

POLICY BRIEFING

August 2017

E/S/R

PRE-DIABETES: A WINDOW OF OPPORTUNITY?

1. Introduction

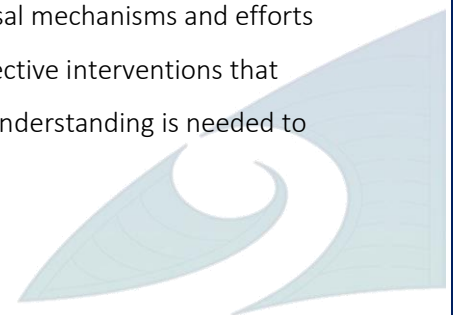
The purpose of this policy briefing is to set out the take home messages from an Institute of Environmental Science and Research (ESR) project that has examined how a number of different stakeholders, namely policy makers, clinicians, health managers and communities (including Māori), are responding to the problem of pre-diabetes. The attraction of tackling pre-diabetes is that it facilitates the identification of individuals and/or populations at higher risk of developing diabetes and thus the targeting of interventions to delay or stop the development of diabetes and its complications.

This project has been aligned to He Pikinga Waiora, a project funded by the Healthier Lives National Science Challenge to develop an implementation framework for activating community partnerships, indigenising evidence based initiatives and creating sustainable and effective intervention pathways.

The 'systems' map (Figure 1) depicts stakeholder views about the way in which social, economic, cultural and individual factors mediate people's risk of developing pre-diabetes, type 2 diabetes and complications. The 'systems' map is intended to *stimulate dialogue* between stakeholders and *prompt learning* about the mix of policies, strategies, programmes and actions necessary to improve health outcomes and reduce health inequities.

1.1 Why a systemic approach?

'Wicked problems' such as the prevention of chronic conditions are characterised by high levels of complexity, uncertainty and conflict. These problems are not easily understood nor are they tackled successfully using a reductionist approach, which breaks complex problems into smaller simpler problems. Our research has regarded the aetiology of type 2 diabetes ("diabetes") as a complex interacting mix of genetic, physiological, psychological, familial, social, cultural, economic and political factors. In this way, both biomedical research on specific physiological causal mechanisms and efforts to change behaviour form a necessary but insufficient basis to develop effective interventions that work in 'real world settings'. There is no simple solution. A bigger picture understanding is needed to develop a multi-level comprehensive approach to addressing diabetes.





1.2 Context

Diabetes is a common chronic condition that significantly impacts on the health and wellbeing of New Zealanders. People with diabetes are at increased risk of cardiovascular disease, kidney failure, blindness and lower-limb amputations. It is estimated that 260,000 people have diabetes, 100,000 have undiagnosed diabetes, and one out of four New Zealanders are pre-diabetic which places them at increased risk of developing diabetes and cardiovascular disease¹. Māori, Pacific Islanders Indo-Asians and people with a lower socioeconomic status are at an increased risk of developing pre-diabetes and diabetes. Healthcare costs are expected to grow from NZ\$540 million in 2006/2007 to NZ\$1.78 billion by 2021. The prevention, early detection and treatment of diabetes represents a serious challenge to health services and is a priority long-term condition for the Ministry of Health.

Diabetes is largely a preventable condition. However, while lifestyle modification interventions such as weight loss, a healthier diet and/or physical activity hold the potential to slow or prevent the onset of diabetes, there are a number of challenges to scaling up these interventions especially for communities deemed 'hard to reach'. The challenge then is to move beyond a narrow focus on intervention efficacy to include consideration of effective implementation in specific settings with a focus on prolonging sustainability and facilitating uptake. Our 'systems' map is intended to make visible how stakeholders are responding to pre-diabetes, and identifies barriers to exploiting what some stakeholders see as a 'window of opportunity' to curb the diabetes epidemic.

2. Developing the 'systems map'

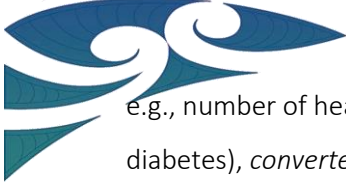
We used systems dynamics² to create a 'systems' map of some of the big picture drivers for pre-diabetes, describe the ways in which different stakeholders are attempting to address pre-diabetes, and highlight some of the ways in which interventions may be undermined. Data for the 'systems' map was obtained from key informant interviews undertaken either in person or by telephone with policy makers, primary and secondary care clinicians, health promoters, researchers and patients³. Interviews lasted between 45 minutes to 1 ½ hours and were audio recorded. With the exception of patient interviews which were transcribed, verbatim notes were taken for all other interviews. The data was analysed thematically⁴. We describe the 'system' in terms of *stocks* (accumulated quantities,

¹ People with pre-diabetes are glucose intolerant and have a HbA1c of 41-49 mmol/mol. Having pre-diabetes does not necessarily mean that a person will go on to develop diabetes. The probability of progressing from pre-diabetes to diabetes is estimated between 30 and 70 percent.

² System Dynamics enables an appreciation of complex situations where multiple variables interact, knowledge is incomplete, time lags between cause and effect are significant, and no one stakeholder has an overview of the 'whole system'.

³ A total of 24 key informant interviews were undertaken including 12 with patients from Te Kōhao Health and Poutiri Trust with pre-diabetes and/or diabetes.

⁴ For example, the *obesogenic environment* which highlights the way in which the environments that people 'live, work and play' can undermine the capacity of people to make healthy choices. This points to limitations of lifestyle



e.g., number of healthy people), *flows* (changes to the stocks, e.g., number of people progressing to diabetes), *converters* (variables that influence flows, e.g., screening rate), *time delays* (e.g., between becoming obese and developing diabetes) and *feedback loops* (e.g., balancing (B in the system) and reinforcing (R in the system))⁵.

3. The 'systems' map

The backbone of the 'systems' map (following Jones et al., 2006⁶) is the way in which healthy people develop pre-diabetes, recover or progress onto diabetes (without complications) and then develop diabetes (with complications). Points to note include:

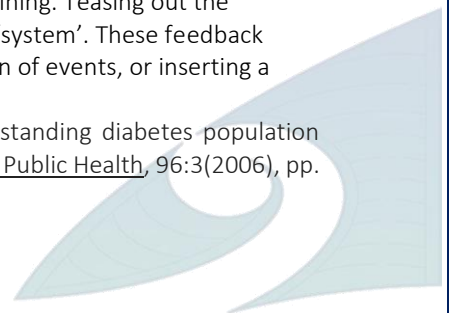
- The number of healthy people is determined by the inflow of births and outflow of people developing pre-diabetes or dying with normal glycemic levels. Our goal is to maximise the number of healthy people by preventing the onset of pre-diabetes or helping those with pre-diabetes and diabetes reverse their condition.
- The 'systems' map differentiates between people with a diagnosis and those without a diagnosis of pre-diabetes and type 2 diabetes.
- Many of the risk factors that determine whether a healthy person will develop pre-diabetes and then go on to develop diabetes are thought to be the same. These risk factors are likely to influence whether a person with pre-diabetes or diabetes can recover and become healthy. We focus on two specific risk factors: genetic predisposition and people with unhealthy weight⁷. However, the system is more complex, and not all individuals with an unhealthy weight will develop pre-diabetes, and not all pre-diabetics progress to diabetes. Furthermore, individuals may have the same level of genetic predisposition but this 'genetic risk' can interact with the individual's environment (e.g., lifestyle) leading to different health outcomes.

interventions that assume individual responsibility and cautions against victim blaming. In this way, issues such as food insecurity, urban design, the marketing of energy dense and nutrient poor food require interventions beyond those provided by healthcare services to address structural causes.

⁵ Reinforcing feedback loops are destabilising and tend to exhibit growth or decline over time. In contrast, a balancing feedback loop is stabilising and usually indicates a 'system' is self-maintaining. Teasing out the causality in a 'system' helps us to see what kinds of feedback predominates in the 'system'. These feedback loops provide opportunities for interventions, which may involve breaking the chain of events, or inserting a new programme, policy or action which helps to stabilise dynamics.

⁶ Jones, A., Homer, J., Murphy, D., Essien, J., Milstein, B., and Seville, D "Understanding diabetes population dynamics through simulation modeling and experimentation", *American Journal of Public Health*, 96:3(2006), pp. 488-494.

⁷ People who are obese are considered at high risk of developing diabetes.





- A public health approach is used to categorise leverage points because this has utility when examining the mix and spread of interventions. These levels include: primary prevention (focused on healthy people), secondary prevention (focused on risk factors) and tertiary prevention (focused on preventing and managing complications).
- The 'systems' map is necessarily a simplification of stakeholder views and is at a high level. The 'systems' map does not model the differential impact of diabetes by breaking down the stocks and flows by ethnicity, gender and age.
- The behaviour of the 'system' over time such as the increasing prevalence of diabetes and the increasing financial burden on the health system is determined by the structure of the 'systems' map. That is, by interacting balancing and reinforcing feedback loops. The 'systems' map contains at least five feedback loops, and the implications of these loops for the prevention of diabetes is discussed in the next section.



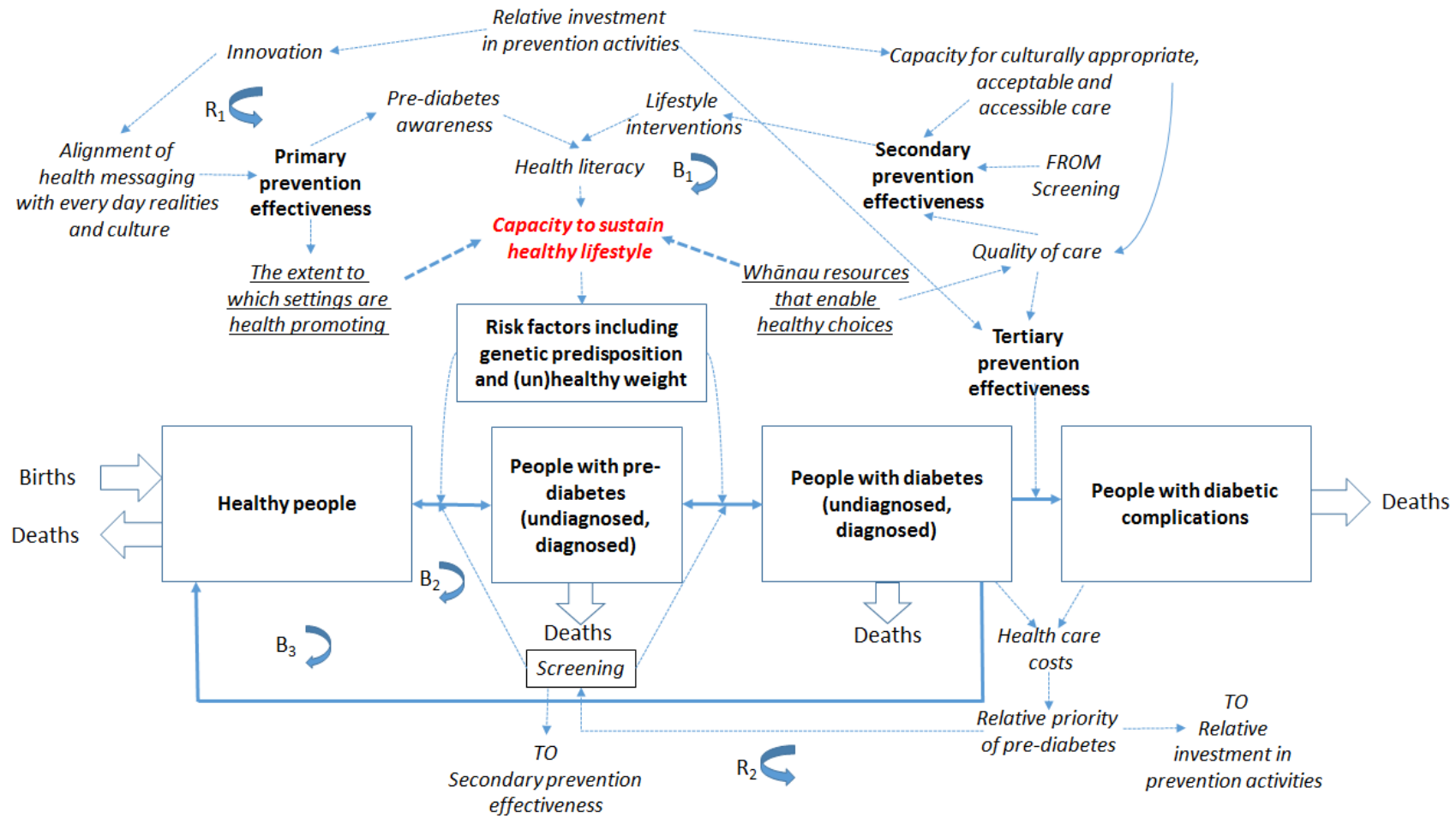


Figure 1: 'Systems' map





Key: Feedback loops

Reinforcing feedback loops are destabilising and tend to exhibit growth or decline over time. In contrast, a balancing feedback loop is stabilising and usually indicates a 'system' is self-maintaining

- *Building public health literacy (B₁):* This is a balancing loop. Currently diagnosis of pre-diabetes or diabetes triggers a discussion (in primary care) about lifestyle changes to delay or stop the progression of pre-diabetes to diabetes, or encourage self-management of diabetes to avoid complications. Healthy choices lead to healthy eating and exercise patterns which can reduce the risk of developing diabetes, and in some cases reverse pre-diabetes. However, knowledge about healthy diet and exercise is insufficient to bring about lifestyle change. The capacity to sustain a healthy lifestyle is influenced by resources to enable healthy choices (e.g., sufficient disposable income and patient/whānau peer support) and the extent that the settings where people 'live, work and play' make the healthy choice the easy choice (e.g., removing sugary drinks from schools). Public health literacy needs to be built at many different levels to avoid 'victim blaming' and stigmatising those with pre-diabetes and/or diabetes. This requires actions such as raising awareness of the social determinants of health amongst policy makers, health professionals and non-health stakeholders to establish healthy policies and practices.
- *Reversing the pre-diabetes epidemic (B₂):* This balancing loop is viewed by many stakeholders as a 'window of opportunity' to address the growing prevalence of diabetes, a point at which individuals are not as adversely affected by diabetes or its complications. Lifestyle changes and drug treatment may reverse pre-diabetes but the potency of this loop is undermined by difficulties in sustaining a healthy lifestyle which can increase the risk that those with pre-diabetes will go on to develop diabetes. Clinically, a 'one size fits all' approach may be ineffective. Some individuals with pre-diabetes could be 'resistant' to lifestyle interventions (e.g., weight-loss might not have the desired effect) and may benefit from taking glucose lowering drugs immediately (if acceptable) for maximum efficacy in the treatment of the disease. This loop assumes that early diagnosis of pre-diabetes will result in lifestyle change of the individual which will reverse the pre-diabetic diagnosis.
- *Recovery from diabetes (B₃):* This is a relatively weak balancing loop whereby people with diagnosed diabetes successfully manage to reverse diabetes, and is very much dependent on the effectiveness of secondary prevention activities to stop or delay the development of complications including cardiovascular disease and renal failure. Bariatric surgery (a tertiary prevention intervention) is the most effective method to-date for long-term amelioration of diabetes.
- *Moving beyond business as usual (R₁):* This is a reinforcing loop that identifies that growing concern about the prevalence of pre-diabetes leads to innovative ways of supporting people to adopt healthy lifestyles, at least some of which, such as community gardens, are outside the formal healthcare system. This enhances the effectiveness of primary prevention interventions which can raise awareness about pre-diabetes and positively impact on the levels of health literacy in the community. However, the inability to scale up (and out) primary preventive initiatives due to factors such as lack of evaluation and funding diminishes their ability to raise awareness about pre-diabetes and the need to adopt healthy diets and exercise patterns. The influence of health literacy is then reduced by lack of resources and presence of obesogenic settings which create barriers to healthy choices. This loop assumes value in a community development approach.
- *Growing awareness of pre-diabetes (R₂):* This is a reinforcing loop that shows that concerns about the growing number of people with pre-diabetes (undiagnosed and diagnosed) and financial implications for the health system, influence relative priority of pre-diabetes and resources allocated to early detection (more heart and diabetes checks), service improvement (e.g., self-management and shared care projects) and innovations outside formal healthcare services (e.g., diabetes innovation fund projects). These activities heighten the visibility of pre-diabetes which in turn influences its relative priority. This loop assumes primary care is an effective place to intervene.



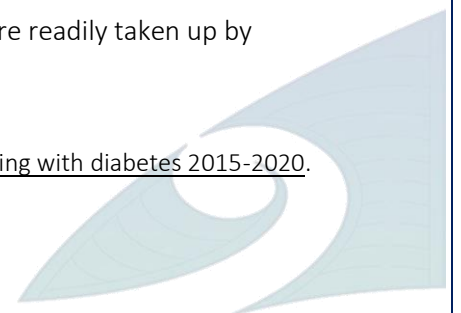
4. Policy implications

The Ministry of Health's priority areas for action⁸ include a focus on pre-diabetes, enabling effective self-management, improving service quality, early detection of diabetes and reducing complications, and integrated care between primary and secondary health services. Individually, all these strategies to a lesser extent will reduce the burden from diabetes including health disparities. Our 'systems map' focuses on the identification and management of pre-diabetes, and in this section we consider the extent that pre-diabetes is a powerful leverage point.

While addressing the diabetes epidemic by intervening early to reduce the number of new cases of diagnosed diabetes makes sense, the effectiveness of this strategy is diluted by the system dynamics depicted in Figure 1. Some insights include:

- Success at reducing the prevalence of pre-diabetes may not necessarily decrease prevalence of diabetes in the short term given that there is uncertainty whether any individual with pre-diabetes will go on to develop diabetes and in addition to an aging population where people with diabetes are living longer.
- Concerted effort to screen for pre-diabetes as represented by the 'growing awareness of pre-diabetes' loop (R_2) may result in unintended consequences associated with unnecessary medicalization including stigmatisation, victim blaming, patients adopting a fatalistic attitude to the onset of diabetes, increasing clinician workloads and potentially diverting scarce resources from the management and treatment of diabetes. A lack of understanding about why some pre-diabetic individuals do not go on to develop diabetes may mean some resources focused on individuals who did not need treatment. This highlights the opportunity for basic science research to aid in the identification of pre-diabetic individuals who will and will not progress to diabetes. A clinical approach will be right for some people but not others so monitoring the unintended consequences noted above is an important activity.
- Difficulties in translating lifestyle interventions from the context of a clinical trial into a 'real world' community setting may serve as a roadblock. There are questions about the ability of primary care workforce to deliver lifestyle interventions in the ways that have sufficient fit with Māori and Pasifika needs, aspirations and values. This is also true of non-health stakeholders such as sports and recreation clubs who struggle with 'low participation' groups. The existence of 'hard to reach' clients raises further questions about the potential of lifestyle interventions to further increase health inequities as these are more readily taken up by

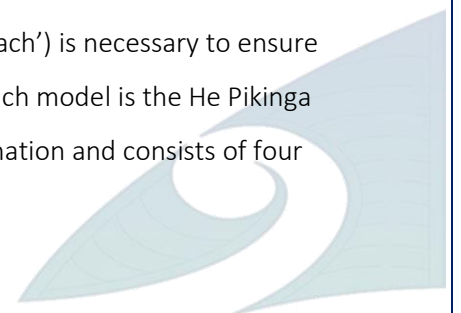
⁸ Ministry of Health [Living well with diabetes: a plan for people at high risk of or living with diabetes 2015-2020](#). Ministry of Health, Wellington, 2015.

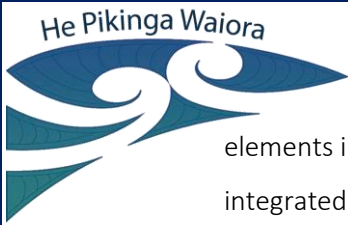




affluent and educated individuals. In addition, variations in the quality of care received by people with diabetes raises concern about the capacity of the primary care sector (rather than particular general practices or health services) to effectively address pre-diabetes.

- A focus on lifestyle as represented by the 'building health literacy' loop (B₁) can downplay the significance of social, cultural, economic and political factors. The social determinants of health such as income, food security, safe neighbourhoods, education and housing have a powerful influence on the effectiveness of lifestyle interventions. Settings where people 'live, work and play' matter. There needs to be a shift from 'building health literacy' to 'building public health literacy' to understand how the social determinants of health impact on people's ability to make healthy choices.
- An unhealthy weight is a risk factor that is shared with various chronic conditions, and lifestyle advice will be similar for each chronic condition.
- This analysis suggests that the effective prevention of diabetes requires both the development and testing of interventions to provide people with the necessary resources so that they have the opportunity to adopt healthy eating and exercise patterns, and capacity building of various settings in order to help people make healthy choices ('health by stealth'). This also involves raising awareness about the link between diet, exercise and diabetes, but importantly includes helping people to understand how structural issues such as food marketing and transport policy influence the availability, affordability and acceptability of healthy food and exercise opportunities. Cultivating such a systemic understanding is necessary to mobilise public support for deep interventions which may challenge the status quo.
- This analysis reinforces the need to strengthen the 'beyond business as usual' (R₁) loop through experimentation and evaluation. This will require inter-sectoral collaborations that actively engage with communities to co-design meaningful interventions that make a difference in everyday lives but also attend to wider influences on community health including socioeconomic factors.
- A focus on wellness rather than pre-diabetes provides an expansive frame to sweep in different cultural understandings of health (e.g., spiritual and whānau health) in order to inform the development of culturally appropriate, acceptable and accessible interventions.
- Lastly, engaging with those communities who are least likely to benefit from health interventions (and may even be considered by some as 'hard to reach') is necessary to ensure that any innovations do not unwittingly increase inequities. One such model is the He Pikinga Waiora Implementation Framework which prioritises self-determination and consists of four





elements including cultural-centeredness, community engagement, systems thinking and integrated knowledge translation⁹.

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⁹ Oetzel, J., Scott, N., Hudson, M., Masters, B., Rarere, M., Foote, J., Beaton, A., and Ehau, T. (2017) Implementation framework for chronic disease intervention effectiveness in Māori and other Indigenous communities. *Globalization and Health*, 13(69). <https://doi.org/10.1186/s12992-017-0295-8>

