Contents available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

Review

A position statement on screening and management of prediabetes in adults in primary care in Australia

Kirstine Bell [a], *Jonathan E. Shaw* [b], *Louise Maple-Brown* [c,d], *Wendy Ferris* [e], *Susan Gray* [f], *Giuliana Murfet* [g,h], *Rebecca Flavel* [i], *Bernie Maynard* [j], *Hannah Ryrie* [k], *Barry Pritchard* [l], *Rachel Freeman* [m], *Brett A. Gordon* [n,*]

[a] *Charles Perkins Centre and School of Life and Environmental Sciences, University of Sydney, NSW, Australia*
[b] *Baker Heart & Diabetes Institute, VIC, Australia*
[c] *Menzies School of Health Research, NT, Australia*
[d] *Department of Endocrinology, Royal Darwin Hospital, Australia*
[e] *Diabetes Service, Hunter New England Local Health District, NSW, Australia*
[f] *Pharmaceutical Society of Australia & University of Queensland, QLD, Australia*
[g] *Diabetes Centre, Tasmanian Health Service - North West, TAS, Australia*
[h] *Deakin University, VIC, Australia*
[i] *Diabetes WA, WA, Australia*
[j] *Lake Munmorah Doctor's Surgery, NSW, Australia*
[k] *Dietitians Association of Australia, ACT, Australia*
[l] *Exercise & Sports Science Australia, QLD, Australia*
[m] *Australian Diabetes Educators Association, ACT, Australia*
[n] *Holsworth Research Initiative, La Trobe University, VIC, Australia*

ARTICLE INFO

Article history:
Received 13 February 2020
Received in revised form
6 April 2020
Accepted 27 April 2020
Available online 1 May 2020

Keywords:
Glucose
Diet
Physical activity
Lifestyle
Prediabetes
Diabetes

ABSTRACT

Prediabetes has a high prevalence, with early detection essential to facilitate optimal management to prevent the development of conditions such as type 2 diabetes and cardiovascular disease. Prediabetes can include impaired fasting glucose, impaired glucose tolerance and elevated HbA1c. This position statement outlines the approaches to screening and management of prediabetes in primary care.

There is good evidence to implement intensive, structured lifestyle interventions for individuals with impaired glucose tolerance. The evidence for those with impaired fasting glucose or elevated HbA1c is less clear, but individuals should still be provided with generalised healthy lifestyle strategies. A multidisciplinary approach is recommended to implement healthy lifestyle changes through education, nutrition and physical activity. Individuals should aim to lose weight (5–10% of body mass) using realistic and sustainable dietary approaches supported by an accredited practising dietitian, where possible. Physical activity and exercise should be used to facilitate weight maintenance and reduce blood glucose. Moderate-vigorous intensity aerobic exercise and resistance training should be

* Corresponding author at: Holsworth Research Initiative, La Trobe Rural Health School, La Trobe University, VIC, Australia.
E-mail address: b.gordon@latrobe.edu.au (B.A. Gordon).
https://doi.org/10.1016/j.diabres.2020.108188
0168-8227/

prescribed by an accredited exercise physiologist, where possible. When indicated, pharmacotherapy, metabolic surgery and psychosocial care should be considered, in order to enhance the outcomes associated with lifestyle change. Individuals with prediabetes should generally be evaluated annually for their diabetes status.

Contents

1. Introduction

Prediabetes is a metabolic condition characterised by elevated blood glucose, but not meeting the diagnostic criteria for diabetes. It includes impaired fasting glucose (IFG), impaired glucose tolerance (IGT) and elevated glycated haemoglobin (HbA1c). One in six Australian adults older than 25 years of age have prediabetes [1]. Without intervention, approximately 33% will develop type 2 diabetes within a decade. Also, those with prediabetes are at greater risk of developing cardiovascular disease (CVD) than those without prediabetes [2,3]. The Australian National Diabetes Strategy 2016–2020 prioritises the prevention of type 2 diabetes [4] and it is the position of the Australian Diabetes Society (ADS), the Australian Diabetes Educators Association (ADEA), the Dietitians Association of Australia (DAA), Exercise and Sports Science Australia (ESSA) and Pharmaceutical Society of Australia (PSA) that early detection of prediabetes represents a vital step for initiating proactive intervention and support strategies to prevent or delay the onset of type 2 diabetes and associated comorbidities, including CVD.

This position statement has 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. This statement provides general information and advice, and does not explicitly address populations with specific needs including prediabetes in children or adolescents, disability or mental health. The reference list may not be exhaustive as the position statement is not a systematic literature review, rather a review of pertinent publications.

2. Pathogenesis and definition

Prediabetes occurs on a continuum of glucose dysregulation, resulting from insulin resistance and pancreatic islet β-cell dysfunction. Initially, insulin resistance is counteracted by increased insulin secretion which maintains normoglycaemia. However, when the pancreatic β-cells are no longer able to compensate adequately for insulin resistance, blood glucose becomes elevated, resulting in prediabetes. Prediabetes can include IFG, IGT or elevated HbA1c individually or 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 and dysfunctional β-cells that are unable to secrete sufficient insulin in the face of a glucose challenge. Prediabetes can be identified based on fasting venous blood glucose levels, blood glucose levels 2 h after a 75 g oral glucose tolerance test (OGTT), or a HbA1c test.

3. Clinical significance of prediabetes

Imbalances in glucose homeostasis without intervention, increase the risk of progression from prediabetes to type 2 diabetes. Women with prediabetes before pregnancy have a higher risk of developing gestational diabetes mellitus (GDM) [6,7]. GDM affects 9% of pregnancies in Australia [8], with rates as high as 30% in high-risk ethnically-diverse regions of Australia [9]. Women with a history of GDM also have an increased risk of progressing to type 2 diabetes later in life [10]. Children born to mothers diagnosed with GDM during their pregnancies also have a much higher risk of future prediabetes and type 2 diabetes [11].

Prediabetes increases the risk of CVD by approximately 20% [12]. A *meta*-analysis of 53 prospective cohort studies, including >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, health risks were observable in people with an IFG level as low as 5.6 mmol/L (19). Further, the AusDiab study reported that IFG was an independent predictor for CVD mortality (hazard ratio 2.5 (95% CI: 1.2–5.1) when compared to normal glucose tolerance, although IGT was not (1.2 (0.7–2.2)) [13].

4. Screening and detection

Early detection of prediabetes through screening is paramount for providing timely intervention and support, reducing the risk of type 2 diabetes and associated health complications. The screening process for prediabetes is the same as for type 2 diabetes. Individuals should be screened using clinical risk factors, via the Australian Type 2 Diabetes Risk Assessment (AUSDRISK) screening tool.

4.1. *Australian type 2 diabetes risk assessment tool (AUSDRISK)*

The AUSDRISK is a short questionnaire, designed to estimate the risk of progression to type 2 diabetes over five years [14], using the risk factors for prediabetes and type 2 diabetes (Table 1). 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.

4.2. *Pathology screening*

Prediabetes can be identified by fasting blood glucose, HbA1c or an OGTT. Each test has benefits and limitations, and therefore the most appropriate test should be tailored to the individual. Each test will identify a slightly different group of individuals, such that each person may fall into one or multiple prediabetes states, i.e. IFG, IGT and elevated HbA1c. Since the clearest evidence of benefit for structured, intensive lifestyle intervention is among people with IGT, and much less certain in IFG or elevated HbA1c, it is recommended that an OGTT is performed before referral into a structured, intensive lifestyle program. Those with IFG or elevated HbA1c, but not IGT, should still be provided with general lifestyle advice.

4.2.1. *Fasting venous blood test*

A fasting venous blood test can be used to identify those with IFG, but not IGT. A fasting blood glucose of 6.1–6.9 mmol/L is indicative of IFG (Fig. 1) [15]. A fasting glucose of 7.0 mmol/L or above is indicative of type 2 diabetes [15].

4.2.2. *HbA1c*

HbA1c can be used to identify those at high risk of progressing to diabetes, but there is uncertainty about the precise range of HbA1c that should be used to identify prediabetes. The American Diabetes Association recommends 5.7–6.4% (39–46 mmol/mol) (23), while the International Expert Committee recommended 6.0–6.4% (42–46 mmol/mol) [16]. In the

Table 1 – Non-modifiable and modifiable risk factors for the development of prediabetes.

Non-Modifiable Risk Factors	Modifiable Risk Factors
Increasing age	Overweight/obesity
Certain ethnic backgrounds including Aboriginal, Torres Strait Islander, Middle Eastern, South Asian, Pacific Islander and North African	Waist circumference (Caucasian Men: >94 cm, Asian Men: >90 cm, Women: >80 cm)
Family history of prediabetes or type 2 diabetes	Unhealthy eating patterns
Personal history of GDM	Insufficient physical activity and/or excessive sedentary behaviour
	Smoking
	Poor sleep
	High blood pressure
	Metabolic syndrome (insulin resistance, high blood pressure, dyslipidaemia, central adiposity)
	Polycystic Ovary Syndrome (PCOS)
	Medications that can induce hyperglycaemia including steroids

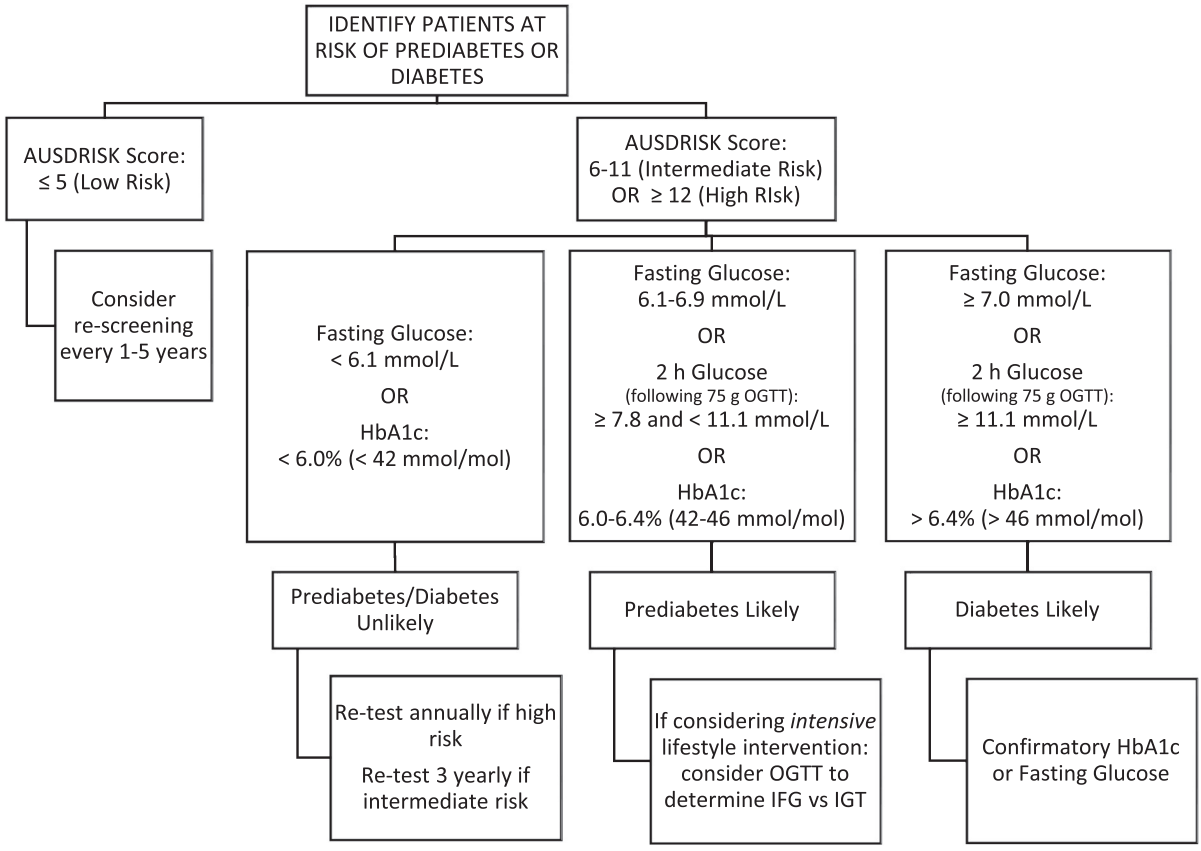

Fig. 1 – Flowchart for the screening and detection of prediabetes and diabetes.

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 [17]. IFG or IGT cannot be identified by HbA1c. 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.

4.2.3. *Oral glucose tolerance test (OGTT)*

An OGTT should be performed if the differentiation of IFG from IGT has implications for management decisions (i.e. structured, intensive lifestyle program vs general lifestyle strategies) [15].

IFG is defined as:

- Fasting blood glucose 6.1–6.9 mmol/L

AND

- If measured: 2-hour blood glucose <7.8 mmol/L

IGT is defined as:

- Fasting blood glucose <7.0 mmol/L

AND

- 2-hour blood glucose ≥7.8 and <11.1 mmol/L

5. Management & education

There is strong evidence supporting lifestyle strategies as effective for managing prediabetes and delaying the onset of type 2 diabetes, through weight reduction, healthy eating and regular physical activity [18,19]. It is possible that lifestyle strategies are also beneficial for stress reduction, improved sleep and smoking cessation. Lifestyle interventions are therefore recommended for all individuals with prediabetes.

Structured, intensive lifestyle interventions differ from generalised lifestyle strategies in that they usually involve a predefined program of visits and clinical monitoring supported by relevant, trained health professionals. Further, structured, intensive lifestyle interventions often come at an additional cost and burden to the individual and the healthcare system. There is strong evidence supporting structured, intensive lifestyle interventions for those with IGT, but less certain for those with IFG. Indeed, several trials have shown no effect of intensive lifestyle on the incidence of diabetes in those with isolated IFG [20–22]. Individual factors should be considered when initiating a management plan, however the use of multidisciplinary teams and referral to appropriate health professionals and lifestyle programs, wherever possible, is important [15].

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. Person-centred healthcare should respectfully and responsively incorporate the individual's needs, preferences, literacy and numeracy skills, health literacy, values, cultural and religious requirements [24]. Goals are tailored to the individual's choices, and the health professional assesses their readiness and confidence for change. Creating a management plan in collaboration with an individual with 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.

5.1. *Multidisciplinary team*

A multidisciplinary team of health professionals is best positioned to support lifestyle, psychological and pharmacotherapy interventions. Table 2 identifies health professionals who typically form the multidisciplinary team.

Proactive, collaborative, multidisciplinary teams can offer expertise, practical advice and support to optimise 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 individuals. Advice should be tailored to the individual's needs and preferences but should not conflict between health professionals.

5.2. *Lifestyle interventions*

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

There is evidence that weight loss in individuals who are overweight or obese plays a significant role in the management of prediabetes. Lifestyle interventions resulting in a weight loss of 5–7% can reduce the risk of developing type 2 diabetes by between ~30–70%, 3–6 years after the intervention [25]. The Diabetes Prevention Program (DPP) 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% [18], although some studies in non-white populations have shown diabetes prevention without weight loss [26]. The DPP involved intensive education, with participants attending 16 individual dietitian consultations plus physical activity program and telephone support. In order to reproduce these outcomes in people at risk, additional funding for accredited practising dietitians (APD) and accredited exercise physiologists (AEP) would be required to achieve the same intensity intervention in Australia. Alternatively, individuals would need to be willing to pay out of pocket costs for these services.

Lifestyle interventions can be provided through referrals to specific health professionals, such as APDs, AEPs or physiotherapists. Intensive lifestyle programs are often offered in different modalities (face-to-face, telephone, webinars and community programs). Lifestyle intervention can have a lasting impact of up to 20 years [27].

5.2.1. *Healthy eating*

Dietary advice for individuals with prediabetes should be consistent with the Australian Dietary Guidelines [28]. These dietary guidelines provide the evidence-based nutrition foundations, but are flexible enough to encompass a range of healthy eating approaches. 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 [29].

Long-term weight loss or maintenance is more likely to be achieved with realistic and sustainable dietary approaches [29] and a focus on macronutrient quality [30–32] rather than on a particular diet or nutrient. Vegetarian and vegan diets [33], the Dietary Approaches to Stop Hypertension (DASH) diet [34], and the Nordic diet [35] have been associated with a reduced risk of progressing to type 2 diabetes. Mediterranean, lower carbohydrate, lower glycemic index, and higher protein diets might improve glycaemic management, however these have only been investigated in individuals with diabetes [36]. An APD can provide individualised dietary advice and support, appropriate for the individual's unique nutritional, social, cultural and personal needs.

Weight loss requires an energy deficit [37]; therefore, moderation of portion sizes and choosing nutrient-dense 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) is encouraged. Reducing the con-

Table 2 – Health professionals who are typically involved in the multidisciplinary care of people with prediabetes.

Key/Necessary Health Professionals	Additional/Support Health Professionals
General Practitioner with or without support from Practice Nurse	Podiatrist
Nurse Practitioner	Specialist medical practitioners such as Obstetrician, Endocrinologist
Credentialled Diabetes Educator	Psychologist and/or social worker
Accredited Practising Dietitian	
Accredited Exercise Physiologist/Physiotherapist	
Pharmacist	

Note: access to these health professionals will vary by region and state of metropolitan development (i.e. remote centres) and it is recognised that an individual may not have access to all health professionals listed.

sumption of foods such as fast-food, cakes, biscuits, confectionery, fried snacks, sugar sweetened beverages and alcohol can support reductions in an individual's energy consumption, while maintaining or improving nutrient-density.

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

- Encourage higher intakes of minimally processed fruits and non-starchy vegetables, particularly green leafy vegetables [32,38]. 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 [38–42]. Ideally, these foods will be intact or minimally processed whole kernel grains (e.g. barley, quinoa, steel cut or rolled oats, freekeh) [32,43].
- Encourage consumption of legumes, such as lentils, chickpeas and beans [44].
- Promote foods rich in mono and polyunsaturated fats, such as avocado, extra-virgin olive oil, canola oil, nuts and seeds and oily fish [30,44,45]. 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 [30].
- Encourage adequate dairy consumption [32,40,46] such as milk, yoghurts and cheese. Low- or reduced-fat dairy products can support energy-deficit targets.
- Limit foods containing low-quality carbohydrates, such as highly refined grain products, fried potatoes, added sugars and sugar sweetened beverages [32,38,45,47]. 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 [32,38].

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 after six months in people with prediabetes [48]. Similarly, the Prevention of Diabetes through lifestyle Intervention and population studies in Europe and Worldwide (PREVIEW) showed that 84% of overweight adult participants with prediabetes starting a low-calorie diet (meal replacements) achieved the targeted $\geq$ 8% body weight loss within an 8 week timeframe [49]. Of the study participants, 64% had IFG-only, 13% had IGT-only, and 23% had both IFG and IGT. The mean weight loss was 11 kg (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 APD is recommended.

5.2.2. *Physical activity*

Regular physical activity and exercise should be part of a therapeutic strategy to reduce blood glucose. Increased cardiorespiratory fitness has been associated with a reduced risk of developing IFG, type 2 diabetes and other negative consequences of obesity [50]. In addition to reducing the risk of developing IFG and type 2 diabetes, exercise positively affects prediabetes risk factors and subsequently, quality of life [51–53].

Both epidemiological and clinical trial data support the recommendation of 30 min of moderate-vigorous intensity exercise on most days of the week [54,55]. Resistance training has also been associated with a 20–39% risk reduction in developing type 2 diabetes [56]. Minimal differences between modes of exercise, i.e. aerobic or resistance, are apparent, with both improving insulin resistance and assisting with management of prediabetes [54]. However, the benefits of exercise on glucose levels are likely to be additive when both aerobic and resistance exercise are undertaken [57,58].

To maximise the benefits of exercise and physical activity, individuals with prediabetes should be referred to an AEP or physiotherapist where possible, to design an individualised exercise prescription. The exercise prescription should be 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 min of moderate-vigorous intensity aerobic and resistance exercise should be undertaken each week, with no more than two consecutive days without exercising [52]. Added 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 training adherence along with health and fitness benefits [59,60].

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 [61]. Results from *meta*-analyses considering a broad range of populations, including some clinical populations [62,63], demonstrate that interval training is more effective for improving insulin resistance and cardiorespiratory fitness than is 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 [64]. However, exercise should be participated in frequently to optimise the metabolic responses to mitigate the risk of developing IFG or type 2 diabetes [65]. 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 when starting interval training (55).

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 predia-

betes [66]. Progressive resistance training results in muscle hypertrophy and muscle protein content adaptations, which improve glucose utilisation and regulation [67]. Improved muscle strength and body composition have been demonstrated only with prescribed and/or supervised resistance training programs [68]. Participating in resistance training results in improved general health behaviours [69] and completion of greater volumes of aerobic exercise [56]. Resistance training should therefore be considered an important part of the standard exercise care for prediabetes.

Previous exercise and physical activity guidelines suggested that 150–300 min of aerobic exercise each week could be accumulated in bouts of at least 10 min duration [60,70]. More recent physical activity guidelines from the United States have removed the specified duration and instead promote regular movement and activity throughout the day to accumulate between 150 and 300 min of active time [71].

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 regulation [72,73], which is proportional to the severity of insulin resistance experienced [74]. Interrupting prolonged sitting with light- or moderate-intensity activity such as walking, has demonstrated substantial improvements in glucose metabolism [75–77]. 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 min [60]. Importantly, adhering to exercise guidelines might not be sufficient to mitigate the metabolic or cardiovascular risks associated with prolonged sedentary behaviour [78–80].

5.3. *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, therefore, remains the primary intervention.

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 [18]. Therefore, when required, pharmacotherapy for diabetes prevention should be prescribed in conjunction with lifestyle modification. Younger adults are likely to benefit most, as the long-term benefits of a delay in type 2 diabetes onset may be the greatest in this group. The combination of lifestyle and GLA, however, has not been tested explicitly in trials [81].

Amongst GLAs, metformin is safe, inexpensive and has the strongest evidence regarding effectiveness of diabetes prevention [82,83]. 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% [82]. The Diabetes Prevention Program demonstrated that with continued use of metformin in the pharmacology intervention arm, the reduced risk of diabetes remained at the 15-year follow-up [83].

Other medications that have been reported to reduce the incidence of diabetes in those at risk include acarbose, thiazolidinediones, liraglutide, and the combination of phentermine and topiramate [23,84–90].

5.4. *Metabolic surgery*

In individuals aged 37 to 60 years with a body mass index (BMI) of $\geq$ 34 in males and $\geq$ 38 in females, bariatric surgery is effective at reversing [90] and preventing type 2 diabetes [91]. The Swedish Obesity Subject study reported type 2 diabetes incidence rates of 28.4 and 6.8 cases per 1000 person-years in the control and surgery groups respectively [91]. IFG at baseline was associated with a more distinct diabetes prevention effect of metabolic surgery; however, BMI did not influence the effect (95, 96).

5.5. *Psychosocial care*

Individuals with prediabetes are at a higher risk of depression and anxiety [92]. 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 [93].

Although the evidence currently exists for type 1 and 2 diabetes, rather than prediabetes, psychological distress may reduce the capacity to engage in daily health management behaviours; therefore, prediabetes management plans should include emotional health assessment and behaviour change support [92]. Regular interactions with members of the multidisciplinary team are required and can be further supported through referral to a psychologist or social worker. Strategies for enhancing behaviour change and providing emotional support are provided in Table 3. 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* [92].

6. Creating a holistic prediabetes management plan

A diagnosis of prediabetes is a critical time to implement a multidisciplinary management plan to reverse prediabetes or at least delay onset of type 2 diabetes. Management strategies should be person-centred and include healthy eating and physical activity. Pharmacotherapy, psychological support or other concurrent lifestyle and health interventions may be considered as required. Consequently, there is a wide range

Table 3 – Strategies to promote positive behaviour change and emotional support for people with prediabetes.

Behaviour Change Strategies	Emotional Support Strategies
Define self-care behaviours that the individual is confident they can change	Identify individuals who are suffering distress
Collaborative goal setting with individual	Alleviate distress (CBT, reinforce positive behaviours, realistic expectations, enhance motivation)
Define strategies to achieve the goal (including barriers to change)	Identify those suffering from psychiatric disorders including depression and refer those to specialist mental health care
Change and track outcomes	Encourage healthy lifestyles including healthy eating, physical activity, improved sleep and stress management, to support mental health
Continuing support and referral as needed	

of health professionals involved in the multidisciplinary team providing care and support of individuals with prediabetes.

Culturally appropriate and person-centred care engages the individual as an active decision-maker in their own health and prediabetes management plan. 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 an efficient approach to providing education and support to individuals with prediabetes. The format also has 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. To maximise their effect, group education programs should be local and evidence based. 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.

A prediabetes education program should:

- Be led by an appropriately trained facilitator;
- Include a written curriculum with clearly defined learning aims, objectives, and proposed outcomes;
- Provide content and resources with appropriate readability for health literacy levels of the program's target population;
- Evaluate program aims and objectives, program fidelity and support continuous quality improvement.

Ongoing monitoring and support

The frequency of ongoing monitoring needs to be individualised. There is no indication for self-monitoring capillary blood glucose by individuals with prediabetes but annual testing 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 individual to assess the efficacy of interventions and disease progression.

Ongoing support from the general practitioner and other health professionals in the multidisciplinary team is vital to encourage and assist individuals to achieve and maintain 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 [94,95]. 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.

7. Summary of recommendations

This position statement considered and synthesised the available evidence to inform treatment recommendations and the coordination of care services. However, this was not gathered through a systematic review. The following recommendations are made:

- 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).
- An oral glucose tolerance test is recommended before referral to a structured, intensive lifestyle program, as the clearest evidence for benefit of these programs is among people with IGT.
- The management of prediabetes should be multifaceted, including lifestyle interventions, diet, physical activity, psychological support and with pharmacotherapy as appropriate.
- Education is best provided on diagnosis, and as frequently as needed or desired to support behavioural or pharmacological interventions.
- Care needs to be person-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 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 not available).
- No medications are TGA-indicated for prediabetes. Glucose-lowering agents, such as metformin, are generally not as effective as a structured, intensive lifestyle intervention; however, these may be worthwhile in younger individuals who do not respond to lifestyle interventions alone.
- There is no indication for self-monitoring capillary blood glucose 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 to assess the efficacy of interventions and any disease progression.

Acknowledgements

The authors would like to thank the following people for their assistance with this position statement: Cathy Latino, Steve Flint and Alisha Muldoon. The support of the Australian Diabetes Society, Australian Diabetes Educators Association, Exercise & Sports Science Australia, the Dietitians Association of Australia and the Pharmaceutical Society of Australia was invaluable in producing this document through the members that provided peer review. JES was supported by an Australian National Health and Medical Research Council (NHMRC) Fellowship #1079438 and LMB by an NHMRC Practitioner Fellowship (#1078477). GM was supported by National Partnership Agreement on Improving Health Services in Tasmania clinical scholarship funding.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

Barry Pritchard is employed by Exercise & Sports Science Australia (ESSA) and Rachel Freeman is employed by Australian Diabetes Educators Association (ADEA). Hannah Ryrie was employed by Dietitians Association of Australia (DAA) during the development of the project and writing the statement. Susan Gray was a volunteer member of a leadership committee for Pharmaceutical Society of Australia (PSA) at the time of completing the project and writing the statement. These organisations promote the interests and employment of health professionals recommended in this statement to screen and manage individuals with prediabetes. The remaining authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.diabres.2020.108188.

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