A Position Statement on Screening and Management of Prediabetes in Adults in Primary Care in Australia

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Contents

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Introduction

Prediabetes is a metabolic condition characterised by elevated blood glucose levels, but not meeting the diagnostic criteria for diabetes. It includes impaired fasting glucose (IFG), impaired glucose tolerance (IGT) and/or elevated glycated haemoglobin (HbA1c).

Prediabetes affects nearly 1 in 6 Australian adults (more than 2 million individuals) over the age of 25 years (1). Without intervention, approximately 1 in 3 will develop type 2 diabetes within ten years. In addition, people with prediabetes are at higher risk of developing cardiovascular disease (2, 3). The Australian National Diabetes Strategy 2016-2020 prioritises the prevention of type 2 diabetes (4) and it is the position of our organisations, that early detection of prediabetes represents a vital step for initiating proactive intervention and support strategies for preventing or delaying the onset of type 2 diabetes and associated comorbidities including cardiovascular disease.

This position statement has therefore been developed to provide consensus-based clinical recommendations for the screening and management of prediabetes in adults in the Australian primary care setting, with a focus on practical implementation. It is the hope that this will assist in planning service requirements and support health professional bodies and health services to advocate for increased services to improve outcomes for those with prediabetes.

A working party was convened to develop the position statement based on existing evidenced-based literature and guidelines with representatives from the Australian Diabetes Society (ADS), the Australian Diabetes Educators Association (ADEA), Dietitians Australia (DA), Exercise and Sports Science Australia (ESSA) and Pharmaceutical Society of Australia (PSA). Membership of the working group is shown in Appendix 1. This statement provides general information and advice and will not be explicitly addressing populations with specific needs including prediabetes in children or adolescents, disability or mental health. It will be important to individualise care for people in these populations.

The reference list provided is not exhaustive as the position statement is not a systematic literature review, rather a review of pertinent publications relevant to screening and management.

Summary of Recommendations

- Individuals with clinical risk factors for prediabetes are recommended to receive formal screening using the Australian Type 2 Diabetes Risk Assessment (AusDRisk) screening tool. For those at high risk, pathology screening is recommended (fasting venous blood glucose test, HbA1c or Oral Glucose Tolerance Test).
- The management of prediabetes should be multipronged, including lifestyle interventions, psychological support and with pharmacotherapy as appropriate.
- Education is best provided on diagnosis, and as frequently as needed or desired to support any behavioural or pharmacological interventions. Regular and ongoing support from a multidisciplinary health professional is strongly encouraged.
- Care needs to be patient-centred, treating the individual as an active participant in their health care team.
- A collaborative, multidisciplinary health team needs to be involved in the professional care and support of an individual with prediabetes. This typically includes, but is not limited to, the General Practitioner and/or Nurse Practitioner, Practice Nurse and/or Credentialled Diabetes Educator, Accredited Practising Dietitian, Accredited Exercise Physiologist or Physiotherapist and their Pharmacist.
- Advice should be tailored to the individual's needs and preferences but should not conflict among health professionals. It is imperative that the multidisciplinary team works cohesively and communicates effectively to provide unified messages to patients.
- Lifestyle strategies should include weight reduction, healthy eating, regular physical activity and reducing sedentary behaviour, stress management and smoking cessation, as appropriate. Weight loss of 5-10% has been shown to halve the risk of progression to type 2 diabetes.
- Structured, intensive lifestyle programs have added cost and burden but have the clearest evidence of benefit among people with IGT (evidence of benefit in IFG or raised HbA1c is less certain).
- No medications are TGA-indicated for prediabetes. Glucose-lowering agents (GLA), such as metformin, are generally not as effective as a structured, intensive lifestyle intervention,

however, may be beneficial in younger individuals who do not respond to lifestyle interventions alone.

- There is no indication for self-monitoring capillary blood glucose levels by individuals with prediabetes.
- The frequency of ongoing monitoring needs to be individualised. Annual retesting of HbA1c is recommended (and supported by Medicare). Other health outcomes, such as weight and blood pressure, can be reassessed more regularly, for example, to assess the efficacy of interventions and any disease progression.

1. Prevalence, Pathogenesis and Definition

Prediabetes affects nearly 1 in 6 Australian adults (more than two million individuals) over the age of 25 years (1). Without intervention, approximately 1 in 3 people with prediabetes will develop type 2 diabetes within ten years. Those with prediabetes are at higher risk of developing cardiovascular disease at any timepoint (2, 3).

Prediabetes occurs on the continuum of glucose dysregulation, resulting from insulin resistance and pancreatic islet β-cell dysfunction. Initially, insulin resistance is counteracted by increased insulin secretion resulting in normoglycaemia. However, when the pancreatic β-cells are no longer able to compensate adequately for insulin resistance, the blood glucose level becomes elevated resulting in prediabetes. Prediabetes can include IFG, IGT or both conditions concurrently. In IFG, normoglycaemia can no longer be maintained in the fasting state, which is determined primarily by glucose output from the liver and therefore, IFG is closely associated with hepatic insulin resistance (5). In contrast, IGT is associated with high peripheral insulin resistance, together with dysfunctional β-cells that are unable to secrete sufficient insulin in the face of a glucose challenge. In either diagnosis, the blood glucose levels are elevated above the normal ranges but are not yet high enough to be diagnostic of type 2 diabetes.

Prediabetes can be identified based on fasting venous blood glucose levels, an HbA1c test or glucose levels at 2 hours after a 75g oral glucose tolerance test (OGTT). See 'Section 3.3: Pathology' for more details on the screening and detection of prediabetes.

2. Clinical Significance of Prediabetes

Imbalances in glucose homeostasis mean that, without intervention, there is a high risk of progression from prediabetes to type 2 diabetes. Prediabetes can also be part of the definition of the metabolic syndrome, which includes any three of the following risk factors: elevated blood glucose levels, elevated blood pressure, abnormal blood lipids and excess abdominal weight (i.e. waist circumference) (6). The metabolic syndrome often precedes type 2 diabetes, with affected individuals experiencing a fivefold increased risk of developing type 2 diabetes (7).

Similarly, women with prediabetes before pregnancy have a higher risk of developing Gestational Diabetes Mellitus (GDM) (8, 9). GDM affects 9% of pregnancies in Australia (10), with rates as high as

30% of pregnancies in high-risk ethnically-diverse regions of Australia (11). Women with a history of GDM have an increased risk of progressing to type 2 diabetes later in life, 26% developed type 2 diabetes within 15years (12). GDM places both the mother and baby at risk of pregnancy complications, such as pre-eclampsia, macrosomia, neonatal hypoglycaemia and respiratory distress (13), and further increases risk to mother and baby of developing type 2 diabetes later in life (14, 15). Children whose mothers developed GDM during their pregnancies also have a much higher risk of obesity, the metabolic syndrome and type 2 diabetes (16).

Insulin resistance and any degree of elevated glucose levels in prediabetes also contribute to the increased risk of cardiovascular disease (CVD) by an approximate 20% (17). The meta-analysis study of 53 prospective cohort studies that included over 1.5 million individuals from general populations identified that prediabetes was associated with an increased risk of CVD with IGT posing the highest risk (18). However, they noted that health risks could be seen in people with an IFG level as low as 5.6mmol/L (19). Further, the AusDiab study showed when compared to normal glucose tolerance, IFG was an independent predictor for CVD mortality (2.5 (95% CI: 1.2-5.1) whereas IGT was not (1.2 (0.7-2.2)) (20).

3. Screening and Detection

Early detection of prediabetes through screening is paramount for providing timely intervention and support and thus preventing type 2 diabetes and associated health complications.

The screening process for prediabetes is the same as for type 2 diabetes. Individuals can be screened based on clinical risk factors, using the Australian Type 2 Diabetes Risk Assessment (AusDRisk) screening tool and then those with prediabetes identified through blood testing.

3.1 Risk Factors for Prediabetes

Non-Modifiable Risk Factors

- Increasing age
- Certain ethnic backgrounds including Aboriginal, Torres Strait Islander, Middle Eastern, South Asian, Pacific Islander and North African
- Family history of prediabetes or type 2 diabetes
- Personal history of GDM

- Polycystic Ovary Syndrome (PCOS)

Modifiable Risk Factors

- Overweight/obesity
- Waist circumference (Caucasian Men: > 94cm, Asian Men: > 90cm, Women: > 80cm)
- Unhealthy eating patterns
- Insufficient physical activity and/or excessive sedentary behaviour
- Smoking
- Poor sleep
- High blood pressure
- Metabolic syndrome (insulin resistance, high blood pressure, dyslipidaemia, central adiposity)
- Medications that can induce hyperglycaemia including steroids

3.2 Australian Type 2 Diabetes Risk Assessment Tool (AUSDRISK)

The Australian Type 2 Diabetes Risk Assessment Tool (AUSDRISK) is a short questionnaire, designed to estimate the risk of progression to type 2 diabetes over five years (21). Scoring includes questions based on the risk factors for prediabetes and type 2 diabetes. Adults in the 'intermediate risk' (scoring 6-11) or 'high risk' category (scoring 12 and above) should be tested for prediabetes (Fig 1). Re-screening or testing should occur every 1-5 years, depending on the risk score and progression of type 2 diabetes risk factors.

3.3 Pathology

Prediabetes can be identified by an OGTT, fasting blood glucose or HbA1c. Each test has benefits and limitations and therefore the most appropriate test should be matched to the individual. Each test will identify a slightly different group of individuals, such that some people will fall into all three states (IFG, IGT and raised HbA1c), while most will fall into only one or two states. Since the clearest evidence of benefit for a structured, intensive lifestyle intervention is among people with IGT, and evidence for benefit in IFG or raised HbA1c is much less certain, it is recommended that an OGTT is performed before referral into a structured, intensive lifestyle program. Those with IFG or raised HbA1c, but not IGT, should still be provided with general lifestyle advice, but the primary target group for structured, intensive lifestyle interventions should be people with IGT.

3.3.1 Fasting venous blood test

A venous fasting blood test can be used to identify those with IFG but not IGT. A fasting blood glucose (FBG) of 6.1 – 6.9 mmol/L is indicative of IFG (Fig 1) (22). A fasting glucose level of 7.0 mmol/L or above is diagnostic of type 2 diabetes (22).

3.3.2 HbA1c

HbA1c can also be used to identify those at high risk of progressing to diabetes, but there is uncertainty about precisely what range of HbA1c should be used to make a diagnosis of prediabetes. The American Diabetes Association recommends 5.7-6.4% (39-46 mmol/mol) (23), while the International Expert Committee recommended 6.1-6.4% (42-46 mmol/mol) (24). In the absence of good evidence that intervening in people with prediabetes defined by HbA1c is beneficial, we recommend the narrower range of 6.0-6.4% (Fig 1). This is also the range recommended in Canada and the UK (25, 26). Similar to recommendations for diagnoses made by fasting glucose, if entry into a structured intensive lifestyle program is being considered, an OGTT is recommended to determine if IGT is present.

NOTE: HbA1c can be unreliable in a variety of conditions in which red cell turnover or haemoglobin binding of glucose is abnormal. This includes haemoglobinopathies, anaemia, iron deficiency, and significant renal impairment. Individuals who have one of these conditions or who come from populations known to have a prevalence of haemoglobinopathies should be tested utilising blood glucose, not HbA1c.

3.3.3 Oral Glucose Tolerance Test (OGTT)

An OGTT involves a fasting venous blood test, immediately followed by an oral 75g glucose load. A subsequent venous blood test is taken after 2 hours. An OGTT should be performed if the differentiation of IFG vs IGT has implications for management decisions (see section 3.3 ‘Pathology’) (22).

IFG is defined as:

- Fasting blood glucose (FBG) 6.1 – 6.9 mmol/L
- If measured: 2 hour blood glucose <7.8 mmol/L following 75 g OGTT

IGT is defined as:

- Fasting plasma glucose (FBG) < 7.0 mmol/L
- 2 hour blood glucose ≥7.8 and <11.1 mmol/L following 75 g OGT

4. Management & Education

There is strong evidence supporting lifestyle strategies as effective in managing prediabetes and preventing or at least delaying the onset of type 2 diabetes. Lifestyle strategies aim to reverse prediabetes and reduce associated risk factors through weight reduction, healthy eating, regular physical activity, stress reduction/improved sleep and smoking cessation. Lifestyle interventions are therefore recommended for all individuals with prediabetes.

Structured, intensive lifestyle interventions differ to more generalised lifestyle strategies in that they usually involve a predefined program of visits and clinical monitoring with a set lifestyle approach supported by relevant, trained health professionals. However, structured, intensive lifestyle interventions often come at an additional cost and burden to the individual and while there is strong evidence for their benefit for those with IGT, there is less evidence in those with IFG.

An individual's prediabetes management plan also needs to be appropriate to the individual's age and concurrent medical conditions (e.g. intensive lifestyle interventions with a focus on weight loss are unlikely to be effective and may be harmful in the elderly). In initiating a management plan, the use of multidisciplinary teams and referral to appropriate health professionals/lifestyle programs, wherever possible, is important (22).

Education and support are best provided upon diagnosis, and as required to support any behavioural or pharmacological interventions. There is strong evidence that person-centred approaches to providing care and support are most effective (23). A person-centred approach treats the individual as an active participant in their health care team. Also, all care needs to incorporate the individual's needs, preferences, literacy and numeracy skills, health literacy, cultural and religious needs. Goals are tailored to the individuals' choices, and the health professional assesses their readiness and confidence to change. Person-centred healthcare shows respect and is responsive to the preferences, needs, and values of the individual. Making a management plan in collaboration with the individual for their prediabetes helps them to identify what is important to them, the knowledge they already have and any limitations or barriers for setting realistic and personally-relevant goals.

4.1 Multidisciplinary Team

The management of prediabetes should be individualised, multi-faceted, and involve a multidisciplinary team of health professionals. Management options include lifestyle interventions, psychological support and pharmacotherapy.

Multidisciplinary teams for prediabetes frequently include:

- General Practitioner with or without support from Practice Nurse
- Nurse Practitioner /Credentialled Diabetes Educator
- Accredited Practising Dietitian
- Accredited Exercise Physiologist/Physiotherapist
- Pharmacist

Additional multidisciplinary team members, as needed:

- Podiatrist
- Specialist medical practitioners such as Obstetrician
- Psychologist and/or social worker

Proactive, collaborative, multidisciplinary teams can offer expertise, practical advice and support across the range of intervention approaches for prediabetes to support self-management and wellbeing. However, as several different management approaches have proven efficacious in prediabetes, it is imperative that the multidisciplinary team works cohesively and communicates effectively to provide unified messages to patients. Advice should be tailored to the individual's needs and preferences but should not conflict between health professionals.

4.2 Lifestyle Interventions

Lifestyle interventions for prediabetes encourage weight loss through healthy eating and physical activity and can also include stress management and improving sleep.

There is evidence that weight loss in individuals who are overweight/obese has significant benefits in prediabetes. Lifestyle interventions resulting in weight loss of 5-7% reduce the risk of developing type 2 diabetes by 57% (27), with a further reduction in those that sustained weight loss of 5% after three years (28). The Diabetes Prevention Program in the United States demonstrated that for every

kilogram of body weight lost, there was a relative risk reduction of type 2 diabetes of 16% (29). The trial involved intensive education with participants attending 16 individual dietitian consultations plus an exercise program and telephone support. In the current Australian health system, additional funding for Accredited Practising Dietitians and Accredited Exercise Physiologists would be needed to achieve the same intensity of the interventions in order to reproduce these outcomes in people at risk, unless individuals were willing to pay out of pocket for these services.

Lifestyle interventions can be provided through referrals to specific health professionals, such as Accredited Practising Dietitians, Accredited Exercise Physiologists and/or Physiotherapists. Alternatively, a number of evidence-based intensive lifestyle programs (face-to-face, telephone, webinars, community programs) are on offer in Australia. The effect of lifestyle intervention can have a lasting impact of up to 20 years (30). Regardless of the lifestyle intervention, it is essential that individuals receive consistent messaging and support from all members of their healthcare team.

4.2.1 Healthy Eating

Dietary advice for individuals with prediabetes should be consistent with the Australian Dietary Guidelines (31). These dietary guidelines provide the evidence-based nutrition foundations, but are flexible enough to encompass a range of healthy eating approaches/patterns. The most suitable dietary patterns in prediabetes are those that assist with weight management and focus on food groups that have been linked to prevention of chronic diseases. A variety of healthy eating approaches are effective for weight loss, with no one macronutrient composition being superior over the longer term (32).

Long-term weight loss/weight maintenance is more likely to be achieved with realistic and sustainable dietary approaches (32) and a focus on macronutrient quality (33-35) rather than a particular diet or nutrient. A meta-analysis of various dietary approaches suggests value in a range of evidence-based diets including Mediterranean, lower carbohydrate, lower glycaemic index, and higher protein diets to improve glycaemic management (36). Vegetarian and vegan diets (37), the Dietary Approaches to Stop Hypertension (DASH) diet (38), and the Nordic diet (39) have also been associated with a reduced risk of progressing to type 2 diabetes. An Accredited Practising Dietitian can provide individualised dietary advice and support, appropriate for the individuals' unique nutritional, social, cultural and personal needs.

Weight loss requires an energy deficit (40); therefore, moderation of portion sizes and choosing nutritious, lower energy-density whole foods (e.g. whole grains, fruit and vegetables) over less

nutritious, energy-dense foods (e.g. refined, high fat and high sugar processed foods) should be the first step. The 2011-2012 Australian Health Survey revealed that Australians consume 35% of their energy from discretionary foods at the expense of health promoting core foods (41). Discretionary foods are those high in saturated fat, salt, sugar or alcohol with a high energy density and low nutritional value. Reducing the consumption of foods such as fast-food, cakes, biscuits, confectionery, fried snacks, sugar sweetened beverages and alcohol will significantly reduce an individual's energy consumption and may result in weight loss.

Strategies to improve diet quality that are associated with a reduced incidence of developing type 2 diabetes and other chronic diseases include:

- Encourage higher intakes of minimally processed fruits and non-starchy vegetables, particularly green leafy vegetables (35, 42). Non-starchy vegetables should make up the largest proportion of most meals (suggested 50% of the plate).
- Encourage higher fibre, low glycemic index and wholegrain carbohydrate foods (42-46). Ideally, these foods will be intact or minimally processed whole kernel grains (e.g. barley, quinoa, steel cut or rolled oats, freekeh) (35, 47).
- Encourage consumption of legumes, such as lentils, chickpeas and beans (48).
- Promote foods rich in mono and polyunsaturated fats, such as avocado, extra-virgin olive oil, canola oil, nuts and seeds and oily fish (33, 48, 49). Trans fats (found in deep-fried foods and commercial baked goods, such as cakes, biscuits, pastries and pies) should be avoided. Trans fats are not commonly used in Australia. (33).
- Encourage adequate dairy consumption (35, 44, 50), particularly low- or reduced-fat dairy products such as milk, yoghurts and cheese.
- Limit low-quality carbohydrates, such as highly refined grain products, fried potatoes, added sugars and sugar sweetened beverages (35, 42, 49, 51). For example; white bread and crackers, hamburger buns, fries, cakes, biscuits, pastries, confectionery and soft drink.
- A variety of healthy protein foods should be encouraged, including lean red meat, fish, poultry, eggs, tofu and nuts. Red meat should be limited to 2-3 times per week and processed meats, including sausages, bacon, ham, salami, and other deli meats, should be avoided (35, 42).

With the support of an Accredited Practising Dietitian, the above dietary recommendations implemented over the longer term may assist in the reversal of prediabetes and/or the prevention of type 2 diabetes.

Very Low Calorie Diets

Very-low-calorie diets (VLCD) using specially prepared meal replacement products, along with regular dietetic support, have been shown to induce weight loss of approximately 15% of initial body weight after 12 weeks, and a significant reduction in blood glucose levels after six months in people with prediabetes (52). Similarly, the Prevention of Diabetes through lifestyle Intervention and population studies in Europe and Worldwide (PREVIEW) showed that in 84% of overweight adult participants with prediabetes starting a low-calorie diet (meal replacements) achieved the targeted ≥ 8% body weight loss within an 8 week timeframe (53). Of the study participants, 64% had IFG-only, 13% had IGT-only, and 23% had both IFG and IGT. The mean weight loss was 11kg (11% total body weight) and was accompanied by significant improvements in risk factors for prediabetes including fat mass, hip circumference, HOMA-IR and metabolic syndrome z-score. If a VLCD is considered, concurrent education and support from an Accredited Practising Dietitian is recommended.

4.2.2 Physical Activity

It is well established that regular physical activity and exercise should be part of a therapeutic strategy to improve blood glucose control. Increased cardiorespiratory fitness has been demonstrated to reduce the risk of developing IFG, type 2 diabetes and attenuate the negative consequences of obesity (54). In addition to reducing the risk of developing IFG and type 2 diabetes, exercise positively affects blood lipids, blood pressure, cardiovascular events, mood, sleep and subsequently, quality of life (55-57). Both epidemiological and clinical trial data support the recommendation of 30 minutes of moderate-vigorous intensity exercise on most days of the week (58, 59). Participating in resistance training has also been demonstrated to reduce the risk of developing type 2 diabetes by up to 30% (60). Minimal differences between modes of exercise (aerobic or resistance) are apparent, with both improving insulin resistance and assisting with management of prediabetes (57). However, the benefits of exercise on glycaemic control are likely to be additive when both aerobic and resistance exercise are undertaken (61, 62).

To maximise the benefits of exercise and physical activity, individuals with prediabetes should be referred to (where feasible) an Accredited Exercise Physiologist or Physiotherapist, to design an individualised exercise prescription based on the preferences, needs, values and capabilities of the

individual with the goal to improve cardiorespiratory fitness, muscular fitness and glycaemic control. Ideally, 150-300 minutes of moderate to vigorous intensity aerobic and resistance exercise should be undertaken each week, with no more than two consecutive days without exercising (56). Additional benefit may be obtained with additional exercise or exercise completed at higher intensities, such as high-intensity interval training. Supervised exercise is generally recommended over non-supervised programs to improve compliance along with health and fitness benefits (63, 64).

High-intensity interval training (HIIT) has the potential to induce physiological adaptations that could delay the development of type 2 diabetes in a time efficient manner (65). Results from meta-analyses considering a broad range of populations (including some clinical populations (66, 67) demonstrate that interval training is more effective for improving insulin resistance and cardiorespiratory fitness than moderate-intensity continuous training (i.e. walking). Immediate glucose responses to exercise are variable and likely to be of very short duration; nonetheless, brief improvements in glucose regulation contribute to overall glycaemic control (68). The transient glucose response might be mediated by energy-expenditure, highlighting the potential benefit of HIIT however, exercise should be participated in frequently to optimise the metabolic responses to mitigate the risk of developing IFG or type 2 diabetes (69). Interval training appears to be safe (the nature of and frequency of adverse events is not different to continuous aerobic exercise training), however it is recommended that individuals are clinically stable and supervised to begin with (55). Individuals who are not at elevated risk for adverse events from exercise can begin immediately, increasing the volume and intensity of aerobic exercise slowly to increase their physical capacity. Engaging an Accredited Exercise Physiologist or Physiotherapist for an individualised exercise prescription is recommended to design a program that avoids barriers to exercise/physical activity.

Resistance training is the most effective exercise modality to increase muscle mass, which has been associated with insulin sensitivity and a reduced risk of developing prediabetes (70). Progressive resistance training results in muscle hypertrophy and muscle protein content adaptations, which improve glucose utilisation and regulation (71). Improved muscle strength and body composition have been demonstrated only with prescribed and/or supervised resistance training programs (72), with additional compliance strategies not necessary (73). Participating in resistance training results in improved general health behaviours (74) and completion of greater volumes of aerobic exercise (60). Resistance training should therefore be considered as a critical part of the standard exercise care for prediabetes, that should be formulated with assistance (if not supervised) by an Accredited Exercise Physiologist or Physiotherapist.

In previous exercise and physical activity guidelines (from Australia and the United States of America), it was suggested that 150-300 minutes of aerobic exercise each week could be accumulated in bouts of at least 10 minutes duration (64, 75). The most recent physical activity guidelines from the United States of America have removed the necessity for bouts of aerobic exercise to be of at least 10 minutes duration and instead are promoting regular movement and activity throughout the day to accumulate between 150 and 300 minutes of active time (76). In addition to performing regular exercise, strong evidence supports reducing overall sedentary time while a growing evidence-base supports regularly disrupting sedentary behaviour. Prolonged sitting has a negative influence on glycaemic control (77, 78), which is proportional to the severity of insulin resistance experienced (79). Interrupting prolonged sitting with light or moderate intensity activity such as walking, has demonstrated substantial improvements in glucose metabolism (80-82). Individuals at risk of developing type 2 diabetes, such as those with prediabetes, should reduce the amount of time they spend in sedentary behaviours and complete brief resistance or aerobic activity breaks from sitting every 30 minutes (64). It is important to note that adhering to baseline exercise guidelines might not be sufficient to mitigate the metabolic or cardiovascular risks associated with prolonged sedentary behaviour (83-85).

4.3 Pharmacotherapy

Several classes of medications have been assessed for their potential to prevent or delay the progression from prediabetes to type 2 diabetes, though none have a specific Therapeutic Goods Administration (TGA) indication for prevention of type 2 diabetes. Nor have any trials shown benefit of medications for clinical outcomes beyond prevention of type 2 diabetes, such as myocardial infarction or renal failure. Lifestyle intervention is ultimately recommended as primary intervention and one has to balance the risk to benefit ratio of any medication that may be considered.

Glucose-lowering agents (GLA) such as metformin, α-glucosidase inhibitors, thiazolidinediones and drugs used for obesity treatment have been considered for their capacity to delay progression to diabetes. Whether GLAs prevent the progression to type 2 diabetes or merely reduce the blood glucose on the day they are taken is still uncertain. GLAs such as metformin are generally not as effective as an intensive lifestyle intervention. Therefore, pharmacotherapy for diabetes prevention, in conjunction with intensive lifestyle modification, is likely to be most beneficial in younger adults, as the long-term benefits of a delay in type 2 diabetes onset may be the greatest in this group. This combination of lifestyle and GLA, however, has not been tested explicitly in trials (86).

Metformin is safe, inexpensive and has the strongest evidence regarding effectiveness of diabetes prevention (87, 88). A systematic review and meta-analysis reported that metformin treatment in individuals at risk for diabetes improves weight, lipid profiles, insulin resistance, and reduces new-onset diabetes by 40% (87). The Diabetes Prevention Program (DPP) demonstrated that the benefits of reduced risk of diabetes with metformin remained at the 15-year follow-up, with continued use of metformin in the pharmacology intervention arm (88).

Other medications that have been reported to reduce the incidence of diabetes in those at risk (IGT or prediabetes) include acarbose, thiazolidinediones, liraglutide, and the combination of phentermine and topiramate (27, 89-95).

4.4 Metabolic surgery

In individuals 37 to 60 years with morbid obesity, identified as a body mass index (BMI) of ≥34 in males and ≥38 in females bariatric surgery has been shown to be effective in the prevention of progression to type 2 diabetes (95, 96). The Swedish Obesity Subject study reported type 2 diabetes (aged 37-60 years) incidence rates of 28.4 and 6.8 cases per 1000 person-years in the surgery and control groups respectively (95, 96). The effect of bariatric surgery on prevention of progression to diabetes was influenced by the presence or absence of IFG but not by BMI; IFG at baseline was associated with a more distinct diabetes prevention effect of metabolic surgery (95, 96).

In Australia, eligibility criteria for surgery are primarily based on body mass index (BMI) and the presence of obesity-related complications (97).

4.5 Psychosocial Care

Individuals with prediabetes are at a higher risk of depression and anxiety (98). The combination of prediabetes and depression or anxiety symptoms has been associated with a higher risk of developing type 2 diabetes, above either health condition alone (99). Furthermore, the numerous daily self-management tasks involved in managing a chronic condition can be complex and challenging and places individuals at an increased risk of diabetes-related distress (98). Although, the evidence currently exists for type 1 and 2 diabetes, rather than prediabetes at this stage, psychological distress may reduce the capacity to engage in daily health management behaviours; therefore, prediabetes management plans should include psychological/emotional care and support as well as behaviour change support (98). Ongoing psychological care should be provided through regular interactions with

the GP and multidisciplinary team. This can be further supported through referral to a counsellor, psychologist or psychiatrist as appropriate.

Supporting Behaviour Change

- Define self-care behaviours that the individual is confident they can change;
- Collaborative goal setting with individual;
- Define strategies to achieve the goal (including barriers to change);
- Change and track outcomes;
- Continuing support and referral as needed.

Tips to Providing Emotional Support

- Identify individuals who are suffering distress;
- Alleviate distress (CBT, reinforce positive behaviours, realistic expectations, enhance motivation);
- Identify those suffering from psychiatric disorders including depression and refer those to specialist mental health care;
- Encourage healthy lifestyles including healthy eating, physical activity, improved sleep and stress management, to support mental health.

Further information for health professionals can be found in the *National Diabetes Services Scheme (NDSS) Diabetes and Emotional Health: A handbook for health professionals supporting adults with type 1 or type 2 diabetes* (98).

4.6 Putting it Together: Creating a holistic prediabetes management plan

A diagnosis of prediabetes is a critical time to implement a management plan to reverse prediabetes or at least, delay onset of type 2 diabetes. The culmination of this section highlights that the management of prediabetes needs to have a multipronged approach. Management strategies should be person-centred and may include healthy eating, physical activity, pharmacotherapy (when appropriate), psychological support and/or other concurrent lifestyle and health interventions as required. Consequently, there is a wide range of health professionals involved in the multidisciplinary team providing care and support of individuals with prediabetes (see section 4.1). The

multidisciplinary team needs to work cohesively and communicate effectively to provide consistent advice and support.

Care needs to be culturally-appropriate and person-centred, treating the individual as an active decision-maker in their own health and prediabetes management plan. Making a management plan in collaboration with the individual helps to identify what is important to them, the knowledge they already have and what is needed/wanted, barriers to change and setting realistic and personally-relevant goals. Considering a person's readiness and willingness to make a change as well as their existing knowledge and understanding of prediabetes is an important starting point.

Group Education Programs for Prediabetes

Structured group education programs targeting lifestyle and behaviour change have been shown to be beneficial for individuals with prediabetes (8). Group education programs can be a time-, resource- and cost-efficient approach to providing education and support to individuals with prediabetes. They also have the benefit of allowing peer-to-peer sharing, learning and support.

Programs may be provided by the primary care team or by public, private or community organisations with expertise in prediabetes and healthy eating, physical activity and weight management. Regardless, group education programs should be local, evidence-based and have reproducible outcomes. Referral to group education programs should complement, rather than replace, ongoing individual care within the primary care setting. It is imperative that the primary care team members are familiar with, and agree with, the key principles of the program and provide ongoing education and care consistent with the teachings of the program for it to be effective.

Characteristics of a quality prediabetes education program

- Evidence-based, reflect clinical guidelines and cover the following: knowledge and understanding, self-management and self-determination. Programs can be considered evidence-based if they have a theoretical basis and/or are supported by published evidence in peer reviewed journals or another base to show its effectiveness;
- Person-centred, using a variety of techniques to promote active learning, and be flexible enough to meet different needs, personal choices and learning styles;
- Led by an appropriately trained facilitator, as defined by the program;
- Include a written curriculum with clearly defined learning aims, objectives, and proposed outcomes;

- Content and resources must be evaluated for appropriate readability and health literacy levels for the program's target population;
- Evaluation that measures program aims and objectives, program fidelity and supports continuous quality improvement.

Referral Pathways

The GP is responsible for coordinating the care of individuals with prediabetes including referrals to appropriate members of the multidisciplinary team as needed.

The Medicare Chronic Disease Management Plan (CDMP) provides 5 rebated visits (10 for Aboriginal and Torres Strait Islander people) to allied health professionals within an individual's multidisciplinary team. This includes: Accredited Practising Dietitians, Accredited Exercise Physiologists, Physiotherapists, Credentialled Diabetes Educators, or Social Workers. There is no list of eligible chronic medical conditions, rather a general definition "A chronic medical condition is one that has been (or is likely to be) present for six months or longer, for example, asthma, cancer, cardiovascular disease, diabetes, musculoskeletal conditions and stroke". The Department of Health website states "the CDM items are designed for patients who require a structured approach, including those requiring ongoing care from a multidisciplinary team". It is important to note that subsidised may not be completely covered, and therefore a gap payment may still be payable. A CDMP may be available to people with prediabetes if they have additional chronic health conditions, such as CVD, asthma, osteoporosis or osteoarthritis. Currently, those with prediabetes alone (i.e. without comorbidities) are unable to access allied health care through a CDMP.

Alternatively, individuals could choose to access private allied health services, if available and affordable. Private health funds may provide some rebate, depending on an individual's level and type of cover, however out-of-pocket expenses are still likely. Improved funding and access to services are required for individuals with prediabetes to support and encourage healthy lifestyle strategies and delay or prevent the onset of type 2 diabetes. Local accredited health professionals can be identified through the governing professional bodies.

4.7 Ongoing Monitoring and Support

There is no indication for self-monitoring capillary blood glucose levels by individuals with prediabetes. In line with the RACGP guidelines for type 2 diabetes, individuals with prediabetes are also at low risk of hypoglycaemia and therefore self-monitoring of blood glucose is not recommended (22).

The frequency of ongoing monitoring of pathology and other biomarkers needs to be individualised. Annual retesting of HbA1c is recommended and supported by Medicare. Other health outcomes, such as weight, lipids and blood pressure can be reassessed at the discretion of the multidisciplinary team and in conjunction with the person with prediabetes to assess the efficacy of interventions and disease progression.

Ongoing support from the GP and other health professionals in the multidisciplinary team is vital to encourage and assist individuals to achieve and maintain specific and overall health and lifestyle improvements. Many diabetes prevention programs in the literature provided extensive health professional contact hours for advice and ongoing support over long periods of time (100, 101). While this can be difficult to replicate in practice, it highlights the importance of building strong, supportive, lasting professional relationships with individuals on top of providing clinical education and advice.

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Appendix 1.

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Chair: Dr Kirstine Bell, APD, CDE, PhD. University of Sydney, NSW Australia.

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- Bernie Maynard, RN, CDE, Lake Munmorah Doctor's Surgery, NSW Australia
- Dr Brett Gordon, AEP, PhD, La Trobe University, VIC Australia
- Giuliana Murfet, NP, CDE, FADEA, Diabetes Centre, Tasmanian Health Service - North West, TAS Australia; PhD Candidate, Deakin University
- Hannah Ryrie, APD, Dietitians Australia, ACT Australia
- Professor Jonathan Shaw, MD, FRACP, FRCP (UK), FAAHMS, Baker Heart & Diabetes Institute, VIC Australia
- Professor Louise Maple-Brown, MD, FRACP, PhD, Menzies School of Health Research, NT Australia
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- Rebecca Flavel, APD, CDE, Diabetes WA, WA Australia
- Susan Gray, Susan Gray, Pharmacist, Diabetes Educator, Pharmaceutical Society of Australia, PhD Candidate, University of Queensland.
- Wendy Ferris, Physiotherapist, CDE, Total Health Care, NSW Australia

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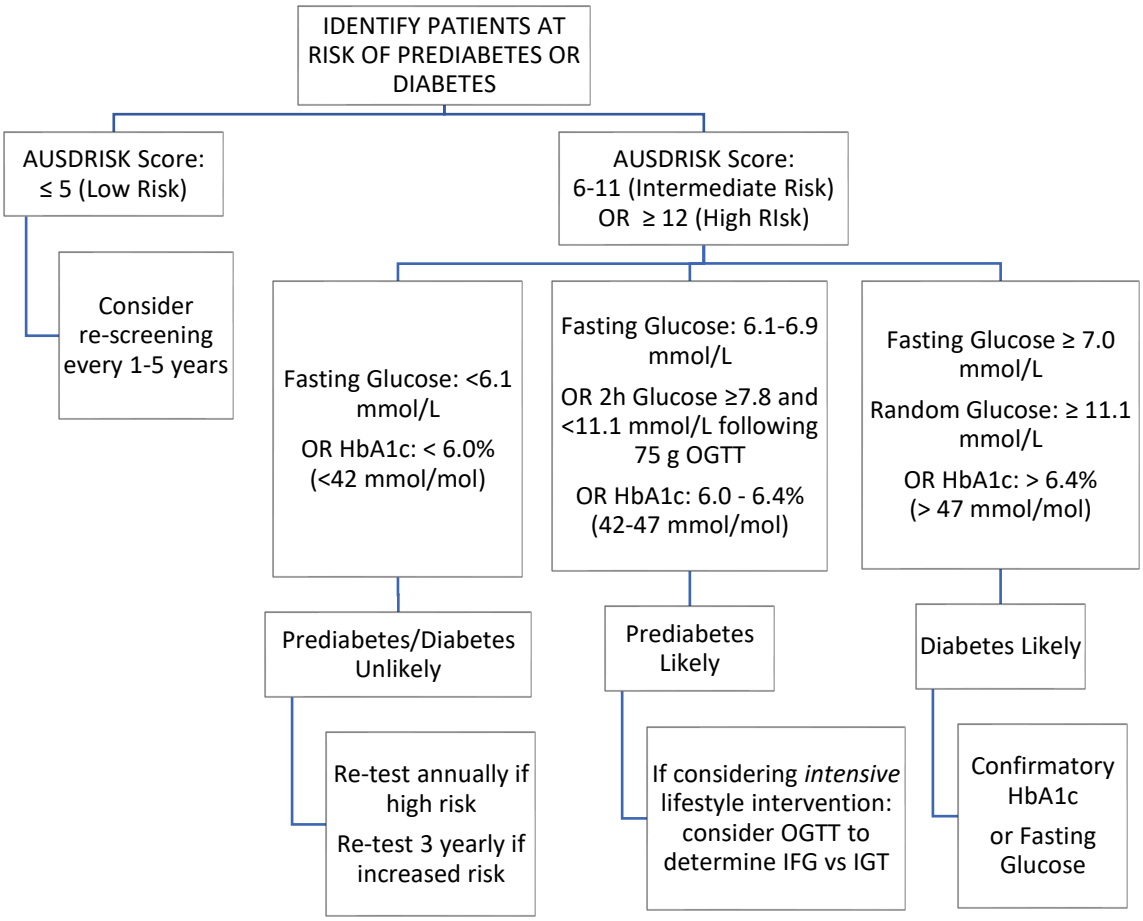

Figure 1: Flowchart for the screening and detection of prediabetes and diabetes