with Māori. To ensure culturally safe practices and processes were in place, she was supported by DT-L, an experienced Māori public health doctor and researcher and a long-term research collaborator. Participants were approached first by phone, sent information and followed up by phone or email. No potential participants had a previous relationship with SA. Those wishing to participate were invited to choose the interview time and place, and to bring anyone else they wanted to the interview. The majority were interviewed at their home, but a few chose their own or the interviewer's workplace. An interviewer safety protocol was adhered to. Three participants invited spouses who were actively involved in the interview, several others

had family in the background but the majority chose to be interviewed alone. Cultural practices such as removing shoes on entry to the home, allowing time for personal and *whānau* (extended family) introductions and establishing relationship connections, participating in food and drink if offered, and offering a *koha* (a gift/contribution) were an integral part of interviews with Māori. Participants were assured confidentiality and anonymity in the use of their interview data.

The interview schedule was developed collaboratively, informed by results from the pilot evaluation and was semi-structured, with open-ended questions that covered a range of experiences relating to the diagnosis of prediabetes and factors influencing making dietary changes. For the purposes of this paper, questions explored what motivated the desire to undertake the dietary intervention, and what facilitated and challenged the adoption and maintaining of dietary improvements, with a further two questions relating to cost and the food environment added later (Table 1). With consent, all interviews were audio-recorded. Participants received a *koha* (\$NZ30 gift voucher) following the interview to acknowledge their contribution to the study. Interview duration was approximately 1 h. Interviews took place between April 2018 and March 2020, a period determined by recruitment for the main study. This occurred over a 2-year period with some subgroups (e.g. Māori males) recruited later in the process. Data saturation was reached once adequate numbers for all subgroups were interviewed.

### Data analysis

Interview recordings were transcribed by an external transcriber, and transcripts underwent minimal editing by SA to improve readability. Transcripts were sent to participants for approval and comment. No-one requested changes. The data set comprised the interview transcripts and brief notes written by SA following each interview.

All authors contributed to data analysis to ensure the validity and reliability of themes, with Māori cultural oversight and input provided by DT-L. Data were analysed by thematic analysis, using a pragmatic descriptive general inductive approach<sup>(32)</sup>. This was an iterative process with interim analysis undertaken at various points, and the team met regularly throughout the study for verbal discussion of insights and issues. Consequently, two further questions were added after forty-two interviews (Table 1). Data analysis was undertaken manually and involved thorough reading of the transcripts, coding participants' talk and grouping the codes into inductively derived themes under *a priori* headings determined by the interview questions (Table 1).

Inductive themes were identified as dominant concepts or patterns evident in participants' responses. Using Word files, coding and analysis were undertaken systematically and separately for subgroups by gender, ethnicity and

**Table 1** Relevant questions from interview schedule

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Motivators:	<ul style="list-style-type: none"> <li>• Did you feel motivated to want to make dietary changes? If so, can you tell me about the things that motivated you? If you weren't motivated, why was that?</li> </ul>
Facilitators:	<ul style="list-style-type: none"> <li>• Please tell me about the things that helped you to make the dietary changes.</li> <li>• Focusing on the changes you made to your diet, have you managed to maintain these changes? If so, how?</li> </ul>
Challenges:	<ul style="list-style-type: none"> <li>• Please tell me about the things that you found difficult when trying to change your diet. How did these impact on you? How did you manage these?</li> <li>• For any changes that you made that couldn't be sustained, what would have made it easier to have sustained them?</li> </ul>
Other influential factors:	<ul style="list-style-type: none"> <li>• Do you have any other health issues? If so, did this impact on making dietary changes?</li> <li>• Did your family/whānau influence how you managed your diet? If so, how?</li> <li>• If employed, did your workplace or colleagues influence how you managed your diet? If so, how?</li> </ul>
Additional questions following interim analysis:	<ul style="list-style-type: none"> <li>• If you had had to pay to participate in the PIP programme would you have taken part?</li> <li>• Do you feel that the promotion of unhealthy foods in your supermarket and local fast food outlets had any impact on your ability to improve your diet? If so, in what way?</li> </ul>

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**Table 2** Thematic schema

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<i>A priori</i> headings	Induced themes
Motivators for wanting to make dietary changes	Determination to not get diabetes Wanting to be healthy and to contribute to others Encouragement of others
Facilitators for adopting and maintaining dietary changes	Strong desire to be healthy for self and others Personal determination Feeling supported
Challenges around adopting and maintaining dietary changes	Compromised control of life and environment Feeling unsupported by others Social occasions Financial constraints Other health conditions Meeting the challenges

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glycaemic outcome to enable comparisons across groups. Initial coding and creation of themes were undertaken by SA. The other authors independently reviewed eight transcripts each and following further discussions, the final thematic schema was determined (Table 2). The socio-ecological model, which focuses on individual, societal and environmental factors<sup>(22)</sup>, was used to interpret and frame these findings. A summary of findings was sent to interview participants and the other participants in the main study.

## Results

In total, fifty-eight people participated and were recruited from across the eight participating primary care practices. Participants' ages ranged from 28 to 69 years, with half being aged 60 years or older. Their demographic and outcome profiles are shown in Table 3. Twenty-eight were Māori. The non-Māori participants were all NZ Europeans (NZE). A further twelve people (4 Māori; 8 NZE) were invited but declined to participate, with eight citing they were too busy and four giving no reason.

Seven of those twelve were NZ European males who had not regressed to normoglycaemia.

The key findings are presented below, with the inductively derived themes described under the *a priori* headings: motivators, facilitators and challenges. These descriptive themes are then discussed in the next section. Of particular interest was that the themes identified were similar in each group (Māori and non-Māori, women and men, and those whose HbA1c had returned to normoglycaemia and those whose had not). Unless otherwise stated, therefore, the descriptions below apply across demographic and glycaemic outcome groups. Brief quotes from interview transcripts are included in the text, and longer quotes illustrating each theme are shown in Table 4.

### ***Motivators for wanting to make dietary changes***

Three themes regarding motivators for wanting to make dietary changes were identified, and these were a combination of personal and interpersonal factors.

#### *Determination to not get diabetes*

The biggest motivator was a fear of diabetes and a strong determination not to progress to diabetes. Over half of

**Table 3** Participant characteristics (n 58)

Characteristics purposefully selected:		Numbers	Percentage
Ethnicity	Indigenous Māori	28	48
	Non-Māori (NZ European)	30	52
Gender	Female	30	52
	Male	28	48
Outcome at 6 months*	Normoglycaemia	26	45
	Persistent prediabetes or progression to diabetes	32	55
Other characteristics:			
Family history of diabetes	Yes	31	53
Other health issues e.g. hypertension, arthritis, depression, sleep apnoea	Yes	51	88
Employment status	Employed	39	67
	Not employed	11	19
	Retired	8	14
Living situation	Alone	5	9
	With 1 other (mainly a spouse or partner)	31	53
	With > 1 other	22	38

\*Normoglycaemia, prediabetes and diabetes outcomes at 6 months defined according to glycosylated Hb (HbA1c) level at 6 months and the New Zealand diagnostic criteria<sup>(21)</sup>.

the participants (53%) had a family history of diabetes, and others had in-laws diagnosed with diabetes (Table 3). Most had observed or assisted family members, friends or colleagues to cope with diabetes and its health consequences and did *'not want to end up like that'*.

#### *Wanting to be healthy and to contribute to others*

Many wanted to take charge of their own health, mustering their will and determination to start making healthful dietary changes. Some aged over 55 years realised they were no longer *'bullet proof'* and needed to act to stay healthy, and two Māori men were moved to act by the absence of older healthy Māori men in their community. A common refrain was wanting to enter older age in a healthy state and be around for close family members, especially grandchildren, *'so that they can probably remember who I am.'*

#### *Encouragement of others*

The encouragement of others was a strong motivator to initiate dietary change. Having others alongside supporting them provided the impetus many needed to take the first steps. Mostly encouragement was provided by a spouse or partner, adult child or workmate, but another important motivator was the encouragement of their primary care nurse to go on the PIP programme.

#### **Facilitators for adopting and maintaining dietary changes**

Factors facilitating the adoption and maintenance of healthful dietary changes comprised three induced themes which were also a combination of personal, interpersonal and organisational factors. Personal and interpersonal factors were similar to those that motivated participants to want to make these dietary changes.

#### *Strong desire to be healthy for self and others*

The desire to be healthy for oneself and for others, to be around to watch *'grandkids get older and older'* and to contribute to family, was strongly evident in people's comments when asked what helped them stay on track with their dietary changes. Feeling *'so much better than I used to – physically and mentally'* helped keep the momentum. As part of the endeavour to be well, people talked about developing and nurturing healthy strategies. This involved planning food and meals, establishing and maintaining routines, reading labels and generally taking control of their food.

#### *Personal determination*

Most people also felt that their own will or determination was what enabled them to stay the course, that it was *'mind over matter'*. Even those whose 6-month results showed no improvement felt their grit and determination had helped them. Part of this was taking control, having *'pig-headed resolve'* and, as above, developing and nurturing healthy strategies.

#### *Feeling supported*

Just as it was a motivator, the support of others, particularly within the household, was also a facilitating factor. The large majority lived with others (91%), and many reported spouses or partners not only supporting them but also making dietary changes themselves, being *'quite happy to change with me [and] always helping me.'* Both receiving praise for changes made and being reprimanded when tempted or when lapses occurred were a boost to confidence and determination, highlighting the importance of relationships in the endeavour to improve eating patterns. Some participants were also encouraged and supported by work colleagues, and a few felt more supported by them than their family members.



**Table 4** Sample quotes for subthemes

Subtheme	Sample quotes
Motivators: <i>Determination to not get diabetes</i>	<i>Fear of losing my limbs. Fear of not having a healthy old age. Fear of being dependent on others because of my health. Looking at what my sister looks like and thinking, 'I don't want to be there.'</i> (PIP02: Māori Female, PD) <i>I'd seen what the old man went through and I don't want to go through that again; didn't want to go through what he went through. From a guy that did a shitload of gardening, was always active fishing and everything else, to a guy sitting in a wheelchair wishing he wasn't alive. It's just like, don't want that.</i> (PIP36: NZE male, NG)
Motivators: <i>Wanting to be healthy and to contribute to others</i>	<i>You just want to participate; just want to be available for them when the kids have got things on. That usefulness you know; there's still a role to do . . . I didn't really want to lose any value in any of that. So I just need to be healthier.</i> (PIP38: Māori female, PD) <i>So it's the future of new grandchildren; I want them to meet me. My mother only met my eldest daughter, she didn't meet the other two. That inspires me to take care of my journey.</i> (PIP52: Māori Female, NG)
Motivators: <i>Encouragement of others</i>	<i>I think it's little things that my mother in-law and my mother have said, "You need to take this seriously, because you don't want to become a diabetic."</i> (PIP11: NZE Female, PD) <i>(My nurse's) approach to it. She told me about it and she didn't push it. She encouraged me.</i> (PIP01: NZE Female, NG)
Facilitators: <i>Strong desire to be healthy for self and others</i>	<i>Feeling a bit healthier. When I was doing up my shoelaces I'd be puffing before, where now I'm not. I'm lying on my stomach when I sleep. I notice those changes that have come. So, I'm wanting to continue that on.</i> (PIP20: NZE Male, NG) <i>I'm trying to put things right so I can be around till my grandkids are teenagers, so they can remember me. Not, when they're only two or three and 'This is a photo of your granddad.' I want them to grow up so they can visualise me in their minds."</i> (PIP09- Māori Male, PD)
Facilitators: <i>Personal determination</i>	<i>It's my responsibility, this prediabetes, it's not theirs. So we go out, they eat what they want, friends and family. It's my responsibility. I can't be passing things over to people, because at the end of the day I'm the one who has to do it.</i> (PIP52: Māori Female, NG) <i>Definitely, because it's all a mindset eh, I believe. Because once your mind's right you make better decisions.</i> (PIP12: Māori Male, PD)
Facilitators: <i>Feeling supported</i>	<i>'Cause she's (wife) my biggest support and probably my best critic that I listen to . . . She's always telling the kids, "Look after your father. You know, not to give him too much sweet stuff."</i> (PIP09; Māori Male, PD) <i>(My nurse) has given me some good tips . . . I think she's doing her best to help me so I owe it to her, and myself, to just make more of an effort and be more aware of what I'm doing really.</i> (PIP3: NZE Female, PD) <i>Probably the appointments every month at the doctors. Again, routine, appointments. I think it's every month I go there. They weigh and measure and do blood sugars</i> (PIP11: NZE Female, PD)
Challenges: <i>Compromised control of life and environment</i>	<i>Just after, [my wife] went to hospital and I was struggling with that; up to the hospital every day, every day, every day. From January last year to November, I lost five kgs, and then in a month I put on seven kgs because of eating on the run - home from work, up to the hospital, oh, bugger it, I'll have some takeaways tonight. Then friends invite you around for tea and there's enough food there to sink a battleship, so I eat it all because, "This is a good feed tonight."</i> (PIP28: Māori Male, NG) <i>TV advertisements and stuff . . . You know, that's everywhere - fast food, milkshakes, like advertisements for food. I think I'm bombarded with it . . . You can't go to the supermarket without being bombarded</i> (PIP42: NZE Male, NG)
Challenges: <i>Feeling unsupported by others</i>	<i>Because he's (partner) not very good at cooking so he would always buy takeaways. I said, "Can you not buy pizza?" Then he'd buy it and go, "Oh I forgot. Sorry I forgot." Lots of, "I forgot." Then he would buy something and, "Here I bought this for you." "You know I'm not allowed that." "Yeah I forgot." He'll feel disappointed because I didn't eat it. So there was a little bit of not trying to hurt his feelings.</i> (PIP08: Māori Female, NG) <i>Because the grandkids like takeaways, which is not necessarily a good thing, and being there of course I was helping eat their tea</i> (PIP24: NZE Male, PD)
Challenges: <i>Social occasions</i>	<i>We have patients bringing food in all the time - cakes, slices and cookies - and it's so easy to just go in there and have it every single day</i> (PIP01: NZE Female, NG) <i>Probably just when you're at the marae. You know, a lot of fatty meat and a lot of sweet stuff . . . It's the socialising that captures you into what's there to be offered on the table . . . 'Cause the food is nice, it's rich, and it's inviting. And I think, catching up with friends; you sit down, you talk, you eat.</i> (PIP09; Māori Male, PD)
Challenges: <i>Financial issues</i>	<i>Plus you haven't got the money to buy it, too, that's another thing . . . Like they say eat more fish, eat more chicken, but it's what you can afford. Fish ain't the cheapest things</i> (PIP57: Māori Male, NG) <i>Cause my husband and I, we're on a very tight budget and it's not every day we have all the treats. We like to have every day meals and stuff. So, we're very restricted</i> (PIP04: Māori Female, PD)
Challenges: <i>Impact of other health issues</i>	<i>I went to the Sleep Clinic and got diagnosed with really bad sleep apnoea - really bad . . . I was just so tired. It was too easy to just do easy prepare meals.</i> (PIP26: NZE Female, PD) <i>I just let everything go after I had that [hip joint replacement] op. Then I went, 'Huh, you let it go too far. Oh, you better wake up now.'</i> (Laughter)

**Table 4** Continued

Subtheme	Sample quotes
Challenges: <i>Meeting the challenges</i>	<p>Interviewer: <i>So when did you decide you needed to stop and wake up? When they said, 'You've got diabetes,' practically.</i> (PIP46: Māori Female, Diabetes)</p> <p><i>Often I'll just say if someone's there and it's afternoon teatime 'Oh no I had a late lunch thanks.' Just so I'm not saying, 'I don't want this.'</i> (PIP13: NZE Female, NG)</p> <p><i>I would eat their (kids') food. So, what I do now is I actually feed myself first. I know that sounds crazy (laughter)... So, I eat my dinner early, like 4-30 to 5-00 and then it's time for their dinner when it's ready, about 6-00... so I'm not tempted to eat their food.</i> (PIP17: NZE Female, PD)</p>

NZE, NZ European; PD, Persistent prediabetes post 6 month intervention; NG, Normoglycaemia post 6 month intervention.

The PIP programme and the nurses were also frequently mentioned as sources of encouragement and support for participants' endeavours. Many people mentioned that being monitored by the programme and feeling accountable to their PIP nurse were extremely helpful and *'made a huge difference'*. The ability to manage the promotion of unhealthy food temptations was *'because of the nurse, the PIP programme'*. Many spoke very highly of their PIP nurse and valued the care and attention they provided, with one person saying *'as long as you're being noticed things can change'*. Seeing improvements in their own health, getting good results and being praised for these were also considered helpful.

### **Challenges around adopting and maintaining dietary changes**

Five themes were identified encapsulating the challenges participants faced regarding dietary changes. These included a combination of personal, interpersonal and external environmental influences. A sixth theme describes strategies people used to work with these challenges.

#### *Compromised control of life and environment*

Being overly busy, working irregular hours, being out of routine and experiencing stress prevented or interrupted good food habits contributing to a sense of poor control over one's life and environment. This sometimes dovetailed with feeling a lack of personal motivation or self-will, almost a sense of self blame, although some acknowledged the powerful influential role of external factors, such as proximity to unhealthy food outlets and being exposed to unhealthy food advertising and promotions. *'Fast food was too easy and it was accessible'*. Sixteen participants were specifically asked whether they felt these factors influenced their dietary choices. While some felt their personal resolve minimised this influence, others reported being strongly influenced by them.

#### *Feeling unsupported by others*

Feeling unsupported by those in their household or by others of influence was very challenging for many. Several people talked of family members who appeared to sabotage their efforts to eat healthily by cooking or

offering them unhealthy options or eating unhealthy foods in front of them knowing it was tempting. It was also difficult when grandchildren lived in or visited as *'chocolate turns up when the grandchildren turn up; a lolly and chips and those sort of things'*.

#### *Social occasions*

People commonly described social occasions as difficult because there was often a strong societal expectation to partake in eating sizeable portions or the wrong type of food. Special family and work events were described as involving unhealthy food and eating together was an important part of the event. Temptations were often presented, beyond special events, *'in work places, in the home and historical behaviours in the family that you're dealing with, if you're involved with social activities.'* Marae (traditional Māori meeting place) events, where the offering and partaking of food are of particular cultural importance, were singled out by some Māori because *'there's always a hākari (feast)...[and] everything is sweets and cakes, and all those sorts of things'*.

#### *Financial constraints*

Some people found that insufficient money limited their ability to buy more healthy foods as *'to eat better is a bit more expensive'* and a few reported having to work closely with their PIP nurse to manage this limitation. While PIP intervention appointments with the nurse was at no cost to participants, amongst the sixteen people asked whether they would have participated if it had cost money, 11 (69%) felt they would not have.

#### *Other health conditions*

Having other health conditions also presented a challenge for many. A large majority (88%) of participants had some other significant health issue and many had several. A wide range of conditions were mentioned, including hypertension, asthma, arthritis, depression and heart disease. For some, getting prediabetes on top of other health problems was a motivator to make lifestyle changes, but for others, it was just another thing to deal with on top of everything else and sometimes their other conditions took priority. Some participants described how certain conditions impacted negatively on their ability to maintain lifestyle changes;



for example, depression or insomnia affected energy and motivation, and arthritis or injuries lessened the ability to exercise. While a couple of people found some of the PIP dietary advice conflicted with that for another health issue, most found it reinforced what they had been advised elsewhere and were grateful for another impetus to make changes.

#### *Meeting the challenges*

When talking about the challenges they faced, many people went on to describe strategies they had developed to work with or minimise the negative impacts. These were often small things (such as drinking water before going to the supermarket or social occasions to minimise feelings of hunger, or taking one's own lunch to work to avoid buying unhealthy food). Developing their own strategies empowered them, and they felt proud of themselves for taking such control.

### **Discussion**

Prediabetes is a common condition, and progression to type 2 diabetes can be prevented through healthful lifestyle changes<sup>(7-9)</sup>, if appropriate, acceptable and timely advice, guidance and support are given<sup>(33)</sup>. Participants in the PIP study welcomed the opportunity to participate in the diabetes prevention programme and described a number of themes regarding what motivated them to want to attend the programme and make dietary changes, and what facilitated and challenged them when initiating and maintaining these dietary changes. The socio-ecological model (SEM)<sup>(22)</sup> provided a useful theoretical framework for interpreting these themes, and we have framed our findings around the five SEM levels in the following way: personal (motivation and determination), interpersonal (relationships with others), organisational (healthcare services), environmental (availability of healthy foods) and policy (access to no cost prediabetes primary care interventions) (see Fig. 1). Importantly, the more proximal variables are nested within the more distal ones.

The motivators and facilitators described comprised a mix of personal and interpersonal organisational factors. The determination to not get diabetes, to be around for family, to improve their own well-being and to live a long healthy life were powerful motivators for initiating wanting to make dietary changes, as well as being powerful facilitators for adopting and maintaining them, and demonstrated that participants wanted to take personal ownership of their health and well-being. Simultaneously, they stressed that the supportive interpersonal relationships (including the support of the nurse) were of crucial importance to motivate them into and facilitate this change process. Another powerful facilitator was the organisational capacity of their primary care provider of the PIP programme. Key challenges comprised a combination of

personal and interpersonal influences, namely when personal determination and supportive relationships were absent, but these were intertwined with environmental and policy influences of varying degrees, such as social expectations, financial constraints and the obesogenic environment.

In accord with the holistic nature of the SEM, the variables of influence were interconnected. The presence of personal determination and supportive relationships with others helped, and their absence hindered the adoption and maintenance of new healthful habits and eating patterns. Yet, the two are difficult to disentangle as they are intricately woven together when it comes to having a sense of control over both one's eating patterns and proximal food environment. While individual will and personal resolve are a necessary part of behaviour change<sup>(34)</sup>, the ability to muster and maintain this determination appears to be greatly facilitated by supportive relationships, at both interpersonal and health provider organisational levels. Self-efficacy, in this case the confidence to know one can make healthful behaviour changes<sup>(35)</sup>, has been shown to be an important contributor to successful dietary changes and weight loss<sup>(36)</sup>, but for meaningful or sustained change, this confidence relies on supportive personal and environmental factors<sup>(37)</sup>. The words expressed by one participant when talking about his PIP nurse that '*as long as you're being noticed, things can change*' are a reminder that personal determination does not occur in a vacuum but rather is nurtured and sustained by others' interest and engagement, and the practical support of a trained supportive healthcare provider. The findings also point to the importance of the human face within health services, and that the quality of one's relationship with a health professional can make a difference in health seeking behaviours. Other studies have also emphasised the importance of relationships in changing dietary behaviours<sup>(38,39)</sup>, and many facilitators and barriers found in this study have also been observed among women seeking weight loss<sup>(39-42)</sup> and those with type 2 diabetes attempting to modify their diet<sup>(14,43)</sup>.

A nuanced approach tailored to individual cultural and personal needs, and circumstance, coupled with a strong and ongoing relationship with a health provider appears to be important components of successful diabetes prevention interventions. An integrative review examining knowledge, attitudes and practices regarding nutritional care for those with prediabetes stressed the importance of patient-centred approaches and individualised structured support<sup>(44)</sup>, and a systematic review found that a trusting relationship with a familiar healthcare professional was a hallmark of successful diabetes prevention programmes<sup>(45)</sup>. Both of these were integral to the planning, design and features of the PIP programme<sup>(27,28)</sup>, and results from this qualitative study are consistent with these review findings.





**Fig. 1** (colour online) The socio-ecological model of the primary care-based prediabetes intervention and diabetes prevention with corresponding multilevel intervention strategies

The community/environment sphere in our socio-ecological model (Fig. 1) is supportive food environments, within which the personal, interpersonal and organisational variables are nested. The importance of supportive food environments when attempting to make dietary changes cannot be underestimated<sup>(46)</sup>. It is likely that participants in this study described more fully the proximal personal, interpersonal and healthcare provider influences, as they were more readily recognised than the distal more complex social, environmental and policy factors. However, some participants in this study were mindful of the influence of the wider food environment. They found the ready availability of unhealthy food options a real challenge, and financial constraints also influenced food choices. Other studies have similarly highlighted the powerful influence of food environments on dietary behaviours, with poorer, marginalised ethnic minority and indigenous populations particularly susceptible to these influences<sup>(20,43,47)</sup>. It is possible that these distal influences may have contributed to the regression, or not, to normoglycaemia in this study, and this warrants further research.

Our finding that the motivators, facilitators and challenges regarding dietary change were similar across groups

also warrants further research. This finding highlights perhaps the complex but fundamental relationship that food plays in all our lives; however, the nuances may vary. For example, while social occasions were a challenge for both Māori and non-Māori, for Māori, this challenge appeared more strongly based in powerful cultural expectations around the giving and partaking of food<sup>(13)</sup>. How these influential factors present, and how they can be managed will differ between individuals and social groups, necessitating tailored diabetes prevention approaches that work with the unique socio-cultural and personal factors that prompt behaviour change, facilitate engagement and support the retention of people in diabetes prevention programmes<sup>(41,48)</sup>. This is especially important given the well-recognised ethnic disparities in the prevalence of prediabetes and diabetes<sup>(1,20)</sup>.

Healthy food was perceived to be more expensive by some. Despite this, the trained primary care PIP nurses were able to work with participants within this constraint to some extent and as best they could, providing realistic guidance. While this was at least partially workable, a high proportion of those asked felt that they would not have participated in the PIP programme if there had been a nurse



consultation cost to them. This suggests that financial constraints can mitigate against accessing supportive diabetes prevention programmes and developing healthful eating, particularly in those most at risk of developing diabetes. As prediabetes and diabetes disproportionately affect those in lower socio-economic and socially marginalised communities<sup>(49)</sup>, this issue could be partially addressed through the provision of no cost programmes such as the PIP programme that are embedded within primary care settings and provide supportive individualised targeted dietary advice, particularly as many already visited their primary health centre for the treatment of other conditions. Indeed, a cost effectiveness analysis of the PIP pilot programme showed that it was likely to be a cost-effective strategy for weight loss and diabetes prevention<sup>(29)</sup>. For these reasons, our SEM policy sphere (Fig. 1) positions access to no consultation cost primary care prediabetes interventions as a facilitative policy initiative that supports the other variables of influence.

Many participants developed strategies to manage the dietary change challenges they faced, illustrating that, with information, advice and support, a considerable level of self-empowerment is achievable. The broader food environment, however, particularly the promotion and ready availability of unhealthy options, was an issue for some and public health measures to modify their negative influences remain steadfastly important<sup>(50)</sup>.

### **Strengths and limitations**

This study involved a robust sample of Māori and was stratified by demographic and outcome groups. The main limitation of the study was that the participants were selected from the group who had chosen to take part in further research, and they may have been more motivated to make changes. Further, a lower proportion of Māori consented to take part in further research (23%) compared with the wider study cohort (34%), suggesting a smaller proportion of Māori than non-Māori was willing to take part in further research.

### **Conclusions**

In conclusion, the motivators, facilitators and challenges when making and maintaining dietary change for those with prediabetes involved personal, interpersonal, organisational, environmental and policy factors, highlighting the multi-faceted nature of influences on dietary behaviour change. The presence or absence of personal determination and supportive relationships was commonly reported as important influences, but they must be considered within the context of the wider socio-cultural and environmental influences that appeared to be less readily recognised. The similarity in influential factors across the participants, irrespective of their demographic background or clinical outcome after completing the 6-month dietary intervention points to the importance food plays in all

our lives and warrants further investigation. The commonality of experience across the sample does not call for a universal approach to diabetes prevention efforts, but rather the identification of the specific ways these motivators, facilitators and barriers arise in, and are part of, people's lives. It is important that achievable individual goals and strategies are negotiated and tailored accordingly within the wider context of the obesogenic and socio-economic environment, and the influences and challenges this presents across socio-cultural groups. Efforts to tackle the obesogenic environment, particularly in lower socio-economic areas and among minoritised and indigenous populations should continue, alongside initiatives to develop personal skills<sup>(23)</sup>, as in the PIP programme<sup>(27,28)</sup>.

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