Co-designing a community-based intervention for prediabetes among Tongan youths in New Zealand.

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ABSTRACT

The Tongan population is the second largest Pacific ethnic group in New Zealand, and they have a high rate of prediabetes, characterised by high obesity, hypertension, sedentary behaviours, and unhealthy diets. Addressing this condition through a Tongan community centred based programme, the progression of type 2 diabetes and future health complications can be prevented. **Aim:** The overall objective of this study was to investigate the Tongan youths and adults' understanding of prediabetes by mobilising them into collective actions to lead healthier lives. **Methods:** There were three phases of this study. *Phase one* explored the perception and understanding of prediabetes and its impact on health and well-being among 8 youth and 11 adults. *Phase two* applied the Bratteteig co-design methodology to co-develop and implement a community-based intervention called *Polokalama mo'ui lelei* to address the main characteristics of prediabetes (diet, physical activity, weight management and enhanced knowledge about prediabetes). *Phase three* involved two online focus groups (youth group=4, adult group = 3) to evaluate the effectiveness of the *Polokalama mo'ui lelei.* **Findings:** *Phase one* findings highlighted that the Tongan youth and adults have limited knowledge of prediabetes which was attributed to the lack of understanding and access to health promotion services. This was compounded by generational health information that had been conceptualized within families, further enhancing their limited understanding. *Phase two* of the co-designed program showed improvements in weight management measurements; however, the number of participants was too small (n=10) to infer meaningful findings. *Phase three* findings highlighted key barriers for accessing the program, such as household income, education and motivation factors, and socio-cultural and economic factors. **Conclusion:** Education and knowledge about prediabetes was viewed as a major issue for the Tongan community members when they had learnt about it. The co-design approach in phase two was demonstrably a socially relevant approach to undertake with the Tongan community,

but the method used was not a culturally relevant approach. As a result, a major development from this study was the establishment of the *Fengaueaki Fakataha* model, a new Tongan model of health. This model provides Tongan cultural insights and protocols which help explain the findings, and it could be used as a guide for conducting future research when working with Tongan communities.

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1 Pita 4:10

God has given us A GIFT from his great variety of SPIRITUAL GIFTS. Use them well to serve one another.

1 Peter 4:10

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Chapter 1: TALATEU (Introduction and overview)

1.1 My personal journey.

I am the eldest granddaughter of Viliami Totomoeila and Laiti Uingi Pulu (paternal side) and the eighth eldest granddaughter of Aisake Laisenia and Serai Ravutu Kabukeinadave (maternal side). My father Taufa Tahi Pulu hails from the village of Tongoleleka, and Kotu Ha'apai, Tonga. My mother, Alisi Tinaitakala Kabukeinadave comes from the village of Mualevu in Vanuabalavu, Lau and from the village of Yavusania in Nadi, Fiji. Although I have strong connection to both my Fijian and Tongan heritage, my upbringing was strongly embedded in the Tongan culture or way of living known as the *anga fakatonga.* The *anga fakatonga* encompasses all values, beliefs and practices regarded as elements of Tongan culture and traditions (1). As the eldest granddaughter in my Tongan *kāinga (extended family),* there is an expectation to do well at school, to know the cultural protocols and traditions, as well as fulfill various cultural responsibilities. The responsibility I was born into meant that I needed to portray a good role model to the younger generation. It also meant preserving and passing on the cultural teachings of my ancestors and to care for the health and well-being of my *kāinga.* These expectations and responsibilities weighed heavy on me, and my dad would often say "*Ko koe lahi taha 'aipe kātaki ke lahi pea ke 'ofa ki ho kāinga*" which translates as "You are the eldest, therefore have a big heart to be patient, forgiving and bear all the responsibilities, as well as love your family." These words go beyond to emphasize the blessings that comes with fulfilling my responsibility to others and how my actions and words reflect my family and the values they instilled in me.

Both of my parents grew up in the Seventh Day Adventist church where my dad later became a church pastor, and my mum became a high school science and math teacher. They served the church for more than 20 years. Growing up in Tonga, we were very much involved in

community outreach programmes conducted through the church. The passion my parents had for serving others was a major part of my upbringing which gave me a sense of responsibility for my community. In 2006, my family migrated to New Zealand to further our (my siblings and I) education. I completed high school and continued to university. Upon completing my Bachelor in science, I did a master's degree in health psychology. While studying fulltime I was involved in many community events from volunteering for the Victim support organization, facilitating Pasifika suicide prevention workshops in South Auckland, to being involved in Prostate cancer and Hospice charities. I later discovered that I was very much interested in Pacific health and therefore pursued a PhD pathway.

I specifically focused on the Tongan community because I was able to relate to the people and understood the Tongan values, and worldview as characteristically communally oriented and collective. Consequently, the benefit of the collective group was always important and taken as a priority. An aspect of prioritizing the greater good of the group was through means of *fua fatongia* (fulfilling one's responsibility) to the *kāinga*, church and community (1). Therefore, my way of *fua fatongia* was practiced through conducting this PhD research to positively contribute to the health and well-being of the *kāinga*, church members, and Tongan community.

1.1. Health issues in Pasifika communities.

In Aotearoa New Zealand, many Pasifika communities are thriving in education, employment and business, sports, music, language, arts, and culture, yet they experience poorer health outcomes and inequities compared to many other ethnic groups. Pasifika peoples have a high chronic non-communicable disease (NCD) burden, especially from cardiovascular diseases (CVDs) and type 2 diabetes mellitus (T2DM). CVDs are New Zealand's number one cause of death which refers to any heart disease that involves narrowed or blocked blood vessels (e.g., acute coronary syndrome, heart attack, congenital heart disease) (2). On the other hand, T2DM is the most common form of diabetes, which results from the body not creating enough insulin (a hormone responsible for transporting sugar from the bloodstream to the cells to use for energy) to keep blood glucose (sugar) levels within the normal range (between 4 and 8mmol/L). With T2DM, the body either does not produce enough insulin or the cells in the body do not recognize the insulin that is present, which causes high levels of glucose in the blood (3). Pasifika peoples experience risk factors for T2DM at a younger age, and therefore increasing the prevalence of prediabetes.

1.2. Prediabetes stage: Preventing CVDs and T2DM.

Prediabetes is a serious health condition where blood sugar levels are higher than normal, but not high enough to be diagnosed as T2DM. Although it places people at higher risk of developing T2DM and CVDs, following a healthy lifestyle may increase the chance of delaying or preventing both conditions from developing. Interventions that have been implemented in the community rarely include end-users, such as Pasifika peoples, as part of the research planning and implementation. This can be attributed to the Western research approaches that unintentionally silence, rather than foster, individual participants' voices (2, 4-6). Furthermore, Western approaches focus on scientific methods that typically exclude the

indigenous ways of being or interpretation. Subsequently, health researchers lose the opportunity to harness the end-users' unique contributions, experiences, perspectives, and knowledge that would better inform the development of culturally tailored effective interventions (7-9).

1.3. Community participation.

Health researchers must consider the varied nature of relationships and networks, and how they may work together synergistically to meet peoples' needs and ensure that community participation is an essential component in health research. Therefore, the community-based participatory approach has been considered more effective particularly in socially disadvantaged communities. Research shows that intervention programmes that use a culturally and community-centred approach are far more likely to be effective in addressing social and health conditions, such as prediabetes (10-12). Such an approach will give communities some control over their affairs and a sense of ownership and empowerment which have the potential for greater uptake and sustainability of a programme.

1.4. An ethnic-specific approach.

Many of the Pacific health interventions (12-14) often take a pan-Pasifika approach that responds to a number of indigenous Pasifika ethnicities through shared values such as reciprocity, relationship, respect, and being community oriented. Given the diversity and heterogeneity of the Pasifika population, conducting ethnic-specific research can lead to a more in-depth understanding of the research processes. Ethnic-specific research focuses on specific Pasifika groups rather than grouping them under the Pasifika umbrella. Further, it embraces cultural diversity and maintains a sense of autonomy and self-determination in each respective community (15-17). Hence, this study took an ethnic-specific approach to focus solely on the Tongan population. To date, there is limited research regarding addressing

prediabetes in Tongan communities. Since the Tongan population is youthful, with a median age of 20.5 years, the current study chose Tongan youths between the ages of 18-24 years old as the research target population. Additionally, the current study aimed to investigate the Tongan youths' understanding of prediabetes and addressed specific risk factors by empowering them to use collective actions to lead healthier lives.

1.5. Thesis outline.

To contextualize the research aim mentioned previously, the following Chapter 2 'PUIPUITU'A (Background)' provides an overview of the research context, the research objectives, and the impact of prediabetes on Pasifika communities and New Zealand in general, including the current data on the prevalence of prediabetes and interventions that have been conducted amongst ethnic minorities. It highlights the gaps in the research literature regarding addressing key risk factors of prediabetes amongst the New Zealand Tongan population, and the importance of using an ethnic-specific approach in addressing their health issues. Additionally, Chapter 3 'FOUNGA NGAUEAKI (Methods and resources)' discusses the data collection and analysis method used in the study. It provides an explanation and justification for the research methods used, as well as explain the data collection methods with a particular focus on the scope and parameters used. Thereafter, Chapter 4 'OLA 'O E FEKUMI (Findings)' presents the data analysis and findings of the study and in Chapter 5 'PŌTATALA (Discussion)' the findings are interpreted and explained with provisions of their implications on the Tongan community. Finally, Chapter 6 'FAKAMĀ'OPO'OPO (Conclusion and recommendations)' outlines the strengths, limitations and recommendations of the study and final concluding remarks of the research.

Chapter 2: PUIPUITU'A (Background)

1.2 Understanding the research context.

In Aotearoa New Zealand and abroad, the increase in T2DM is directly linked to increasing rates of obesity and overweight. There is an increasing incidence of early onset of T2DM which puts more people at risk of health complications and early mortality (18). The 'PUIPUITU'A' (Background)' chapter lays a foundation for the research by providing essential context. The subsequent sections of this chapter will provide a comprehensive breakdown of the impact of T2DM amongst New Zealanders including Tongans and Pasifika people and explain the significance of the study and how it fits into the existing body of knowledge within the public health field. This chapter will draw upon relevant literature regarding community-based interventions and risk factors for T2DM particularly in ethnic minority communities and present the research objectives. It will also provide a brief overview of the rationale behind the chosen research methods.

A report from Langimalie Health Centre (a Tongan health provider in Auckland, New Zealand) provided insight on the distribution of age among patients with T2DM. The 1,166 Tongans with T2DM on its register represented 17% of the total number of patients enrolled. Amongst those with T2DM, 89% were older than 45 years old and were mostly females (57%) and 11% of the patients were in the 15-44 age bracket (19). Although not much is known about the prevalence of T2DM in the Tongan population, research show that they are exposed to greater risk factors including smoking, alcohol, poor nutrition, and obesity. Majority of the Tongans living in New Zealand have adverse socio-economic circumstances and are unable to access factors (e.g., healthy nutrition, quality housing) that support health living resulting in developing prediabetes (20). However, there is limited ethnic-specific

research on implementing lifestyle interventions to address prediabetes among the Tongan community.

Employing a community-based participatory research (CBPR) and co-design approach was considered the most appropriate methodology for the current study, as it engaged the Tongan community in all aspects of the research process, and it was built upon existing community relationships and strengths. The CBPR approach further enabled the Tongan community to be equal partners in the research process and identified aspects of inquiry outside the Westernised research paradigm. Furthermore, it helped build public health capacity in the Tongan community and empowered them to find solutions to health issues. The CBPR and co-design approaches also involved letting go of prior assumptions and actively learning from and working with each other as equal partners. While working alongside the Tongan community, they were able to create a culturally appropriate intervention fitting for the context of Tongan peoples' lives.

The original idea of the current study stemmed from the Pasifika Prediabetes Youth Empowerment Programme (PPYEP) research project which involved researchers working in a collaborative partnership with Pasifika communities. This community-based research project investigated empowerment and co-design modules to build capacity of Pasifika youth to develop community interventions for preventing prediabetes. The evaluation of the PPYEP showed the importance of trust and reciprocity in community partnerships, the capacity and capability of youth advocacy, and the value of a community-centred and culturally relevant approach to healthy interventions. Recommendations from this research project emphasized that researchers developing community-centred interventions work closely with indigenous and consider a co-designed approach, enabling community representatives to take on equal roles as decision makers in the research (21). The current study builds on the knowledge-based on co-design and prediabetes intervention derived from the PPYEP project to focus

specifically on the Tongan community context. There is scarce Pasifika ethnic-specific research on community-based interventions that utilises co-design with end-users. This study focuses on the Tongan ethnic group to provide Tongan-specific solutions to health issues. The Tongan youth dominate the composition of the New Zealand Tongan population, and they have a high risk of developing prediabetes (see below), thus they are a key focus group of this research. The current study aims to examine the Tongan youths' and their family members' understanding of prediabetes and to reduce the prevalence of prediabetes by empowering Tongan youths within their communities to use collective actions to lead to healthier lives.

1.3 Study objectives.

The specific objectives of this study were:

1) To examine Tongan youths' (18-24 years old) perceptions and understanding of prediabetes, including identifying the barriers to leading healthier lives.
2) To develop a culturally relevant community-based intervention programme aimed at addressing risk factors for prediabetes among Tongan youth.
3) To evaluate the effectiveness of the co-design approach and the intervention programme, particularly on community-uptake and relevance to the Tongan community.

1.4 Tongan communities and youth in New Zealand.

Based on the 2018 Census data (22), within the New Zealand Pasifika population, the Tongan population are the second largest Pasifika ethnic group. The Tongan population has a median age of 20.5 years in comparison to the European population (41.4 years). Over 75.7% of the Tongan population reside in Auckland, with 64.4% of Tongans are born in New Zealand, compared to 35.6% of Tongans who are born overseas (23). A large proportion of Tongan

families live with extended families due to high living costs (20, 24). Statistics New Zealand (24) reported that the proportion (40%) of Tongans living in extended families was higher than the corresponding proportion (20%) of the New Zealand population. In the 1960s and 1970s, an influx of Tongan immigrants arrived in New Zealand to pursue work opportunities, and they continued to migrate to help family members, entering the country through the Pasifika access category offered by the New Zealand government (25). Tongans brought with them their culture, traditions, and Christian beliefs and established a collectivist. A collectivist has been defined as emphasizing the needs and goals of the group over the needs and desires of individuals (26). In a collectivist culture, relationships with other members of the group and the interconnectedness between people play a central role in each person's identity (20, 27).

1.4.1 The anga fakatonga in Aotearoa New Zealand.

Although Tongan people are far from their ancestral home, their communities continue to embrace the *anga fakatonga in* Aotearoa New Zealand. There are four values (*fefaka'apa'apa'aki, feveitōkaiaki, tauhi vā, and fakatōkilalo*) that underpins the *anga fakatonga* (28-30). An important value of the *anga fakatonga* is the concept of *fefaka'apa'apa'aki* or mutual respect. It is deeply engrained in the way people interact with each other despite one's age, social status, or background. Further, *fefaka'apa'apa'aki* encompasses reflecting kindness via the language used, gestures and behaviour one exerts when interacting with others, as well as respecting people's heritage, customs, environment, ancestors, spiritual beliefs, and traditions. Another value that is central to the *anga fakatonga* is *feveitōkaiaki* which refers to sharing and fulfilment of mutual obligations. *Feveitōkaiaki* highlights the significance of helping one another, sharing resources, and working together for the collective wellbeing of the community. This practice is often observed in Tongan

social gatherings, where community members gather together to assist in various tasks, such as preparing feasts, building houses, or celebrating events (28, 29).

In the *anga fakatonga* building and maintaining strong relationships or *tauhi vā* is of utmost importance as it emphasizes the interconnectedness and reciprocity within relationships, whether they are familial, social, or communal. *Tauhi vā* is more than just a conceptual idea, it involves specific practices and behaviours that contribute to nurturing and preserving relationships. This is highlighted in the way Tongans emphasize *tauhi vā* in traditional ceremonies (e.g., weddings, graduations, funerals, milestone celebrations, *kava* drinking) where people exchange gifts, affirm the interconnectedness of individuals, and foster a sense of community and togetherness (31, 32).

Moreover, *fakatōkilalo* refers to the act of showing humility and generosity when interacting with people. When an individual engages in *fakatōkilalo* they are demonstrating their acknowledgement of another person's position or authority and expressing their willingness to show respect by humbling themselves as a sign of deference. This practice can be observed in various contexts, such as when greeting elders or people of higher social status, participating in formal ceremonies, or addressing leaders. These values '*fefaka'apa'apa'aki, feveitōkaiaki, tauhi vā, and fakatōkilalo*' play a crucial role in shaping the Tongan peoples' behaviour, interactions, relationships, and the overall cohesion of the Tongan community. Though aspects of these values are traditional, it continues to hold relevance and significance in the Tongan communities in Aotearoa New Zealand (20, 29).

Tongans often take pride in preserving their cultural heritage and passing it down to future generations. There are number of elements that are usually identified as centrally important to the *anga fakatonga* including family and community, respect for hierarchy and tradition, Christian faith, gender roles, and feasts and celebrations (27, 29, 31, 33-37).

1.4.1.1 Family and community.

For Tongans, the concept of self is interwoven with the family and community dynamics. They have a collective identity that is intricately connected to one's familial and communal relationships. Consequently, their reputation and standing within the community reflect not only their actions but also the honor and integrity of their family. The family and community are social structures that influence individual behaviours, interactions, and roles within the broader context (36). Tongan families are socially structured and organized by the *nofo 'a kāinga* (dwelling of the family) concept, which encompasses immediate and extended family members. The relationship between members of the *kāinga* (immediate and extended family) is reciprocal and interdependent, with each member fulfilling an expected role and responsibilities to one another (1, 30). The *nofo 'a kāinga* concept serves as a social welfare system where the *kāinga* are supportive in various aspects of Tongan peoples' lives, including family and church obligations, caregiving, and child-rearing. Within the *nofo 'a kāinga* system there are certain taboos that are accompanied with respect or *faka'apa'apa* behaviours and language between brothers and sisters, children and their parents, cousins, grandparents, and other extended family members. This *faka'apa'apa* aspect is reflected in how brothers and sisters are not allowed to sleep in the same house or room or discuss any sexual topics (30). Tongans pay their utmost respect to the older generation and the role they play in their families. From a very young age, children are taught values (*fefaka'apa'apa'aki, feveitōkaiaki, tauhi vā, and fakatōkilalo)* that are reflected in how the family is structured, how they prioritize relationships and their responsibility in the family and community (1). Within the family and community there is emphasis on togetherness, respect, and support which fosters a sense of belonging and shared identity among Tongans. The strong bonds of kinship, mutual support, and collective responsibility contribute to the cohesion and

resilience of Tongan society. While modernization has brought changes to these dynamics, aspects of family and community continue to shape the lives of Tongan people (20, 27).

1.4.1.2 Respect for hierarchy and tradition.

In the *anga fakatonga* respect for hierarchy and adherence to traditional protocols are evident in family gatherings, religious events, and cultural ceremonies. The use of formal language and proper titles when addressing individuals of higher rank is still practiced, reinforcing the importance of respect and deference. Traditional titles and ranks are highly regarded, and proper etiquette and respect for authority are essential (37). One example in which respect for hierarchy and tradition is manifested in the *anga fakatonga* include the elders holding a revered place in the family, community, and customary practices.

1.4.1.3 Christian faith.

Another important feature in the lives of Tongan people is their Christian faith. Christianity is embedded in the *anga fakatonga*, and the church is where their Christian faith, traditional values and beliefs are nurtured and maintained (20, 38, 39). The church is an influential institution that shapes the Tongan peoples' cultural, spiritual, health beliefs and economic life and has become intertwined with their daily routines and decision-making processes. The church also plays a role in preserving the Tongan cultural traditions and conduct activities beyond worship namely community-building initiatives such as social welfare programs, education, and other services that contribute to the well-being of the community. Given that the church constitutes the essence of *anga fakatonga*, the influence of church leaders in Tongan communities provides the platform to explore how community-based strategies within the Tongan cultural framework can extend knowledge of and responses to health issues (39-41).

1.4.1.4 Gender roles.

Gender roles in the *anga fakatonga* are traditionally defined by distinct responsibilities and expectations for men and women. Some aspects of the traditional gender roles still hold significance in Tongan communities (27, 37). Many Tongan ceremonies and rituals are gender-specific and this is reflected in *kava* ceremonies where men gather in a designated space to prepare and consume *kava*, whereas women play supporting roles in preparing food and facilitating the overall event. Additionally, in church, men often hold leadership positions within the churches while women play active roles as participants and supporters of religious activities.

Within the immediate family, the father is traditionally the provider of the family's income. The mother on the other hand, is expected to tend to the children, do household chores and prepare food. The father of the household often holds authority and makes major decisions, whereas the mother hold a central role in the family structure and maintaining family ties. Moreover, the women are involved in caregiving, nurturing, and passing down cultural traditions and values to the next generation. In general, these gender roles are evolving and adapting to changing social and economic dynamics (27, 42).

1.4.1.5 Feasts and celebrations.

Feasts and celebrations hold immense significance in the *anga fakatonga*. They serve as a means of expressing respect, unity, and cultural identity. At these feasts and celebrations, traditional foods like *lū sipi* (stuffed lamb in taro leaves), *'ota ika* (marinated raw fish), *talo* (taro) and *'umu* (earth oven-cooked dishes) are often prepared and shared among family and community members. The sharing of food symbolizes a spirit of reciprocity, where everyone contributes and benefits collectively. In addition, traditional music and clothing also play a vital role in these events, showcasing the depth of *anga fakatonga* and pride. During these

special celebrations whether it's held at the church, within the community or family Tongans place emphasis on hospitality, generosity and sharing of resources (30, 43).

1.4.2 Intergenerational views of the anga fakatonga.

The older and younger generation have a heterogeneous view of *anga fakatonga*, where the older generation seems to hold on to traditional *anga fakatonga* in which Tongan values are crucial in maintaining identity and success (the ability to contribute to the extended family and fulfilling community obligations (20). On the other hand, the New Zealand Tongan younger generation is exposed to greater material wealth, less traditional customs, and more flexibility in adapting both Westernised and Tongan cultures. There are aspects of the *anga fakatonga* integrated with mainstream New Zealand culture and behaviours to allow adaptation, survival, and a degree of flexibility (20, 34, 44, 45). For instance, traditional wedding ceremonies would take one to two weeks to fulfil cultural protocols; however, these practices no longer exist because families live in a Western capitalist context and need to work to cover living expenses. Despite aspects of the *anga fakatonga* adapting and changing over the years, Tongans continue to take pride in their cultural identity (20, 46, 47) which is also reflected in the Tongan diaspora. The Tongan diaspora play a role in the preservation, adaptation, and evolution of the *anga fakatonga*. While challenges exist, the efforts of Tongans living in New Zealand and abroad to maintain their cultural identity, traditions, and connections with their homeland contribute to the rich tapestry of global cultural diversity (1, 31).

1.4.3 The Tongan peoples' socio-economic status.

The majority of Tongans are in low-income job occupations, which affects their quality of life. According to the New Zealand 2018 Census, more than half of the Tongan population receives an annual income of $21,000 or less (23). Of those employed, the majority are

between the ages of 15 and 29 years. Most Tongans receive low income resulting in parents working two to three jobs to make ends meet, and many families live in overcrowded houses. The impact of receiving less income takes a toll on every other aspect of their lives, including their health. Since they are unable to access factors such as healthy foods and quality housing that support good health, they are exposed to greater risk factors such as poor nutrition and obesity, high risk unhealthy behaviours (smoking and alcohol), which lead to poor health outcomes (20, 48).

1.5 The health of the New Zealand Pasifika population.

1.5.1 Ethnic diversity in New Zealand.

Aotearoa New Zealand has an ethnically diverse population composed of: Europeans (70.2%), the largest group, followed by Māori (16.5%), Asians (15.1%), Pasifika peoples (8.1%), Middle Eastern/Latin Americans/Africans (1.5%) (49). The Pasifika population is one of the fastest-growing ethnic groups in New Zealand. Based on New Zealand's 2018 Census data, the Pasifika population increased from 7.4% (295,941) to 8.1% (381,642) with a medium age of 23.4 years old compared to the 38.0 years for the general population (50, 51). Additionally, over 35.7% of the Pasifika population are under the age of 15 years, compared to 20.4 % of the total population (51, 52), and thus Pasifika peoples are described as being youthful.

1.5.2 The New Zealand Pasifika population.

The term 'Pasifika peoples' refers to individuals who identify themselves with at least one of the ethnic groups originating from the Pacific Islands of Polynesia, Micronesia, and Melanesia (53). There are more than 40 different Pasifika ethnic groups in New Zealand with various cultures, languages, and histories (54, 55). However, most Pasifika peoples can identify with one or more of the following ethnic groups: Samoan (182,721), Tongan

(82,389), Cook Islands (80,532), Niuean (30,867), Tokelauan (8,676), Fijian (19,722), Tuvaluan (4,653), Kiribati (3,225) and Rotuman (981) (51). Statistics New Zealand (51) highlighted that 91.9% of the Pasifika population lives in the North Island, with almost 63.9% residing in Auckland alone, mainly in the South Auckland region. While Samoans make up the largest proportion of the Pasifika population, they have the slowest population increase growth (10%) compared to Kiribati (90%), Fijian (47%), Tuvaluan (35%) and Tongan (20%) ethnic group (48, 56, 57). Pasifika peoples have assimilated into the Western culture, yet they continue to maintain strong links with the Pacific Islands through family, culture, history, and language (17).

It has been projected that Pasifika people will make up 10% of the general population by 2026 (56), in part due to Pasifika women having higher fertility and teenage pregnancy rates compared to the general population. Pasifika health review reports show that their fertility rate was 2.73 births per woman, compared to the national rate of 2.02. Also, Pasifika teenage pregnancy rates were three times higher than the New Zealand European teenage pregnancy rates (25). Overall, these changing characteristics and distribution of the projected New Zealand population are useful for developing social policies in areas such as education and health for Pasifika peoples. For instance, where different ethnic groups experience different health conditions, ethnic projections can help identify likely future health service needs (57).

1.5.3 Health equity.

Health influences all aspects of people's lives from birth throughout childhood, adolescence, and adulthood. The World Health Organization (WHO) (58) defines health as "a complete state of physical, mental and social well-being, not merely the absence of disease or infirmity". According to the Ministry of Health (MoH) (59), good health benefits other aspects of people's lives. For example, parents who have good health and mental well-being

can support the social development, educational outcomes, and lifelong experiences of their children, wider families, and community.

The New Zealand Public Health and Disability Act 2000 emphasizes pursuing health equity in which people of various ethnic groups require different approaches and resources to achieve equitable health outcomes. Under the same Act, strategies highlighted the direction for the health and disability sectors and the government's priorities, which include goals and objectives to improve health outcomes and reduce health disparities between all New Zealanders, particularly for Māori and Pasifika peoples. In doing so, a holistic concept of health that differs from the Western biomedical model has become more acceptable because it does not separate people from their social, cultural, and physical environment. This concept of health is woven into the fabric of New Zealand society and has prominence in Māori and Pasifika models of health and well-being (60).

1.5.4 Socio-economic determinants of health.

There is increasing recognition of the role various social, economic, environmental, and political factors play in determining health experiences and outcomes for individuals and social groups (61, 62). These factors interact and impact people's health outcomes. There is strong evidence that socio-economic factors have the greatest impact on the health of the New Zealand population (63-65). The socio-economic determinants of health refer to the circumstances in which people are born, live and work in, as well as the wider set of systems or forces shaping the conditions of their daily life (66). These include income, employment status, housing, and education which operate independently, and they can have both direct, indirect, interrelated, and cumulative effects over a lifetime (63, 67, 68).

People living in the most socio-economically deprived areas experience worse health outcomes than those living in the least deprived areas. For instance, Simpson et al. (2016)

(69) highlighted that between 2009 and 2013, children aged 0 to 14 years from the most deprived neighbourhoods had higher rates of hospital admissions than children from the least deprived neighbourhoods. Those with inadequate housing, low levels of education, higher levels of unemployment and low income have difficulties accessing health services and have greater exposure to health risks (70, 71). A person's level of education also affects their income and job opportunities and subsequently have an impact on accessing adequate housing and health services (63, 71, 72). Disparities in socio-economic determinants create unfair and avoidable differences in health for individuals, families, and communities. The negative impact of socio-economic determinants on the Pasifika peoples' health has been consistently reflected by their poor health outcomes and reduced life expectancy (44, 64, 65, 73-75).

1.5.5 Non-communicable diseases and Pasifika peoples.

Non-communicable diseases (NCDs) are conditions that are not acquired by transmission between people, and include CVDs, cancer, diabetes, and chronic respiratory diseases. These NCDs are the primary causes of morbidity, mortality, and health disparities in Aotearoa New Zealand. As reported by the MoH (76), diabetes is closely linked with CVDs, particularly T2DM. People living with T2DM are twice as likely to develop CVDs, and together are responsible for the increased deaths among Pasifika peoples each year compared to any other conditions (2). Pasifika peoples have the highest burden of T2DM compared to other ethnic groups in New Zealand (55). They are diagnosed at a younger age with prediabetes and are more likely to have poorly controlled T2DM (44, 73, 74). Considering that Pasifika peoples have a more youthful age structure (50, 51, 77), this infers a longer period of exposure to unhealthy lifestyles and other health-related issues (e.g., lack of health service uptake).

1.5.6 Pasifika peoples' view on health.

Pasifika peoples have beliefs about individual health, family, community needs and realities that differ from New Zealanders (53). For Pasifika people, good health is achieved when there is a positive and balanced relationship between the cultural, spiritual, and environmental dimensions. Their understanding of health tends to be characterized by a holistic perspective, where healthy and strong families are the basis for the well-being of individuals and communities (53, 78, 79). These beliefs influence their health choices and behaviours, and therefore impact on health decision-making behaviours (e.g., avoiding doctors' visits and health interventions) (44, 78). Despite Pasifika peoples having adverse socio-economic circumstances, their community involvement, strong cultural resources with strong family ties, church affiliation and community support serves as a protection mechanism. The collective strength and responsibility within Pasifika families and communities assert that the key to promoting a healthy lifestyle and services is through working with families and communities (80).

Like all New Zealanders, Pasifika peoples desire good health and well-being. Consequently, the New Zealand government created the 'Ola Manuia': Pacific Health and Well-being Action Plan 2020-2025' to help achieve equitable health outcomes for Pasifika peoples with goals of improving responsiveness to Pasifika communities, contributing to best practice services for Pasifika peoples and their families. In addition, services and programmes targeting Pasifika people should work more collaboratively with other government agencies, the wider health system, and Pasifika communities (81, 82).

Pasifika communities share a broad set of cultural infinities, such as mythology and customary practices, yet exhibit cultural distinctions. Each Pasifika ethnic group have variation in terms of language, migratory experiences and socio-cultural belief systems and

practices (48, 56). While most health research previously focused on pan-Pasifika approaches, there is a dearth of research that investigates the growing diversity and heterogeneity of each Pasifika-specific population and health practices. An important factor for Pasifika health research is considering the specific cultural, ethnic, and social context. Given the diversity and heterogeneity of the Pasifika population, conducting ethnic-specific research can lead to a more in-depth understanding of the research processes. It also gives various Pasifika ethnic communities ways to embrace their own culture and maintain a sense of autonomy and self-determination (83-85).

1.6 Risk factors of T2DM.

1.6.1 Obesity.

T2DM has many risk factors, including age, race, stress, pregnancy, certain medications, genetics, and high cholesterol. However, one of the best predictors of T2DM is being overweight or obese. Almost 90% of people with T2DM are obese (86-89). Obesity is defined as having an excessively high amount of body fat or adipose tissue in relation to lean body mass and it has been described as "one of today's most blatantly visible, yet most neglected public health problem" (p.1) (90). New Zealand has the third highest adult obesity rate in the Organization for Economic Co-operation and Development (OECD) countries (91). There has been an increase in obesity rates among New Zealand adults and children from 2006 to 2018 (91, 92). The national obesity rates among adults have increased from 27% to 32% and children from 8.4% to 10.7% (92). Across all ethnic groups in New Zealand, Pasifika adults and children have the highest obesity rates (59, 93). The New Zealand Health Survey 2018/2019 highlighted a higher prevalence of obesity among Pasifika adults (66.5%) compared to Māori (48.2%), European/other (29.1%), and Asians (13.8%). The prevalence of

obesity among Pasifika children (28.4%) was also higher than among Māori (15.5%), European/other (8.2%) and Asian children (9.9%) (91).

In obese individuals, the adipose cell releases non-esterified free fatty acids, hormones, adipocytokines, and other substances that are involved in insulin resistance, which affects the maintenance of normal blood glucose concentrations (91, 94). The body mass index (BMI) is commonly used to estimate whether an individual is healthy based on weight and height. An individual's BMI is calculated by dividing their weight in kilograms by their height in metres squared (kg/m2). A BMI of 30 or more is considered obese (95, 96). Obesity is a complex, multi-factorial condition that develops from the interaction of genetic, metabolic, social, behavioural, and cultural factors (97). Primarily, obesity arises because of how the body regulates energy intake, energy expenditure and energy storage. Despite the various factors that influence body weight, most experts believe that the rapid increase in the prevalence of obesity is due to an increasing 'obesogenic environment' that promotes over-eating, drinking and limits opportunities for physical activity (98, 99).

There are four obesogenic environments: physical, economic, policy and socio-cultural (100-102). The physical environment encompasses the visible world and the less tangible factors such as the availability of training opportunities, nutrition, and exercise expertise. The economic environment refers to the costs related to food and physical activity. The political environment refers to the rules related to food and physical activity, which includes the laws, regulations, policies, and institutional rules, whereas the socio-cultural environment refers to a community's or society's attitudes, beliefs and values regarding food and physical activity. These environments highlight the surroundings, opportunities or conditions of life that promote obesity in individuals or populations (99). Life-long exposure to the obesogenic environment has arguably contributed to the high prevalence of obesity among the younger generation of New Zealanders, and the co-comorbidity of other NCDs, including CVDs and

T2DM (103). Some researchers have noted that more than a third of the variation in obesity prevalence between communities could be explained by the socio-economic and urban composition of the community, with around a further 10% explained by the ethnic composition of communities (104).

1.6.2 Prediabetes.

Obesity is directly correlated to prediabetes. Prediabetes is a health condition in which blood sugar levels are higher than normal, but not high enough to be clinically classified as T2DM (105). The recommended prediabetes diagnostic screening test utilized in New Zealand is known as the glycated haemoglobin or HbA1c test. Hb is the haemoglobin protein in the blood that carries oxygen around the body. A type of sugar in the body known as glucose can attach to the Hb and form glycated haemoglobin. The higher the glucose levels in the blood, the more it attaches to the Hb, and the higher a person's HbA1c level (106). The HbA1c test measures the concentration of glycated haemoglobin, or sugar attached to blood cells, indicating blood glucose levels over a period of up to 120 days. In New Zealand, prediabetes is defined as having an HbA1c of 41-49mmol/mol, or a fasting glucose concentration of 6.1-6.9 mmol/L or 7.8-11.0 mmol/L through using the Glucose Tolerance Test (106-108). Individuals with prediabetes cannot use insulin effectively, and therefore, they consistently have high blood sugar levels. Between 50-70 percent of people with prediabetes are likely to progress developing T2DM in their lifetime and they are mostly unaware that they have prediabetes until they are formally diagnosed with the condition (105, 109).

Prediabetes can affect peoples' physical health and well-being. Individuals with prediabetes often have the following symptoms: extreme thirst, needing to urinate frequently, dry skin, feeling hungry, blurred vision, feeling drowsy, and their wounds are slow to heal (108). Not all people with prediabetes will experience these symptoms. However, the increase in glucose

levels can lead to serious health complications such as the increased risk of disease of the arteries and damage to the blood vessels, heart, and kidney (105, 110). In contrast, prediabetes can often go unnoticed without any apparent symptoms until T2DM develops (105). There is limited research on the direct impact of prediabetes on health and well-being. However, there is strong research on lifestyle intervention (especially through physical activity and dietary modifications) that have shown to be very successful in reversing the disease.

According to Coppell et al. (2013) (111), approximately 670,000 of all New Zealanders have prediabetes, and 18.6% of the population aged 15 years and over have been diagnosed with prediabetes. It is a growing NCD issue which greatly impacts Pasifika people. Coppell et al.'s 2013 report (111) show a high prevalence of prediabetes among Pasifika people ranging from 13.6% in youth (aged 15 to 24), to 56.9% in adults (aged 65 to 74), compared to their New Zealand counterparts, 7% and 44.5% respectively. Teng et al. (2019) (112) and Mazahery et al. (2021) (113) emphasized that younger people with prediabetes are likely to develop T2DM quicker than older people with prediabetes. Evidence suggests that the prevalence of childhood obesity has increased over the years, hence the early onset of prediabetes (113-115). Pasifika peoples are especially at risk of developing prediabetes, T2DM, and associated comorbidities due to the obesogenic environment (116, 117). The early onset of prediabetes results in worse health outcomes and possible increased morbidity risk and decreased life expectancy (118-121).

1.7 New Zealand specific prediabetes studies.

The disproportionately high prevalence of prediabetes among Māori and Pasifika people in New Zealand has led to the implementation of community-based interventions. Several major T2DM and prediabetes community intervention studies have been conducted in New

Zealand, including the following: Dunedin Community Exercise programme (DCEP) (122); Te Wai o Rona project: Diabetes Prevention Strategy (123); Ngāti and Healthy project (121); Ola Fa'atauta Project (124); Simon et al. (1996) (125), Simon et al. (1998) (126) study and the PPYEP (12).

The DCEP is a 12-week intervention programme comprised of biweekly exercise and education sessions led by health professionals. This intervention programme was designed for communities at high risk of T2DM. Within 12 weeks, two sessions consisting of 45 minutes of physical activity and 45 minutes of exercise were conducted weekly. Higgs et al. (2017) (122) conducted a single cohort study to explore the health outcomes of those who participated in the intervention programme and assessed the health-related physical fitness change. Results show a significant change in the six-minute walk distance (84m; 95% CI 46-121) and a non-significant change in waist circumference.

The Te Wai o Rona: Diabetes Prevention Strategy and Ngāti and Healthy projects were specifically designed for Māori communities. Simons et al. (2008) (123) incorporated the Te Wai o Rona project with the objective to reduce the rate of T2DM among Māori through building on the community and whanau structures already in place. It was incorporated in a randomised trial to test whether intensive lifestyle changes across whole communities over a period of several years can prevent progression to T2DM. The results highlighted the benefits of involving a Māori community health worker in the intervention programme, which was evident in the significant weight loss among all participants (1.3 kg (s.d 3.7 kg), $p< 0.001$).

The Ngāti and Healthy project consist of three main components: local community health promotion programmes; community education programme for high-risk individuals; and the structural strategy (sought to make the local government supportive for people to make sustainable changes). Coppell et al. (2009) (121) employed an interrupted time-series

prevalence survey process to measure its impact in reducing insulin resistance prevalence among participants over two years. The Ngāti and Healthy project was proven effective in terms of reducing insulin resistance (from 35.5% to 25.4%). However, the impact of the intervention was mostly observed among women aged 25-29 years.

The Ola Fa'autauta project is a one-year programme that involves promoting low fat, ad-libitum diets, leisure-time physical activity, and training church members to become leaders of the nutrition education, and aerobic session. Swinburn et al. (1997) (124) employed a quasi-experimental design and implemented the Ola Fa'autauta in three Samoan churches with one church serving as a control group. The results show that nutrition education had little impact on knowledge and behaviour. Despite this, the intervention churches lost an average of 0.4 ±0.3 kg compared to a 1.3 kg ± 0.6 kg weight gain in the control church.

Two research projects conducted by Simmons et al. (1996, 1998) (125, 126) also made an important contribution to community-based interventions implemented in Pasifika communities. Simmons and his colleagues utilized a quasi-experimental design for both research projects. However, they differed in their prevention goals for prediabetes, study duration, and intervention outcomes. Simmons et al. (1996) (125)'s first study implemented the intervention programme over four months, focusing on evaluating the acceptability and impact of a pilot programme for diabetes awareness and exercise. It also included one educator presentation, one video presentation and a four-month exercise problem. Simmon's second study (126) was a two-year programme based on evaluating the impact of a diabetes-related lifestyle programme on diabetes knowledge, exercise habit, dietary habit, and body size. It comprised of diabetes awareness sessions followed by exercise groups, reduced membership fees at the local gym, as well as cooking demonstrations, and local health promotion services involving diabetes community health educators.

Both projects highlighted an increase in diabetes knowledge and the amount of exercise amongst the participants that were in the intervention group compared to those in the control group. Simmons et al. (1998) (126), emphasized that the intervention group reduced their fat intake compared to the control group and that lifestyle changes, diabetes awareness, and empowerment of communities can reduce the risk factors for T2DM. On the other hand, Simmons et al. (1996) (125) incorporated a culturally tailored intervention to further increase peoples' diabetes knowledge and exercise.

Although many of these community-based interventions were led by researchers and health professionals, limited intervention programmes employed a co-design method where participants work with researchers or health professionals in co-developing an intervention programme. An example of a project that utilized a co-design method is the PPYEP which consisted of five interactive co-design modules which was piloted among Pasifika youth from two different geographical communities (12). The youth co-designed an 8-week lifestyle intervention targeting 25–44 year old Pasifika peoples who were at risk of developing prediabetes. The specific objectives of the project included: undertaking a scaled-up version of a previously piloted programme that focused on developing the following: public health capacity and capability of Pasifika youth to address obesity-related health issues; prevention plans that focused on specific risk factors for prediabetes; community activities that lead healthier lives. The results showed an overall decrease in body weight (2.4%), waist circumference (1.6%) and an increase in the average number of daily steps (physical activity) following the intervention. More importantly, there was a high retention of intervention participants (81% completed; 26 out of 32) which highlights the benefits of working closely with communities and using a co-design approach.

Overall, these community-based interventions prioritized cultural-centeredness, community engagement, and integrated knowledge translation by engaging end-users. More importantly,

these interventions were underpinned by Māori (121, 123) and Pasifika (125-127) health concepts, values, and perspectives that fit the context in which the participants lived. All these interventions utilized a holistic cultural approach that were embedded in the community-based intervention programmes. Amongst the community interventions designed for Pasifika people, the PPYEP project was the first to utilize a specific co-design approach for young people, and it was highly adaptable for cultural relevance.

1.8 T2DM.

The diagnosis of diabetes is based on a laboratory test measuring either HbA1c or venous plasma glucose measurements (see table 1).

Table 1

Diagnosis criteria for T2DM.

Criteria
• 2x Fasting glucose ≥ 7.0 mmol/L on different days • 2x HbA1c≥ 50 mmol/mol (6.7%) on different days • (Note: International/ADA definition HbA1c≥ 48 mmol/mol (6.5%) • 2x Random glucose ≥ 11.1 mmol/L on different days • 1x Glucose Tolerance test ≥ 11.1 mmol/L
Or any of the combo:
• 1x HbA1c≥ 50 mmol/mol +1x Fasting glucose ≥ 7.0 mmol/L on different days • 1x HbA1c≥ 50 mmol/mol +1x random glucose ≥ 11.1 mmol/L on different days • 1x Fasting glucose ≥ 7.0 mmol/L + 1x Random glucose ≥ 11.1 mmol/L diabetes on different days

Note. Criteria for testing T2DM and the measurements included.

Diagnosing diabetes requires an HbA1c test that is ≥ 50mmol/mol. There are two main types of diabetes: type 1 (T1DM) and T2DM. Both types of diabetes affect the way the body regulates blood sugar, but T1DM occurs when the pancreas stops producing insulin. Some people are genetically predisposed to developing T2DM based on studies of twins showing that when one twin has T2DM, the other twin is 75% at risk (128). Regardless of the role of

genetics, there is strong evidence indicating that the environment, and lifestyle factors play a major role in the high prevalence of T2DM (122, 129).

The 'Economic and Social cost of Type 2 diabetes' report (130) highlighted that T2DM is a "serious and growing problem that is on a trajectory to reach epidemic proportions within the next 20 years" (p.1) (130). This report further revealed that in the next 20 years, it is projected that New Zealanders suffering from T2DM will increase from 4.7% to 6.6%-7.4% of the population, whereas the Pasifika population has prevalence rate of 9.6 % which is projected to increase to 12.4%-16.2%. Based on the MoH Virtual Diabetes Register 2005-2017 (131) data, the prevalence of diabetes (T2DM accounting for 90% of people with diabetes) is highest in older age groups, reaching approximately 15% to 20% in people aged over 65 years. Nevertheless, the prevalence is increasing in younger people aged 25-39, especially among Māori and Pasifika peoples with a prevalence of (16%), which is two to three and a half times higher than New Zealand Europeans (18). People who develop T2DM earlier in life have a greater likelihood of developing it again later in life (112). If left untreated or poorly managed, more severe complications such as lower-limb amputation, stroke, eye disease, kidney failure and a higher risk of heart disease may occur (18, 132-136).

The MoH's diabetes reports (18) show that the total direct health care cost for a person with diabetes is approximately ($2.1 billion) which is three times higher than people without diabetes. On a wider scale, T2DM has explicit social costs primarily through loss of work and support payments, and implicit costs caused by the impact of chronic disease on family and community life which is estimated as being more than the direct health care cost (18). The total current annual cost of T2DM is estimated to be $2.1 billion (represents a staggering 0.67% of New Zealand's total Gross Domestic Product) that is projected to increase by 63% to $3.5 billion dollars over the next 20 years. Thus, the increasing health and economic cost of New Zealand's growing T2DM epidemic requires urgent focus on identifying and

implementing effective intervention programmes, especially in the Pasifika communities (130).

1.9 Community-based interventions.

Lifestyle interventions have been conducted in various settings. The majority have been delivered to individuals and families by healthcare professionals in healthcare/clinical settings. They are well established in the clinical trial settings but not in real world community settings. Translating evidence from clinical settings to a community oriented public health programme provides critical knowledge; however, understanding intervention uptake and how to effectively sustain the intervention has been identified as a gap in the current knowledge base (137-140).

Implementing lifestyle interventions among ethnic minorities presents unique challenges. For instance, interventions designed for the New Zealand general population were less effective for Pasifika communities and may have contributed to increased health inequities (141). Examples of community-based interventions utilized among ethnic groups in New Zealand include the following: Ola Fa'autauta project, Mana Tū project, Te Wai o Rona diabetes prevention strategy, DCEP, PPYEP and Ngāti and Healthy diabetes prevention project (11, 12, 122, 127, 142-144). These interventions have all shown to be effective, as they were culturally tailored, community centred, and account for the ethnic-specific health inequalities.

Goodyear-Smith et al. (2015) (145) noted that community-based interventions for ethnic minorities that lack cultural relevance result in poor uptake and low rates of use by communities. Prior research reported that Pasifika people do not prioritize health programmes focused on weight management, body size or dietary intake (146). Pasifika people associate 'being healthy' with being a more productive member of the family and the community.

Therefore, they prioritize fulfilling their obligations and contributing to family and community (147) as opposed to focusing on individual aspects related to weight loss.

According to Bell et al. (2017) (148) and Kaholokula et al. (2012) (149), a focus on body size, diet and exercise were unrelated to engaging in healthier lifestyles and achieving positive changes. The family-centric and holistic approaches were considered important drivers in understanding peoples' needs and overcoming health barriers (11, 144, 148, 149). This was evident in a six-month community-based intervention known as the Partnership to improve lifestyle interventions lifestyle programme (PLP) that was designed for Pacific people in Hawaii (149). The PLP utilized a participatory research approach and integrated family and community members as an in-built support structure, as part of the intervention. It focused on the critical role family played in decision making, which aligned with the Pasifika cultural systems, as well as community factors that affected peoples' adoption and maintenance of healthy lifestyle changes. Another study by Kaholokula et al. (2014) (150) compared the PLP intervention programme with a six-month standard behavioural weight loss maintenance programme involving phone call follow-up sessions that were delivered individually by trained community peer educators. Given the effectiveness of the PLP, it was suggested that it should be replicated in other ethnic groups, including New Zealand Pasifika people (150). This reaffirmed the need for a culturally appropriate intervention underpinned by Pasifika worldviews of understanding health concepts and participation in community affairs (127, 146, 151).

Community-based interventions allow for the adaption of established or novel intervention approaches to be more relevant to an indigenous community, and actively engage them in all aspects of the research (152-154). Economos and Irish-Hauser (152) noted that community-based interventions are cost-effective when conducted properly, focused on benefitting the larger population, and addressing high mortality and morbidity diseases. Various factors

impact health outcomes, including the socio-cultural context, physical environment, and political factors. Thus, when an intervention has been implemented population-wide, multifaceted, and integrated approaches should be utilized. For instance, incorporating a host of skills in engaging and responsibly interacting with communities and community agencies was required (155).

It is important to recognize that each community is unique, with various factors operating differently based on cultures, religious beliefs, values, and other experiences. Therefore, it is important that researchers recognize peoples' needs, cultural context, values, resources, and strengths that exist in a community to help facilitate and identify critical intervention motivators (156). For example, interventions targeting specific cultural groups may focus on traditional foods, cultural exercise patterns, and modes of healing, which may contribute to building trust between the community and researchers. The approach enables the community to have a sense of ownership and connectedness (150, 156). With ethnic minorities, community-based interventions allow the researchers to align the programme with the community's needs, wants and cultural context, which is crucial for the uptake of the intervention. Therefore, delivering an intervention embedded in cultural needs and values further anticipates increased engagement and empowers communities to make positive lifestyle changes (143).

Another important feature of a community-based intervention is involving the community in all aspects of the research process, as it offers several advantages for both the community and researchers (154). Community members have in-depth knowledge of the resources and dynamics existing within their communities. Therefore, they are better able to identify and solve their problems through acquiring community capacity skills (157, 158). Furthermore, the knowledge-base that is constructed by the community can guide the research and allow for more relevant, culturally appropriate interventions to be implemented (152). Utilizing this

approach in health interventions can give communities some control over their affairs and a sense of ownership, and empowerment, which have the potential for greater uptake and sustainability of the intervention (155, 159).

1.10 Co-design.

Co-design is a relatively new method employed in public health-based interventions to identify problems and generate and implement solutions through harnessing the knowledge and creativity of citizens and staff (160). Researchers use different co-design steps in the design and implementation of intervention programme.

1.11 Co-design principles.

1.11.1 Equitable relationships.

The core principles underpinning the co-design methodology include equity, understanding experiences, and prioritizing improving health or services (outcome-based) (104, 161). Equity refers to the partnership formed between the researchers and the participants. The paradigms commonly used in healthcare and clinics where interventions are primarily designed by researchers and health professionals do not apply in co-design because there is a shift away from participants being passive recipients of the research design, to actively participating with the researchers or health professionals in designing the research work (162, 163). The partnership formed between participants and researchers enables co-operation, and co-learning between parties where mutual exchange of information and trust takes place. It avoids researchers imposing their own goals and ideas on design sessions and enables shared decision-making in all aspects of the research. Such a participatory approach allows the participants to identify the problem and become part of the solution. The creation of collaboration and co-ownership of the outcomes in co-design can lead to participants feeling empowered (164-167).

1.11.2 Prioritise improving health outcomes.

Another core principle of co-design is prioritizing the improvement of the services or health of the target group. Co-design activities are outcomes-based and possess a practical focus, with clarity of vision and direction (168, 169). The co-design approach focuses on developing a practical, real-world solution to issues facing families and communities, and therefore improving services and health is at the forefront of the research. Furthermore, it seeks to ensure that shared creative intent between all participants' outcomes are identified. As different people gather to elicit and give an 'insider's knowledge', part of the co-design process is testing these ideas in the community and making changes to ensure that the approach is effective. It involves turning ideas into specific actions and choosing what improvements to make and how to make them, as well as transforming the improved ideas into action. It also includes systems development and promotes community capacity building to improve the community's services and health. Although it can be challenging, particularly regarding increased co-ordination efforts, the interests of diverse people must be managed and balanced with a focus on improving services, and health outcomes for the target group (143, 169, 170).

1.12 Co-design practices.

Co-design approaches have been successfully used in redesigning healthcare services to fit the needs of the consumers. It has been extended to develop health interventions for minority and indigenous groups in Aotearoa New Zealand (127, 143, 171-173). Previous research highlighted that co-design fits well when collaborating with these groups as it allows tool redevelopments, and refining based on the socio-cultural needs of the end-users (146, 170, 174, 175). The method captures and understands the participants' needs and fosters expression, reflection, and sharing to inform the development of the intervention. The

generation of discussion in co-design aligns with the indigenous knowledge of systems, creation stories and oral stories, which provide a culturally empowering way to generate discussion and insights from communities.

According to the WHO (176), research involving indigenous peoples needs to be based on mutual respect that is beneficial and acceptable to both parties and takes cultural differences into account. Pasifika peoples' worldview leans more towards a traditional and indigenous paradigm that includes the importance of family, spirituality or Christian beliefs, and connection with their natural resources, such as agriculture and land (170). These priorities align with the core principles and values of co-design, and therefore, co-design interventions will have a stronger likelihood of reducing health inequities among ethnic minorities than the status quo. The co-design interventions adopted in New Zealand for indigenous and minority groups emphasized how it strongly reflects the priorities, experiences, and preferences of these groups with NCDs. It supports family members to stand with authority, as well as place target groups at the centre of the research by including families, employing culturally safe practices, addressing the broader determinants of health, and focusing on system issues rather than on individuals (12, 121, 127, 174, 177-179).

Co-design methods can be adapted to the cultural setting they are applied to and be used to prioritize the participants' cultural values and worldviews. Research shows that culturally tailored interventions that were co-designed were proven more effective than standard interventions amongst minority and indigenous groups. For instance, a culturally tailored lifestyle intervention programme known as the Ngāti and Healthy programme improved nutrition and physical activity behaviours and prevented T2DM in the Māori community (Ngāti Porou) (121). Thus, involving participants in all aspects of the research is a key ingredient in delineating an appropriate intervention as researchers gain inside knowledge

from participants. I think this is a critical advantage that co-design has over the traditional researcher lead projects.

This chapter provided an overview of the background literature and research relevant to the scope of this study. Through an extensive exploration of existing, theories, methodologies, and key findings, we have established the foundation upon which this research is built. This chapter further discussed the existing literature and the context in which this research is situated. For example, the impact of prediabetes on Pasifika communities and Aotearoa New Zealand including the current data on the prevalence of prediabetes and interventions that have been conducted amongst ethnic minorities. The research context, theoretical frameworks, and empirical studies discussed previously have highlighted the gaps, limitations and opportunities that form the basis for the research objectives. The following chapter will provide the methodology, co-design research processes and outline the approach to data analysis for the proposed research.

CHAPTER 3: FOUNGA NGAUEAKI (Methods and resources)

The ‘FOUNGA NGAUEAKI’ chapter outlines the strategies, techniques and procedures woven together to address the research objectives (see below), including the resources used and steps taken by the researcher to gather and analyse data. Moreover, it presents the rationale behind the methodologies employed, the ethical considerations governing the implementation, and the strategies utilised to ensure the reliability and validity of the findings.

Ethical approval was initially granted by the Massey University Human Ethics Committee (SOA 19/34) for phase one of the study. The Ethics Committee further required a second application that described the proposed co-design programme and evaluation phases, which were subsequently approved. The ethical approval for this research was crucial to ensure that the research was conducted in a way that respect the rights, well-being, and dignity of the participants, as well as adhere to established ethical guidelines and standards. Providing consents forms and information sheet (see in Appendix 6 & 7) to the participants helped maintain the integrity and credibility of the research while safeguarding the rights and well-being of individuals who volunteered to participate in this research.

Using CBPR and co-design methods, the study objectives were:

1) To examine Tongan youths’ (18-24 years old) perceptions and understanding of prediabetes, including identifying the barriers to leading healthier lives.
2) To develop a culturally relevant community-based intervention programme aimed at addressing risk factors for prediabetes among Tongan youth.

3) To evaluate the effectiveness of the co-design approach and the intervention programme, particularly on community-uptake and relevance to the Tongan community.

1.13 Community-based participatory research approach.

CBPR is an approach that involves community members (i.e., in this case, Tongan youth) and researchers working together as equal partners to undertake the research. Together, as partners, CBPR facilitates co-learning by building the capability of community members while also building the knowledge base of researchers (180-182).

1.14 Co-design approach.

Bratteteig's co-design approach was first introduced in the project plan, and it was used because it had been used previously in Māori and Pasifika communities (163). Bratteteigs's co-design is comprised of six steps: 1) opportunity identification (involve steps from putting together research proposal, forming research team, building partnerships, capacity building and project planning); 2) knowledge generation (identifying knowledge regarding the participants' understanding of prediabetes and health priorities); 3) identification of needs and desires (determining the participants' needs and desires to help manage and prevent prediabetes); 4) description of the health and well-being requirement (to ensure that the participants' health and well-being needs were met throughout the research); 5) envisaging the intervention programme (turning ideas into a tangible product using arts and crafts); and 6) testing the programme (involve piloting intervention questionnaires, resources and processes prior to implementing the intervention programme) (163). However, in undertaking steps one (opportunity identification) and two (knowledge generation) with the Tongan community, it became evident that Bratteteigs' model was not culturally sensitive and relevant, and therefore, I had developed a new model based on Tongan cultural values,

principles, and practices. This model is named *Fengaueaki Fakataha*, and as I developed it dynamically, it was embedded throughout the study, because this was more inclined with the *anga fakatonga* and protocol.

1.15 Phase 1: To examine Tongan youths' perception and understanding of prediabetes.

1.15.1 Opportunity identification.

Bratteteig's first step (opportunity identification) involved processes from putting together the research proposal, forming a team, building partnerships and a team culture, capacity building and project planning. Prior to beginning the research process, I spoke to members of the Wellington Tongan community about my study. I sought advice regarding the most appropriate church (one that has the target participants) to work with. Consulting with the Wellington Tongan community led me to the Tongan Wellington Methodist Parish (TWMP), an urban church that is part of a national Methodist church registry. In the Tongan community, the church is a popular meeting place that not only provides an important spiritual space for Tongans, but also a setting where many social and cultural activities Tongans engage in on a day-to-day basis, that are organized and supported. Some examples include youth activities, *faikava* (*kava* drinking) sessions, choir practices, Sunday school, early childhood centres (ECE), band practice, and sporting tournaments (1, 38). Therefore, it was necessary to conduct the research in a church setting.

I had meetings with the TWMP *faifekau* (church pastor) and youth leader to discuss the study and verbally requested for consent to conduct research with their youth. Once they had given their approval, I attended their church services, activities, choir practice, and youth programme to build rapport with the TWMP members. This process of building rapport with the TWMP members was a lengthy process as I got to know the people, their church roles,

and protocols. Through my Tongan heritage, I was able to make genealogical, historical, and cultural links as a way of affirming a sense of familiarity and connectedness.

It was important to follow church protocols and in November 2019, I was invited to present my research to the church elders and leaders at the church board. Thereafter, the TWMP members collectively agreed to co-partner in this study. Once the church confirmed permission to undertake the research, it remained important to continue liaising with the church leaders, allowing them to guide me through their church protocols and provide advice on when to begin the study.

The church leaders I mainly collaborated with included the youth leader, health leader and secretary, who were the main mediators between the research team and church members. Furthermore, they updated me with any changes in the church programme and relayed information to the church members. These church leaders were consulted at every stage of the research process, to ensure they were given all the relevant information about the research objectives, research implementation, and the role of the community as co-partners.

1.15.2 Knowledge generation.

Bratteteig's second step of (knowledge generation) occurred in a focus group context. The initial process of the 'knowledge generation' stage was informing the TWMP members about conducting a focus group for the family members and youth participants. A focus group is a research technique used to collect data through group interaction. It has been used in previous studies (170, 183-185) to explore attitudes and opinions, solve problems, generate ideas, and explore issues in detail. Compared to other forms of research techniques, focus groups enable researchers to learn about the concerns within a particular community and allow the information obtained to guide future action (186, 187). My research team (two casual research assistants, and a Masters intern) and I planned the focus group programme and

ensured that we had all the resources prepared. I facilitated the focus groups, and a junior research assistant took notes, while the participants shared their health beliefs, values, and worldviews. The 'knowledge generation' process focused on understanding the participants' health views, priorities, and knowledge of prediabetes.

1.15.3 Planning focus group meetings.

Advanced planning of the focus group meetings was an important aspect of ensuring accurate and meaningful data collection. It involved preparing a presentation regarding the impact of prediabetes and its risk factors, developing questions that relate to the objectives of the study, and materials (e.g., voice-recorder, pen, sticky charts, consent forms). I carefully generated the questions to facilitate deep and meaningful discussions. These questions are highlighted in Appendix 1 and were created in three categories: engagement questions (involved introducing participants and being certain that they are comfortable with the topic of discussion); exploration questions (involved getting to the core of the discussion; and exit questions (involved checking to see if anything was missed in the discussion).

After preparing the questions for the focus groups, a meeting was held with the research team to inform them of the focus group schedule and programme, as well as to delegate tasks. The junior research assistants were given tasks such as: obtaining signed consent forms, note-taking during the focus group discussions, and helping with setting up and unpacking resources needed for the focus group (e.g., food, digital recorder).

1.15.4 The focus groups.

In January 2020, two focus groups were conducted separately: (1) 18–24-year-old Wellington Tongan youths (n=8); (2) Tongan adults (n=11); and a *kāinga* member of the youth (e.g., a parent, grandparent, aunt/uncle/or a guardian). The central question was to investigate their awareness and understanding of prediabetes. The participants were recruited via the snowball

sampling strategy where the youth leader assisted in identifying potential community members, and those who were interested in taking part in the study were contacted. Both focus group meetings were held on Friday nights (from 7pm to 9pm), as this was the only time church members gathered for choir practice, band practice, *faikava* (*kava* drinking) and their youth programme. The research team arrived at the church hall an hour before the schedule to set up the venue and await the participants to arrive. The focus group discussions were conducted in the church hall room, and the seats were set up in a circle, with refreshments always made available for the participants. Despite the study only requiring participants to be part of the focus group, other members of the church walked in to show their support and to listen to the discussions. This was culturally appropriate in a Tongan community.

The church has a hierarchy that is respected by the members. As a facilitator, it was important to listen to how church members addressed their church leaders to know one's place within the church hierarchy. While interacting with the participants, I was mindful of their roles in the church and the elders in the group, as this indicated who was suitable to conduct the *lotu* (prayer). Given that the *faifekau* was not present, I respectfully asked the *setuata* (who is considered the head church leader followed by the *faifekau*) and the youth leader to do the *lotu*, where they acknowledged God and asked for guidance before proceeding the focus group discussions. The participants were informed about the focus group schedule (see Appendix 2) and that the discussions were confidential. I asked them to raise their hands when contributing to the discussion to avoid everyone speaking at once and for note-taking purposes. At the beginning of the focus group discussions, I explained the research processes, their involvement in the study, and how the study could help inform health policies. The participants were given the opportunity to ask any questions regarding the study.

1.15.5 Youth focus group.

With the youth group, an icebreaker activity was incorporated to welcome the participants and warm up the interaction between the young participants and the research team. Following the ice-breaker activity, I conducted a presentation informing them of prediabetes, the symptoms, risk factors, and the impact of prediabetes on health. Afterwards, I proceeded to ask a set of questions that I had prepared (see Appendix 1). At first, the youth were shy to share their thoughts; however, this had slowly changed when one of the youths began sharing his *kāinga*'s experience with T2DM. Further on in the discussion, there was excitement in their tone, particularly when they discussed potential ideas that could be incorporated in the prediabetes intervention, as it gave them a sense of empowerment. The focus group meeting took up to two hours in duration.

1.15.6 Understanding experiences.

Co-design methods also emphasize the need for researchers to understand the experiences of participants. Having empathy of the participants' experiences is key in the early stages of building trust and respect between both parties. As participants and researchers collaborate, there is a mutual understanding of the community as a social rather than a physical setting. A social setting is where participants' experiences are influenced by various factors, including socio-economic status, access to health services and cultural worldviews (188-190). Since the development process for an intervention is based on the participants' input, these factors may surface and therefore provide strategies for progress. Congruent with the co-design framework, Pasifika research highlights the importance of considering Pasifika peoples' experiences and perspectives and that these be represented in culturally appropriate ways.

Multiple generative methods that are visual, creative, and expressive are also used in the co-design process. These generative methods build from the individual to a collective process of

externalizing thoughts, making each participant's contribution visible. Throughout the generative process, participants can see their contribution and shared decision-making about what knowledge is included and taken forward. Instead of conducting research in a manufactured environment or using process maps and statistical approaches, techniques such as prototyping and storyboarding are employed to capture experiences, explicit knowledge, habits, behaviours, and ideas. These visual representations allow participants to reflect and consider, share, articulate, and express their experiences (191). Moreover, participants can compare with the experiences and perspectives of others. This shared collective process of first-hand knowledge contributed by participants has an ethos of empowerment and real engagement, which helps researchers understand the experiences of participants. The outputs from these generative methods differ from interviews, surveys, and observations as it generates visual, subjective, and tangible material that researchers can work with as opposed to writing reports (192-195). Acknowledging cultural differences is also part of understanding the participants' experiences. Co-design methods emphasize understanding the participants' culture to enable immersion, dialogue, and empathy between parties (166, 196). This cultural awareness plays a role in understanding the design from the participants' point of view and prioritizing their input. Incorporating and acknowledging cultural ways of interpretation further contribute to the sustainability of the intervention as opposed to utilizing a traditional Western approach that is fixed on the scientific method (5, 197). Since most of the existing community-based interventions are designed with minimal input from participants and lack cultural relevance, a co-design approach allows the use of culturally centred methods and involves participants in the design process. Co-design methods in health science focuses on a contextually-based implementation of an intervention developed through engaging participants. It also involves listening and attempting to understand each participant's reality as different but complementary to others. As a result, it has great

potential as a methodology for understanding health barriers and enhancing research output (190, 198).

1.15.7 Adult focus group.

Similar to the youth, a focus group was set up for the adults which comprised of the youths' *kāinga* members. The focus group discussions were conducted in the Tongan language, and the adults who had previously experienced or currently had T2DM spoke about their own experiences and health journeys. Others spoke about the negative impact of T2DM and how Tongans would often only react when symptoms were presented. The structure for conducting the focus groups was similar for both the youth and adult groups; however, the approach was more formal with the adult group.

During the focus group meetings, my research team and I listened intently to identify the participants' knowledge of prediabetes, barriers to understanding and accessing help for prediabetes, motivations for attending an intervention programme, and processes that needed to be established in the Tongan community. Throughout the focus group process, participants were asked to elaborate and clarify ideas that were vague, ensuring the information provided by the participants were understood correctly. The focus group meeting took an hour and a half, ending with a *lotu.* All the participants were given shopping vouchers to show our appreciation and gratitude in reciprocity for their participation and time to this study.

1.15.8 Post focus group.

After every focus group interaction, I conducted a debrief for the research team to reflect on the programme and provide feedback. I took all the feedback on board and planned for phase two. I transcribed and translated the data obtained from each of the focus group interactions and analysed them using a thematic analysis technique which led to the development of a Tongan *Fengaueaki Fakataha* model. Weaving the Tongan knowledge and worldview in the

methodology was a marker of acknowledgement, respect, and protocol. Thus, parts of the communication processes (*Fakafehokotaki, Fakafanongo, Fakasino, Fakamahu'inga'i* and *Fakamuimānoa*) that formulated the concept of *Fengaueak*i *Fakataha* were interlaced throughout the remaining of this Chapter. Chapter 4 will discuss the entire *Fengaueaki Fakataha* model more in depth.

1.16 Phase 2: Co-designing a community-based intervention programme aimed at addressing prediabetes characteristics among Tongan youth.

1.16.1 Fakafehokotaki (nurturing relationships and connecting ideas).

In the Tongan language, the term *fakafehokotaki* means "to connect" (p. 32) (199). *Fakafehokotaki* encompasses nurturing relationships and connecting ideas. Building a relationship with the participants was important to nurture these relationships as we connect ideas to help design a Tongan intervention programme. For phase two, the workshop groups were conducted similar to phase one but with more resources (e.g., arts and crafts, post-it notes, charts, voice-recorder), and involved more creative and interactive processes.

1.16.2 Fakafanongo (To listen deliberately or intently).

The term *fakafanongo* means "to listen deliberately or intently" (p.30) (199). This form of communication took place from the co-designing process to the evaluation of the intervention programme. It emphasized listening emphatically with your eyes, ears and heart to peoples' words, tone, and body language. During the facilitation of the co-design process, I engaged in the *fakafanongo* process while the participants shared their health experiences, values, and factors that impact their health and well-being.

1.17 Phase 2 | Part 1.

1.17.1 Fakasinoaki (Putting ideas into action).

The term *fakasinoaki* is translated as to increase, develop, or become pronounced" (p.98) (199). For this study, *fakasinoaki* refers to putting ideas into action. To be more precise, *fakasinoaki* encompasses finding solutions to factors that negatively impact Tongan peoples' health through co-designing an intervention programme. There were two parts to phase two including the *fakasinoaki* process and refining the co-design prototype. Phase two was conducted on a Friday evening from 7pm to 9:30pm, one week after conducting the phase one focus groups. The programme began with a *lotu* followed by a slide presentation informing participants of the impact of prediabetes on Pasifika peoples compared to other New Zealand ethnic groups, and the key themes obtained from phase one.

The first part of phase two was conducted separately for both the youth and adults, which involved participants engaging in the following activities: (a) post-it activity, (b) priority activity, (c) bus stop activity. These activities emphasized the *fakasinoaki* process of the research.

1.17.1.1 a) Post-it activity.

The 'post-it activity' involved presenting themes (cultural factors, lifestyle factors, income and education) from phase one on charts (see Appendix 3). Each chart had a theme that was posted on the wall. The purpose of this activity was to help the participants generate personal knowledge relating to each theme. The youth were asked to write their views relating to each theme on the post-it-notes and stick it on the charts.

1.17.1.2 b) Priority activity.

Following the 'post it activity', the total number of post-it-notes were highlighted under each theme. The priority activity was used to prioritize the factors that impact healthy living.

Based on the themes with the highest number of post-it-notes, the participants and the researcher agreed to prioritize the cultural and lifestyle factors that contribute to healthy living. Like the youth, the adult focus groups were asked to focus on the prioritized themes. The youth prioritized cultural and lifestyle factors, while the adults prioritized education and lifestyle factors.

I created a subgroup of females and males in both the adult and youth focus groups where each focused on a particular theme. Each subgroup discussed the theme and transformed them into an actionable question. For example, the youth female subgroup looked at cultural factors and came up with questions, such as, "how do cultural factors impact on Tongan peoples' health?". This led to them thinking and discussing different ways of counteracting the different impacts.

1.17.1.3 c) Bus stop activity.

The 'bus stop activity' was used by Te Morenga et al. (2018) (170) as a tool for Māori participants to create and express ideas. Similarities in cultural values warranted the transfer of the activity to the Tongan community. This activity enabled the participants to artistically transform and express their ideas. The research team set up five stations of arts and crafts on the tables, and participants were told to use any materials of their choice. The two subgroups that were formed previously were asked to discuss 'the actionable questions' and formulate potential solutions. The bus stop activity was a way of modelling their discussions and ideas through arts and crafts (see Appendix 4), and both subgroups came up with a model and presented it. For example, the male youth subgroup presented a prison model that embodied how people were slaves to their health issues. They named the model 'Free my dox' and noted that the walls of the prison symbolized the risk factors that contribute to prediabetes. It also represented the peoples' health choices and lifestyle factor. They further explained that being a prisoner surrounded by walls restricted them from living an active life and from being

a contributing member to their *kāinga* and community. In order to break through the prison walls, people needed to be educated and make healthier life choices. The group collectively selected the two best ideas that were most aligned with the community's values and cultural protocol.

After the youth presented their models, there was further discussions regarding the motivations and barriers to accessing an intervention programme. Throughout the research, the majority of the participants had resonated more with the term *Polokalama mo'ui lelei* (health programme) than 'intervention programme' and so the former term was utilized. The youth mentioned that even though the study was youth-based, it was important to include the entire congregation to benefit everyone. Many ideas were brought forward by the youth regarding physical activities, nutrition, and education components for the *Polokalama mo'ui lelei*. They placed emphasis on wanting a *Polokalama mo'ui lelei* that was inclusive, interactive and fun. However, the ultimate issue was finding a time to implement it. The youth highlighted that so many things were going on at church (e.g., youth practice, choir practice, church service, and band practice) and at home (e.g., babysitting the younger siblings), that they would find it difficult to attend.

The *fakasinoaki* process for the adult group was conducted similarly to that for the youth group. One model displayed by the adult females subgroup reflected the concept of health being a collective journey. Further, they mentioned that health professionals need to guide the health journey in church and educate people about risk factors for prediabetes. The discussions that occurred after the model presentations focused on the importance of having health professionals lead the journey at church by initiating ongoing health-based programme so that people felt motivated.

The outcome of the *fakasinoaki* process led to the development of three main components of the *Polokalama mo'ui lelei* which includes the following: 1) prediabetes education, 2) physcial activity and 3) food nutrition (education and demonstrating healthy cooking and recipes). For the prediabetes education component, the adults suggested having a health professional deliver health messages in church. They noted that it would be important to have the health messages delivered in the Tongan language and organized at a time that suits everyone given that some elderlies do not speak english and have busy schedules. More importantly to incorporate a family-base approach education geered to empowering families to live a health lifestyle. On the contrary, the youth suggested that the delivery of health messages should be interactive, interesting and motivating. Furthermore, for health professionals to deliver health education using lay words so that people better understand it. Another suggestion made by the youth was the idea of including low intensity exercises during the education break sessions.

As for the physcial activity component, the adults emphasized having a program that church members are able to participate in such as having a collective church walk. The adults highlighted being mindful of how the physical activities should be carried out given the cultural relational taboos. In a Tongan gathering women are expected to wear clothing that covers their legs and not overly form-fitting and certain exercise movements are considered inappropriate. Therefore, some adults suggested splitting the physical activities into groups of men and women. The youth on the other hand suggested having a physical activity that has some degree of competition, one that includes everyone. For example, having a game of touch rugby or amazing race once a week. They also proposed having varied physical activities to motivate them as oppose to having the same physical activity repeatedly.

With the food nutrition component, the adults suggested having a cooking competition where everyone can showcase healthy recipes and share it in church. In contrast, the youth proposed

having a food nutrition program similar to the ‘Master Chef cookout’ and include a chef or nutritionist to teach cooking skills, healthy recipes, provide healthy alternatives for kids lunches. They also mentioned including everyone in the church to participate in the program because they are able to better support each other.

Both the youth and the adults agreed to integrate the following factors to guide the implementation of the *Polokalama mo’ui lelei:* to ensure that the *Polokalama mo’ui lelei* is cutlurally appropriate, to ensure families and church members are also part of it and to ensure that the activities are fun and interactive.

1.18 Phase 2 | Part 2: Refining the prototype.

Following the first part of phase two, a taskforce group was established, and it included representatives from the youth and adults group, a medical health doctor, a youth leader, church secretary, a health leader, and a Masters student intern (specialised in nutrition). The purpose of this group was to refine and finalise the prototype of the proposed *Polokalama mo’ui lelei,* and to identify intervention outcomes for the community. The first taskforce group meeting had a similar set up as the focus group meetings and was conducted on a Friday night immediately after the church choir practice. Data obtained from phases one and two (part one) were presented to the taskforce group, and it was the basis for discussing the motivations and barriers to accessing the *Polokalama mo’ui lelei* and the various components (education, nutrition, physical activity). From the discussions, a draft prototype for the intervention was developed. Of note, while preparing for another meeting with the taskforce group in March 2020, the New Zealand COVID-19 pandemic occurred, and a nationwide lockdown was instigated for a period of four weeks. This effectively precluded all community activities, and whilst the nation slowly regained local activities, the government implemented restrictions, such as capping the number of people who could meet indoors and outdoors. For

my research, it meant all community-based research (and fieldwork) was prohibited for almost two months, placing the study on hold (See 'Research restrictions' section below). After finalising the intervention prototype with the taskforce group, they suggested naming the *Polokalama mo'ui lelei* '*Mo'ui fakalakalaka*' which refers to onward or forward movement towards a healthier lifestyle. Thereafter, a presentation was made at the TMWP board meeting to inform the church members, as well as to ask permission to implement the *Polokalama mo'ui lelei*. The church members showed their support by accepting the proposal.

1.19 Research restrictions.

Following New Zealand's first major national lockdown in late March 2020, the government imposed several levels of restrictions (4=lockdown to 1=normal levels) that inhibited any university-level and researchers to begin or re-start research in the community, with safety precautions in place. Unfortunately, the church continued their gatherings through an online platform and as a result, the Friday night church gatherings were cancelled. Despite this, I continued to meet up with the health leader to discuss ways of getting the taskforce group back on board. By March 2021, the church services resumed back to normal face-to-face gatherings at their church premises. Regardless of the existing rapport with the TWMP church members, it was difficult to regain the research momentum that was achieved at the beginning of the study.

At the taskforce meeting, I explained to them that it was important to begin the *Polokalama mo'ui lelei* as soon as possible, given the time-frame scheduled. They were very supportive and noted that another meeting should be held the following week to confirm a start date, and refine the intervention prototype. Further discussions about the various components of the *Polokalama mo'ui lelei* and alternative options were also considered, particularly if there was

going to be another covid-19 lockdown. Tasks were delegated to members of the taskforce group and one of my responsibilities was to ensure these tasks were implemented. For example, the church secretary and health leader took care of the physical activity component while the adults representative took care of the education component. A Facebook taskforce chat group was set up for the purpose of meeting online if an in-person meet up was not possible, as well as provide weekly reminders for the *Polokalama mo'ui lelei* and informing them of any changes.

1.20 Implementing the proposed Polokalama mo'ui lelei.

Table 2

Data collected before and after implementing Polokalama mo'ui lelei.

Data collected	Week 0	Week 10
DKB questionnaire	✓	
Prediabetes at risk test	✓	
Blood pressure	✓	✓
Waist circumference	✓	✓
Weight and height	✓	✓
6 Minutes walk test (6MWT)	✓	✓

The *Polokalama mo'ui lelei* outlined in Appendix 5 was 10 weeks long, involving physical activities (on Monday and Friday evenings) and education sessions based on nutrition and prediabetes (on Friday evenings). The physical activities conducted by the health leader and church secretary were 45 minutes long. Furthermore, the education sessions delivered by the nutrition student intern and the Diabetes New Zealand organization team were each an hour long. In the first week of the intervention programme, a presentation was delivered to the participants, informing them of the research objectives and outlining the *Polokalama mo'ui lelei*. Furthermore, baseline measures (Week 0) were taken as highlighted in Table 2.

1.20.1 Waist circumference.

The waist circumference is a measurement taken around the abdomen at the level of the umbilicus or belly button. This type of measurement is commonly used by health experts to screen for possible health risks associated with obesity (200). The first waist measurement was taken in week zero, and the second one in week 10. Participants were measured individually and asked to stand straight while a measuring tape was placed horizontally around their waist, above their belly button. A junior research assistant and the medical doctor measured the participants' waists and recorded them in centimeters (cm). The waist measurements does not reflect the full picture of ones' health, but it can highlight a potential important risk factor for CVDs and T2DM (201).

1.20.2 Height.

A standiometer was used to measure the height of participants in centimeters (cm) and to establish a baseline BMI measurement. I gave a demonstration regarding how to stand on the base of the standiometer. I stood below the height meter barefoot, with relaxed shoulders, buttocks and heels touching the wall, arms on each side of the body, and legs straight together. I also showed the participants that they must look straight ahead while the height meter is lowered to their head. The height meter was lowered where there was a lot of hair, and a little pressure was applied to touch the top of their head.The measurement appeared in the reading window and was recorded by the junior researcher.

1.20.3 Weight.

The participants' weight were measured in kilograms (kg), using a digital weighing scale (sanitas digital glass). Prior to standing on the scale, participants were asked to take their shoes off and stand with both feet in the centre of the scale. The junior researcher recorded their weight and rounded it to one decimal place.

The height and weight measurements for the participants were taken twice, one in week zero and the other in week 10. They were used to calculate the BMI for the participants by dividing weight in kilograms by the square of height in meters (kg/m^2).

1.20.4 Blood pressure.

A blood pressure cuff was used to measure the participants' blood pressure in units of millimetres of mercury (mmHg). Two nurses and a medical doctor measured the participants' blood pressure while they were seated in a chair with their feet flat on the floor and arms rested comfortable at heart level. Blood pressure measures were assessed twice and the conservative test measure of the two was reported in this study. The first blood pressure measurement taken was in week zero, and the second in week 10.

1.20.5 6 Minute Walk Test (6MWT) measure.

The 6MWT is a measure of fitness. Health care providers use the 6MWT to evaluate a patience's ability to exercise (202). Before conducting the 6MWT test, I measured 19 meters distance on the church hall floor and marked every 4.75-meter interval with cones. Participants were informed that the 6MWT measured the distance a person can walk over a total of six minutes. They were allowed to self-pace and rest as needed as they traverse back and forth the marked 19 meters distance. Once the six minutes came to an end, the number of rounds completed, as well as the extra distance they covered by the number cone they ended at were recorded over the six minutes timeframe. Some participants had arrived late, the procedure was repeated. This measure was conducted before and after the intervention programme.

1.20.6 Diabetes Knowledge and Behaviour (DKB).

The Diabetes Knowledge and Behaviour (DKB) questionnaire developed by Simmons et al. (1994) (203) was administered to examine the impact of diabetes awareness, and exercise/healthy eating programme in the community. It was administered to the participants once, prior to undertaking the intervention programme. This interviewer-directed questionnaire took approximately 30 minutes for participants to complete.

1.20.7 Prediabetes risk test.

The prediabetes risk test developed by the Centres for Disease Control and Prevention in the United states of America (USA) was utilized in this study to identify participants that were at high risk for prediabetes. This tool has been used by Pasifika communities in the USA, and therefore was considered an appropriate tool to incorporate in the study (204). The test was administered once prior to implementing the *Polokalama mo'ui lelei* which took 5 minutes to complete.

During every intervention session, the participation attendance was recorded, and after the sessions the taskgroup provided feedback regarding the programme. The health leader and church secretary kept the church members updated by posting reminders on the church Facebook page. Minor modifications of the *Polokalama mo'ui lelei* were made; however, its framework was the same throughout the 10 weeks period. The taskforce group took into consideration factors that may affect the programme, and therefore implemented alternative options. For instance, on days the church had a funeral or a conference meeting, a workout programme was posted online so that people could do it in their own time.

On the 10th week of the *Polokalama mo'ui lelei,* post intervention measures were taken including BMI measures (height and weight), waist measurements and the 6MWT, as shown in Table 2, and described earlier.

1.21 Phase 3: Evaluate the effectiveness of the Polokalama mo'ui lelei.

1.21.1 Fakamahuingai'i (Evaluation of the 'Polokalama mo'ui lelei').

The feasibility and sustainability of the *Polokalama mo'ui lelei* was evaluated by examining participation, fidelity to the planned strategy, participant satisfaction, and human/ material resources of the Tongan health programme. To understand the overall impact of the implemented co-designed intervention, two separate Zoom meetings were conducted for the youth (n=4) and adults (n=3) for a duration of 2 hours. The reduced number of participants in this phase was due primarily to the COVID pandemic whereby the church had not returned to face-to-face gatherings, and as such it was difficult to engage participants. The following aspects of the *Polokalama mo'ui lelei* were investigated:

a) To examine whether the *Polokalama mo'ui lelei* was successful in addressing the risks of prediabetes among Tongan youth in the community.
b) To identify and understand the co-designed intervention and behavioural drivers that were important to the Tongan community.

This chapter presented the incorporation of CBPR and co-design approaches to meet the specific research objectives. Of note, although the current research initially employed Bratteteigs's co-design model, and it became evident that it was not culturally appropriate for the study, and therefore, the *Fengaueaki Fakataha* model was introduced and embedded throughout the study, as it was more align with the *anga fakatonga* and protocol. The following chapter will outline the findings as a result of the modified methods employed.

CHAPTER 4: OLA ‘O E FEKUMI (Findings)

In this chapter the data collected and analysed will provide meaningful insights. The findings will be presented in a structural manner commencing with phase one of the study to phase three addressing the specific objectives: 1) to examine Tongan youths’ perceptions and understandings of prediabetes, including identifying the barriers to leading healthier lives; 2) to develop a culturally relevant community-based intervention programme aimed at addressing risk factors for prediabetes among Tongan youth; 3) to evaluate the effectiveness of the co-design approach and the intervention programme, particularly on community-uptake and relevance to the Tongan community. Visual representations and illustrative quotes from participants will be displayed to better explain the complexities relating to preventing prediabetes amongst Tongan people.

1.22 Phase 1: To examine Tongan youth and adults’ perception and understanding of prediabetes.

The recordings from the focus group discussions were transcribed and translated by the researcher. I reviewed the transcriptions more than four times to be familiar as possible with the data while taking notes. The notes were labelled using short phrases and grouped together based on the content. From this process, coding categories were identified and labelled using different colours as highlighted in Figures 1 and 2. I re-read the transcripts to further highlight any texts that corresponded to the different coding categories (views on prediabetes, contributing factors to prediabetes, preventative approaches and suggestions for an intervention programme, and health beliefs). When grouping the texts into the coding categories, patterns and themes were identified. The key themes were categorized and reviewed to ensure that they were useful and accurate representations of the data. This

procedure was repeated to confirm, verify, and expand themes, and to see if there were new themes.

Figure 1

Coding process utilized in analysing data for the adult focus group.

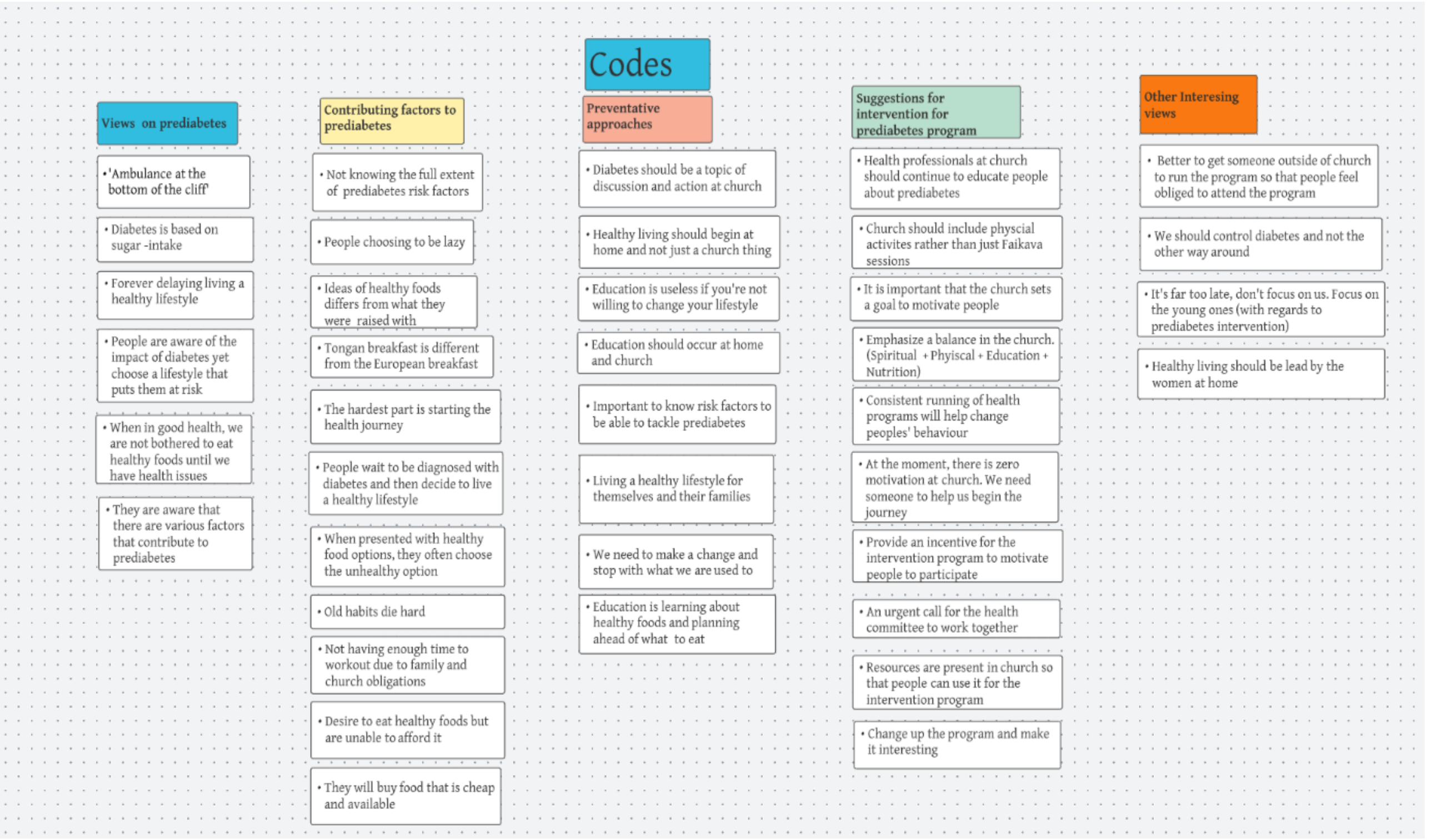
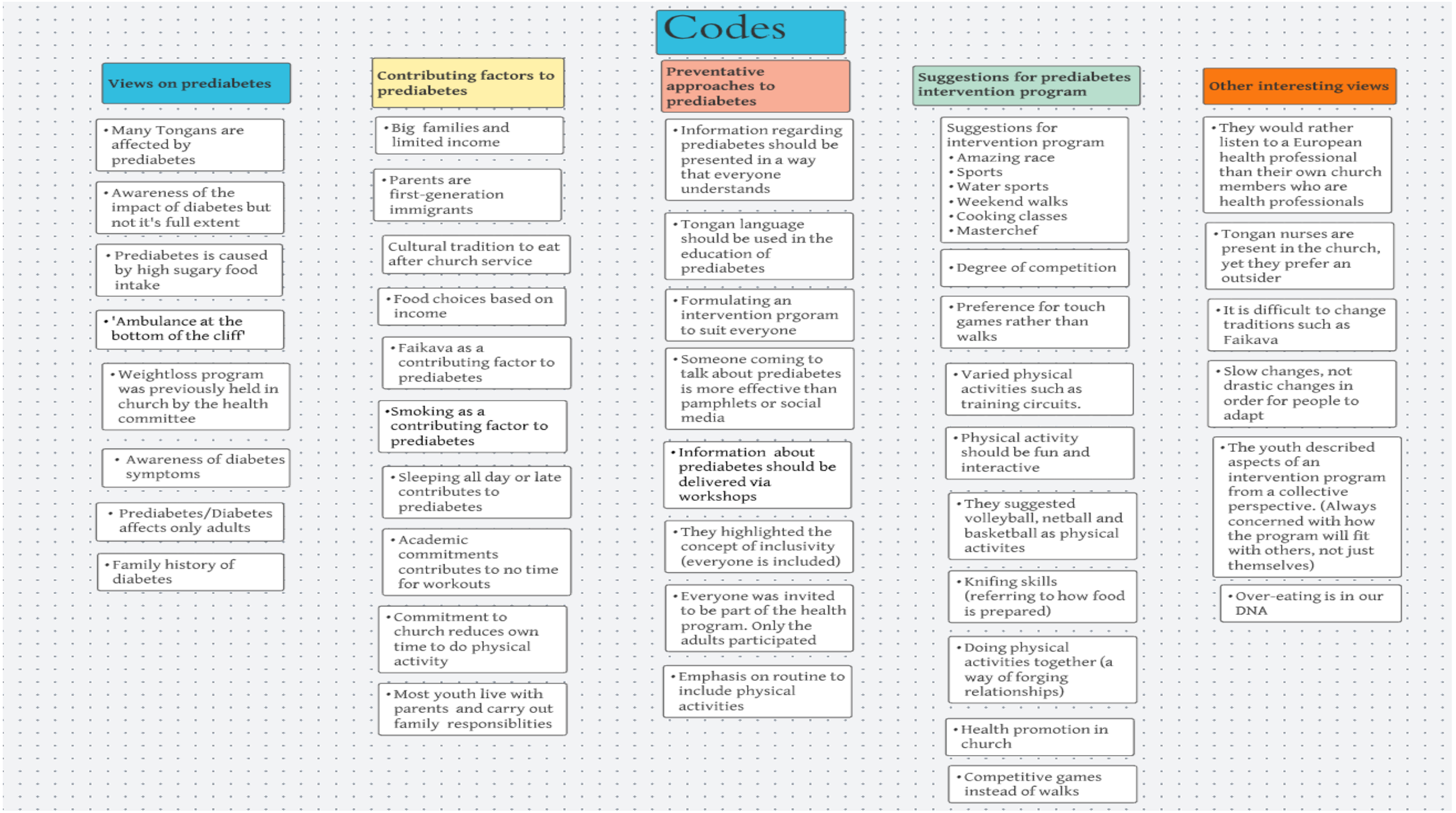


Figure 2

Coding process utilized in analysing data for the youth.



The data derived from this phase was analysed using a thematic analysis process which generated four major themes:

1. knowledge and awareness regarding prediabetes.
2. barriers to understanding and accessing help for prediabetes.
3. enabling factors for attending a health programme.
4. processes that need to be established in the community.

1.22.1 Knowledge and awareness regarding prediabetes.

This major theme encompassed the participants' understanding of prediabetes and its risk factors. Secondary to this major theme are two subthemes that are displayed in Tables 3 and 4.

Table 3

Summary of the quotations under the subtheme 'Limited knowledge and awareness of prediabetes.'

Limited knowledge and awareness of prediabetes	Q*1	Youth: "*I think most people just understand it as like heaps of sugar and stuff. But then like as in risk factors show…. You know that weight can cause it, and not moving enough. You know little factors like that are things that people don't really notice*" (YM8).
	Q2	Family member: *"With prediabetes it's difficult because there is no sign or symptoms to alert you. We often just turn up to get screened and get told that we have T2DM. If we understood what the risk factors were, we would have been able to prevent it"* (FM3).

Note. *= Subsequent numbering "Q" refers to quotations

1.22.1.1 Limited knowledge and awareness of prediabetes.

At the start of the focus group sessions the participants appeared to have limited knowledge and awareness of prediabetes. The term 'prediabetes' was new to most participants especially the youth, whereas some adults had knowledge of prediabetes. Consequently, I provided a brief education presentation on prediabetes. In general, the participants were aware that prediabetes was a health issue in the Tongan community, but many did not fully understand

the impact of prediabetes. From the data gathered, 80% of the participants understood prediabetes as solely caused by consuming high sugary food and their remarks were similar to the following statement: "*I think most people just understand it as like heaps of sugar and stuff. But then like as in risk factors show…. You know that weight can cause it, and not moving enough. You know little factors like that are things that people don't really notice*" (Table 3: Q1).

Subsequently, the participants' discussions were based on the following concept: "*With prediabetes it's difficult because there is no sign or symptoms to alert you. We often just turn up to get screened and get told that we have T2DM. If we understood what the risk factors were, we would have been able to prevent it"* (Table 3: Q2) which reflected the participants' inadequate knowledge and awareness of prediabetes. The participants were not aware of the risk factors of prediabetes, yet they had some understanding of T2DM. Despite having limited knowledge and awareness of prediabetes, the participants drew their understanding of prediabetes from family members' experiences of T2DM. Considering that there was no Tongan translation for prediabetes, the adults often used the term *mahaki suka* which also refers to T2DM. The participants' discussions often centred on food preparation and consumption which echoed their understanding of prediabetes as specifically caused by consuming high sugary foods.

Table 4

Summary of the quotations under the subtheme 'Perceptions and understanding of prediabetes.'

Perceptions and understanding of prediabetes	Q1	Youth: "*I think they just all waiting aye. Like everyone just waits (to be diagnosed with T2DM). Everyone just waits until someone gets it and then… (make a change in lifestyle)*" (YM8).
	Q2	Family member: "*Given that we are old, it's far too late*" (refers to making healthy lifestyle changes) (FM10).

1.22.1.2 Perceptions and understanding of prediabetes.

The participants' view on prediabetes were collectively similar to the following statement: "*I think they just all waiting aye. Like everyone just waits (to be diagnosed with T2DM). Everyone just waits until someone gets it and then… (make a change in lifestyle)*" (Table 4: Q1). They also mentioned that Tongans were unable to see the seriousness of prediabetes and only considered changing their lifestyle when presented with health complications related to T2DM such as frequent urination, drowsiness, and slow-healing sores. All the participants perceived prediabetes as an adult-onset condition. However, the youths' discussions placed emphasis on the need for adults to change their lifestyle, while the adults suggested the following: "*Given that we are old, it's far too late"* (refer to making healthy lifestyle changes) (Table 4: Q2), and they mentioned the need to educate the younger generation about prediabetes since some of the adults have already been diagnosed with T2DM.

1.23 Barriers to understanding and accessing help for prediabetes.

This theme refers to factors that prevent participants from understanding and accessing support to prevent T2DM. Based on the data analysed, there are three factors that act as barriers to understanding and accessing help for prediabetes: education and motivation; cultural factors; and household income. These factors were interrelated and are highlighted in Tables 5,6,7, and 8 as subthemes together with supporting quotations. Both the youth and adults were aware of how individual choices impact their lifestyle, but there was greater emphasis on the impact of external factors on healthy living.

Table 5

Summary of quotations under subtheme 'Education and motivation'.

Education and motivation	Q1	Youth: "*Just knowing like some of our family members they are not directly from New Zealand. They grew up in the islands. So, just that lack of understanding about prediabetes is a huge barrier to why it's a big problem in the community. What I mean is I don't think they understand like to the full extent. They know it's a problem, but they don't know how big of a problem it is"* (YM3).
	Q2	Family member: "*Another factor that contributes to unhealthy living is how we are set in our ways. It's difficult to stop unhealthy lifestyle because we are used to it…For me, people are just lazy and not willing to do physical exercises. These are the things I see as contributing to unhealthy lifestyles"* (FM2).
	Q3	Family member: *"We often just wait to be taken to the hospital like how the church secretary got sick"* (FM6).

1.23.1 Education and motivation.

A major barrier to understanding and accessing help for prediabetes that the participants noted was the Tongan peoples' lack of education and motivation to live a healthy lifestyle. The participants underlined that Tongan communities do not fully understand the risk factors of prediabetes, and therefore are not motivated to make any changes to their lifestyle. One aspect that contributed to the lack of education and motivation was indicated by the following statement: "*Just knowing like some of our family members they are not directly from New Zealand. They grew up in the islands. So, just that lack of understanding about prediabetes is a huge barrier to why it's a big problem in the community. What I mean is I don't think they understand like to the full extent. They know it's a problem, but they don't know how big of a problem it is"* (Table 5: Q1).

Moreover, 90% of participants highlighted the difficulties of changing one's lifestyle as shown in the following remark: "*Another factor that contributes to unhealthy living is how we are set in our ways. It's difficult to stop unhealthy lifestyle because we are used to it…For*

me, people are just lazy and not willing to do physical exercises. These are the things I see as contributing to unhealthy lifestyles" (Table 5: Q2). People live a sedentary lifestyle because they are accustomed to it which reflects their lack of motivation to adopting a healthy lifestyle. Taken together, participants reported that in most cases Tongans "*often just wait to be taken to the hospital like how the church secretary got sick"* (Table 5: Q3), or experience severe health complications before even considering making changes in their lifestyle.

Table 6

Summary of quotations under subtheme 'Cultural factors: social obligations'.

Cultural factors: Social obligations	Q1	Youth: "*the time you have to exercise and stuff kind of cuts down like especially for us Pasifika knowing that we have commitments like church. I know that most of our kids and stuff are into our sports as well……Just cuts down like the amount of time we have and also knowing our parents will tell us to like sleep or like go have a rest*" (YM3).
	Q2	Family member: "*Not only that we need to stop with eating but in many cases, we are unable to do any physical activities. We are unable to put in at least half an hour of physical workout because we are busy with the children's stuff, the church and family"* (FM3).

1.23.2 Cultural factors: Social obligations.

Another factor that hinders Tongans from understanding and accessing help for prediabetes is their culture. The two main cultural factors that play a huge role in influencing the participants' health is their social obligations and Tongan traditions. These social obligations are centred around their church, family, and school sports which are influenced by their cultural values. Hence the reason why the participants' social obligations are categorized as cultural factors. The participants noted that their social obligations occupy a lot of their time and the social obligations that they were committed to are demonstrated in the following quotations: "*the time you have to exercise and stuff kind of cuts down like especially for us Pasifika knowing that we have commitments like church. I know that most of our kids and*

stuff are into our sports as well…….Just cuts down like the amount of time we have and also knowing our parents will tell us to like sleep or like go have a rest" (Table 6: Q1) and *"Not only that we need to stop with eating but in many cases, we are unable to do any physical activities. We are unable to put in at least half an hour of physical workout because we are busy with the children's stuff, the church, and family"* (Table 6: Q2). As a result, they are unable to engage in any health activities or programmes.

Table 7

Summary of quotations under subtheme 'Cultural factors: Tongan cultural traditions'.

Cultural factors: Tongan cultural traditions	Q1	Youth: "*I think the traditional process has kind of like emerged within our feeds as well. Like you know, we have misinale (annual missionary offering) and all that stuff and it's bound to have pigs and everything. I think that having like traditional, like it's supposed to be a big..supposed to be corn beef. Like it's always been the lifestyle for Tongans*" (YM8).
	Q2	Youth: "*I think she is kind of right like in a way, because I like to faikava as well. I think in a way it relates to prediabetes because I know most of the men and also the youth when they faikava on a Friday, they will sleep the whole Saturday. And then some people just wake up at three in the afternoon get up and you know shower, kai (eat), and then go straight to another faikava. So, that's Friday, Saturday and then you come to church on Sunday, and then faikava Sunday. So, you're not really doing anything. But some people are different. Like some parents and men are different, they like to work out on Saturday, mow the lawns. I know, for me, I just faikava Friday, wake up and then if I go faikava Saturday then Sunday. So, not really doing anything on the weekend"* (YM5).
	Q3	Youth: "*I reckon, like stopping kava is not going to happen. It will always going to be…… I think, the only change you're going to make is based on time limit. Some of the men probably drink from like 8pm to like 4am so maybe if they only drink from 8pm to 12am that way they get back home and rest"* (YM 8).
	Q4	Family member: "*one aspect of why diabetes is a big problem as well is cause just over the importation like import into the islands, like corn beef… Like just those kinds of foods (referring to processed foods). Just cause…. I know they last longer. And like we kind of like adapted it into to our cultural tradition"* (FM3).

1.23.3 Cultural factors: Tongan cultural traditions.

Furthermore, the Tongan traditions that contribute to people engaging in unhealthy lifestyles include having big feasts in social gatherings or celebrations and drinking *kava* for long periods of time. In the *anga fakatonga*, food plays an important social and cultural role in maintaining social norms, and practices which have been highlighted in Table 7: Q1 and Q4. In any Tongan gathering, such as funerals, church conferences, birthdays, and weddings food will always be present, yet there are rules and expectations regarding food and the following quotation highlights the notion that preparing large amounts of food for a traditional gathering as being favourable amongst Tongans: "*I think the traditional process has kind of like emerged within our feeds as well. Like you know, we have misinale (annual missionary offering) and all that stuff and it's bound to have pigs and everything. I think that having like traditional, like it's supposed to be a big…supposed to be corn beef. Like it's always been the lifestyle for Tongans*" (Table 7: Q1). Moreover, the participants noted that most of these foods are high in fat or considered unhealthy.

The participants indicated how Tongans have brought their culture and lifestyle from the Islands to New Zealand in relation to the type of foods served. Most of the participants agreed that "*one aspect of why diabetes is a big problem as well is cause just over the importation like import into the islands, like corn beef… Like just those kinds of foods (referring to processed foods). Just cause…. I know they last longer. And like we kind of like adapted it into to our cultural tradition"* (Table 7: Q4). During the church week of prayer, people would often prepare big feasts for every meal rather than having light meals as breakfast because the majority of the participants and their families were raised in Tonga where the food they ate were similar across meals. For example, they would have foods high in carbohydrates (e.g., taro, cassava, yam) and protein (e.g., beef, fish, pork) for breakfast, lunch and dinner.

Another cultural tradition that influences Tongan peoples' health is drinking *kava* for long periods of time. Both the youth and participants agreed that *faikava* prevents people from healthy living. The youth were more interested in discussing ways of limiting *faikava* sessions, whereas the adults (especially the males) appeared to disregard the topic. Most of the youths' views on *faikava* aligned with the following statement: "*I think she is kind of right like in a way, because I like to faikava as well. I think in a way it relates to prediabetes because I know most of the men and also the youth when they faikava on a Friday, they will sleep the whole Saturday. And then some people just wake up at three in the afternoon get up and you know shower, kai (eat), and then go straight to another faikava. So, that's Friday, Saturday and then you come to church on Sunday, and then faikava Sunday. So, you're not really doing anything. But some people are different. Like some parents and men are different, they like to work out on Saturday, mow the lawns. I know, for me, I just faikava Friday, wake up and then if I go faikava Saturday then Sunday. So, not really doing anything on the weekend"* (Table 7: Q2). Both the youth and adults acknowledged that *faikava* is a Tongan tradition that will be difficult to exclude, and so the best option they suggested was to encourage a restriction on the tradition as shown in the following quotation: "*I reckon, like stopping kava is not going to happen. It will always going to be… I think, the only change you're going to make is based on time limit. Some of the men probably drink from like 8pm to like 4am so maybe if they only drink from 8pm to 12am that way they get back home and rest"* (Table 7: Q3).

Table 8

Summary of quotations under subtheme 'Household income'.

Household income	Q1	Youth: *"You know based on like just little things, like when you thirsty you know!!!, you rather get like a one dollar drink, like a can of coke than get like a five dollar smoothy. Do you know what I mean? And again, on top of that based on Island families. You know like my family has like eight of us, so you not going to get like 5 smoothies for all eight of us. So, then you don't care to shape up. Then you probably going to get more of a 12 pack of like coke instead of getting, like you know … I just feel like that its (referring to income) kind like a huge factor, why I think most Tongans like eating bad and everything" (YM8).*
	Q2	Family member: "*You know, most Islanders…they are low-income people. They will buy foods that are cheap and available. And those are the factors that contribute to prediabetes and T2DM. For instance, we all want to eat healthy foods……When you receive your income you go to the shops and even though you would like to buy something healthy, you will only be able to buy food that you can afford……For most islanders, when they are told to go buy bread that has wheat; the expansive one. We will go and buy cheap bread that is not considered healthy because we are able to afford it……We all want to eat bread that is healthy, but we are not like the palagis or people who have high statuses who can afford it" (FM3).*

1.23.4 Household income.

Household income was also a factor that prevented people from understanding and accessing help for prediabetes. Both the youth and adults indicated that food choices were greatly influenced by income, and many were aware of the following aspect: "*You know, most Islanders…they are low-income people. They will buy foods that are cheap and available. And those are the factors that contribute to prediabetes and T2DM. For instance, we all want to eat healthy foods…When you receive your income you go to the shops and even though you would like to buy something healthy, you will only be able to buy food that you can afford…For most islanders, when they are told to go buy bread that has wheat; the expansive one. We will go and buy cheap bread that is not considered healthy because we are able to afford it"* (Table 8: Q2).

The youth participants shared similar views that Tongans have big families, and therefore only purchase foods that they are able to afford and often these foods are considered unhealthy which was evident in the following quotation: "*You know based on like just little*

things, like when you thirsty you know!!!, you rather get like a one dollar drink, like a can of coke than get like a five dollar smoothy. Do you know what I mean? And again, on top of that based on Island families. You know like my family has like eight of us, so you not going to get like 5 smoothies for all eight of us. So, then you don't care to shape up. Then you probably going to get more of a 12 pack of like coke instead of getting, like you know …. I just feel like that its (referring to income) kind like a huge factor, why I think most Tongans like eating bad and everything" (Table 8: Q1).

1.24 Enabling factors for attending the *Polokalama mo'ui lelei.*

This theme refers to motivating strategies that will encourage participants to attend the programme. In the group discussions three subthemes emerged from this major theme including education, nutrition, and physical activities. These subthemes relate to the *Polokalama mo'ui lelei* components. Tables 9, 10 and 11 presents identified motivating strategies for each component using quotations. In general, the participants noted that the *Polokalama mo'ui lelei* should provide an incentive to initially motivate people to participate in health programmes. The youth insisted on ensuring that the activities were fitting for everyone in church and not just for the youth. They viewed the positive impact of including everyone, and that involving the entire church will mean that there will be more collective support and motivation for the programme.

Table 9

Summary of quotations under subtheme 'Health education component'.

Health education component	Q1	Youth*: "I feel like within our church, we have two…. couple of nurses. They wouldn't really like…you know!!! Most of the Tongan mums will be like, nah!!! I know myself … you know what I mean...Like I know what I know. Even though they've studied the same thing but then if they heard it from someone else then you know it's different"* (YM8).
	Q2	Youth: *"I think especially for the church, for Wesley church, I think like the pamphlets and stuff probably won't really work for them. But I think like a talk or something at the church service or something, kind of like what we have here. I think that would kind of really wake them up"* (YM5).
	Q3	Family member: *"Once we finish this programme how about we educate our kids at home. I'm sure you have spoken to them. It is also beneficial when we go home and discuss about these health issues. And I believe that the church is there as a greater support, and they are our family too. For me, we need to begin health education from home because once church service is finished, we all disperse home and won't continue to pertain to the church. When we go home and educate our families about healthy living it becomes easier when the church steps in to run health programmes. Therefore, I encourage families to go home and educate your family members. This will make things easier"* (FM1).

1.24.1 Health Education component.

Both the youth and adult participants were aware of the importance of educating Tongan people about prediabetes, especially when they are at high risk of developing the condition. An important component of education that the participants highlighted was the idea of establishing health promotional messages in the church. The church has members who are health professionally trained, the congruent views shared were: "*I feel like within our church, we have two…couple of nurses. They wouldn't really like...you know!!! Most of the Tongan mums will be like, nah!!! I know myself … you know what I mean...Like I know what I know. Even though they've studied the same thing but then if they heard it from someone else then you know it's different"* (Table 9: Q1). The participants expressed that they prefer health professionals who are not part of the church to educate them regarding prediabetes. Furthermore, the youth noted the importance of having Tongan health professionals conduct

health education in the Tongan language since many of the older adults spoke limited English.

Both the adults and youth emphasized incorporating motivating strategies such as the one mentioned here: "*I think especially for the church, for Wesley church, I think like the pamphlets and stuff probably won't really work for them. But I think like a talk or something at the church service or something, kind of like what we have here. I think that would kind of really wake them up"* (Table 9: Q2), and implementing methods of delivery that is fun, interactive and involves health professionals engaging with the church members. Some of the participants also displayed the importance of educating family members at home and stated: "*Once we finish this programme how about we educate our kids at home. I'm sure you have spoken to them. It is also beneficial when we go home and discuss about these health issues. And I believe that the church is there as a greater support, and they are our family too. For me, we need to begin health education from home because once church service is finished, we all disperse home and won't continue to pertain to the church. When we go home and educate our families about healthy living it becomes easier when the church steps in to run health programmes. Therefore, I encourage families to go home and educate your family members. This will make things easier"* (Table 9: Q3).

Table 10

Summary of the quotation under subtheme 'Nutrition component'.

Nutrition component	Q1	Youth: "*I don't think there should be like drastic changes just cause that it might be like a cultural shock, for like our people. I think just starting off with like small, like alternatives…. For example, like one person will make lū (taro leaves), even if it was just lū (taro leaves) without the coconut cream"* (YM3).

1.24.2 Nutrition component.

For nutrition, participants displayed how this may have impacted on Tongan peoples' health, particularly as sharing food is an integral part of *anga fakatonga*. While the adults focused on including a nutritionist to educate and demonstrate healthy cooking, the youth focused on the nutrition session delivery aspect. The youth had similar suggestions to the following: "*I don't think there should be like drastic changes just cause that it might be like a cultural shock, for like our people. I think just starting off with like small, like alternatives…. For example, like one person will make lū (taro leaves), even if it was just lū (taro leaves) without the coconut cream"* (Table 10: Q1). Overall, there was greater emphasis on incorporating cooking demonstrations, cooking classes, and integrating church members in the programme.

Table 11

Summary of quotations under subtheme 'Physical activities component'.

Physical activities component	Q1	Youth: "*Based on activities with like the boys, as a youth I could see us more like waking up to like going to play a touch game instead of like a walk……I feel like, its motivational for us. But if it's for the church to go for a walk. I won't get up. But also, if it will be touch, I will be like sweet as…. Allgood.!!!"* (YM8).
	Q2	Youth: "*I think especially for our youth, a walk will be good, will still be good. I think at the same time exercising your body is …. you are also building a relationship, like a closer relationship within ourselves. So, I noticed that our youth leader, Takipo…. So, our Wellington anniversary, like we… went to the beach, I wasn't there because I was busy doing some stuff but, you know the youth were all there. So, I think, for me personally, I think the walking or doing things together, not separate, not just the boys and the girls. But as a … As a group. So, everything we do just so that we can build a closer relationship. So, like, yeah! I think also at the same time exercising the body and also other little activities you can do while you walk. Like if you want a little rest, you can have little games in between, so make it more fun."* (YM5).
	Q3	Family member: "*We need different activities throughout the year so that people don't get bored. Based on my experience people drop out when the programme is boring. It would be good to have different programmes to motivate and encourage people. For example, someone from Massey university comes and offers to give a prize for a weight loss competition, cooking competition or any competitions. I reckon that a lot of people will turn up. And it's something for our church health committee to think about when establishing a health programme"* (FM3).

1.24.3 Physical activities component.

The participants recognised the important role of exercising in reversing prediabetes. They highlighted aspects of physical activities that would motivate them to attend the *Polokalama mo'ui lelei.* The adults agreed with the following statement: "*We need different activities throughout the year so that people don't get bored. Based on my experience people drop out when the programme is boring. It would be good to have different programmes to motivate and encourage people. For example, someone from Massey university comes and offers to give a prize for a weight loss competition, cooking competition or any competitions. I reckon that a lot of people will turn up. And it's something for our church health committee to think about when establishing a health programme"* (Table 11: Q3).

The youth had varying views regarding the type of physical activities to include in the programme. Some youth suggested that the physical activities should have some degree of competition: "*Based on activities with like the boys, as a youth I could see us more like waking up to like going to play a touch game instead of like a walk……I feel like, its motivational for us. But if it's for the church to go for a walk. I won't get up. But also, if it will be touch, I will be like sweet as…. Allgood.!!!.* (Table 9: Q1). Other youth participants opposed and viewed incorporating a competitive physical activity unnecessary which was reflected in this statement: *"I think especially for our youth, a walk will be good, will still be good. I think at the same time exercising your body is …. you are also building a relationship, like a closer relationship within ourselves. So, I noticed that our youth leader, Takipo…. So, our Wellington anniversary, like we… went to the beach, I wasn't there but because I was busy doing some stuff but, you know the youth were all there. So, I think, for me personally, I think the walking or doing things together, not separate, not just the boys and the girls. But as a … As a group. So, everything we do just so that we can build a closer relationship. So, like, yeah! I think also at the same time exercising the body and also other*

little activities you can do while you walk. Like if you want a little rest, you can have little games in between, so make it more fun." (Table 11: Q2). Overall, the majority of the youth noted that it was more important to include physical activities that were interactive, fun, and fitting for all age groups.

1.25 Processes that need to be established in the community.

This theme refers to the systematic changes and approaches that needed to be implemented in the Tongan community to help address the risk factors for prediabetes. The participants' discussions on the processes that need to be established in the community generated two subthemes highlighted in Tables 12 and 13 with supporting quotations.

Table 12

Summary of the quotations under subtheme 'Promoting healthy living in church'.

Promoting healthy living in church	Q1	Family member: "*There are many people that have knowledge about healthy living and what needs to be done, yet it seems to be a different story when applying it to their lifestyle. I think when we speak of education, we don't instil this knowledge in our lifestyle. When we practice 'education' this means waking up in the morning and preparing a healthy breakfast rather than eating unhealthy foods"* (FM3).
	Q2	Family member: *"It is important for the health committee to go back and draw up a plan, a programme regarding what needs to be done. It's not about just educating people but also bringing someone to give a cooking demonstration on healthy foods"* (FM3).
	Q3	Family member: "*It is better to discuss healthy living and also work towards it. For instance, if the church runs a health programme…Like on Fridays we gather for choir practice and once that is finished, men will stay and drink kava till 2 am. I'm thinking if we come and begin an exercise programme for an hour before choir practice. We should talk about healthy living and find ways to begin the journey. I believe we should do exercises because we already have resources like the church hall. There is a shower for people to use after exercising. After exercising we can then continue with the other church programmes. I believe that is this part of the health committee's responsibility to begin an exercise programme"* (FM 11).

1.25.1 Promoting healthy living in church.

Regarding health promotions, the youth identified the need to include church-based health promotions to educate people about prediabetes and healthy living. The adults noted that education and action should go hand-in-hand as described in this quotation: "*There are many people that have knowledge about healthy living and what needs to be done, yet it seems to be a different story when applying it to their lifestyle. I think when we speak of education, we don't instil this knowledge in our lifestyle. When we practice 'education' this means waking up in the morning and preparing a healthy breakfast rather than eating unhealthy foods"* (Table 12: Q1). The adults further suggested that health promotions should be embedded in church: "*It is better to discuss healthy living and also work towards it. For instance, if the church runs a health programme…Like on Fridays we gather for choir practice and once that is finished, men will stay and drink kava till 2 am. I'm thinking if we come and begin an exercise programme for an hour before choir practice. We should talk about healthy living and find ways to begin the journey. I believe we should do exercises because we already have resources like the church hall. There is a shower for people to use after exercising. After exercising we can then continue with the other church programmes. I believe that is this part of the health committee's responsibility to begin an exercise programme"*. (Table 12: Q3). There were also discussions that were similar to the following statement regarding the importance of activating the church health committee so that they can initiate promoting healthy living in church: "*It is important for the health committee to go back and draw up a plan, a programme regarding what needs to be done. It's not about just educating people but also bringing someone to give a cooking demonstration on healthy foods"* (Table 12: Q2).

Table 13

Summary of quotations under the subtheme 'Structural change in church'.

Structural change in church	Q1	Youth*: "The time that you have to exercise and stuff kind of cuts down like especially for us Pasifika people knowing that we have commitments like church. I know that most of our kids and stuff are into our sports as well…. Just cuts down like the amount of time we have"* (YM3).
	Q2	Family member*: "It is important for the health committee to go back and draw up a plan, a programme regarding what needs to be done. It's not about just educating people but also bringing someone to give a cooking demonstration on healthy foods"* (FM3).

1.25.2 Structural change in church.

The participants reported that the church acts as the main religious and social hub for the Tongan society. Moreover, they are aware of the impact of church on lifestyle and health. While the adults highlighted the importance of fitting health programmes in the church schedule, the youth reported that numerous programmes held at the church makes it impossible to implement a health programme. The adults focused more on the role of the church health committee in influencing health behaviours and as noted in the following quotation: *"It is important for the health committee to go back and draw up a plan, a programme regarding what needs to be done. It's not about just educating people but also bringing someone to give a cooking demonstration on healthy foods"* (Table 13: Q2). Moreover, the adults highlighted that the health programmes established in church needs to be carried out consistently, and not as a one-off event.

The youth also reported that their obligations to carry out church activities occupied a lot of their time. Therefore, implementing a health programme in church would be a challenge, as shown in the following statement: *"The time that you have to exercise and stuff kind of cuts down like especially for us Pasifika people knowing that we have commitments like church. I*

know that most of our kids and stuff are into our sports as well…. Just cuts down like the amount of time we have" (Table 13: Q1).

1.26 Phase 2: To co-design a community-based Polokalama mo'ui lelei.

1.26.1 The development of a Tongan co-design model.

A major finding from this phase of the study was the establishment of a Tongan model of health, the *Fengaueaki Fakataha* model (see Figure 3 below). The *Fengaueaki Fakataha* model was developed as a direct result of using the initial two Bratteteig co-design steps, which highlighted that the Westernised approach to co-design was not culturally sensitive to addressing the needs of the Tongan community and worldview. Therefore, this model was developed for the purposes of ensuring that the values, principles, and Tongan community processes were interwoven into this study.

Figure 3

The Fengaueaki Fakataha model.

Figure 3 illustrates the concept of Tongan co-design, values, beliefs, and practices. The *Fengaueaki Fakataha* model has two parts:

The **inner elements** of the pentagon encompasses the Tongan peoples' social context and its impact on health, which includes the Tongan *ngatu*, *fonu* (turtle), and different shades of people linking hands in a circle representing various influences that will be discussed below.

2) The **communication processes** (*Fakafehokotaki*, *Fakafanongo*, *Fakasinoaki*, *Fakamahuinga'i*, and *Fakamuimānoa*)

The Tongan *ngatu* is a traditional cloth made from the bark of the mulberry tree and are often decorated with motifs and patterns taken from the natural environment or associated with important people and events. It has been the treasure of Tongan peoples' ancestors, passed from generation to generation. To date, the *ngatu* is still one of their prestige, traditional and cultural wealth used in gift-giving, and other traditional rituals as a sign of respect (205). In the *Fengaueaki Fakataha* model, the *ngatu* represents the *anga fakatonga* which embraces all Tongan values, practices, and beliefs that shape their worldview, ways of communicating, and behaviour.

The *anga fakatonga* is an important part of the Tongan identity that provides an implicit knowledge of how to behave and interpret peoples' behaviours in different situations (1, 20, 34, 46, 206). The *fonu* (turtle) painted on the *ngatu* represents the Tongan peoples' health, whereas the different shades of people linking hands in a circle represents the importance of including everyone (e.g., stakeholders, health professionals, church leaders, communities, and researchers) to work collectively when addressing health issues in the Tongan community. It also represents the Tongan notion of forming partnerships with the communities to find solutions to health issues.

Fundamental to the *anga fakatonga* are the Tongan values: *fefaka'apa'apaki* (mutual respect), *feveitokai'aki* (sharing, and fulfilment of mutual obligations), *tauhi vā* (loyalty and commitment to relationships) and *fakatokilalo* (humility and generosity) (1, 38, 46, 207). These values are motivating and guiding principles that influence Tongan attitudes and behaviours which are embedded within the communication processes of the *Fengaueaki*

Fakataha model. These processes are unique to the Tongan people as they emphasize the holistic nature of life and the centrality of good relationships, as well as the connections between the land, sea, sky and the spirituality that binds them together in the past, present and future (46). Throughout the research, these communication processes enabled Tongan youth and adults to create meaning, structure reality, develop ways of knowing, categorize, and process information, and transform abstract notions into concrete ideas. The first part of the model will be further explored in Chapter 5. In this study, the term *Fengaueaki Fakataha* and co-design will be used interchangeably, depending on context.

1.27 Communication processes of the Fengaueaki Fakataha model.

These communication processes have been briefly described in Chapter 3 in relation to the data collection processes. However, this section elaborates on cultural aspects that are linked to the various communication processes.

1.27.1 Fakafehokotaki.

In the *anga fakatonga*, *fakafehokotaki* goes beyond superficial interactions to form sustainable, enduring, and genuine relationships. The *fakafehokotaki* concept is comprised of three components, including *fefakamaheniak*i (introducing yourself), *fetu'utaki* (connecting with others), and *fakahoko* (informing people about the research). These components are interwoven processes, expressed in many forms and levels depending on one's place within the social or church hierarchy. For example, the *fakafehokotaki* process carried out with the Tongan youth was less formal, whereas the *fakafehokotaki* process that occurred amongst the church leaders and adults was more formal, particularly in the way the researcher communicated with them, and the levels of Tongan words and vocabulary used. For instance,

I was able to use Tongan colloquial language when interacting with the youth, whereas with the adults my communication shifted to a more respectful dialogue.

The *fakafehokotaki* process helped build and strengthen the rapport between the research team and the Tongan community. This process involved the space where the *fefakamaheni'ak*i, *fetu'utaki,* and *fakahoko* occurred. At the co-design stages of the research, the *fakafehokotaki* process centred on discussing where and when to carry out the *Polokalama mo'ui lelei.* The major concept of *fakafehokotak*i is ensuring that the church leaders were consulted at every stage of the research process.

1.27.2 Fakafanongo.

The *fakafanongo* process inherently takes place when you are interacting with people. However, in a co-design setting it goes beyond simply hearing. The *fakafanongo* process involves listening emphatically with your eyes, ears and heart to peoples' words, tone and body language while the participants share their health beliefs, values and worldviews. Through the *fakafanongo* process, I gained knowledge regarding the church dynamic, hierarchy and environment which was helpful with regards to finding the best time to implement the health programme and who would be the best church leaders to liaise with regarding the research processes.

1.27.3 Fakasinoaki and Fakamahuingai'i.

The *fakasinoaki* and *fakamuhingai'i* communication processes are action-oriented, and therefore, it was more suitable to describe it along with the methods involved in gathering data. Both processes were described earlier in Chapter 3 with the *fakasinoaki* process centred on transforming abstract plans into concrete actions. It was conducted in a way that participants felt comfortable to express their ideas. For example, the youth were separated in two groups, one for the males and the other for the females. On the other hand, the

fakamahuingai'i process highlighted the evaluation of the *Polokalama mo'ui lelei* and the various aspects that were part of the evaluation process. This included examining participation, fidelity to the planned strategy, participant satisfaction, and human/ material resources of the Tongan health programme.

1.27.4 Fakamuimānoa (Concluding the study).

The concept *fakamuimānoa* refers to the concluding phase of the study. Primarily it highlights the processes involved once the research is complete. This includes disseminating the results of the study to the Tongan community and thanking them for their participation and support. It also entails acknowledging that my *faifatongia* to the Tongan community for this study has come to an end; however, addressing prediabetes is an ongoing collective journey. Again, encouraging the Tongan community to continue living a healthy lifestyle, given the numerous community-wide benefits.

1.28 Co-designed Programme Implementation

Table 14

Pre to Post intervention changes in intervention-based measurements.

Variables	N* n=#	Mean	SD
change in weight (kg)	10	-0.89	1.49
change in BMI (kg/m^2)	10	0.41	1.88
change in waist circumference (cm)	8	3.01	3.36
change 6MWT	2	-1.10	15.69

Prior to implementing the 10 weeks *Polokalama mo'ui lelei*, measures including the 6MWT, height, weight, waist circumference, and blood pressure were taken. The participants also completed a DKB and the prediabetes risk test. The prediabetes risk test further confirmed that all participants were at risk of prediabetes. More than half of them have not been told that they have prediabetes and diabetes. Of the 10 participants who took part in the *Polokalama mo'ui lelei*, seven of them were females between the ages of 18 and 45. However, only eight participants completed the DKB questionnaire which provided demographic insights. Amongst the eight participants that completed the DKB questionnaires, seven participants had at least a high school qualification or a school leavers certificate. Additionally, most of the participants highlighted having a family history of T2DM. Two other participants were unable to complete the questionnaires and were uncontactable, so there is no information on these participants.

The 10 weeks *Polokalama mo'ui lelei* was co-ordinated by the researcher with the support of the taskforce group (a group comprised of representatives from the youth and family, medical health doctor, youth leader, church health committee leader and a Masters student intern).

Participants received twice weekly physical activities: one was the social netball competitions, and the other was a circuit training workout led by the church secretary and health leader. Furthermore, the education sessions were held once a week covering the following topics: how to read nutrition labels; home based exercises and benefits of regular exercising; menu planning, healthy foods and choices; prediabetes-based education; portion sizes; food nutrition and cooking demonstration. These sessions were conducted by a Masters student (in nutrition) who was undertaking an internship under my mentorship, a church nurse and a representative from Diabetes New Zealand.

The findings presented here for the intervention programme can be described as ubiquitous, because not all participants completed the measurements required for pre and post intervention due to a variety of reasons. Amongst the 10 participants, nine participants completed the blood pressure, waist circumference and BMI measures, while four participants completed the 6MWT. Some of the participants were unable to complete certain measures due to family functions, funerals or church meetings that occurred at the same time of the *Polokalama mo'ui lelei*. Thus, the findings are characteristic of those study participants that completed the data measurements and cannot be generalised to the general Tongan community. The means and standard deviations for the measures acquired from the participants' pre and post intervention were calculated. Table 14 showed changes in weight of 0.89 kg (compared to the average weight of 116.76 kg at baseline); the average BMI changed from 0.41 kg/m^2 (from the average baseline of 38.17 kg/m^2) and the average decrease in waist circumference was 3.01cm (from baseline 121.6 cm). This shows that the *Polokalama mo'ui lelei* made a positive difference in each participant's weight, BMI, and waist circumference measurements, but not for the 6MWT. Many of the participants did not attend both pre and post 6MWT measures due to reasons mentioned earlier. However, as the intervention study sample was too small to carry out meaningful statistical analyses. As such, the *Polokalama*

mo'ui lelei was a subsidiary pilot of the co-design process so that I could better understand the needs and gaps of prediabetes prevention at a community level.

1.29 Phase 3: To evaluate the effectiveness of the co-design approach and community-based Polokalama mo'ui lelei.

Following the completion of the *Polokalama mo'ui lelei*, the participants took part in the evaluation process based on these various elements: participation factor, fidelity to the planned strategy, participation satisfaction, as well as the human/material resources of the co-design approach. The analysed data from the evaluation process reflected three major themes including factors that affected peoples' participation to the *Polokalama mo'ui lelei*, their views of the programme and suggestions for future health programmes.

Figure 4

Coding process for the evaluation of the Polokalama mo'ui lelei for the adults.

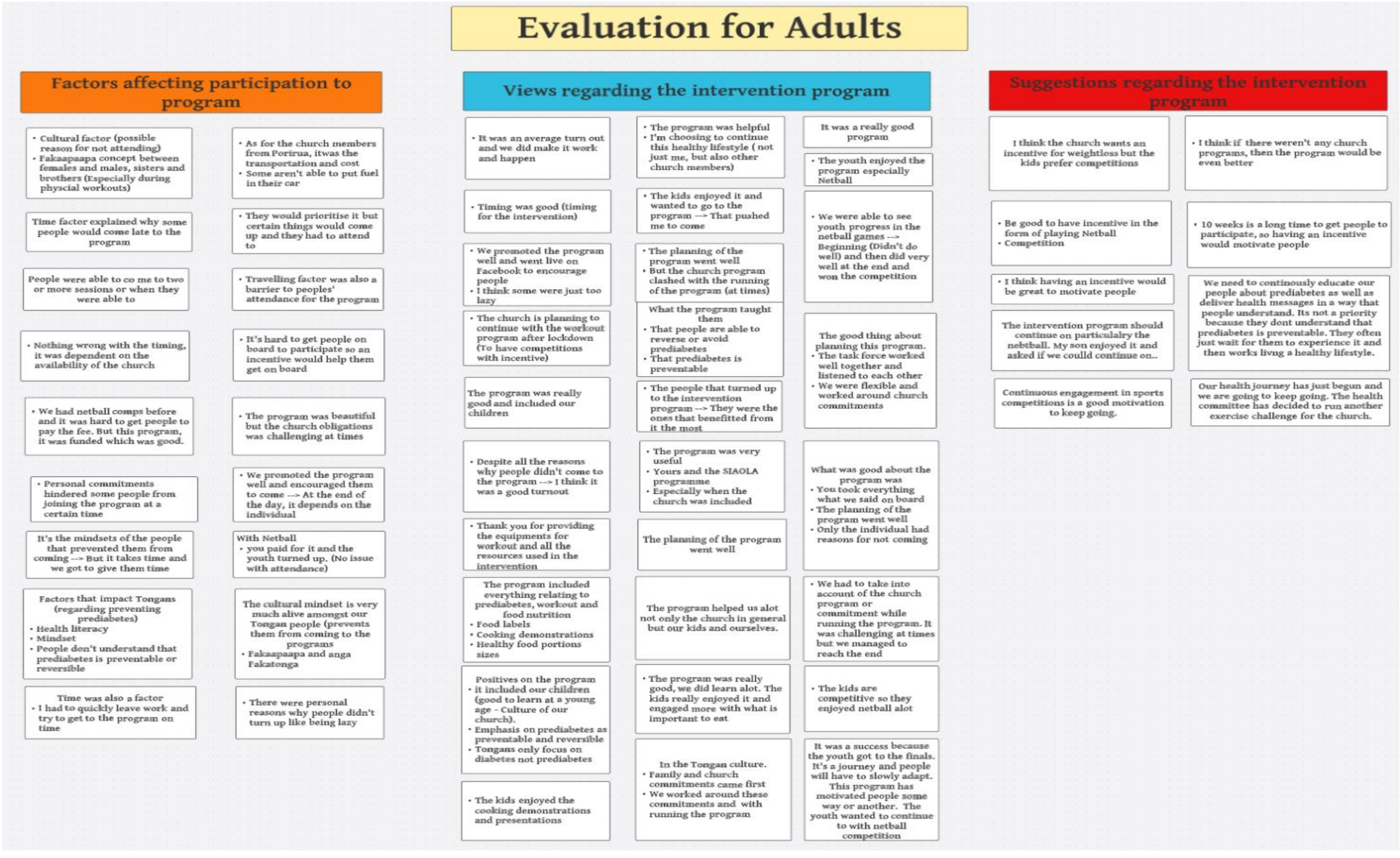
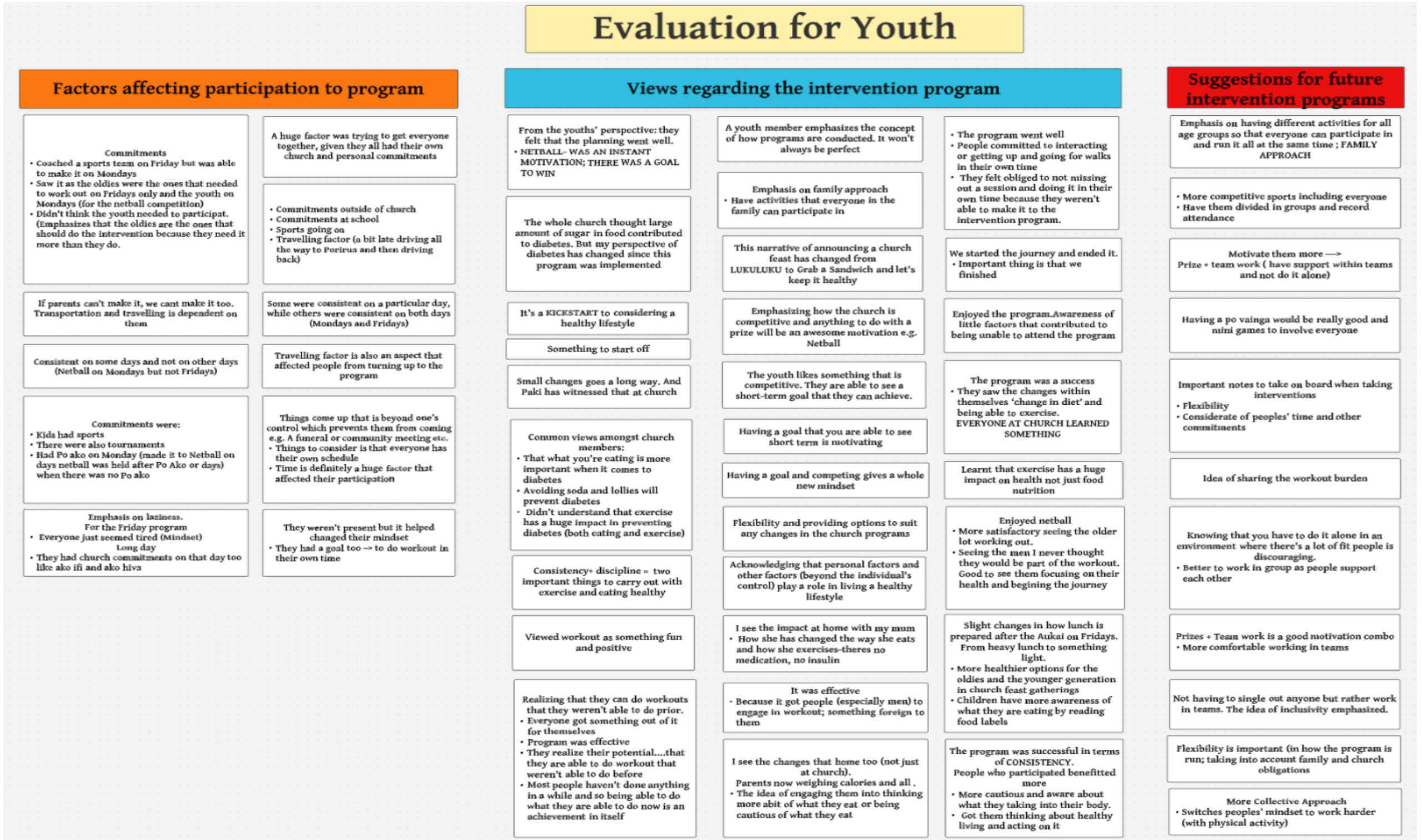


Figure 5

Coding process for the evaluation of the Polokalama mo'ui lelei for the youth



Figures 4 and 5 illustrates the overall thematic analysis. The recordings from the Zoom meetings were transcribed and translated by the researcher. Initial coding was generated through reading the transcriptions at least three times. Sections of the transcribed script (usually phrases or sentences) were highlighted using different colours corresponding to different codes. Each code described the ideas or feelings expressed in part of the text relating to the participants' perspectives or collection of views on the *Polokalama mo'ui lelei.* The data were collated together into groups identified by the codes, providing a condensed overview of the main points and common meanings that recurred throughout the data. Following the coding process, patterns and themes were identified. The procedure of review, verifying and expanding on themes were repeated by the researcher until saturation of the themes could no longer be expanded.

1.30 Factors that affected peoples' participation to the programme.

This major theme refers to the reasons why participants were unable to attend the 10 weeks *Polokalama mo'ui lelei* consistently. Four subthemes (time factor, transport factor, cultural factor, and individual factor) emerged from the analysed data which is highlighted in Tables 15 to 18 with corresponding quotations.

Table 15

Summary of the quotations under the subtheme 'Time factor'.

Time factor	Q1	Youth: "*Oh, and one of it was, our problem was just like getting there and getting back because it was a bit late driving all the way to Porirua and then driving back here"* (YM9).
	Q2	Youth: "*Yeah, I think because other people had like other commitments on Friday, for example, some kids had sports, so obviously their parents would take them to their rugby training. There was also tournaments and stuff that prevented them from coming. Their only available day would probably be Monday, but for me on the other hand, because I mentioned before, I have Pō ako (night classes) on Monday, I couldn't make it. I could only come to netball on the days that I was available on, or the days that if netball was later or if netball was earlier, then I'd come to Pō ako"* (YM2).
	Q3	Family member: "*For me it was the time as well that I found challenging. I finish at 5:30pm and I have to try to get there to the physical workout programme. It's usually the time…. when people know that they will be late to the programme they just choose to stay home instead"* (FM13).
	Q4	Family member: "*I think it was…timing was all good. I think it was just probably certain times there would be events that would happen during that day. You know, it wasn't like…. you know!! there would be people that would show up once and then two gaps and then again. I think it was like you know you would prioritize it but because you were busy. But out of all we saw that it was the same people that came to the programme…I mean nothing wrong with the timing or the day or whatever it was just like….it was just dependent on those who could make it, the availability of the church and all that"* (FM12).

1.30.1 Time factor.

'Time factor' was considered a barrier to participants attending the *'Polokalama mo'ui lelei'*. Some church members attended the *Polokalama mo'ui lelei* consistently, while others attended 5 to 10 sessions throughout the 10-week programme (2 sessions per week). The youth further emphasized that the time in which the sessions of the health programme was conducted did not fit their busy schedules which impacted their attendance. This was

reflected in one of the youth's statements: "*Yeah, I think because other people had like other commitments on Friday, for example, some kids had sports, so obviously their parents would take them to their rugby training. There was also tournaments and stuff that prevented them from coming. Their only available day would probably be Monday, but for me on the other hand, because I mentioned before, I have Pō ako (night classes) on Monday, I couldn't make it. I could only come to netball on the days that I was available on, or the days that if netball was later or if netball was earlier, then I'd come to Pō ako"* (Table 15: Q2). Conversely, the distance the participants travelled from their homes to the church where part of the programme was held took a lot of time as highlighted by one of the participants: "*Oh, and one of it was, ... our problem was just like getting there and getting back because it was a bit late driving all the way to Porirua and then driving back here"* (Table 15: Q1).

The adult participants also highlighted the challenges of rushing from work to attend the *Polokalama mo'ui lelei*. For instance, one of the adults mentioned: *"For me it was the time as well that I found challenging. I finish at 5:30pm and I have to try to get there to the physical workout programme. It's usually the time…. when people know that they will be late to the programme they just choose to stay home instead"* (Table 15: Q3). In contrast, another adult disagreed and noted that 'time' was not an issue: "*I think it was…timing was all good. I think it was just probably certain times there would be events that would happen during that day. You know, it wasn't like…. you know!! there would be people that would show up once and then two gaps and then again. I think it was like you know you would prioritize it but because you were busy. But out of all we saw that it was the same people that came to the programme…I mean nothing wrong with the timing or the day or whatever it was just like….it was just dependent on those who could make it, the availability of the church and all that*" (Table 15: Q4).

Table 16

Summary of the quotations under the subtheme 'Transport factor'.

Transport factor	Q1	Youth: "*If I had like my own car and stuff, honestly! I would have picked up all the younger boys, but that's just because that's just me. …If we all have our own travel, then the participation will be... You know what I mean? If our parents can't make it because they're working, then we could all still go"* (YM8).
	Q2	Family member: "*I think some of them don't have petrol*" (FM13).

1.30.2 Transport factor.

Another factor that affected peoples' participation in the programme was transport. The adult participants highlighted that most of the church members lived in the Porirua suburb (a 40-minute drive north out of the Wellington city centre) and some were faced with the following challenge: "*I think some of them don't have petrol*" (Table 16: Q2) to travel to the *Polokalama mo'ui lelei.* Furthermore, the youth highlighted the benefits of having transport and how it could have a positive impact regarding attending the *Polokalama mo'ui lelei.* A youth participant further stated: "*If I had like my own car and stuff, honestly! I would have picked up all the younger boys, but that's just because that's just me. …If we all have our own travel, then the participation will be... You know what I mean? If our parents can't make it because they're working, then we could all still go"* (Table 16: Q1).

Table 17

Summary of the quotations under the subtheme 'Cultural factor'.

Cultural factor	Q1	Family member: "*I believe that the anga fakatonga is also a barrier that hinder people from participating in the exercise programme. There are some elderlies that still have that type of thinking towards the type of exercises we do. Although we are in a different country, different environment, it's the norms to do those type of exercises such as stretching your legs and so forth. For me, there are some people who are uncomfortable and so it prevents them from coming…I believe it's one of the points, particularly how our culture is with the respect that occurs between sisters and brothers. The brothers won't be able to do exercise with their sisters around and vice versa, and so they won't turn up."* (FM11).
	Q2	Family member: "*These cultural ways are hard to change; however, despite having that type of mindset, there was an overall good turn up"* (FM13).

1.30.3 Cultural factor.

Certain cultural factors also accounted for the peoples' lack of participation to the programme, namely the *faka'apa'apa* concept between family members of the opposite sex. The adults addressed the impact of the *anga fakatonga* when carrying out physical activities as shown in the following statement: "*I believe that the anga fakatonga is also a barrier that hinder people from participating in the exercise programme. There are some elderlies that still have that type of thinking towards the type of exercises we do. Although we are in a different country, different environment, it's the norms to do those type of exercises such as stretching your legs and so forth. For me, there are some people who are uncomfortable and so it prevents them from coming…I believe it's one of the points, particularly how our culture is with the respect that occurs between sisters and brothers. The brothers won't be able to do exercise with their sisters around, and vice versa and so they won't turn up" (*Table 17: Q1). Moreover, they emphasized that: "*These cultural ways are hard to change; however, despite having that type of mindset, there was an overall good turn up"* (Table 17: Q2).

Table 18

Summary of the quotations under the subtheme 'Individual factor'.

Individual factor	Q1	Youth: "*I guess laziness just comes into play, to be honest. It's end of the week Friday. Most people are on that mindset…. they just finished work (and just too tired to go to the Polokalama mo'ui lelei programme)"* (YM8).
	Q2	Family member: "*I think it's the mindset of the individual. If they want to go and if they…. you know!!! care about their health then that's the way to go. But you know it does take time and we got to give time to them"* (FM12).
	Q3	Family member: *"Some people think that they are not affected by prediabetes; therefore, they don't feel the need to come to the Polokalama mo'ui lelei"* (FM11).

1.30.4 Individual factor.

Both the youth and adults conveyed that the lack of participation was attributed to the peoples' lack of motivation, mindsets, and attitudes toward the *Polokalama mo'ui lelei*. One of the youth participants stated: "*I guess laziness just comes into play, to be honest. It's end of the week Friday. Most people are on that mindset...they just finished work (and just too tired to go to the Polokalama mo'ui lelei programme"* (Table 18: Q1*).* Another participant noted*: "I think it's the mindset of the individual. If they want to go and if they…. you know!!! care about their health then that's the way to go. But you know it does take time and we got to give time to them"* (Table 18: Q2). While others mentioned: *"Some people think that they are not affected by prediabetes; therefore, they don't feel the need to come to the Polokalama mo'ui lelei*" (Table 18: Q3).

1.31 Participants' views regarding the 'Polokalama mo'ui lelei'.

This major theme refers to the participants thoughts about the overall health programme. Based on the data analysed, four subthemes were generated and are highlighted in Tables 19 to 22 together with supporting quotations.

Table 19

Summary of the quotations under the subtheme 'Common outlook of the Polokalama mo'ui lelei'.

Common outlook of the *'Polokalama mo'ui lelei'*	Q1	Youth: "*I reckon it was successful as well like they have mentioned, but yeah, because you started it, and you went along with it. Even though there was like some days, there was not really that much people that turned up, but you pushed through it, it was that consistency that you had. You finished it and everyone, the people that participated benefited from the programme that you had on and it like, you know it changed... Like we've mentioned before, it changed everyone's' lifestyle to be healthy and stuff. Yeah, they've put more effort into knowing what they're taking into their body. Yeah! Yeah! it was really good; it was really successful as well" (YM9).*
	Q2	Family member*: "The programme went really well and even though the church had other commitments that didn't stop us from continuing on with the programme" (FM13).*

1.31.1 Common outlook of the Polokalama mo'ui lelei.

There were distinct facets of the *Polokalama mo'ui lelei* that the participants considered satisfactory, particularly with regards to the consistency of the programme, how the researcher dealt with the numerous unforeseen church obligations and completing the programme. The majority (90%) of the participants thought: *"the programme went really well and even though the church had other commitments, that didn't stop us from continuing on with the programme"* (Table 19: Q2). These participants' thoughts also aligned with the following statement: "*I reckon it was successful as well like they have mentioned, but yeah, because you started it, and you went along with it. Even though there was like some days, there was not really that much people that turned up, but you pushed through it, it was that consistency that you had. You finished it and everyone, the people that participated benefited from the programme that you had on and it like you know it changed... Like we've mentioned before, it changed everyone's' lifestyle healthy, to be healthy and stuff. Yeah, they've put more effort into knowing what they're taking into their body. Yeah! Yeah! it was really good; it was really successful as well"* (Table 6: Q1). More importantly, there was a general consensus amongst the participants regarding how inspiring the *Polokalama mo'ui lelei* given that it was educational, inclusive, and motivational.

1.31.2 Health education factor.

Table 20

Summary of the quotations under the subtheme 'Health education factor'.

Health Education factor	Q1	Youth*:"I was more consistent on Monday, and didn't turn up on Fridays and then there were people who were more consistent on Fridays and Mondays…Well, for me, it was also what I learned was the huge impact of exercise towards the health of our body and all. Growing up, I thought it was always just about what you're eating, stuff like that. With diabetes, since I was a little kid, I was always just like, "Oh, eat too many lollies, drink too much soda, and all then you're going to end up getting diabetes." I always kept my body away from it, but then I didn't understand the huge influence exercise can do towards your body. It's not only the eating, it's both, if you know what I mean"* (YM8).
	Q2	Youth: "*The intervention programme was really successful. We as the group who planned it learned things, but everyone at church learnt something. From younger members to the oldies, they all learned something and together, we made a change. We… only ourselves could see that change"* (YM2).
	Q3	Youth: "*I also realize with church stuff. When we have lukuluku (shared lunch) when someone would stand up and say that we have lukuluku, it was always… we stopped saying lukuluku, but started saying like, "Oh, maybe just grab a sandwich on the way, let's keep it healthy and all that"* (YM9).
	Q4	Youth*: "Yeah, I saw a lot of changes because with aukai (after fasting period) on Fridays, it used to be a heavy lunch, but ever since our intervention programme started up and just learning about the food we eat and stuff like that… it just made a huge change with the meals we have at aukai. Things are getting healthier. We have more healthier options for the older generation, but the younger generation as well. I remember one Monday when we were playing netball, I went to Pak n Save and I came back with a pic of soy mix and it was Takipo's son Vai…. I offered him some and he was like, "Oh, can I please check the back of the packet?" He was reading the grams and stuff, seeing how much sugar it is and the things that are contained in that packet. It's real good seeing what the programme has changed and yeah, it was really good"* (YM 2).

The participants noted that they learned a lot from the programme. Although the attendance rates fluctuated throughout the *Polokalama mo'ui lelei*, they gathered knowledge on prediabetes which was highlighted in the following statement: *"I was more consistent on Monday and didn't turn up on Fridays and then there were people who were more consistent*

on Fridays and Mondays…Well, for me, it was also what I learned was the huge impact of exercise towards the health of our body and all. Growing up, I thought it was always just about what you're eating, stuff like that. With diabetes, since I was a little kid, I was always just like, "Oh, eat too many lollies, drink too much soda, and all then you're going to end up getting diabetes." I always kept my body away from it, but then I didn't understand the huge influence exercise can do towards your body. It's not only the eating, it's both, if you know what I mean" (Table 20: Q1). The participants also considered the educational component of the *Polokalama mo'ui lelei* a success, as shown in the following quotation: "*We as the group who planned it learned things, but everyone at church learnt something. From younger members to the oldies, they all learned something and together, we made a change. We… only ourselves could see that change"* (Table 20: Q2).

Moreover, the participants noted that those who attended the programme shared their knowledge with the rest of the church congregation which changed their food narrative. This was reflected in the following statement: "*I also realize with church stuff. When we have lukuluku (shared lunch) when someone would stand up and say that we have lukuluku, it was always……. we stopped saying lukuluku, but started saying like, "Oh, maybe just grab a sandwich on the way, let's keep it healthy and all that"* (Table 20: Q3). These changes were also evident in their food choices and portions: "*Yeah, I saw a lot of changes because with aukai (after fasting period) on Fridays, it used to be a heavy lunch, but ever since our intervention programme started up and just learning about the food we eat and stuff like that… it just made a huge change with the meals we have at aukai. Things are getting healthier. We have more healthier options for the older generation, but the younger generation as well. I remember one Monday when we were playing netball, I went to Pak n Save and I came back with a pic of soy mix, and it was Takipo's son Vai…. I offered him some and he was like, "Oh, can I please check the back of the packet?" He was reading the*

grams and stuff, seeing how much sugar it is and the things that are contained in that packet. It's real good seeing what the programme has changed and yeah, it was really good" (Table 20: Q4).

Table 21

Summary of the quotations under the subtheme 'Inclusivity factor'.

Inclusivity factor	Q1	Youth: "*It made me see exercising in a... you can be happy while exercising because every time someone will mention, oh, let's go exercise… I'll be like, Oh, what? Say what now? Now, it just made me see that you can actually... exercising doesn't have to be all boring, it can be fun*" (YM9).
	Q2	Youth: "*It's good when everyone has that insight or motivation that they can do it themselves, or they're able to do that stuff now the programme's over. They know that they can go for walks and stuff. They've done that before. They know that they can do burpees and all. They've been doing it at church, stuff like that. I feel like each of them got something out of it…like to get something out of it for themselves, or to know more for themselves. Yeah, I feel like the programme was really effective…Cause most like heaps of people haven't done anything in a while besides the young kids"* (YM8).
	Q3	Family member: "*What stood out for me about the programme was Daryl's (Otago Masters student in nutrition) presentation on food labelling and how to read labels and all the other health promotions. The health education was a lesson for our kids. It taught our kids what prediabetes is. Remember their thoughts are only based on diabetes. What they don't know is that prediabetes is reversible, and we can prevent it from progressing to diabetes"* (FM13).
	Q4	Family member*: "I think the main thing was with the kids. Every Friday night they looked forward to attending the programme. You know to come and do the training and all. And it was like …I think there were times when I was like…. where we had things on, or I was busy. Even the last programme we couldn't make it because we had something on that day. But you know! I think the main thing was that…. like the kids were enjoying it as well and that was something to kind of push me to be like Oh, we got to get there, we got to get there and stuff"* (FM12).

1.31.3 Inclusivity factor.

The participants outlined that involving all the church members in the programme was an aspect that was appealing and effective, because it involved the participants' children. For example, one adult mentioned: "*What stood out for me about the programmes was Daryl's (Otago Masters student in nutrition) presentation on food labelling and how to read labels*

and all the other health promotions. The health education was a lesson for our kids. It taught our kids what prediabetes is. Remember their thoughts are only based on diabetes. What they don't know is that prediabetes is reversible, and we can prevent it from progressing to diabetes" (Table 21: Q3). Since the programme was family orientated, as the children were involved, it was also a motivational factor for the youth and adults*: "I think the main thing was with the kids. Every Friday night they looked forward to attending the programme. You know to come and do the training and all. And it was like …I think there were times when I was like…. where we had things on, or I was busy. Even the last programme we couldn't make it because we had something on that day. But you know! I think the main thing was that…. like the kids were enjoying it as well and that was something to kind of push me to be like Oh, we got to get there, we got to get there and stuff"* (Table 21: Q4).

As church members attended the *Polokalama mo'ui lelei*, the participants also recognised a change in mindset and attitudes amongst themselves and their family members towards physical activities and healthy living in general. One of the youth participants stated: "*It made me see exercising in a... you can be happy while exercising because every time someone will mention, oh, let's go exercise... I'll be like, Oh, what? Say what now? Now, it just made me see that you can actually... exercising doesn't have to be all boring, it can be fun*" (Table 21: Q1). Another youth participant also mentioned: "*It's good when everyone has that insight or motivation that they can do it themselves, or they're able to do that stuff now the programme's over. They know that they can go for walks and stuff. They've done that before. They know that they can do burpees and all. They've been doing it at church, stuff like that. I feel like each of them got something out of it…like to get something out of it for themselves, or to know more for themselves. Yeah, I feel like the programme was really effective…Cause most like heaps of people haven't done anything in a while besides the young kids"* (Table 21: Q2).

Table 22

Summary of the quotations under the subtheme 'Motivational factor'.

Motivational factor	Q1	Youth: "*Honestly, I loved playing netball, but then it was more satisfactory seeing the older lot get up on like Fridays. I'll come after Uni or something and see like some of the men that I didn't even think will be, be in there, like you know participating. It was good to see them all trying to focus on their health and do something about it to be honest*" (YM8).
	Q2	Youth: "*I know personally, my parents they weigh their food as well. They weigh our food at home, the calories and all that stuff. It's good to see that everyone's thinking a bit more about their eating"* (YM8).
	Q3	Family member: "*The programme was well implemented, and we were happy being part of it. It won't end there. We are still waiting for lockdown to be over so that we can continue doing another physical workout programme"* (FM11).

1.31.4 Motivational factor.

The *Polokalama mo'ui lelei* motivated participants to engage in physical activities, as well as encouraged them to continue with healthy living. A youth participant noted: "*Honestly, I loved playing netball, but then it was more satisfactory seeing the older lot get up on like Fridays. I'll come after Uni or something and see like some of the men that I didn't even think will be, be in there, like you know participating. It was good to see them all trying to focus on their health and do something about it to be honest*" (Table 22: Q1). The adult participants, on the other hand, reflected the following view: "*The programme was well implemented, and we were happy being part of it. It won't end there. We are still waiting for lockdown to be over so that we can continue doing another physical workout programme"* (Table 21: Q3). In general, the participants revealed that even though the *Polokalama mo'ui lelei* has concluded, their family members were motivated to live a healthy lifestyle: "*I know personally, my parents they weigh their food as well. They weigh our food at home, the calories and all that stuff. It's good to see that everyone's thinking a bit more of their eating"* (Table 21: Q2).

1.32 Suggestions for future health programmes.

This major theme reflects ideas on health programmes that could be implemented in the community to help address the risk factors for prediabetes. The analysed data encompassing this major theme highlighted three subthemes: incentives; family-based approach within the church; incorporating health programmes into the church schedule. These subthemes are presented in Tables 23, 24, 25 with supporting quotations.

Table 23

Summary of quotations under the subtheme 'Incentive factor'.

Incentive factor	Q1	Youth*: "You're saying setting up something that enables people to feel obliged to be part of. Like for netball, the competition factor was a big thing. The youth turned up to it because there was a reward at the end. If they played and they won, they got to the semi-finals"* (YM 8).
	Q2	Youth: "*Just the idea of having a competition might have influenced the mindset of everyone, but yeah, that was something that I found with netball"* (YM8).
	Q3	Family member*: "I believe that if there was an incentive in the programme like a prize for those who lost the most weight to begin with. It would be good given that the programme is 10 weeks long" (*FM11).

1.32.1 Incentive factor.

The participants indicated that it was challenging for people to begin their health journey. Therefore, providing incentives was considered one way to encourage others to engage in the health programme. The adult participants emphasized incentive in the form of a prize: *"I believe that if there was an incentive in the programme like a prize for those who lost the most weight to begin with. It would be good given that the programme is 10 weeks long".* (Table 23: Q3). On the contrary, the youth emphasized incentives in the form of competition. For example, one of the participants mentioned the following: "*You're saying setting up*

something that enables people to feel obliged to be part of. Like for netball, the competition factor was a big thing. The youth turned up to it because there was a reward at the end. If they played and they won, they got to the semi-finals" (Table 23: Q1). Additionally, another youth noted: "*Just the idea of having a competition might have influenced the mindset of everyone, but yeah, that was something that I found with netball"* (Table 23: Q2).

Table 24

Summary of the quotation under the subtheme 'Family-based approach within the church'.

Family-based approach within the church	Q1	Youth: "*I feel like they would have been more committed if their kids could participate. If we were to change some games or stuff by trying to see something that everyone can participate in that's still enjoyable, but that way, since their kids will want to go, everyone goes. You know what I mean? Since they're going, their kids can come to. Whereas for netball, they could go, but their kids can't play, unless they're over 12 or something like that"* (YM 8).

1.32.2 Family-based approach within the church.

The youth also suggested integrating a family-based approach in the health programmes. Those who participated in the netball competitions suggested that the *Polokalama mo'ui lelei* events should involve all family members to motivate families to participate in the programme as reflected by the following statement: "*I feel like they would have been more committed if their kids could participate. If we were to change some games or stuff by trying to see something that everyone can participate in that's still enjoyable, but that way, since their kids will want to go, everyone goes. You know what I mean? Since they're going, their kids can come to. Whereas for netball, they could go, but their kids can't play, unless they're over 12 or something like that"* (Table 24: Q1).

Table 25

Summary of the quotations under the subtheme 'Incorporating health programmes into the church schedule'.

Incorporating health programmes into the church schedule	Q1	Youth: "*Because on Fridays, I realized that I would have to cancel some Fridays due to like church stuff. Friday is like akohiva (choir practice) and ako ifi (band practice) and every fourth Friday, that's the youth Friday. So, we would have to prepare for Sunday and if it was the first Sunday and it was the church leading entry that day, then we would be busy with that which means that we would have to cancel the intervention programme*" (YM2).
	Q2	Family member: "*Looking back at how the programme was conducted we have to look at the Polokalama mo'ui lelei programme as well as the church choir practice and ensure that we participate in both. I reckon if the health programme was implemented and there were no other church programmes running it would have been better"* (FM 11).

1.32.3 Incorporating health programmes into the church schedule.

The participants consistently reported that church obligations take up a lot of their time, and therefore implementing a health programme in church will be challenging as stated in the following: "*Because on Fridays, I realized that I would have to cancel some Fridays due to like church stuff. Friday is like ako hiva (choir practice) and ako ifi (band practice) and every fourth Friday, that's the youth Friday. So, we would have to prepare for Sunday and if it was the first Sunday and it was the church leading entry that day, then we would be busy with that which means that we would have to cancel the intervention programme*" (Table 25: Q2). However, other participants showed that they value church and integrating a health programme in the church schedule should be considered which was highlighted in the following statement: "*Looking back at how the programme was conducted we have to look at the Polokalama mo'ui lelei programme as well as the church choir practice and ensure that we participate in both. I reckon if the health programme was implemented and there were no other church programmes running it would have been better"* (Table 25: Q1).

The findings presented in this chapter provided a comprehensive view regarding the Tongan youths and their family members' understanding of prediabetes, barriers that impact healthy living and factors to consider when mobilising Tongan people into collective actions to lead healthier lives. The analysis revealed certain factors that were also highlighted in other community-based interventions specifically the factors that impact health living. More importantly, our findings have implications for practical implications emphasizing the need for future research directions. While our study adds valuable insights, it is important to acknowledge the limitations of the study, which will be discussed in the following chapter.

CHAPTER 5: PŌTATALA (Discussion)

This chapter will provide a comprehensive analysis of the findings shedding light on the implications of the study. Furthermore, the PŌTATALA (Discussion) chapter explores how the findings align with the research questions, consider their significance within the broader context of preventing prediabetes amongst Pasifika people, and suggest possible avenues for future study. The structure of this chapter begins with a recapitulation of the main findings followed by analysing key overarching themes such as 'knowledge and awareness of prediabetes' in relation to the research objectives.

There are several major findings; however, the most important finding that has arisen from this study was the development of the *Fengaueaki Fakataha* model, which is comprised of five communication processes (*Fakafehokotaki*, *Fakafanongo*, *Fakasinoaki*, *Fakamahuinga'i*, and *Fakamuimānoa*), encompassing inseparable elements, including the Tongan *ngatu*, *fonu* (turtle), and different shades of people linking hands in a circle. These elements have been aligned to reflect the major themes, as shown in Table 26, and further highlight the socio-cultural context, values, belief systems, and worldview that shape the Tongan peoples' understanding of health, how to address prediabetes, and who should be involved in the prevention process.

Table 26

Summary of the key themes linking to each element of the 'Fengaueaki Fakataha' model.

Key overarching themes	Subthemes	Elements of the *Fengaueaki Fakataha* model	Communication processes
1) Knowledge and awareness of prediabetes	• Cultural factors • Lack of culturally relevant health promotions • Poor health literacy	*****Tongan ngatu	1)Fakafehokotaki 2)Fakafanongo 3)Fakasinoaki 4)Fakamahuinga'i 5)Fakamuimānoa
2) Barriers to understanding and accessing help for prediabetes	• Education and Motivation • Cultural factors • Household income	*Tongan ngatu *Different shades of people linking in a circle	
3) Enabling factors for attending a *Polokalama mo'ui lelei*	• Health promoters • Motivating *Polokalama mo'ui lelei* strategies	*Tongan ngatu * fonu (turtle) *Different shades of people linking in a circle	
4) Factors affecting peoples' participation in the *Polokalama mo'ui lelei*	• Time factor and transport factor • Cultural/Church factor	*The Tongan ngatu *fonu (turtle)	

The communication processes should be viewed as guiding markers in building trust, creating, and building personal connections that allows open and trusting communication between the researchers and Tongan community. These communication processes are underpinned by four core values that form the pillars of Tongan society including:

- acknowledging and returning respect *(faka'apa'pa*);
- humility and is open to learning *(anga fakatōkilalo*);
- maintaining good relationships *(tauhi vā*);
- loyalty (*mamahi'i me'a*).

In the *anga fakatonga*, 'relationships' determine the kind of communication and exchange that can take place between people. Therefore, there is emphasis on nurturing, sustaining and

maintaining a connection with the people they are communicating with (31, 33, 46, 208, 209). The difference between the universal understanding of communication and Tongan forms of communication, is that Tongans place greater emphasis on the importance of connecting with people rather than a one-way process. These communication processes highlight the nuances transmitted through behaviour, and elements of speech rather than through the words themselves. They are embedded in the *anga fakatonga* and are essential to explain and discuss (below) the major themes identified from the research findings.

1.33 Tongan youths' understanding of prediabetes**.**

1.33.1 Knowledge and awareness of prediabetes.

The first major theme highlighted that 90% of the participants had limited knowledge and awareness of prediabetes. It has well been established that having 'knowledge' is considered an essential factor in the prevention of any health condition, lest it be prediabetes (210). Consequently, the participants' lack of knowledge and awareness had a significant long-term impact, often leading to the full development of T2DM. As there is no effective screening programme for prediabetes, this inhibited the focus on when and how health promotion strategies can focus on preventing important modifiable factors, and behaviours relating to diet and nutrition that are linked to prediabetes risk. The three factors that contributed to the participants' limited knowledge and awareness of prediabetes were cultural factors, lack of culturally relevant health promotions and poor health literacy.

1.33.2 Cultural factors.

Culture plays a huge role in influencing Tongan peoples' knowledge and awareness of prediabetes which is reflected in the following factors: health beliefs, and cultural traditions. These cultural factors also act as barriers to understanding and accessing help for prediabetes which will further be discussed in the following sections.

1.33.3 Lack of culturally relevant health promotions.

One other factor that contributes to the participants' limited knowledge and awareness of prediabetes is the lack of culturally relevant education about prediabetes (and T2DM) in the community, particularly in arenas where many Pasifika peoples gather, such as the churches. Churches are equivalent to a 'village' social structure (i.e., strong familial and community bonds), and it is one of the most influential institutions in the Tongan community that provides support (1, 34, 207, 208). During the week families spend majority of their time in the church; however, sharing health education about conditions, such as prediabetes, in this collective space, appears to be an under-utilized medium which is well established in previous Pasifika research (84, 211). Since Tongan families spend a large part of their time in church, it would be appropriate to provide health education in the church setting where they mostly congregate on a regular basis. Essentially, the process in which to integrate health promotion in the church programme should be a slow process where the church pastor defines the Christian spiritual dimension of health and encourages other church leaders to lead and support health promotion. Health promotion should not only be a programme aligned into the church schedule, but it should also be engrained in the church services where the pastor and church leaders promote health from the pulpit regularly. Integrating health promotion within a church setting that has a defined spiritual dimension of health coupled with the support of church leaders and families will be an important next step to working with communities to enhance knowledge and awareness not just for prediabetes, but for overall health and well-being.

Many Tongans do not access health information until they experience health complications and are forced to see primary and secondary health care services, and often this is where health information is provided. Although the study participants were aware of the vast array of public health promotions, they held different health perceptions and understanding of

health conditions compared to the mainstream population. The majority of public health promotions utilize educational tools that reflect the dominant Western culture which in general, does not appeal to the Tongan peoples' values, beliefs, and communication style (212, 213). Tongans perceive their identity, beliefs, and values primarily through spoken and artistic means (e.g., song and dance), and are tactile learners, who learn by doing and actions, rather than sitting quietly and taking notes. However, the health promotion resources available online and in the clinics are often pre-packaged to convey a general message mainly focusing on the mainstream population. For Tongans to engage in accessible knowledge and resources, they need to perceive health education as having cultural relevance to them.

Tongans use social media regularly and are very much part of social media groups that include their family and church members. During the COVID 19 lockdown period, the TWMP members chose Zoom and Facebook as their main social media platform to communicate and post church announcements. The church leaders posted up different workouts on their Facebook group for church members to follow. One way of keeping church members accountable was encouraging church members to post videos of their workouts online. This suggests that social media can also be used for health promotion. However, in a conventional church setting the ideal way of providing health promotion could align with the Tongan peoples' cultural values, and ways of communicating by aligning with the communication processes (*Fakafehokotaki*, *Fakafanongo*, *Fakasinoaki*, *Fakamahuinga'i*, and *Fakamuimānoa*) as highlighted in the *Fengaueaki Fakataha* model. Incorporating these communication processes in health promotion could enable an enhanced bi-directional dialogue between the church members and health experts to achieve effective forms of health information. Without these processes, the profound effect on the Tongan peoples' receptivity of the information provided and their willingness to use it, could be detrimental to their health and well-being.

1.33.4 Poor health literacy.

The lack of knowledge and awareness regarding prediabetes, can also be explained by the participants' poor health literacy. Many of the adult participants are immigrants to New Zealand, who speak limited English, have lower levels of education, and are likely to experience inadequate literacy skill levels that preclude their understanding of health information. In a Tongan household, the older adults are the decision-makers and there is strong emphasis on avoiding conflict, direct confrontation, and respect for elders, by the younger family members. Being humble, generous, modest, and subservient are qualities that are culturally valued which may restrict the younger generations' overt demonstration of knowledge or expertise in front of the elders (214). Therefore, health knowledge as perceived and provided by the older family members can often become the foundational health knowledge and the normalized way of dealing with prediabetes (and other health conditions). To ensure that the older generation are informed about prediabetes, the information content and framing of health promotion could be modified to suit their health literacy level. Other methods of promoting health should also be included where in-depth discussions can be held, with teaching aides. For example, online modules, and information bulletins. Above all, health messages using the Tongan language will be essential for the older generation to understand the information and they can inform the rest of the household members.

Although the participants highlighted having limited knowledge regarding prediabetes, the community had a general idea of healthy living but tended to choose a lifestyle that placed them at risk of health complications. For example, many of the participants noted that members of the church are health professionals who have knowledge of prediabetes, yet there is limited healthy recommendations or strategies to enhance the health and well-being established in the community. Some participants have mentioned the role of individual factors (e.g., knowledge, attitudes, and genetics) in determining health. Nonetheless, all

participants agreed that socio-cultural and economic factors largely affect healthy living (e.g., consuming unhealthy foods during church feasts), which relates to education and motivation (discussed below).

The participants' limited knowledge and awareness of prediabetes reflected the influence of *anga fakatonga* within their socio-cultural context. With the *Fengaueaki Fakataha* model, the *anga fakatonga* is represented by the *ngatu* element which provide the valued contexts for the Tongan way of thinking, such as the emphasis on the spiritual nature of being, and on the Tongan traditional structure of rank and authority. It further shapes the Tongan peoples' health beliefs that prioritizes people and family, relationships, and communication. Institutions like the church where Tongans develop ideologies and behaviours about health and a way of living are passed down from one generation to another, and the church and family are the most important institutions where nurturing, reinforcing, and maintaining of various facets of the *anga fakatonga* takes place. Therefore, building knowledge and awareness in these spaces are important strategies to consider, particularly if people do not consistently access health services.

1.34 Barriers to understanding and accessing help for prediabetes.

The second major theme, 'Barriers to understanding and accessing help for prediabetes' highlights three interrelated factors that prevent participants from living a healthy lifestyle and combating prediabetes: education and motivation; cultural factors; household income.

1.34.1 Education and Motivation.

The current findings reflected the participants' lack of education and motivation to live a healthier lifestyle which in turn, affects health outcomes. This subtheme relates closely to the

first major theme discussed above but focuses more on the participants' 'misconception' of prediabetes. The majority of the participants reported T2DM as a common condition experienced across multiple generations within their families. For the most part, prediabetes is asymptomatic, and many of the participants and their family members are unaware of the hidden symptoms. The participants' misconception of prediabetes stem from generational and familial experiences. When families are not well informed about prediabetes their misconceptions become further transformed in each subsequent generation, and often it's too late to prevent the progression to a fully-fledged T2DM, which may or may not co-exist with other conditions (e.g., hypertension) and advancing the severity of co-morbidity among Tongan people.

1.34.1.1 Misconception of prediabetes.

The participants' diminished motivation to engage in healthy living relates to their misconception of prediabetes derived from familial experiences and beliefs. One of the youth participants described prediabetes as a "waiting game", while other Pasifika and abroad studies described it as a "train that could not be stopped" (215) and "falling into a deep dark hole" (216). The way prediabetes is described reflects a pervasive belief that prediabetes is largely predetermined, an inevitable consequence of aging or genetics. Some participants further highlighted that prediabetes is an "old people thing" hence, everyone will eventually have it when they grow old. The adult participants had similar views as the following statement: "*Given that we are old, it's far too late"* (refer to making healthy lifestyle changes) (Table 4: Q2) and noted that health programmes should only focus on the younger generation. Further, the asymptomatic nature of prediabetes contributes to people upholding these misconceptions. These views have been reported in other studies (217, 218) where participants who were diagnosed with prediabetes still do not see the seriousness of the condition; therefore, there was no motivation to make immediate lifestyle changes. As long

as these misconceptions remain in Tongan communities, people will continue to have little or no motivation to engage in healthy living due to the asymptomatic nature of prediabetes, and together with the view that the individual behaviour of complacency compounds the urge to take action. Overcoming these misconceptions require educating the Tongan community about prediabetes particularly amongst the older generation who are the decision makers and role models of the younger generation. However, it is also important to incorporate an overall holistic approach to ensure the family environment is supportive of healthy living and that everyone has a responsibility to fulfil.

1.34.1.2 Lack of family support.

Another factor that impacts the Tongan peoples' motivation to live a healthy lifestyle was the lack of support from institutions that influence their health, particularly from within the family-context, church, and the healthcare system. Tongan families are socially structured and are organized by the *'nofo 'a kāinga'* concept, which encompasses immediate and extended family members. The relationship between members of the *kāinga* (immediate and extended family) are reciprocal and interdependent, with each member fulfilling an expected role and responsibilities to one another (27, 219). The *kāinga* are supportive in various aspects of Tongan peoples' lives including family and church obligations, caregiving, and child rearing. Conversely, the *kāinga* concept does not fit within a Westernised world when it comes to attaining achievements in any facet of life at an individual level. For example, while the parents work long hours and potential multiple shift-work jobs, the older siblings are in charge of their younger siblings, which gives them no time to do anything for themselves (e.g., focus on homework, go to the gym). The focus is on sustaining the *kāinga* otherwise there is very little means to provide a healthy lifestyle as often shaped by the well-known social-economic determinants of health (68) (e.g., affordability of healthy food, retain

housing, upkeep of education and avoiding work or school absenteeism due to illness and sickness).

In the *anga fakatonga*, gender and kinship are highly stratified, and this can serve as a barrier to adhere to a healthy lifestyle for families. There are gender differences where females are expected to handle household chores (e.g., cooking, cleaning, child rearing) while men are expected to handle outdoor chores (e.g., grass cutting, gardening). The same attitude is also reflected in other aspects of healthy living where men are reliant on women to take charge of the family affairs, instead of supporting their wives by modelling healthy behaviours. Within the *nofo ʻa kāinga* there is sacredness in the relationship between different members of the family which sets out how they behave and communicate with one another. This is characterized by *fakaʻapaʻapa* and *fakaʻehiʻehi* (avoidance). For example, brothers and sisters do not sleep in the same house and it is taboo for brothers to swear or talk about sex in front of their sisters or female cousins, and vice versa. Therefore, with group exercises Tongans often feel uncomfortable working out with their family members which may prevent them from attending health programmes. Understanding the *nofo ʻa kāinga* dynamic may help identify and respond to the driving forces behind an individual's health needs, as well as serve as a protective factor against prediabetes risks by providing a health enhancing environment. Generally, utilizing the *kāinga* strengths will be a step-forward towards supporting individual members achieve better health outcomes.

1.34.1.3 Lack of church support.

In addition to the family structure, the participants also highlighted that the structurally stratified confounds of the church impact their health. Tongan families often spend three to four evenings each week at church, and attending the events and activities occupies a lot of their time. Moreover, when attending these gatherings, it is often accompanied by the preparation and consumption of large amount of food high in calories, sugar, and fat. With all

the church and family obligations occupying peoples' time, they struggle to set a routine for considering their own family affairs, to save money for, and or plan to lead a healthier lifestyle. Interestingly, in this project's church community, a church health committee exists, albeit the health of the church members was not a prioritized goal of the committee, health programmes were rarely conducted at the church. Having a structural component such as the health committee served an administrative role for the church, and not lest intended to provide environmental support for the health of its community.

Church leaders may be considered agents of change because they have a strong influence on the behaviour of their church members (220-222). Their role plays a critical catalyst needed to motivate church members to engage in healthy behaviours. When there is no validation of a health enhancing behaviour by the church institution (especially by the church leaders), health behaviours will not be perceived normal and acceptable. Therefore, it is important for church leaders to promote health and create an environment that supports healthy living by being good role models themselves and understand and agree with what healthy behaviours mean for their church members.

1.34.1.4 Lack of support from the health care system.

There is also lack of support from the health care system regarding prediabetes prevention as it focuses predominantly on the acute treatment of T2DM. This suggests that health professionals are not providing sufficient education on prediabetes or using system prompts and tools to identify, remind and refer people to culturally appropriate health services. A reasonable approach to tackle this issue could be reorienting the direction of health promotion programmes to prevention at a community-based level rather than providing managing and treatment services at a tertiary level care. According to the participants, there seems to be a lack of health professionals in the communities actively promoting healthy living. Nonetheless, research show (223) that there are Pasifika community health professionals

including nurses that visit people at their homes. It would be more fitting to have health professionals visit the church where the *anga fakatonga* is nurtured and where Tongans spend a lot of their time. Even so, this could possibly be a role of the church health committee rather than utilizing someone who is not part of the church. The overall lack of education and motivation experienced by the participants, highlights the influence of generational knowledge, the church, and health care system on the Tongan peoples' health.

1.34.2 Cultural factors.

1.34.2.1 Health beliefs.

The current findings highlighted 'cultural factors' as a significant barrier to preventing prediabetes. The specific cultural factors that impact health are the Tongan peoples' health beliefs and the cultural traditions underpinned by the *anga fakatonga*. The *anga fakatonga* and church (Christian beliefs) reinforce each other, thereby influencing Tongan peoples' health beliefs. Tongans believe that fulfilling their duty to God will bring blessings not only to their own life but to the lives of others, especially their family members (34). This means prioritizing attending church services, activities, and upholding church responsibilities was an important duty. They believe that committing and fulfilling these church obligations will be rewarded by God with good health and a prosperous life. When these obligations are not met, contracting an illness is regarded as an act of God. The participants view having prediabetes as beyond their control and that nothing can be done to make any changes.

Tongans also have a view of health that is holistic and inextricably intertwined with the well-being of families and communities (1). They follow a collectivist culture where the groups' rights are given priority over the rights of the individual. Thus, their priorities are often centred on their families and community, and not individual health. This view influences the

Tongan peoples' health seeking behaviours (or lack of), and how they make decisions related to health.

1.34.2.2 Tongan cultural traditions.

In this study, the participants highlighted they were unable to attend the *Polokalama mo'ui lelei* due to family and church obligations such as church conferences, funerals, and family events. One fundamental cultural tradition that Tongans continue to practice in New Zealand is having big feasts during church and family gatherings, as well as traditional celebrations (e.g., weddings, birthdays, graduations, and funerals). These occasions occur frequently, and the ceremonial activities are organized mostly by the church. The sharing and consumption of large amounts of food is culturally valued where people are expected to prepare food in abundance and ensure that there is more than enough for everyone to eat, as well as to take away. It also has a spiritual significance highlighting generosity, hospitality, and love. Traditionally, Tongan food prepared for such events would be root crops, fish, fruits, and vegetables. However, traditional foods have been replaced by cheap palatable products such as fatty meat and processed foods. Today, it is difficult for Tongans (and other Pasifika peoples) to maintain a traditional lifestyle living away from their homeland; nonetheless, traditional foodways (refers to the cultural, social and economic practices relating to the production and consumption of food) (224, 225) have shifted over the last 200 years with the introduction of more preserved food (e.g., canned corn-beef, noodles), yet traditional customs such as feasts have been retained and it has evolved into a spectacular show of food feasting.

Another cultural practice that is taking a toll on health is *kava* drinking. *Kava* drinking is an agent of cultural identity that has been continuously reinforced by the church. It is the prerogative of the male older age group, yet the younger males would often join in as well. There are positive uses of *kava*, including medicinal purposes, male bonding, reaffirming, and establishing relationships among other Tongan men (226). Although some studies argued

that *kava* may aid sleep, the long periods of time men spend drinking kava disrupts sleep patterns, as well as contribute to people feeling unmotivated to exercise (227). This cultural practice is important for sustaining relationships between Tongan men, it is questionable as to whether it enables the well-being of the Tongan community, as whilst the men are undertaking consumption, the women and children gather, talk, and wait long hours for the men. The following day families are often tired and are less motivated or unable to do physical activities.

1.34.3 Household income.

Household income is a major socio-economic variable that participants reported as being a barrier to healthy living. The study participants acknowledged that their unbalanced diets (e.g., low intakes of fruits and vegetables) explain the poor access to healthy quality food and what they can afford. Tongan families are large and given that majority are low-income earners they are likely to buy foods that are high in calories to satisfy their appetites, and enough food that can feed the entire family. It has been well established internationally and in New Zealand that low income increases peoples' exposure to harmful environments and behaviours (44, 228-230). On the other hand, having access to more money does not automatically equate to a better-quality diet, but the range of food from which one can choose from increases (231), and although the participants emphasized the correlation between low income and poor diet, there are other aspects of health that low-income earners may experience. For instance, low income affects accessing resources and materials (e.g., education, food security) and it also affects the way parents are able to care for their own and their children's health. Research has shown that the health of people with low-income correlates positively with food insecurity, lack of housing and living conditions per house

(232, 233). The housing problem in New Zealand is predominantly a systemic issue and this results in overcrowding, damp and inadequate housing, and increased risk of health issues such as respiratory illnesses. Furthermore, low income reinforces health-damaging behaviours such as smoking (234), particularly in the context of financial constraints on everyday life and in a family context, given their fiscal responsibilities to the church as well. There are cultural systemic issues that need to be understood and addressed but it is often considered too disrespectful to consult about it in an open forum.

The underlying factors that act as barriers to understanding and accessing help for prediabetes highlights the micro (e.g., family, school, peers, and other close entities) and macro level (e.g., government agencies, banks, corporate businesses that build the houses) players, in addition to cultural practices and beliefs that influence the Tongan peoples' health. The micro and macro level players relates to the different shades of people linking hands in a circle, whereas the cultural practices and beliefs relate to the *ngatu* element of the *Fengaueaki Fakataha* model. Within the *Fengaueaki Fakataha* model the people linking hands in a circle element is placed on the *ngatu* emphasizing the *anga fakatonga* being central to understanding the relationships between the individual, the macro and micro players. The *anga fakatonga* plays an important role in explaining the unique system of perceiving, understanding, and organizing the Tongan cultural values and behaviours. In essence, it determines how the participants define health, value, or prioritise health, recognize prediabetes (and other health conditions and risk factors), and determines whether they seek help or not. On the other hand, the issues caused by micro and macro-level players are beyond the participants' control because they are more established systemic factors which have been manifested in an environment that challenges Tongan (and other Pasifika) family's perceptions or beliefs of health and well-being.

1.35 Enabling factors for attending a *Polokalama mo'ui lelei* components.

1.35.1 Health promoters.

For the *Polokalama mo'ui lelei* in general, participants preferred inviting professionals who were not part of the church to conduct the health programme. They noted that church members felt obliged to attend the programme when others outside of church were promoting health because it gave them a sense of support from the community. Moreover, participants found it easier to follow health information from an outsider than from someone who they knew or was attached to the church. The 'familiarity breeds contempt theory' explains that when an individual knows too much about a person's shortcomings, they are less likely to pay attention to them (235). There were nurses present in church who knew about prediabetes and healthy living, yet they rarely used their expertise to influence the church towards healthier living. This observation is quite puzzling. Often health promotion activities and the Pasifika strategy argued for a 'for Pasifika-by-Pasifika' stance when working with communities (82, 236). However, when there are learned and skilled persons in the community who have the capacity to enable better health outcomes of their community, why are they not utilized in this manner by the church? Perhaps this is something that future research could investigate understanding further, because if health reforms and the environment can be reoriented, then a degree of re-orientation of community institutions such as the church and uptake of skilled persons in the community could potentially be a simple, yet major game-changer in directly improving the health outcomes of the Tongan community.

1.35.2 Motivating strategies.

Across all components (health education, nutrition, and physical activity) of the *Polokalama mo'ui lelei*, the participants emphasized implementing motivating strategies. These include incorporating incentives to encourage participation, having a collectivist approach where everyone (not just the youth) is involved, and incorporating a programme that was fun and interactive which reflect their strengths and what they value. The idea of incorporating incentives stemmed from the church's previous experience of conducting health programmes. The participants saw that having an incentive motivated many church members to attend the weight loss challenge programme. However, the programme was discontinued when the health committee was unable to conduct the programme due to other church obligations. One may argue that incorporating incentives is not sustainable (237-240); however, for the participants it was one way of encouraging them. It was a process to initiate participation and social change so that the people can experience the benefits of the programme first hand.

Another reason that may explain why participants emphasized having a collectivist approach and involving everyone in the church relates to their cultural values, the way in which communications and interactions occur. For example, introducing an approach where people are able to collectively participate in the discussion of their health issues instead of doing a presentation. Including programmes that appeal to the whole family given that they are their largest support network and allowing families to interact with health professionals. The participants highlighted the need for the programme to be fun, interactive, and inclusive. Based on the *Fengaueaki Fakataha* model, the specific motivating strategies that the participants considered as enabling factors reflected what the participants valued. These were the use of incentivisation to enhance participation; having a collectivist approach to the programme and including families to be part of the health programme which relates to the

ngatu element of the *Fengaueaki Fakataha* model. The *ngatu* element symbolizes this 'valued process' component.

1.36 Factors that affected peoples' participation to the Polokalama mo'ui lelei.

1.36.1 Time and transport factor.

The participants noted that the time factor affected their participation to the programme. Both the adults and youth emphasized the challenges of having to fit the *Polokalama mo'ui lelei* in their busy schedules. They have too many obligations involving school, church, and family, and struggled to attend the health programme consistently. During the planning of the programme the participants agreed on certain days to conduct the programme; however, impromptu events linking to church funerals interrupted peoples' attendance. The adults also noted the difficulties of having to travel the distance from their workplace to the church where the health programme was held. For example, many participants lived and worked in the Porirua and Tawa regions who travelled to Wellington city for the *Polokalama mo'ui lelei*. They would finish work at 5:30pm and were unable to attend the programme on time (the programme began at 6pm) given the traffic peak hours on Friday afternoons and travelling such a distance meant spending more money on patrol. Transport was also considered a factor that affected the participants' participation to the programme. Tongan families share a vehicle and in most cases the parents would use their vehicle for work or to attend family and church events. This meant that some of the youth were unable to attend the programme consistently. The youth relied on their family vehicle for transport which contributed to their poor attendance to the health programme.

1.36.2 Cultural factor.

The most significant cultural factor that has a major impact on the participants health behaviour is their health beliefs. This finding relates to the sub theme ‘cultural factors’ relating to the barriers that hindered Tongan peoples’ understanding and accessing help for prediabetes. One of the specific cultural factors that prevented participants from attending the programme consistently linked to participants fulfilling obligations to their families and church. They prioritized these obligations which affected their attendance to the health programme. Another cultural factor emphasized by the adult participants was the sacredness in the relationship between family members of the opposite sex which sets their interpersonal interaction with one another, characterized by *faka‘apa‘apa* and *faka‘ehi‘ehi*. The sub theme ‘education and motivation’ elaborates on the various taboos within the family that influences healthy living. However, these taboos are also cultural factors that affected their attendance in the programme. Given that the adults strongly adhere to the *anga fakatonga*, engaging in a physical workout together with the opposite sex was challenging as it is not part of the *anga fakatonga*. On the contrary, some families may have modified this sacred behaviour for their children which explains why the youth were comfortable engaging in the physical workout, and it was not a reported barrier for the youth.

1.37 Processes that need to be established in the community.

1.37.1 Suggestions for future health programmes.

Upon completing the 10 weeks *Polokalama mo’ui lelei* the participants provided recommendations from the process evaluation that could further improve the implementation process and increase participation in future health programmes. The overall concept highlighted by the participants was the need to provide culturally relevant health information

coupled with health enhancing environments within the family, church, and funding. The *anga fakatonga* is pivotal to understanding Tongan peoples' behaviours, values and how they are organized. Therefore, it should be the foundation of any interaction involving Tongan people. With Tongans, families are organized around a *nofo 'a kāinga* system where members of the *kāinga* are interdependent and supportive of each other. The dynamics of the *nofo 'a kāinga* system highlights the role and responsibility of each member and understanding this concept provides insight regarding how to best support the family to live healthier lives. Including a family-based approach within the intervention where all *kāinga* members are involved will be beneficial for the youth. For example, providing a family-based approach health promotion will enable families to be health cautious about the food they obtain and prepare for the entire *kāinga*, as well as provide an environment that normalizes, enforces, and supports healthy living. Moreover, incorporating physical activities that are family oriented will be motivating as the family work towards a health goal. This way they will be able to support each other in their health journey.

The church is one of the most influential institutions in the Tongan community which plays a significant role in shaping Tongan peoples' spirituality, social life, health, and well-being. Its impact and influence are very much embedded in the lives of Tongan peoples. The participants suggested that health education and activities should be embedded in the church and be part of the church structure to establish a health enhancing environment. One way of enabling this shift is through the church pastor and church leaders emphasizing the spiritual dimension of health and modelling health behaviours to encourage a culture and environment that promotes health behaviours. Small steps should also be taken by selectively altering or integrating health promotions into existing church functions. For example, having health conversations during the women's ministry meeting or activating the church health committee to consistently run health programmes in the church to foster a culture supportive

of healthy behaviours. Given that entire families are often involved in church activities, having health programmes embedded within the church structure will ultimately encourage the initiation and maintenance of health behaviour changes across all age groups and not just the youth alone. Future health programmes should also consider including the spiritual dimension of health in their health messages. However, it is important that health behaviours are modelled by the elders and church leaders for church members to perceive health behaviour as normal and acceptable. Incorporating these aspects within the church will help create a foundation for further health-related programmes.

The participants also highlighted the importance of providing incentives as a motivational strategy when conducting health programmes to encourage participation. This does not necessarily have to be in the form of rewards but through engaging people in community sports competitions or any form of group activity where people are able to see progress. For this to take place funds are required. With the support of health funding, health researchers and health workers are well positioned to provide initiatives that promote greater community engagement. Therefore, the church, health researchers and workers can identify a way to secure funding to sponsor resources for health programmes. Engaging people in such activities would help people adopt health behaviours over time as they experience the benefits of healthy living. Overall, a chain of communication needs to be established where critical knowledge, information and key messages between the church, health professionals and researchers, so that future health programmes can have far-reaching influences. A co-ordinated and continued effort by all is needed to improve future health programmes implemented in a church setting. Taken altogether, the establishment of the *Fengaueaki Fakataha* provides a framework for understanding Tongan peoples' health needs, socio-cultural context, and factors that help mobilise Tongans into collective actions to lead healthier lives.

Congruent with other Pasifika health models (e.g., Kakala model, Fa'afaletui, Ta and Va, Fonua, Fonofale, Tivaevae, Te Vaka Atafaga, Fonua Ola, Popao) (241-246), the *Fengaueaki Fakataha* model is a culturally tailored framework designed to address the health needs and disparities of the Tongan people living in New Zealand. On the contrary, the *Fengaueaki Fakataha* model goes beyond incorporating the Tongan peoples' sociocultural context into the design process to include fostering collaboration and shared responsibilities among the communities, stakeholders, funders, health researchers, and system enablers (represented by the different shades of people linking in a circle of the *Fengaueaki Fakataha* model) to help prevent prediabetes and T2DM. This model aligns well with and can complement the current Te Mana Ola and Pae Ora national plans for Pacific peoples and the general NZ population, that focuses on devolving much of the health and wellbeing responsibilities to the communities, rather than from a top-down approach (241-246).

The various elements (the Tongan *ngatu*, the *fonu*, different shades of people linking in a circle) of the *Fengaueaki Fakataha* model and the communication processes (*Fakafehokotaki, Fakafanongo, Fakasinoaki, Fakamahuinga'i, Fakamuimānoa*) need to be considered synergistically to ensure that the resulting solutions are culturally sensitive, relevant, and effective in meeting the Tongan peoples' health needs. More importantly, to empower Tongan communities by giving them a voice in the decision-making process, as well as foster a sense of ownership and pride among the people.

While the *Fengaueaki Fakataha* model is specific to addressing prediabetes and T2DM in the Tongan New Zealand community, it can be adaptable and useful for the Tongan diaspora and other Pasifika ethnic groups in improving healthcare services, processes and outcomes and addressing other health and social issues. The various elements and communication processes of the *Fengaueaki Fakataha* model reflects the adaptable nature of the *Fengaueaki Fakataha* model which stems from it collaborative, iterative, context-aware, and inclusive approach.

This makes it a valuable model for addressing complex problems and creating solutions that can evolve and thrive in changing environments particularly for Pasifika communities.

In conclusion, the PŌTATALA (Discussion) chapter has presented a comprehensive analysis of the research findings, aiming to address the research questions and objectives set forth at the beginning of this thesis. Through a systematic exploration of the data and critical synthesis of existing literature, this chapter has contributed valuable insight regarding prediabetes prevention amongst Pasifika people especially the Tongan community.

Our findings, as discussed throughout this chapter, have several important implications such as utilizing the church as centres for health-related activities and services, and ensuring that the culturally relevant health information delivered in church is in sync with having a health enhancing environment within the family, church, and funding. These findings advance our understanding of the Tongan peoples' socio-cultural context and its impact on their health behaviours which provide meaningful contributions to both theory and practice.

Moreover, this chapter serves as a critical bridge between the research's empirical findings and its broader implications, providing a reflective exploration of the study's contribution to Pasifika health. While our study has made significant progress in elucidating Tongan peoples' understanding of prediabetes and ways of mobilising them into collective actions to lead healthier lives, it is essential to acknowledge its limitations which will be presented in the following chapter.

CHAPTER 6: FAKAMĀ‘OPO‘OPO (Conclusion and recommendations)

The FAKAMĀ’OPO’OPO (Conclusion and recommendations) chapter acknowledges the strengths and limitations of the study, as well as provide valuable insights for future research or practical applications. There were several limitations of this research. First, the variable study sample size (14-7 participants) across the different phases of the research. Although this study focused predominantly on the qualitative components, the varied participation of community members meant that the overall findings of the research are only reflective of those members that participated, and not of the whole community. Additionally, the intervention programme sample size was considerably small, and as such I could not undertake any meaningful statistical analyses, and therefore that data should be used and interpreted cautiously. Finally, the study was conducted during the initial years of the COVID-19 pandemic in New Zealand (March 2020-2021). This had a major impact on participant attrition in the study.

This study employed a co-design approach to investigate the Tongan youths’ understanding of prediabetes. Through understanding the key barriers to accessing knowledge and programmes to address prediabetes enabled the establishment of the *Fengaueaki Fakataha* model. It is an important strength of this research because the model in its entirety is cognizant of the Tongan cultural values and practices. This culturally relevant model highlights key components to consider when conducting research or promoting health in partnership with the Tongan community. There are myriad of factors that have influenced Tongan peoples’ health as discussed earlier. However, socio-cultural, and economic factors have had the greatest impact on their health.

Furthermore, the *Fengaueaki Fakataha* model highlights key components that reflect the Tongan peoples' socio-cultural and economic context, including their beliefs, values, attitudes, and expectations that underpin their thought processes and health behaviours. This model has shown to yield important, practical insights as a methodology that could be used across different health and Tongan community social challenges. Above all, it can be used to guide effective co-designing and implementation of health intervention programmes. At the core of this model is the *ngatu* which represents the *anga fakatonga*, which shapes the Tongan peoples' worldview, and therefore it should be at the forefront of any research conducted in Tongan communities, and this would be the next step in future research.

Centering the *anga fakatonga*, valuing the Tongan community voice and forming partnerships with system enablers specifically the community, stakeholders, and healthcare providers represent a promising approach to reducing health inequities for Tongans with prediabetes. Through these partnerships, protective factors within the *anga fakatonga* can be supported in meaningful ways. This research has also highlighted that the church should be used as a hub to promote health and build capacity amongst church members. In addition, forming partnerships amongst these system enablers can help to build a strong Pacific health workforce, build supportive environments, and empower communities to promote healthy living standards and practices within their main gathering spaces (e.g., churches). This may also help garner social support among family and church community members which can have an extensive and positive influence.

In conclusion, this chapter has provided an overview of the limitations of the study and outlined valuable suggestions for addressing these limitations and guiding future endeavors in public health. As we move forward, it is my hope that this thesis will serve a valuable resource and catalyst for further advancements in the field of prediabetes and T2DM prevention amongst Pasifika people in New Zealand and abroad.

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APPENDICES

Appendix 1

Questions used in the focus group discussions.

What do you know about prediabetes? Type 2 diabetes? Heart disease? Then you need to give them a presentation on prediabetes and discuss what barriers for understanding and accessing help for this disease?
Tell us how the programme could work for your community?
What processes need to be established for your community?
What would motivate you to attend this programme?

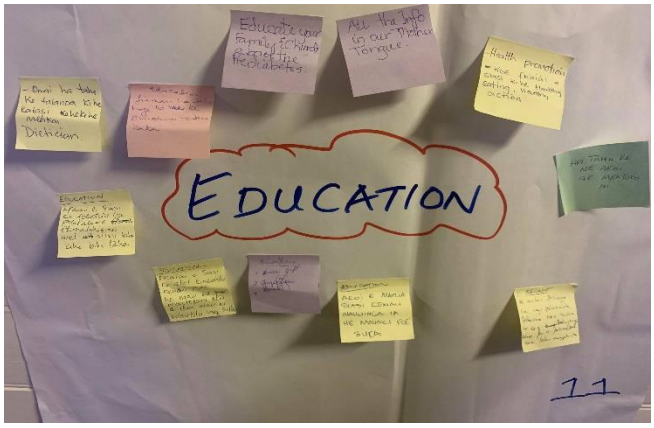
Appendix 2

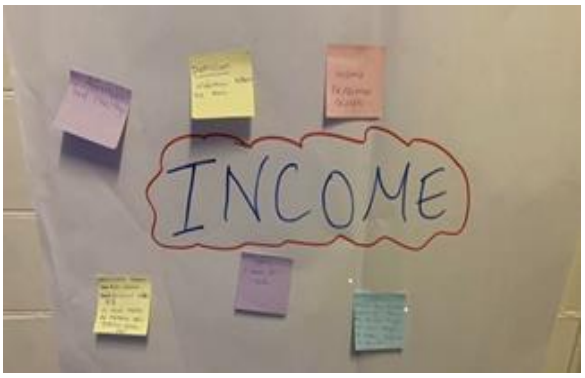
Phase one focus group programme for both the youth and adults.

7:00 pm- Welcoming, Prayer
7:30 pm- Briefing study
7:40 pm- Signing consent form
8:00 pm- Ice breaker
8:05 pm- Part 1- Focus group discussion -Facilitated by the researcher and the white board scribe and the note taking were done by two junior researchers
8:30 pm- Refreshment
8:40 pm- Part 2- Focus group discussion
9:00pm- Final words

Appendix 3

Post it activity for both the adults and youth.





Appendix 4

The bus stop activity for the youth and adults.

Appendix 5

The co-designed intervention programme 'Mo'ui Fakalakalaka'.

	Monday	Friday
Week 1	Sports Competition	Nutrition (Darryl- "How to read a nutrition label") & Station workout
2	Sports Competition	Education (Lana-"Home based exercise") and Station workout
3	Sports Competition	Nutrition (Darryl- "Menu planning, healthy food and choices") and Station workout
4	Sports Competition	Education (Ma'u & Lana-"Benefits of regular exercise") and Station workout
5	Sports Competition	Nutrition (Darryl- "Portion sizes") and Station workout
6	Sports Competition	Diabetes education (guest speaker) and Station workout
7	Sports Competition	Nutrition (Guest speaker-Cooking demonstration and skills) and Station workout
8	Sports Competition	Diabetes education (Ma'u) and Station workout.
9	Sports Competition	Master Chef and Station workout (everyone included)
10	Sports Competition	Station workout and Final assessment (Taskforce group)

Appendix 6

Consent form provided to the participants prior to conducting the focus groups.

Centre for Public Health Research, publichealth.massey.ac.nz
E: vpulu@massey.ac.nz
T: [redacted]
A: Massey University, Wellington Campus, PO Box 756, Wellington 6140
Courier Address Block 3, Level D, Entrance B Wallace St, Wellington 6021

Co-designing a community-based intervention for prediabetes among Tongan youth in New Zealand

FOCUS GROUP PARTICIPANT CONSENT FORM

I have read, or have had read to me in my first language, and I understand the Information Sheet attached as Appendix I. I have had the details of the study explained to me, my questions have been answered to my satisfaction, and I understand that I may ask further questions at any time. I have been given sufficient time to consider whether to participate in this study and I understand participation is voluntary and that I may withdraw from the study at any time.

1. I understand that I have an obligation to respect the privacy of the other members of the group by not disclosing any personal information that they share during our discussion.
2. I understand that all the information I provide will be kept confidential to the extent permitted by law, and the names of all people in the study will be kept confidential by the researcher.

Note: There are limits on confidentiality as there are no formal sanctions on other group participants from disclosing your involvement, identity or what you say to others in the focus group. There are risks in taking part in focus group research and taking part assumes that you are willing to assume those risks.

3. I agree to participate in the focus group under the conditions set out in the Information Sheet attached as Appendix I.

Declaration by Participant:

I _____ [print full name]_|_____ hereby consent to take part in this study.

Signature: _____ **Date:** _____

Appendix 7

Information sheet provided to the participants prior to conducting the overall research.

Centre for Public Health Research, publichealth.massey.ac.nz
E: vpulu@massey.ac.nz
T: [redacted]
A: Massey University, Wellington Campus, PO Box 756, Wellington 6140
Courier Address Block 3, Level D, Entrance B Wallace St, Wellington 6021

Co-designing a community-based intervention for prediabetes among Tongan youth in New Zealand

INFORMATION SHEET

Name of Researchers
Dr Ridvan Firestone, Centre for Public Health, Massey University
Professor Barry Borman, Centre for Public Health, Massey University
Dr Jemaima Tiatia-Seath, School of Maori and Pacific studies, Auckland University

You are invited to take part in this project: 'Co-designing a community based intervention programme for prediabetes among Tongan youth in New Zealand. This project is the subject of my PhD in public health which is being undertaken through Massey University.

This Participant Information sheet will help you decide if you would like to take part. It sets out why we are doing the study, what your participation would involve, what the benefits and risk to you might be, and what would happen after the study ends. We will go through this information with you and answer any questions you may have. We expect this will take about 15 minutes. You may also want to talk about the study with other people, such as family, whanau, friends, or healthcare providers. Feel free to do this.

To be eligible for this study, participants will self-identify as being Tongan and are between the ages of 18 and 24. We would like to recruit youth participants together with representatives of their family. If you agree to take part in this study, you will be asked to sign the Consent Form on the last page of this document. You will be given a copy of both the Participant information Sheet and the Consent Form to keep. We need your help, to further our understanding of developing a culturally relevant intervention to help reduce the prevalence of prediabetes in our Tongan community.

Why are we doing the study?

The purpose of the study is to examine the Pacific Tongan youth understandings of prediabetes and its risk factors, and to reduce the prevalence of prediabetes by empowering Pacific communities using collective action to lead healthier lives. Participants will be recruited from the Pasifika centers in both Massey and Auckland University through networking with Pasifika staff members and students. The study is unique, because you (the participant) will take an active role in developing and implementing ideas that will develop an intervention program to help reduce the prevalence of prediabetes in our community.

What your involvement will be:

The project 'Co-designing a community-based intervention programme for prediabetes among Tongan youth in New Zealand' is comprised of 3 phases. In phase 1, participants will be divided into two focus groups (one for the youth and the other for family members) to examine their awareness and understanding of prediabetes and how to manage this disease in a focus group context.
In phase 2, participants will be divided into three focus groups (the youth, female family members and male family members) to identify problems, generate and implements solutions that can be used as a community-based intervention program. In phase 3, participants will take part in the intervention

evaluation where participants are divided into two focus groups to identify drivers that are important to Pacific people that address health equities of prediabetes and identify and understand motivational drivers of healthy behavior change. Each phase will be carried out on separate days and refreshments will be provided throughout the programme. The focus group discussions will take an hour and a half with a break for refreshments. The discussions will be facilitated and recorded with a digital voice recorder.

What are your rights in the study?

You have the right to:

- *Decline to answer any particular question*
- *Withdraw from the study at any time prior to the data analysis stage*
- *Ask any questions about the study at any time*
- *Provide information on the understanding that your name will not be used unless you give permission to the researcher*
- *Be given access to a summary of the project findings when it is concluded*
- *Ask for the digital recorder to be turned off at any time during the viewing time*

What will happen after the study ends, or if you pull out?

The information you give us will be treated with utmost confidence. The information obtained will be stored away in a locked cabinet, for a period of 10 years before it is destroyed, and will only be viewed by the named researchers. No individual or names will be published.

Where can you go for more information regarding the study, or to raise concerns or complaints?

If you have any questions, concerns or complaints about the study at any stage, you can contact:

Ms. Veisinia Pulu,
Contact number: [redacted]
Email: veisiniapulu@yahoo.com

Dr Ridvan Firestone
Contact number: +64 4 9793107
Email: r.t.firestone@massey.ac.nz

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application 19/34. If you have any concerns about the conduct of this research, please contact Dr Negar Partow, Chair, Massey University Human Ethics Committee: Southern A, telephone 04 801 5799 x 63363, email humanethicsoutha@massey.ac.nz.