



Managing pre-diabetes – a growing health concern

First Published:

3 July 2017

Last updated:

27 July 2021

Key messages

- 1 Pre-diabetes is asymptomatic but puts a person at high risk of developing type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD).
- 2 Early diagnosis, appropriate management and follow-up help to prevent or delay T2DM in persons with pre-diabetes.
- 3 Recommend lifestyle intervention to all persons with pre-diabetes.
- 4 Tailor lifestyle intervention to individual needs for sustained behavioural changes.
- 5 Consider metformin for persons with pre-diabetes when
 - glycaemic status does not improve despite lifestyle intervention OR
 - they are unable to adopt lifestyle intervention,
 especially if persons outlined in the two points above have a body mass index (BMI) of $\geq 23 \text{ kg/m}^2$, are younger than 60 years of age, or are women with a history of gestational diabetes.

Preventing or delaying the progression to T2DM

Pre-diabetes is defined by glycaemic levels that are higher than normal, but lower than diabetes thresholds. Pre-diabetes is asymptomatic but predisposes individuals to T2DM and CVD. Around 14% of Singaporeans have impaired glucose tolerance and without lifestyle changes, at least 35% of persons with pre-diabetes in Singapore will progress to T2DM within eight years.^{1,2} There is a pressing need to address pre-diabetes as part of the efforts to reduce the impact of T2DM and CVD.

Education increases awareness of pre-diabetes and enables individuals to adopt lifestyle changes.

Diagnosis of pre-diabetes

In Singapore, glucose thresholds in Table 1 below are used to diagnose pre-diabetes (impaired fasting glucose or impaired glucose tolerance).

Table 1. Glucose thresholds for pre-diabetes

Pre-diabetes	Fasting plasma glucose (mmol/L)	2-hr post-load glucose (mmol/L)*
IFG	6.1–6.9	<7.8
IGT	<7.0	7.8–11.0

IFG, impaired fasting glucose; IGT, impaired glucose tolerance

In Singapore, glycated haemoglobin (HbA1c) is not currently indicated as a diagnostic test for pre-diabetes.†

Lifestyle intervention

Lifestyle intervention is recommended for all persons with pre-diabetes, as adopting healthy diet and increased physical activity reduces the risk of them developing T2DM by 31 to 37% over 2 to 6 years, and is cost-effective.³⁻⁵

For those who are overweight or obese, aim to gradually achieve and maintain a BMI of < 23 kg/m² or a 5 to 10% body weight loss.

Smokers are advised to stop smoking, as smoking impairs glucose metabolism, insulin sensitivity and secretion.⁶

Healthy diet

A healthy and balanced diet plays a key role in preventing or delaying the progression to T2DM in persons with pre-diabetes.⁷⁻¹²

Advise those who are overweight or obese to achieve weight loss by implementing a negative caloric balance.

Increased physical activity

Obesity and a sedentary lifestyle are major risk factors for developing T2DM and can be modified by an increase in physical activity.⁷⁻¹²

Pedometers or fitness trackers allow progress to be monitored over time and may provide additional motivation.¹³

* 2-hour 75-g oral glucose tolerance test (OGTT).

† For more information on HbA1c as a screening test for diabetes mellitus in Singapore, please refer to the [Ministry of Health Circular No. 08/2019](#).

‡ A standard drink is one can (330 mL) of beer, half a glass (100 mL) of wine, or one nip (30 mL) of spirits or hard liquor.

Instructions on lifestyle intervention

Convey the following points to persons with pre-diabetes during consultations.

Healthy diet

Portion a healthy plate

- Fill half the plate with vegetables and a small portion of fruits.
- Fill a quarter of the plate with lean meat, fish, poultry (skinless), eggs, low-fat dairy or soy products.
- Fill a quarter of the plate with whole grains, such as brown rice, rolled oats, whole grain bread or cereals.

Avoid sweetened beverages and foods

- Opt for water instead of sugar-sweetened beverages (such as soda, fruit juice, energy drinks).

Eat less fat

- Avoid pastries, fried food, and food containing coconut milk or cream.
- Use less oil when cooking and use healthier oils (such as sunflower oil, rice bran oil, olive oil) instead of butter, ghee, or palm oil.

Limit alcohol intake

- No more than one standard drink‡ per day for female.
- No more than two standard drinks‡ per day for male.

Increased physical activity

- Perform at least 150 minutes of moderate-intensity exercise (such as brisk walking, leisure cycling), or 75 minutes of vigorous-intensity exercise (such as jogging, fast-paced cycling, swimming laps) every week.
- Avoid more than two consecutive days without exercise.
- Engage in exercises that require intensity and that accelerate the heart rate.

Sustained behavioural changes

Providing information without individualised advice may not be sufficient to bring about robust and sustained lifestyle changes. Lifestyle intervention should therefore be tailored to each person's needs and continuously encouraged.¹⁴

Tailor lifestyle intervention to individual needs

- Assess lifestyle (such as diet and physical activity preferences, work nature, physical or budget constraints).
- Identify areas for improvement towards a healthier lifestyle.
- Provide advice on practical and sustainable lifestyle changes that fit into daily activities.

Reinforce behavioural changes continuously

- Encourage persons with pre-diabetes to keep a log of their diet, exercise, and weight.
- Advise them to visit the HealthHub website (by scanning the QR code below) to find out more about pre-diabetes and associated lifestyle change programmes. They can also download the HealthHub SG and HealthHub Track applications (App Store or Google Play Store).
- Supplement verbal advice with written information.

Scan the QR code to access pre-diabetes information on the HealthHub website



Pharmacotherapy

Pharmacotherapy for pre-diabetes is less effective than lifestyle changes and may be considered after a trial of intensive lifestyle intervention.^{9,15} Discuss the benefits, side effects, and cost before commencing treatment.

Metformin is the drug of choice as it has the strongest evidence and the longest safety data.^{4,16} It has been shown to reduce the incidence of T2DM in persons with pre-diabetes by 26% over three years.³

Acarbose[§] has shown a favourable trend in preventing or delaying T2DM in pre-diabetes.¹⁷ However, the evidence for acarbose is not as robust or well-studied as for metformin. Consider acarbose only when metformin is not well-tolerated. Acarbose acts mainly by decreasing postprandial glucose. Hence, its glucose-lowering effect is more likely to benefit persons with IGT and not IFG alone.¹⁸

Indication, dosing regimen, and side effects of metformin for pre-diabetes

Consider metformin for persons with pre-diabetes when

- glycaemic status does not improve despite lifestyle intervention OR
- they are unable to adopt lifestyle intervention,

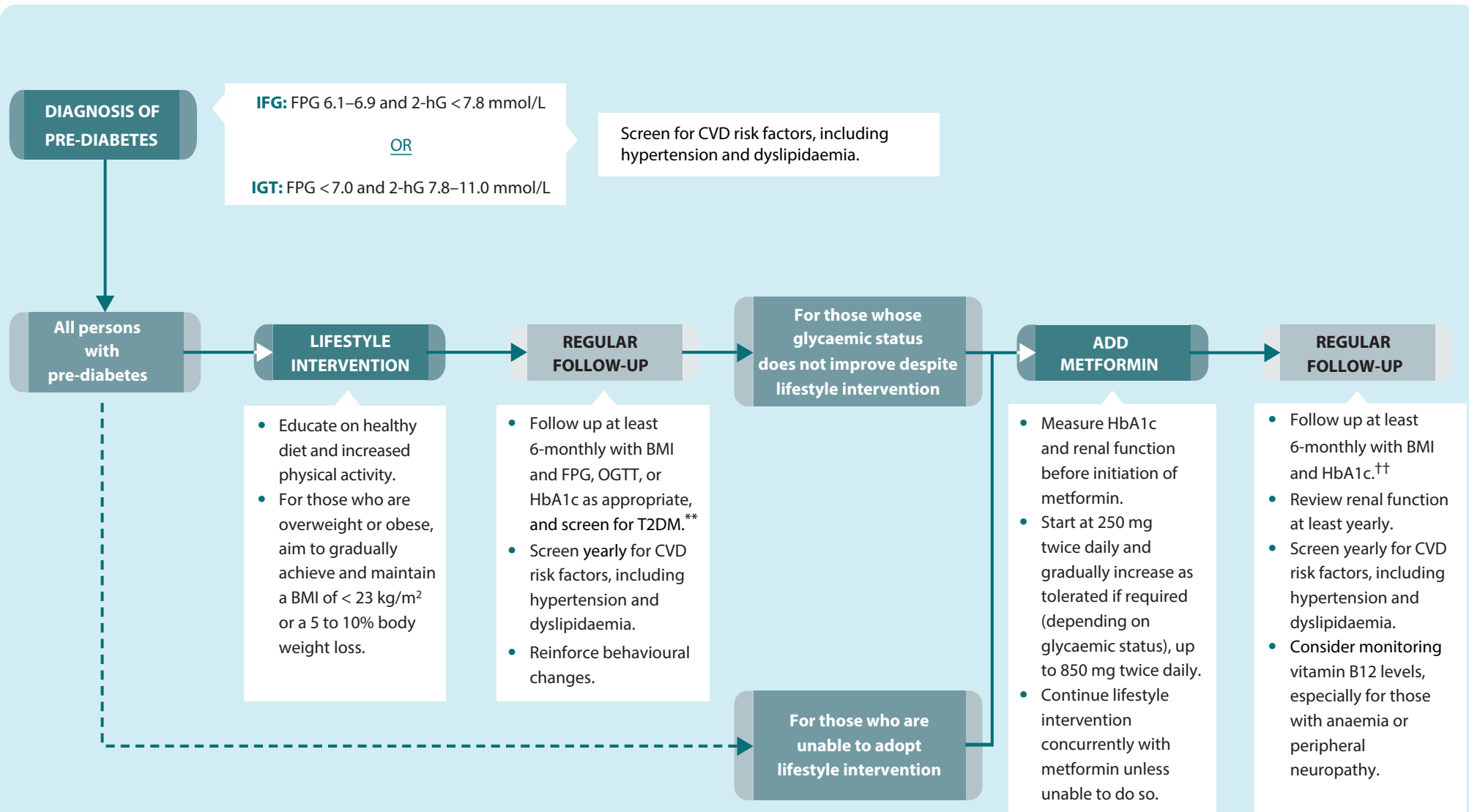
especially if persons outlined in the two points above have a BMI of ≥ 23 kg/m², are younger than 60 years of age, or are women with a history of gestational diabetes.

Start metformin at 250 mg twice daily and gradually increase as tolerated if required (depending on glycaemic status), up to 850 mg twice daily.

Take metformin with meals to reduce side effects such as nausea, vomiting, or diarrhoea.

[§] Off-label for pre-diabetes; locally registered as additional therapy in association with diet in patients with diabetes mellitus.

Figure 1. Pathway for managing pre-diabetes



2-hG, 2-hour post-load glucose; BMI, body mass index; CVD, cardiovascular disease; FPG, fasting plasma glucose; HbA1c, glycated haemoglobin; IFG, impaired fasting glucose; IGT, impaired glucose tolerance; OGTT, oral glucose tolerance test; T2DM, type 2 diabetes mellitus

** If FPG \geq 7.0 mmol/L, 2-hG \geq 11.1 mmol/L, or HbA1c \geq 7%, proceed to manage as per T2DM.

†† If HbA1c \geq 7%, proceed to manage as per T2DM. If HbA1c does not improve and < 7%, consider investigating for T2DM with FPG or OGTT after a metformin washout period (such as 1–2 weeks).

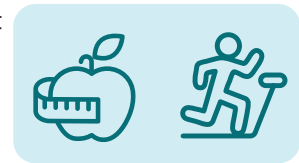
Overview of lifestyle intervention in pre-diabetes

Role of lifestyle intervention

Lifestyle intervention reduces the risk of developing T2DM by **31 to 37% over 2 to 6 years**



For those who are overweight or obese, aim to gradually achieve and maintain a BMI of <math>< 23 \text{ kg/m}^2</math> or a 5 to 10% body weight loss



Ways to implement lifestyle intervention

Diet

Portion a healthy plate

25% Lean meat, low fat dairy or soy products

25% Whole grains, such as brown rice

50% Vegetables and a small portion of fruits



Avoid sugar-sweetened beverages & foods



Eat less fat



Female

Male

Limit alcohol intake

Physical activity

≥ 150 minutes per week of moderate-intensity exercise, such as brisk walking or leisure cycling



leisure cycling (<math>< 16 \text{ km/hr}</math>)

OR

≥ 75 minutes per week of vigorous-intensity exercise, such as jogging or fast-paced cycling



fast-paced cycling ($\geq 16 \text{ km/hr}$)

No more than two consecutive days without exercise

Other modifications



Smoking cessation

How to sustain lifestyle changes

Tailor lifestyle intervention to individual needs



Preference



Budget



Physical condition



Work nature

Reinforce behavioural changes by encouraging a regular log of



Diet



Exercise



Weight

References

Scan the QR code for the reference list to this ACG



EXPERT GROUP

Lead discussant

Dr. Phua Eng Joo (KTPH)

Chairperson

Dr. Darren Seah (NHGP)

Group members

Ms. Debra Chan (TTSH)

A/Prof. Goh Su-Yen (SGH)

Dr. Khoo Chin Meng (NUHS)

Prof. Joyce Lee (UC Irvine)

Ms. Lee Hwee Khim (SHP)

Dr. Lim Hui Ling (International Medical Clinic)

Ms. Ng Soh Mui (NUP)

Dr. Gilbert Tan (SHP)

Dr. Tham Tat Yean (Frontier Healthcare Group)

Ms. Pauline Xie (NHGP)

About the Agency

Established by the Ministry of Health, the Agency for Care Effectiveness (ACE) is Singapore's national health technology assessment (HTA) and clinical guidelines agency. We support providers, patients, and payers make better-informed decisions about patient care. We achieve this by conducting health technology assessments (HTAs), developing clinical guidelines and technology guidance, and providing education. ACE Clinical Guidelines (ACGs) inform specific areas of clinical practice. ACGs are usually reviewed around five years after publication, or earlier, if new evidence emerges that requires substantive changes to the recommendations. To access this ACG online, along with other ACGs published to date, please visit www.ace-hta.gov.sg/acg

Find out more about ACE at www.ace-hta.gov.sg/about-us

© Agency for Care Effectiveness, Ministry of Health, Republic of Singapore

All rights reserved. Reproduction of this publication in whole or in part in any material form is prohibited without the prior written permission of the copyright holder. Application to reproduce any part of this publication should be addressed to: ACE@moh.gov.sg

Suggested citation:

Agency for Care Effectiveness (ACE). Managing pre-diabetes – a growing health concern. ACE Clinical Guideline (ACG), Ministry of Health, Singapore. 2021. Available from: go.gov.sg/acg-managing-pre-diabetes-a-growing-health-concern

The Ministry of Health, Singapore disclaims any and all liability to any party for any direct, indirect, implied, punitive or other consequential damages arising directly or indirectly from any use of this ACG, which is provided as is, without warranties.

Agency for Care Effectiveness (ACE)
College of Medicine Building
16 College Road Singapore 169854

Driving better decision-making in healthcare