HHS Public Access

Author manuscript

N Z Med J. Author manuscript; available in PMC 2022 February 19.

Published in final edited form as:

N Z Med J. ; 134(1530): 57–68.

Pasifika Prediabetes Youth Empowerment Programme: learnings from a youth-led community-based intervention study

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Competing interests:
Nil.

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Abstract

AIM: Using a co-design approach, we describe exploratory findings of a community-based intervention to mobilise Pasifika communities into action, with the intent of reducing the risk factors of prediabetes.

METHOD: A group of 25 Pasifika youth aged 15–24 years from two distinctive Pasifika communities in New Zealand were trained to lead a small-scale, community-based intervention programme (among 29 participants) over the course of eight weeks. The intervention, which targeted adults aged 25–44 years who were overweight or obese, employed both an empowerment-based programme and a co-design approach to motivate community members to participate in a physical-activity-based intervention programme.

RESULTS: Findings show significant reductions in total body weight and waist circumference, as well as improved physical activity.

CONCLUSIONS: The strength of this intervention was evident in the innovative approach of utilising Pasifika-youth-led and co-designed approaches to motivate communities into healthier lifestyles. The approaches used in this project could be utilised in a primary healthcare setting as a community-wide strategy to reduce diabetes risk, particularly among Pasifika peoples.

Prediabetes is a common condition in which blood glucose levels are higher than normal but not high enough to be defined as type 2 diabetes (T2DM). It is defined as having an haemoglobin A1C (HbA1c) between 41–49mmol/mol and no formal diagnosis of T2DM,[1] although it is recognised that increasing levels of HbA1c are associated with an ongoing risk of progression to T2DM.[2] Among obese adults (having a body mass index (BMI)≥30), 32.2% will have prediabetes and, without any intervention, the likelihood of developing

T2DM is high.[1] The New Zealand Society for the Study of Diabetes has endorsed the need for opportunistic screening of prediabetes among younger adults (25+ years), and they have also identified other groups at risk of prediabetes, including: early onset of familial T2DM, women with a past history of gestational diabetes, children and young adults who are obese, particularly if they are Māori or Pacific, and women with polycystic ovarian syndrome.[2]

Prediabetes is not a medical condition per se, but it is often accompanied by other serious co-morbidities, such as hypertension and high cholesterol, which often never display physical symptoms. Prediabetes is especially elevated in Pacific peoples. Among youth aged 15–24 years, 13.6% have prediabetes (vs 7% of New Zealand Europeans (NZE)), and in the Pacific working-age adults (25–44 years), 29.6% (vs 16% of NZE) have prediabetes.[1] Yet, very little is known about the working-age group of younger adults with prediabetes (defined here as 25–44 years old), such as how they manage and cope with the lifestyle challenges imposed by this condition. This age group is particularly important for Pacific peoples and women (who have high rates of obesity and prediabetes),[1,3] particularly as it encompasses the ‘reproductive age’ for New Zealand women:[4] Pacific women are more likely to start their own families at a younger age (median age 26 years and 28 years, respectively) compared to their New Zealand European counterparts (median age 31 years),[4] and, therefore, they are at an increased risk of onset of health problems (eg, gestational diabetes)[4] at an earlier age, with long term implications for the development of chronic conditions in the future.

In New Zealand, there is a critical need for effective, sustainable programmes that can be self-managed by communities, in order to enable independent health and wellbeing and reduce the prevalence of prediabetes. Previous programmes have shown that community-based and community-led programmes that are ‘fit for purpose’ and relevant to the sociocultural environment are advantageous for improving the health and independent living of certain communities.[11,12] Community-based partnerships are essential to address inequities, such as barriers to care, and to explore culturally appropriate services that are community-based, particularly for underserved populations.[13]

Empowering Pacific communities to participate in all stages of any proposed research will enhance intervention development, engagement and uptake and provide evidence-based knowledge that can help inform: (i) how to partner with and mobilise communities; (ii) how to initiate and sustain behavioural change; and (iii) how to explore other research-related questions that may arise as a result of the dynamic nature of the research approach. It is also a unique opportunity for community and researcher partnerships to be established, with a view of progressing a long-term collaboration to develop an in-depth reservoir of knowledge and capability building.[14] There have been several recent examples of community-based partnerships that involved empowering indigenous communities to take the lead in creating effective prevention approaches.[6,15-18] Between 2017 and 2018, a large cluster randomised control trial (OL@-OR@ mobile health (mHealth) programme) using Pasifika and Māori kaupapa research methodology was co-designed with both Māori and Pasifika communities in New Zealand to support healthy lifestyle behaviours.[15] The study investigated whether the use of their mHealth programme improved adherence to health-related guidelines among a sample of 1,224 adults. Results showed their co-designed mHealth programme did not

improve overall adherence to health-related behaviour guidelines among Māori and Pasifika. However, it was clear that the intervention participants who engaged with the programme showed significant improvement relative to the study controls.[19] A recent health intervention programme, Mana Tū, was developed in response to current ethnic and social inequities facing patients with high prevalence rates of T2DM and wider sociocultural determinants.[20] Mana Tū is an initiative to address access issues from within the health system. It focuses on enhancing health services and patient factors that can positively impact on the whānau ability to 'stand with authority' when living with non-communicable diseases (NCDs). Key learnings from Mana Tū highlighted the need to develop individual capacity to use tools and skills for healthy lifestyles and establish a framework for change that brings individuals, whānau (ie, family), health services and systems together to improve short- and long-term outcomes, such as improving understanding of the wider determinants and improving the engagement and experience of services and outcomes. By developing the capacity of individuals and whānau to work closely with the health service provider, Mana Tū has shown to be successful in addressing health inequities for Māori and Pasifika peoples.

More recently, research approaches that include young people (often described as 'youth-led', 'peer-led', 'research actors' or 'agents of change') as a potential step-change movement in health promotion, or to improve the health status (eg, sexual health, mental health, alcohol and drug use) of young people themselves and their respective communities, have been implemented and analysed systematically.[21] The reported findings considered peer-led interventions as particularly useful for knowledge capacity development in young people, because they are more likely to be 'relatable' and have a high level of interaction, which can have a positive effect on behavioural and mind-set change.[21]

This paper presents overall findings from phase two of the Pasifika Prediabetes Youth Empowerment Programme (PPYEP) project, which is a scaled-up approach from our pilot work.[22] In short, the research approach uses an established empowerment framework that was uniquely designed to build the health-leadership capacity of Pasifika youth, transform their knowledge and skillsets into actionable knowledge and ultimately mobilise their communities towards a common purpose. This approach is participatory action research,[23] which includes a suite of modules aimed to build the capacity and understanding of the youth in the following topics: (1) the health status, including lifestyle patterns, of Pasifika people in New Zealand; (2) leadership qualities and identifying how to enhance these skills in a group setting; (3) the supermarket context and budgeting and food literacy skills; (4) the root causes of health and lifestyle issues related to prediabetes; (5) the basic concepts of social change; and (6) how to set-up action plans (using co-design processes). As well as identifying necessary resources, this module also included identifying key stakeholders or potential allies/partners that could enable and enhance the sustainability of an action plan. Accessing the participants' wider community and other networks was also essential for action planning.

These were the specific aims of the anonymised project:

1. Empower young Pasifika peoples' capacity to gain research and health promotion knowledge on their behavioural, personal, social and cultural experiences of healthy lifestyles.
2. Co-design the key features of a small scale community-based intervention, led by the Pasifika youth.
3. Implement and evaluate the short-term success of the interventions.

The project received ethical approval from Health and Disability Ethics Committee (17/CEN/289), New Zealand.

This paper focuses primarily on aims 2 and 3. Note that we have employed the term 'Pasifika', defined here as a collective group of people representing different Pacific Island nations predominately from the South Pacific region. We acknowledge the diversity of Pacific ethnic groups in New Zealand, and in consultation with our community partners, it was decided that a Pasifika approach was relevant for this project due to the growing diversity of Pacific and other ethnic groups; thus the use of the term 'Pasifika'.

Methods

The study comprised two phases. In the first phase, we recruited a convenience sample of 41 young Pasifika youth (15–24 years) from our community partners: (1) urban health provider The Fono, Auckland (a large urbanised community), and (2) rural health provider South Waikato Pacific Islands Community Services Trust (a small rural community, in New Zealand). Our convenience sample underwent an empowerment programme and co-designed action plans to reduce prediabetes risk factors in their communities. In the second phase, the youth translated these action plans into community-based intervention programmes and delivered them in their communities.

Prior to the start of the PPYEP project, our Pasifika facilitators (n=4) were trained extensively to upskill their expertise on how to engage with Pasifika youth, facilitate discussions and deliver the piloted empowerment modular programme. The youth participated for 2–2.5 hours per week throughout the five-month empowerment programme, where they developed practical skills and knowledge through the modules, which were described earlier, and previously published.[22]

Co-design

The community intervention development followed similar processes that underpinned the pilot study.[22] The action planning module builds on the youths' knowledge developed through the empowerment programme and adjoins their individual and collective skills and talents, matched with specific prediabetes health issues. From here, the youth proceeded through a series of processes that triaged-out the plans that were impractical, so that finally the action plans included only those plans that were achievable and realistic for the timeframe of the planned community-based intervention.

During several gatherings further attended by research team members, key decisions were made regarding the intervention aims, design, primary and secondary outcome measures,

recruitment methods and timelines. In this process, our two Pasifika community providers led the engagement processes with their respective youth.

Study design

With the aid of the two research assistants and two community facilitators, the Pasifika youth co-designed each intervention programme as a cross-sectional based programme, which included preparing work for the intervention launch, such as: meeting with the community partners; developing intervention resources, promotion materials, logos and posters; developing a participant recruitment method; conducting participant recruitment; promoting the intervention via social media pages (Facebook) and at community meetings; collecting and processing data, which included establishing a timeline of daily healthy dietary and nutritional habits over the intervention period; and following up with the research team on the progression of the action plan overall. The full details of the co-design approach of the overall project and the empowerment programme will be published separately.

Phase two of the overall project involved translating these action plans into community-based intervention programmes. Two similar co-designed, community-based intervention programmes were established. Unanimously, both communities decided to focus on ‘reducing the risk factors for developing prediabetes’, which included: (1) increasing physical activity; (2) enhancing the awareness of nutritional habits; and (3) building knowledge of health and wellbeing. Studies have shown that, through these mechanisms, behavioural change interventions are successful in reducing the risk of developing T2DM by more than 50% when targeting modest weight loss, such as 30 minutes of walking a day.[24-26]

To be eligible, participants needed to be at high risk of developing prediabetes (eg, being overweight or obese; having high blood pressure; having a parent or sibling with T2DM; having a history of cardiovascular problems and/or polycystic ovarian syndrome and/or high cholesterol levels; having been diagnosed with prediabetes on a previous test;[27] being physically inactive; being Pasifika and/or Māori aged between 25-44 years old), reside within the targeted community where the anonymised project was located and be motivated to make behavioural changes. The eight-week community-based intervention programme, developed by the community facilitators and the youth who participated in phase 1 of the project, was co-designed to reduce risk factors for prediabetes. The programme was also determined by the community partners, as they were not able to commit to a longer time frame, given their other community-based responsibilities. However, the intervention involved weekly group meetings that included a fitness activity (eg, Zumba class or a walking group) at a group level; and at an individual level, each participant had a physical goal of achieving 10,000 stepts per day, starting from 3,000 steps. Educational cards were developed to present to the participants each week and included the following topics: (1) what is prediabetes; (2) dietary knowledge (water vs fizzy drinks); (3) dietary habits (home cooking vs eating out); (4) dietary knowledge (de-mystifying the ideas on carbohydrates); (5) physical activity (30 minutes at various levels); (6) sleep (the importance of sleep and recovery); (7) weight management (avoiding fad diets); and (8) heart health (understanding

the consequences of high (and low) blood pressure). The community facilitators were responsible for delivery of the intervention programme, after they had spent a day in a training workshop with the youth (ie, learning about data collection processes, etc).

Participant Recruitment

Part of the co-design planning was recruitment of study participants. Within each community, participant recruitment was led by the youth and supported by the community facilitators. We employed the snowball approach, whereby each youth identified and recruited one or two people within their neighbourhood who met the eligibility study criteria, described above. Once the initial contact was recruitment, the intervention participants were given the requirements of being involved with the study, and, at the initial intervention gather, they signed consent forms for their participation. The community facilitators provided the support and infrastructure of the intervention and used other recruitment methods, such as inviting potential participants to the initial intervention gathering, using social media (eg, Facebook), using posters and brochures and and word of mouth.

Study procedures

Potential participants were invited to attend an initial meeting regarding the programme, where further information was provided and any questions about the study could be answered. People who were interested and met the eligibility criteria signed up for the study by providing a signed consent form.

Community-based intervention design and outcome measures

The intervention was co-designed to help Pasifika peoples to improve their health by making small, positive and culturally relevant changes to their lifestyle in order to reduce the risk of prediabetes. Various action-planning methods, such as brain-storming intervention ideas, identifying personal and community resources to sustain the intervention, researching written educational materials on prediabetes and self-reflection, were used to achieve the needs of the Pasifika communities and inform the development of the study intervention.

To increase their physical activity, participants were encouraged to take at least 3,000 steps every day and add 1,000 steps a week until they accumulated 10,000 steps per day. For example: week 1: 3,000 steps, week 2: 4,000 steps, and so on. Every week there was an organised intervention session where the participants gathered and participated in an organised physical activity (eg, a 4km walk or a dance class), and educational business cards were discussed with the participants. The purpose of these sessions were to keep the participants engaged in the intervention and ensure their weekly physical activity data was collected and recorded, as well as to provide an opportunity for participants to raise any questions about the intervention. Information cards were co-developed with the research team to focus on increasing awareness and knowledge of better nutritional habits, and they were disseminated on a weekly basis.

Baseline assessments

At baseline, the following data was collected from each participant:

- *Demographics*: gender, date of birth, predominant ethnic group.[28]
- *Anthropometrics*: current weight (kilograms) was measured using an electronic scale (Tanita, Body Composition Analyser BC-418) and a standard tape measure was used to document height and waist and hip measurements (centimetres);[29] blood pressure was collected by measuring participants'right arms while they were seated and had been at rest for at least five minutes (using the standard Sprague stethoscope kits).
- *Health status*: self-reported health condition(s) defined as being diagnosed by a doctor that they have asthma, hypertension, heart troubles, diabetes, stroke, thyroid or psychological or sleep problems.[30]
- *Self-examination* of perceived body size using somatotype pictures[31] (data not presented here).
- *Lifestyle behaviours* (cigarette smoking frequency)[32] and physical activity: 10,000 steps per day,[33] measured using pedometers.

We did not measure nutritional habits, as it was manageable to focus on the physical activity component of the intervention. Additionally, we did not include a food frequency questionnaire, and we did not want to over-burden the youth and community facilitators with more research processes than were necessary.

Post-intervention assessment

At the end of the eight-week intervention period, anthropometric data and the step-count data were re-assessed to identify health and behavioural pre- to post-intervention changes.

We also conducted one-to-one interviews with 26 participants to obtain in-depth understanding of the intervention programme from each participant's perspective, which helped identify logistic and pragmatic knowledge for future co-design programming improvements.

Primary outcome measure

The primary outcome was participant adherence at 8-weeks to reduce the key risk factors: modest goal of bodyweight loss of >3%[34] of baseline bodyweight; increased step-counts from 3,000 to 10,000 steps per day, as a proxy measure of daily physical activity;[33] and improved knowledge and awareness of prediabetes, and about the intention of the intervention.

Secondary outcome measures

Secondary outcome measures were collected at 4–8 weeks post-intervention period via face-to-face interview with the community facilitator. We investigated intervention–user engagement based on each user's understanding; enablers and barriers of the intervention; and future provisions for sustainability. These findings will be published separately.

Statistical analyses

At baseline and at 8-weeks, data collected from all participants were summarised collectively, and by intervention site. Continuous variables were presented as numbers observed, means and standard deviations. Categorical variables were presented as frequencies and percentages. Since any difference may have occurred due to chance, we conducted formal significance testing of baseline differences, basing our tests on non-parametric tests. Statistical analysis were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, US). All statistical tests were two-sided T-tests at a 5% significance level.

Results

Intervention findings

Table 1 presents the baseline demographics of the intervention participants. Thirty-two participants were recruited and enrolled in the study, with the majority being recruited from the South Waikato intervention site. The youth collected the data at the weekly intervention gatherings.

The majority of participants self-identified as being Tongan and Cook Islands Māori. The average age was 33.3 years. The weight range recorded at the start of the intervention was diverse and ranged from 63.8–186 kilograms (kg), and the mean body mass index (BMI) was 37kg/m^2. The participants also have risk factors for prediabetes as determined by their health profile: obese (BMI>30kg/m^2) and Pasifika ethnicity; comorbidity characterised as having pre-high to high blood pressure; and being within the targeted pre-diabetes risk age-range (25–35 years old). By the end of the eight-week intervention, 26 of the 32 (81%) participants completed the study and provided sufficient data for analyses. We did not use the data from the six missing participants, because their data was not complete.

Table 2 shows the participants' pre- to post-intervention changes in anthropometric and physical activity measures. For those participants that provided complete data (n=29/32), there were significant positive changes, as evident by the mean percent change in weight loss (−2.43%), mean percent change in waist circumference reduction (−1.58%) and total average number of steps (range: 14,817–80,182 steps) accumulated from the start of the intervention ($p<0.001$). Note that data on blood pressure was not consistently provided, and as a result it was no longer included in the analyses. Furthermore, although the data is not presented here, there were significant improvements (for 26 participants who provided full data), as characterised by a negative change in percent body weight loss, negative percent change in waist circumference and a high number of average step-counts between the two Pasifika community intervention sites. The rural community achieved a higher mean difference in weight loss and waist circumference, although they accumulated less steps on average, compared to the urban community.

Finally, Table 3 compares 'high steppers' to 'low steppers', as a proxy measure of physical activity levels. Previous studies have defined lower level of physical activity, or low active, sedentary, as achieving ≤7,300 steps per day.[35,36] The study participants sustained a lower level of step-count (by ~1,900 steps), and the percent change in weight loss steps (−3.12%

weight loss) was higher among those who accumulated less steps, than those who achieved higher step counts (−2.20% weight loss).

Discussion

This study presents the initial findings of an innovative approach to public health and community-based intervention that uses co-design and Pasifika youth as the main catalysts in mobilising their communities into action to reduce prediabetes risk. In this small community-based study, the intervention phase of the project resulted in significant improvements in health behaviour change, particularly in weight loss (>2.4%), reducing waist circumference (1.5%) and increasing total number of step-counts. Although the participants did not meet the primary outcome (>3% total bodyweight loss), we think this short, small-scale intervention was trending other successful studies, in which a 3–7% weight loss occurred over a longer time period.[33] Previous studies[19,26,37] have shown that a longer time frame may yield more significant results. However, given the exploratory nature of the co-designed approach and focus on Pasifika youth-led work, this project provided useful observations and understanding on the role of ‘youth health advocacy’ and ‘community mobilisation’. For example, developing and utilising the capacity development of young people within a community has shown to be successful in this study, and the reason behind this is likely due to the employment of local social capital, the acceptability of the intervention, the community culture and the availability of resources and support from within communities themselves. Anecdotally, the Pasifika youth and the community established a sense of belonging and ownership of the project, and as such this project may not have yielded significant positive results if the youth had not established relationships or held familial connections within their community.

Few studies have reported on engaging minority (eg, Pasifika) or indigenous (eg, Māori) youth groups in co-designing and leading community-based health interventions. A recent systematic review of youth peer-led health promotion in Canada, New Zealand and Australia and the US reported limited high-quality evidence of youth-led interventions in health promotion. The majority (n=20) of these studies focused on sexual health interventions and the limitations of engaging indigenous populations due acceptability, culture, available resources and materials and the social deprivation of the target population.[21] Our study was able to show the success of building youth and community capacity for transforming knowledge and skills into actionable knowledge. As an example, at the conclusion of the project intervention, some youth utilised these skills and knowledge and planned and implemented their own intervention at their church (The Fanongo ki he Ui Biggest Loser Challenge) to support the efforts of their own community. Their eight-week programme focused on health education, diet and nutrition and health and exercise. Further insights and examples of actionable knowledge will be published separately.

Although the study was not set up to rigorously compare outcomes between the two intervention communities, we conducted an exploratory analysis of the changes in weight, waist circumference and physical activity/steps between the communities. These findings suggest differences between the rural and urban community intervention sites. Specifically, results show that the intervention had a greater impact in the rural community, as indicated

in the higher negative percent changes in weight and in waist circumference, compared to the urban community. This finding may be explained, in part, by the rural community being observed operating more collectively as a social cohesive unit and being made up of families and neighbours who know each other well; therefore, they provided better support and motivation than the urbanised community, where the neighbours and family nucleus was not a key factor in the make-up of the youth or intervention groups. An unexpected and counterintuitive finding was that those participants who did not attain a high volume of step counts showed a higher percent weight loss compared to those who reported a higher volume of step counts (−3.12% vs −2.20%, respectively). This could, in part, be explained by issues with the pedometers in providing accurate measurements, or the limited timeframe of the physical-activity-based intervention (eight weeks) compared to other intervention-based studies, which ranged in duration from 36 weeks to 12 months.[33,38] Additionally, our study found that the 10,000 steps per day programme, defined as the 'prescribed approach to promoting increased physical activity' (particularly among overweight and obese middle-aged adults),[33] was a struggle for our intervention participants to achieve. Yet, our participants achieved a minimum level of physical activity and continued to show a significant improvement in weight loss (achieving the primary outcome of >3% bodyweight loss particularly for the rural community participants). Regardless, the overall average number of step-counts achieved approximately 67% of the targeted 70,000 steps over a seven-day period, and the significant weight loss achieved in a short period of time re-affirmed the success of the co-designed and youth-led intervention approach.

Limitations

There were evidently limitations to this study:

- The small sample size of the community-based interventions, and the non-responders (defined as those participants that did not provide sufficiently complete data (n=6) for all variables) meant that the findings are only relevant to those study participants that completed the intervention.
- There was a lack of research protocol in ensuring the youth and community facilitators recorded data efficiently and completely, which was in part due to the exploratory nature of the study aimed at allowing youth and communities to take more ownership of the intervention and data. However, we think this will strengthen over time, as communities build their research capacity.
- There was a lack of information to measure nutritional habits, as the young researchers deemed it manageable only to focus on the physical activity component of the intervention. Additionally, we did not include a food frequency questionnaire, so to avoid over-burdening the youth and community facilitators with more research processes than were necessary.
- The restricted timeframe to implement the intervention (eight weeks) meant that the benefits of the intervention were short-lived for both the youth and participants. Co-design planning will need to consider future provisional plans for the sustainability of the intervention.

- The co-design approach to planning the intervention resulted in the inability to control for confounding factors in the analyses due to the aforementioned limitations.

Despite these limitations, the research team have gleaned significant learnings for future co-designed community-based intervention projects that involve young people and indigenous communities. The learnings achieved, and the lived-experiences of the participants, youth and their communities, are considered as perceived advantages of the co-designed and youth-led approaches to community-based interventions of prediabetes risk, and arguably this should be viewed as outweighing the limitations of the study.

Conclusions and recommendations

The success of our intervention was based on the co-designed approach of the study. It enabled Pasifika youth and their respective communities to confidently lead the intervention using their own resources and tailoring the intervention to meet the needs of their community. Thus they developed a sense of ownership of the intervention programme. The achievement of more than 2% weight loss over a short period of timeis a strength compared to longer studies, and this is indicative of the capability of the youth and community facilitators to motivate behavioural change. Another important learning of this study was shown in the high retention of the intervention participants, which provided pragmatic results (26 of the 32 completed the intervention) over the eight-week study. This can be attributed to the close connection between the youth and community facilitators and the participants in the communities. These learnings, and the experiences of the participants, youth and their communities, are considered as perceived advantages of the co-designed and youth-led approach to our community-based intervention of prediabetes risk, and arguably this should be viewed as outweighing the limitations of the study. Finally, we recommend to researchers who work closely with indigenous and minority communities to consider a co-designed approach, which enables community partners to take on an equal role as partners when developing community-based interventions.

Acknowledgements:

We are indebted to the Pasifika communities and their members for participating in this study. We also acknowledge the efforts of everyone that was involved in the overall PPYEP project, particularly the youth.

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Table 1:

Baseline characteristics.

	N	%
Intervention site 1	15	46.9
Intervention site 2	17	53.1
Male	5	15.6
Female	27	84.4
Ethnic group		
Māori	1	3.4
Samoan	1	3.4
Cook Islands Māori	10	34.5
Tongan	14	48.3
Niuean	1	3.4
Other	2	6.9
Missing n=3		
Comorbidity		
Asthma	1	3.1
High blood pressure	2	6.25
Diabetes	1	3.1
Smoker		
Ever	6	18.7
Never	19	59.3

Table 2:

Pre- to post-intervention change in anthropometric and physical activity measures.

Variables	N*	Mean %	95%CL for mean	SD	95%CL for SD	P-value
% change in weight	29	−2.43%	−3.65 , 1.20	3.22	2.55 , 4.36	0.0004
% change waist circumference	29	−1.58%	−3.15 , −0.01	4.14	3.28 , 5.59	0.0491
% change in hip girth#	29	−0.98	−3.09 , 1.12	5.54	4.39 , 7.48	0.347
Total step#	26	47,252	40,462 , 54,043	16,811.1		<0.001

N*=Missing numbers between 3-6; %=percent

#=average; 95% CL=95% confidence limits.

Table 3:

Differences between high and low steppers.

Stepper	Mean	95% CL for mean
High steppers (n=19)		
% change in weight	−2.20	−4.03 , −0.36
% change waist circumference	−0.93	−2.29 , 0.44
% change in hip girth[#]	−0.04	−1.19 , 1.84
Low steppers (n=7)		
% change in weight	−3.12	−5.77 , −4.46
% change waist circumference	0.36	−4.40 , 5.13
% change in hip girth[#]	−4.89	−13.24 , 3.44

%= percent

[#]=average; 95%CL=95% confidence limits.