

Understanding the knowledge, attitudes and practices of providing and receiving nutrition care for prediabetes: an integrative review

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Abstract. To synthesise the literature on nutrition care for prediabetes from both the perspective of healthcare providers and patients, six databases (CINAHL, MEDLINE, Embase, PsycINFO, Scopus and ProQuest) were searched to identify qualitative or quantitative studies that focussed on nutrition care and prediabetes in primary care practice. Studies examining the perspectives of patients with prediabetes and healthcare providers were included. Outcomes of interest included knowledge of nutrition care for prediabetes, attitudes around providing or receiving nutrition care and actual nutrition care practices for prediabetes. Overall, 12 851 studies were screened and 26 were included in the final review. Inductive analysis produced five themes: (i) nutrition care is preferable to pharmacological intervention; (ii) patients report taking action for behaviour change; (iii) healthcare providers experience barriers to nutrition care; (iv) healthcare providers tend not to refer patients for nutrition care; and (v) there are contradictory findings around provision and receipt of nutrition care. This review has revealed the contradictions between patients' and healthcare providers' knowledge, attitudes and practices around nutrition care for prediabetes. Further research is needed to shed light on how to resolve these disconnects in care and to improve nutrition care practices for people with prediabetes.

Additional keywords: healthcare providers, primary care, type 2 diabetes mellitus.

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Introduction

Prediabetes presents an opportunity to decrease the incidence and economic burden of type 2 diabetes mellitus (T2DM) and the associated health complications (World Health Organization 2006). The World Health Organization (WHO) recognises prediabetes as a condition where an individual has an impaired glucose tolerance (IGT) reading of <7.0 mmol L⁻¹ or impaired fasting glucose (IFG) of 6.1–6.9 mmol L⁻¹ (World Health Organization 2006). Guidelines from international and national health authorities recommend that individuals make dietary and other behaviour changes given positive outcomes from lifestyle modification observed in longitudinal studies (World Health Organization 2006; Gillies *et al.* 2007; International Diabetes Federation 2012; Diabetes Australia 2015). The Diabetes Prevention Program (USA), Diabetes Prevention Study (Finland), Indian Diabetes Prevention Program and China Da Qing Diabetes Prevention Study have demonstrated that individuals with prediabetes can reduce their risk of developing T2DM by up to 58% when they engage in lifestyle or pharmacological interventions (Tuomilehto *et al.* 2001; The

Diabetes Prevention Program Research Group 2002; Ramachandran *et al.* 2006; Gillies *et al.* 2007; Li *et al.* 2008). Individuals diagnosed with prediabetes should therefore be supported to change their lifestyle behaviours, including improving diet quality, with the aim of preventing a progression to T2DM.

The International Diabetes Federation (IDF) estimated that 352 million people globally were living with prediabetes in 2017 (International Diabetes Federation 2017), which suggests interventions need to be population-wide and easily accessible. The most appropriate place to provide prediabetes management activities is the initial point-of-contact between individuals and healthcare systems, known as primary care (Keleher 2001; American Academy of Family Physicians 2018). International guidelines from the WHO (World Health Organization 2016) and IDF (International Diabetes Federation 2012) recommend that primary healthcare providers (HCPs) screen, diagnose and manage prediabetes in order to prevent T2DM. National guidelines from the American Diabetes Association (ADA) (American Diabetes Association 2018), Diabetes Canada

What is known about the topic?

- Over 50% of type 2 diabetes cases can be prevented if diet and lifestyle modifications are implemented during the prediabetes stage, but current nutrition care practices are unknown.

What does this paper add?

- Contradictions exist between patients’ and providers’ reported receipt and provision of nutrition care, despite a common preference for lifestyle management of prediabetes.

(Diabetes Canada Clinical Practice Guidelines Expert Committee 2018), Diabetes UK (National Institute for Health and Care Excellence 2015) and Australian Diabetes Society (Colagiuri *et al.* 2009) echo these recommendations and prioritise lifestyle interventions over pharmacological treatment. A key component of the recommended lifestyle interventions for T2DM prevention is nutrition care, which refers to any practice conducted by a HCP that aims to support patients to improve their diet quality (Ball *et al.* 2012).

Individuals with prediabetes who receive individualised nutrition care or attend group nutrition education sessions experience superior weight and blood glucose outcomes than individuals receiving ‘usual care’ (Parker *et al.* 2014; Sun *et al.* 2017), which includes general advice, but no specific, individualised treatment plan (Harlapur and Shimbo 2013). Guidelines specifically recommend that GPs refer individuals with prediabetes for individualised nutrition care, with a trained dietitian where feasible, or to a group education program for diabetes prevention (International Diabetes Federation 2012; The Royal Australian College of General Practitioners 2016; American Diabetes Association 2018; Diabetes Canada Clinical Practice Guidelines Expert Committee 2018). Although patients reportedly prefer to receive individualised nutrition care rather than general advice (Ball *et al.* 2014; Endevelt and Gesser-Edelsburg 2014; O’Brien *et al.* 2016; Sladdin *et al.* 2017), it is unclear what type of support is provided to and received by people with prediabetes. One recent integrative review of 10 studies by Youngs *et al.* (2016) explored the effect of a prediabetes diagnosis on lifestyle change behaviour. The researchers found that further education and individualised support is required to motivate individuals with prediabetes to change their behaviour (Youngs *et al.* 2016). While these findings are important, this study did not include the HCP perspective, and only assessed the effect of a prediabetes diagnosis on an individuals’ perceived ability to change behaviour (Youngs *et al.* 2016). No studies have yet synthesised the literature on nutrition care for prediabetes from both the HCP and patient perspective.

The aim of this study was to integrate the literature on knowledge of nutrition care for prediabetes, attitudes towards providing nutrition care in this context and actual nutrition care practices. By synthesising the perspectives of both HCPs and patients, we can advance our understanding of current practice to

identify opportunities to optimise interventions to reduce the incidence of T2DM.

Methods

An integrative literature review was conducted for a comprehensive analysis of both qualitative and quantitative studies (Broome 2000; Souza *et al.* 2010). This approach is common in healthcare research and is more thorough than a traditional systematic review, as it allows for the simultaneous analysis of a variety of study designs and populations (Broome 2000; Whittemore and Knafel 2005; Souza *et al.* 2010). The review protocol was registered with the International Prospective Register for Systematic Reviews (PROSPERO), registration number: CRD42018103333. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) was used to display the search strategy. The guidelines by Whittemore and Knafel (2005) were used to ensure a systematic, rigorous approach (Souza *et al.* 2010). The SPIDER tool (Sample, Phenomenon of Interest, Design, Evaluation and Research type) (Cooke *et al.* 2012) was used to identify the guiding question ‘What are patients’ and healthcare providers’ (HCPs) knowledge, attitudes and practices around nutrition care for prediabetes in primary care?’.

Data sources and search strategy

A systematic literature search was conducted between December 2017 and February 2018 with assistance from a health librarian. Six databases were searched based on their relevance to the review topic; The Cumulative Index of Nursing and Allied Health Literature (CINAHL), MEDLINE, Embase, PsycINFO, Scopus and ProQuest. Search terms relating to experiences, knowledge, awareness and perceptions were paired with search terms for prediabetes, including ‘prediabetes or pre-diabetes’, and the MESH term ‘prediabetic state’ in two databases. A detailed search strategy is outlined in Table 1. The search terms for impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) were not used because after initial screening, it was apparent that the key articles were identified by the term ‘prediabetes’ alone, while ‘IGT’ and ‘IFG’ identified articles not relevant to this review. A previous integrative review on behaviour change among individuals with prediabetes used a similar search strategy (Youngs *et al.* 2016). Although the current review focussed on both patients and HCPs, it was decided that including these terms in the search might unnecessarily limit the findings, and they were applied at the screening stage instead.

Study selection

Articles were included in the review if they: (i) focussed on the condition of prediabetes as diagnosed by the WHO or ADA

Table 1. Search strategy

Search term	Keywords
Term 1	prediabe* OR pre-diabe* OR MESH term ‘prediabetic state’
Term 2	experience* OR care* OR manag* OR need* OR know* OR perce* OR perspective* OR attitude* OR belie* OR behavio* OR qualitative*
Search	= Term 1 AND Term 2

criteria, including IFG or IGT; (ii) involved adults (>18 years) of any ethnicity or gender who identified as either patients or HCPs; (iii) assessed current nutrition care practices; and (iv) were available in full-text English, peer-reviewed and were published after 2002. This was the year that the ADA (American Diabetes Association 2018) defined prediabetes as a state of elevated risk for T2DM, based on the results of the Diabetes Prevention Program study (The Diabetes Prevention Program Research Group 2002; Dagogo-Jack 2005; Twigg *et al.* 2007). Articles were excluded if they did not focus on nutrition care for a prediabetes population, did not involve a primary care interaction or were of the wrong study design (i.e. not an observational study). Randomised controlled trials and intervention studies were excluded as they do not reflect usual care, which was the aim of this study. Articles that examined prediabetes along with other conditions, such as T2DM, were eligible if they presented the prediabetes data separately. Articles that used terminology such as 'high risk' or 'moderate risk' of T2DM, without explicitly defining prediabetes, were excluded. The inclusion and exclusion criteria are outlined in Table 2.

Data extraction and quality assessment

The search results were imported into EndNote (Clarivate Analytics, Philadelphia, PA, USA) from each database, along with two additional articles found through manual searches. Duplicates were removed electronically from EndNote and then manually removed based on title matching. The results were imported into the online evidence synthesis software, Covidence[®], (Melbourne Vic., Australia) for title and abstract screening. Titles and abstracts were screened in duplicate based on inclusion and exclusion criteria. When conflicts arose, researchers met to review the criteria and a mutual decision was made to include or exclude the article for full-text screening. Full texts of articles were analysed independently by two researchers to ensure they met the criteria. Conflicts that could not be resolved through discussion went to a third, independent researcher. Data were extracted using a standardised table to

display study attributes, including authors, year, setting, study design, sample characteristics and aims.

Quality assessment of articles was completed in duplicate using the Mixed Methods Appraisal Tool (MMAT), which is a straightforward scoring system for mixed methods reviews (Pluye *et al.* 2009). Results were compared and conflicts resolved through discussion with a third researcher. Articles were given a score based on the MMAT scoring metrics guidelines, and are reported in the data synthesis tables (Tables 3 and 4).

Data analysis and synthesis

A systematic approach was used to simultaneously analyse qualitative and quantitative data, following integrative review guidelines by Whittemore and Knafl (2005). Three investigators (M. Somerville, L. Ball and L. T. Williams) performed the data analysis phase to ensure methodological rigour. First, data reduction was performed to divide the data based on methodological design (qualitative, quantitative or mixed method). A predetermined set of subgroups were used to categorise each study, based on the research aim: (i) knowledge and attitudes of nutrition care; (ii) barriers around nutrition care; and (iii) nutrition care practices. Based on these categories, extracted data from each included study was grouped, coded and compared to determine common relationships. Finally, descriptive synthesis was performed to report common themes and display the data. Table 3 presents quantitative findings related to nutrition care, such as percent of HCPs who provided dietary advice or percent of patients who engaged in weight loss behaviours. Qualitative study results reported as themes related to nutrition care for prediabetes are shown in Table 4.

Results

A total of 12 851 studies were identified by the search. Full-text articles were retrieved for 108 studies, 26 of which met the inclusion criteria (Fig. 1). Most of the excluded studies did not focus on nutrition care ($n = 42$) or did not involve a prediabetes population ($n = 20$) (Fig. 1). The included studies were published

Table 2. Inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Setting	Any country Published after 2002	Published before 2002
Population	Adults aged >18 years Diagnosed with prediabetes, impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) OR provide primary care for individuals diagnosed with prediabetes, IFG or IGT Any gender Any ethnicity	Individuals aged <18 years Diagnosed with type 2 diabetes, gestational diabetes or type 1 diabetes
Language	English	Non-English
Outcomes	Qualitative or quantitative measurements of current nutrition care for prediabetes in primary care practice	Prevalence of prediabetes Cost-effectiveness outcomes Biochemical or anthropometric changes Effect of a specific nutrient
Study type	Observational studies Qualitative studies	Interventions or clinical trials
Publication type	Peer-reviewed journal articles	Non-peer-reviewed sources (e.g. newsletters, conference abstracts, commentaries, dissertations)

Table 3. Overview of studies with quantitative designs

Author year; country	Study design	Aim	Setting and participant characteristics	Nutrition care measure/s	Quality score ^A	Key findings	Interpretation
Studies of patients							
Dorsey et al. 2011 USA	Cross-sectional survey	Examine LS behaviours of overweight and obese pt. with PDM or T2DM	Overwt. adults with PDM (<i>n</i> = 563) from the 2006 National Health Interview Survey % male: 40.5; \bar{x} Age y: 57 \bar{x} BMI: 31.6	Responses to behaviour change questions	**	82% reported weight control 62% reported \downarrow fat & calories in diet	Patients engaging in beneficial nutrition care practices
Endevelt et al. 2009 Israel	Cross-sectional Chart audit	Identify if SES predicts PDM management	PDM pt. (<i>n</i> = 210 365) from 2004–06 Macabi Healthcare Services database % male: 50.3	Frequency of referrals to a dietitian in chart notes	**	% receiving referrals to a dietitian: Age group Males Females 18–44 16.25 22.48 45–64 19.20 26.52 >64 14.4 16.88	More F v. M received referrals Overall \downarrow rates of referral
Geiss et al. 2010 USA	Cross-sectional survey	Assess LS changes consistent with \downarrow T2DM risk and factors associated with their adoption among adults with PDM	Self-reported PDM pt. (<i>n</i> = 531) from the 2005–06 NHANES % male: 58.9; \bar{x} Age y: 51.9 \bar{x} BMI: 30.9	Responses to NHANES questions on nutrition care practices and advice	****	52.5% reported wt. control 54.7% reported \downarrow fat or calories 34.6% reported advised to control wt. 36.8% reported advised to \downarrow fat & calories 75% of pt. advised to control wt., did 82% of pt. told to \downarrow fat/calories, did	Patients engaging in beneficial nutrition care practices
Harris and Chew 2014 USA	Cross-sectional survey	Describe pt. primary care visit type (acute care (AC), preventive care (PC) or no care visit (NC)) and their wt. \downarrow , diet and PA efforts	Overwt. and obese African Americans with PDM from an RCT at the, Jean Mayer USDA Human Nutrition Research Center, Tufts University in Boston, MA, USA <i>n</i> = 28(AC) 22(PC) 39(NC) % male: 32.1 22.7 51.3 Age y: 59.1 59.4 53.2	Changes in behaviour based on survey responses and weight loss or gain	****	8% told to \uparrow PA, \downarrow wt. or change diet 71.4% of AC, 86.3% of PC and 64.1% of NC visit pt. reported any wt. \downarrow attempts 2% reported receiving diet advice 57.1% of AC, 77.3% of PC and 38.5% of NC visit pt. attempted diet change	Low % of all pt. received nutrition care; PC visit pt. made most change attempts
Hooks-Anderson et al. 2015 USA	Cross-sectional Chart audit	Determine if race-related disparities exist in providing education in primary care clinics for pt. with T2DM and PDM	EMR data on pt. with PDM (<i>n</i> = 1203) and T2DM (<i>n</i> = 2764) in St Louis, MO, USA PDM <i>n</i> = 524 % male: 27.9 45.9 \bar{x} Age y: 53.3 58.0	Referral code to dietitian, family-community pharmacist or DPP	****	12.6% of all pt. received DPP referral (4% white v. 8.6% African American)	\downarrow rates of referral to DPP for all pt. and racially biased

\downarrow , decrease or lower; \uparrow , increase or higher; \bar{x} , mean; ADA, American Diabetes Association; BMI, body mass index; CHO, carbohydrates; DPP, diabetes prevention program; EMR, electronic medical record; F, females; HCP, healthcare provider; IFG, impaired fasting glucose; LS, lifestyle; M, males; NHANES, National Health and Nutrition Survey; OAD, oral anti-diabetic drug/s; PA, physical activity; PDM, prediabetes; pt., patient/s; RCT, randomised control trial; SES, socioeconomic status; T2DM, type 2 diabetes mellitus; USDA, United States Department of Agriculture; wt., weight; y, years

^A Author year; country; Study design; Aim; Setting and participant characteristics; Nutrition care measure/s; Quality score; Key findings; Interpretation

<p>Kolb <i>et al.</i> 2014 USA</p>	<p>Cross-sectional survey</p>	<p>Assess knowledge, perceptions, attitudes and behaviours of PDM pt. for a technology-enhanced LS modification intervention</p>	<p>PDM patients ($n = 54$) from two urban primary care practices affiliated with Mount Sinai Hospital, New York, USA % male: 18.5% White: 11.1 \bar{x} Age y: 45.7% Black: 38.9 \bar{x} BMI: 36.0% Hispanic: 40.7</p>	<p>Responses to pre-enrolment survey on knowledge, attitudes and behaviours</p>	<p>***</p>	<p>98% report \uparrow motivation to change diet 80% reported it was very to extremely important to \uparrow PA and \downarrow wt 96% reported trying to \uparrow PA and \downarrow wt.; only 10% were successful 75% ate <2 servings of fruit or veg/day 50% ate out >4 times per week 34% skip breakfast regularly %Doctor's Advice: PDM NG \downarrow fat for cholesterol 88.3 77.8 \downarrow wt. for cholesterol 69.8 50.9 Told \uparrow risk for 43.6 10.6 T2DM %Pt. reported LS changes (past year): Controlling wt. 49.6 17.7 \downarrow fat/calories 58.5 20.6 %Pt. reported LS changes (ongoing): Controlling wt. 67.1 44.0 \downarrow fat/calories 69.1 43.3 36.9% of PDM pt. recommended to \downarrow fat/calories and 82.5% of them complied 33.1% of PDM pt. recommended to control or \downarrow wt. and 80% of them complied</p>	<p>Pt. engaged in beneficial nutrition care practices; Pt. had \uparrow motivation levels</p>
<p>Okosun and Lyn 2015 USA</p>	<p>Cross-sectional survey</p>	<p>Examine if pt. aware of their PDM were likely than pt. with NG to report LS changes and determine effect of pt. awareness of PDM and reporting HCP advice on LS change</p>	<p>Cross-sectional data on adults with PDM or normoglycemia (NG) ($n = 9966$) from the 2005–06 and 2007–08 NHANES PDM NG $n = 353$ 9613 % male: 35.4 48.9 \bar{x} Age y: 54.4 44.4 \bar{x} BMI: 30.8 28.0</p>	<p>Responses to NHANES questions on nutrition care practices and advice</p>	<p>****</p>	<p>50% ate out >4 times per week 34% skip breakfast regularly %Doctor's Advice: PDM NG \downarrow fat for cholesterol 88.3 77.8 \downarrow wt. for cholesterol 69.8 50.9 Told \uparrow risk for 43.6 10.6 T2DM %Pt. reported LS changes (past year): Controlling wt. 49.6 17.7 \downarrow fat/calories 58.5 20.6 %Pt. reported LS changes (ongoing): Controlling wt. 67.1 44.0 \downarrow fat/calories 69.1 43.3 36.9% of PDM pt. recommended to \downarrow fat/calories and 82.5% of them complied 33.1% of PDM pt. recommended to control or \downarrow wt. and 80% of them complied</p>	<p>Pt. with PDM engaged in more nutrition care practices than NG adults</p>
<p>Yang <i>et al.</i> 2011 USA</p>	<p>Cross-sectional survey</p>	<p>Examine relationship of receiving HCP advice and adherence to healthy LS indicators among pt. with PDM v. adults without PDM</p>	<p>Subset of respondents ($n = 2853$), including PDM pt. ($n = 996$), from the 2005–06 NHANES PDM No PDM % male: 33.5 66.5 % Age 40–59 33.6 66.4 % Age >60 46.3 53.7</p>	<p>Responses to NHANES questions on nutrition care practices and advice</p>	<p>****</p>	<p>36.9% of PDM pt. recommended to \downarrow fat/calories and 82.5% of them complied 33.1% of PDM pt. recommended to control or \downarrow wt. and 80% of them complied</p>	<p>\downarrow rate of nutrition care provided but \uparrow rate of compliance</p>
<p>Studies of healthcare providers Basava-reddy <i>et al.</i> 2015 India</p>	<p>Cross-sectional survey</p>	<p>Assess knowledge and attitudes of physicians regarding PDM mgmt. using a questionnaire</p>	<p>HCPs ($n = 122$), including GPs (MBBS; $n = 14$), post-grads in general medicine (PG; $n = 48$), physicians (MD; $n = 46$), and diabetes specialists (DM; $n = 14$) at Sri Devaraj Urs Medical College and R.L. Jalappa Hospital and Research Center, Kolar Karnataka</p>	<p>Responses to survey on HCP knowledge, attitudes and behaviours</p>	<p>**</p>	<p>100% MBBS, 91.3% MD and 97.9% PG preferred LS mgmt. to OAD 57% of all HCPs advised \downarrow CHO and fat, and \uparrow protein and fibre 24% of all HCPs advised small, frequent meals, complex CHO and \uparrow veg 7% advised to avoid alcohol/junk food</p>	<p>Prefer LS over OAD mgmt.; nutrition care provided but specific advice varied</p>

(continued next page)

Table 3. (continued)

Author year; country	Study design	Aim	Setting and participant characteristics Sample size (<i>n</i> = <i>P</i>)	Nutrition care measure/s	Quality score ^A	Key findings	Interpretation
Curran <i>et al.</i> 2008 Canada	Cross-sectional survey	Conduct a continuing medical education needs assessment of family physicians' knowledge and awareness of PDM	Family Physicians from Family Practice clinics in Atlantic Canada (<i>n</i> = 744; 399 male)	Responses to survey on PDM mgmt. attitudes and preferences	***	Mgmt. factors % reporting as useful: Wt. loss 77.4 Counselling techniques 73.7 Inter-professional approach 65.6 Roles of non-GPs in PDM mgmt. 63.9	HCPs recognise nutrition care as important
Fearn-Smith <i>et al.</i> 2007 UK	Cross-sectional survey	Develop and pilot a survey instrument assessing general practitioners' (GP) attitudes to the diagnosis and mgmt. of impaired glucose tolerance	HCPs from three different Primary Care Trusts in Devon, UK (<i>n</i> = 222; 120 male)	Mean scores on a five-point Likert Scale for PDM attitudes of HCPs	**	Difficult for GPs to influence pt. behaviour with IGT (\bar{x} = 2.77 (± 0.79)) Pt. require more time than I can give to facilitate LS changes (\bar{x} = 3.63 (± 0.69)) I find LS changes are hard for pt. to maintain long-term (\bar{x} = 3.73 (± 0.58)) I am confident that I can change my pt.'s LS behaviour (\bar{x} = 2.73 (± 0.68))	HCPs identify barriers to providing nutrition care
Mainous <i>et al.</i> 2016 USA	Cross-sectional survey	Evaluate the relationship between HCP attitudes of PDM mgmt. and behaviours for T2DM prevention	HCP survey respondents from the Council of Academic Family Medicine Educational Research Alliance, USA (<i>n</i> = 1248; 629 male)	Responses to survey on PDM mgmt. attitudes and practices	***	% Primary change stressed: Diet change 20.7 ↑PA 10 Weight ↓ 11.3 All changes equally 58	HCPs recognise nutrition care as important
Mehta <i>et al.</i> 2017 USA	Cross-sectional survey	Assess guideline knowledge, alignment of self-reported adherence and actual practice, and referral to DPPs	HCPs (<i>n</i> = 305) who were participants in the Medical Quality Improvement Consortium (<i>n</i> = 305; 171 male)	Responses to survey on PDM mgmt. practices	**	% of HCPs reporting: Providing diet/LS advice 95% Referring pt. to a DPP 45% One-third of HCPs who reported following guidelines, actually did not	Contradictions between HCP perceived and actual nutrition care practices
Tseng <i>et al.</i> 2017 USA	Cross-sectional survey	Assess knowledge of PDM risk factors, screening and mgmt. practices for PDM and attitudes/beliefs of PDM mgmt.	HCP survey respondents from 40 practice sites across the mid-Atlantic region (<i>n</i> = 140; 39 male)	Responses to survey on PDM mgmt. attitudes and practices	**	% HCP knowledge of: PDM wt. loss recommendation 21.9 Referring to wt. ↓ program first 11.3 % Reported initial mgmt. approach: Diet and PA counselling 98.6 Referring to a nutritionist 31.9 Referring to wt. ↓ program 12.1	↑ reported provision of diet advice v. referral for wt. or diet change

Studies of patients and healthcare providers

Anderson <i>et al.</i> 2015 USA	Cross-sectional Chart audit	Compare the mgmt. of PDM between a family practice and internal medicine endocrinology clinic	Endocrinology (EP) and family practice (FP) pt. with PDM in rural Virginia EP (<i>n</i> = 90) FP (<i>n</i> = 78) ̄ Age y: 61.4 57.5 % male: 47 51 ̄ Wt. (kg): 88.3 96.7	Frequency of chart note dictations for nutrition care practices	***	% pt. received: Initial LS mgmt. 91.1 Specific diet advice 16.9 Specific wt. ↓ goals 20.5 ↓ goals 6.7	EP v. FP 76.9 13.3 6.7	Receipt of general nutrition care ↑ but specific care ↓; receipt in EP
Bovier <i>et al.</i> 2007 Switzerland	Cross-sectional survey	Assess the adherence to recommended standards of diabetes care by Swiss primary care physicians	GP's (<i>n</i> = 89), General Internists (<i>n</i> = 85), non-specialists (<i>n</i> = 12), PDM pt. (<i>n</i> = 184) and T2DM pt. (<i>n</i> = 407) from Primary Care Clinics in Switzerland HCPs: Patients: <i>n</i> = 186 591 % male: 72 41 ̄ Age y: 52 55	Responses to survey on PDM mgmt. practices for pt. with PDM v. T2DM	***	% Patients reported: Counselling for diet 66 Counselling 81 for wt. ↓ (obese pt.) 25 Making changes to diet 49 Making changes to wt. (obese pt.) 13 to wt. (obese pt.) 18	PDM T2DM 91 91	Nutrition care provided more often to T2DM v. PDM pt.
Cloney <i>et al.</i> 2011 USA	Cross-sectional Chart audit	Determine if evidence-based PDM mgmt. used and if demographic differences exist in referrals for PDM	PDM pt. (<i>n</i> = 848) from an EMR database from a Midwestern healthcare facility	Frequency of nutrition care practices in relation to demographic	***	2.4% PDM pt. referred for diet counselling 35.7% of non-GPs v. 4.65% of physicians gave referrals for diet	referred for diet nutrition care; non-GPs referred more than GPs	Overall ↓ rate of referral for nutrition care;
Strychar <i>et al.</i> 2006 Canada	Cross-sectional survey	Determine if GPs apply treatment recommendations for IFG and factors associated with the application of the guidelines	HCPs (<i>n</i> = 59) and PDM pt. (<i>n</i> = 50) from the university's department of Biochemistry Patients: ̄ Age y: 61.5 ̄ BMI: 30.6	Pt. and HCP responses to survey on PDM mgmt. practices	***	BMI of pt. referred for diet counselling: 15% <25; 25% 25-29.9; 60% >30 % Patients reported receiving: Diet advice alone 44 Diet advice + OAD 2 Diet + wt. ↓ or PA advice 38 Referral to dietitian 12 Referral to diabetes centre 2 *Refused treatment 2 % HCPs reported recommending: LS modifications 81	Contradictions between the reported provision and receipt of nutrition care practices	

^AQuality score: (*) low quality to (****) high quality.

Table 4. Overview of studies with qualitative and mixed-method designs

Author year; country	Study design	Aim	Setting and participant characteristics Sample size (<i>n</i> = <i>P</i>)	Nutrition care measure/s	Quality score ^A	Key findings	Interpretation
ADA, American Diabetes Association; DPP, diabetes prevention program; EMR, electronic medical record; HCP, healthcare provider; IGT, impaired glucose tolerance; LS, lifestyle; NHANES, National Health and Nutrition Survey; OAD, oral anti-diabetic drug/s; PDM, prediabetes; pt., patient/s; T2DM, type 2 diabetes mellitus; wt., weight							
Studies of patients							
O'Brien <i>et al.</i> 2016 USA	Qualitative interviews	Explore PDM pt.s' perceived risk of T2DM and treatment preferences for evidence-based prevention of T2DM	PDM pt. (<i>n</i> = 35; 16 male) from two large Midwest primary care practices	Knowledge, perceptions and experiences of PDM	***	<ul style="list-style-type: none"> ↓ awareness of T2DM risk from PDM Evidence of T2DM risk is motivating LS preferred over OAD for PDM mgmt., but both acceptable Desire to change behaviour to ↓ T2DM Pt. uncertain about seriousness of PDM diagnosis or action needed Pt. want more structured, consistent and accurate care Written material valued < HCP time 	↓ PDM knowledge; LS mgmt. for PDM preferred > OAD
Troughton <i>et al.</i> 2008 UK	Qualitative interviews	Inform development of PDM intervention by assessing pt. experience of screening, diagnosis, appraisal of PDM and healthcare experience from diagnosis to 1 year later	Sample of previously diagnosed PDM pt. (<i>n</i> = 15; 7 male) in Leicestershire, UK, from a diabetes screening program database	Experiences and perceptions of a PDM diagnosis	***	<ul style="list-style-type: none"> Desire to change behaviour to ↓ T2DM Pt. uncertain about seriousness of PDM diagnosis or action needed Pt. want more structured, consistent and accurate care Written material valued < HCP time 	↑ motivation to change behaviour; prefer individual nutrition care
Studies of healthcare providers							
Kandula <i>et al.</i> 2018 USA	Qualitative interviews	Explore HCPs' perspectives on usefulness of a PDM diagnosis and attitudes towards LS and OAD therapy	GPs and nurse practitioners (<i>n</i> = 15; 7 male) from two large, urban, primary care clinics	Attitudes and perspectives of PDM mgmt.	****	<ul style="list-style-type: none"> LS intervention preferred Barriers to LS mgmt. include: ↓ HCP time, ↓ perceived pt.s' behaviour change ability and ↓ access to programs HCPs consider T2DM prevention is not appropriate for primary care due to: ↓ time and resources, and a sceptical attitude to the likelihood of successful outcomes 	LS mgmt. for PDM preferred > OAD; barriers to nutrition care
Williams <i>et al.</i> 2004 UK	Qualitative focus groups	Explore views of GPs and practice nurses on detection and mgmt. of people at risk of developing T2DM	HCPs (<i>n</i> = 43; 21 GPs and 22 nurses) from 21 practices of a local health board in Wales	Views and knowledge of IGT mgmt.	–	<ul style="list-style-type: none"> HCPs consider T2DM prevention is not appropriate for primary care due to: ↓ time and resources, and a sceptical attitude to the likelihood of successful outcomes 	Barriers to nutrition care
Wylie <i>et al.</i> 2002 UK	Mixed methods: Interviews, focus groups and survey	Investigate GPs' knowledge of and attitudes to IGT	GPs (<i>n</i> = 34) of five primary care groups in England Focus group (<i>n</i> = 26; 18 male); interview (<i>n</i> = 8; 6 male)	Knowledge, attitudes and perceptions of IGT mgmt.	**	<ul style="list-style-type: none"> GPs uncertain about IGT mgmt. and effectiveness of LS advice, but supportive of an IGT mgmt. guideline GPs feel prevention is not a responsibility of primary care 	↓ PDM knowledge; barriers to nutrition care

Studies of patients and healthcare providers	Qualitative interviews	Identify factors that influence HCPs to screen pt. for T2DM and characterise interpretation and relay of test results to pt.	Primary care physicians (n = 20) and pt. with PDM (n = 17) from the University of Michigan Health System	PDM mgmt. and screening decisions based on chart notes	**	Screening practices accurate and frequent but PDM mgmt. suboptimal • No pt. referred to DPP or given OAD • LS important: Diet and PA advice given but inaccurate, unspecific, not guideline-based	Nutrition care important but not provided properly
Hafez <i>et al.</i> 2017 USA	Qualitative focus groups and interviews	Examine how pt. categorised as ↑ risk of T2DM respond to this categorisation and its effect on everyday lives	Interviews with pt. with PDM (n = 10; 5 male) and focus groups with HCPs (n = 14 (Hindhede)/13 (Hindhede and Aagaard-Hansen)) from eight general practices in two regions of Denmark.	Attitudes and experiences of PDM diagnosis and preferences for mgmt.	*/ -	• PDM diagnosis accepted by HCPs and pt. • HCPs and pt. found PDM diagnosis motivating for behaviour change • Pt. note LS as one way to prevent T2DM • Challenges arose when unsuccessful with LS changes and felt it was pointless	↑ motivation to change behaviour; barriers to nutrition care

^AQuality score: (*) low quality to (*****) high quality; - indicates a score of zero.

between 2002 and 2018, with the majority (n = 22) published in the past 10 years. Most studies were conducted in the USA (n = 15), with the others in the UK (n = 4), Canada (n = 2), Denmark (n = 2), India (n = 1), Switzerland (n = 1) and Israel (n = 1). Designs of the included studies were quantitative (n = 18), qualitative (n = 7) and mixed methods (n = 1). Qualitative study methods included semi-structured interviews (Troughton *et al.* 2008; Hindhede and Aagaard-Hansen 2015; O'Brien *et al.* 2016; Hafez *et al.* 2017; Kandula *et al.* 2018), focus groups (Williams *et al.* 2004) or both (Hindhede 2014). One mixed-methods study involved semi-structured interviews, focus groups and questionnaires (Wylie *et al.* 2002).

Ten studies reported data on patients only (Troughton *et al.* 2008; Endevelt *et al.* 2009; Geiss *et al.* 2010; Dorsey *et al.* 2011; Yang *et al.* 2011; Harris and Chew 2014; Kolb *et al.* 2014; Hooks-Anderson *et al.* 2015; Okosun and Lyn 2015; O'Brien *et al.* 2016), nine reported data on HCPs only (Wylie *et al.* 2002; Williams *et al.* 2004; Fearn-Smith *et al.* 2007; Curran *et al.* 2008; Basavareddy *et al.* 2015; Mainous *et al.* 2016; Mehta *et al.* 2017; Tseng *et al.* 2017; Kandula *et al.* 2018) and seven studies provided data on both patients and HCPs (Strychar *et al.* 2006; Bovier *et al.* 2007; Cloney *et al.* 2011; Hindhede 2014; Anderson *et al.* 2015; Hindhede and Aagaard-Hansen 2015; Hafez *et al.* 2017).

Sample sizes ranged from 10 to 43 participants in the qualitative studies and 122 to 210 365 participants in the quantitative studies. Both males and females were represented in studies involving HCPs, with a general trend of more male HCPs, except in one study where only 27.7% of survey respondents were male (Tseng *et al.* 2017). Among the studies that examined patients' perceptions or behaviours, the proportion of male-to-female participants varied greatly, while the majority of patients were aged >45 years (Tables 3 and 4).

Quality assessment of all studies revealed a range of scores from low (*) to high (****). Quantitative study designs tended to rank higher than qualitative studies based on the MMAT scoring tool (Pluye *et al.* 2009). Reasons for low scores among the qualitative studies included poor description of participant selection (Wylie *et al.* 2002; Williams *et al.* 2004; Hindhede 2014; Hindhede and Aagaard-Hansen 2015; Hafez *et al.* 2017) and a lack of researcher reflexivity in how their interactions with participants may influence results (Williams *et al.* 2004; Troughton *et al.* 2008; Hindhede 2014; Kolb *et al.* 2014; Hindhede and Aagaard-Hansen 2015; O'Brien *et al.* 2016; Hafez *et al.* 2017). Quantitative studies received low scores for having a low response rate or complete outcome data (Strychar *et al.* 2006; Fearn-Smith *et al.* 2007; Endevelt *et al.* 2009; Kolb *et al.* 2014; Mainous *et al.* 2016; Mehta *et al.* 2017), reporting a sampling strategy that was irrelevant for the population under study (Basavareddy *et al.* 2015; Mehta *et al.* 2017; Tseng *et al.* 2017) or for failing to adequately report inclusion or exclusion criteria (Fearn-Smith *et al.* 2007; Basavareddy *et al.* 2015; Tseng *et al.* 2017).

Five themes emerged from the data: (1) nutrition care is preferable to pharmacological treatment; (2) patients report taking action for behaviour change; (3) HCPs experience barriers to providing nutrition care; (4) HCPs tend not to refer patients for further nutrition care; and (5) patients and HCPs have opposing reports of receipt and provision of nutrition care.

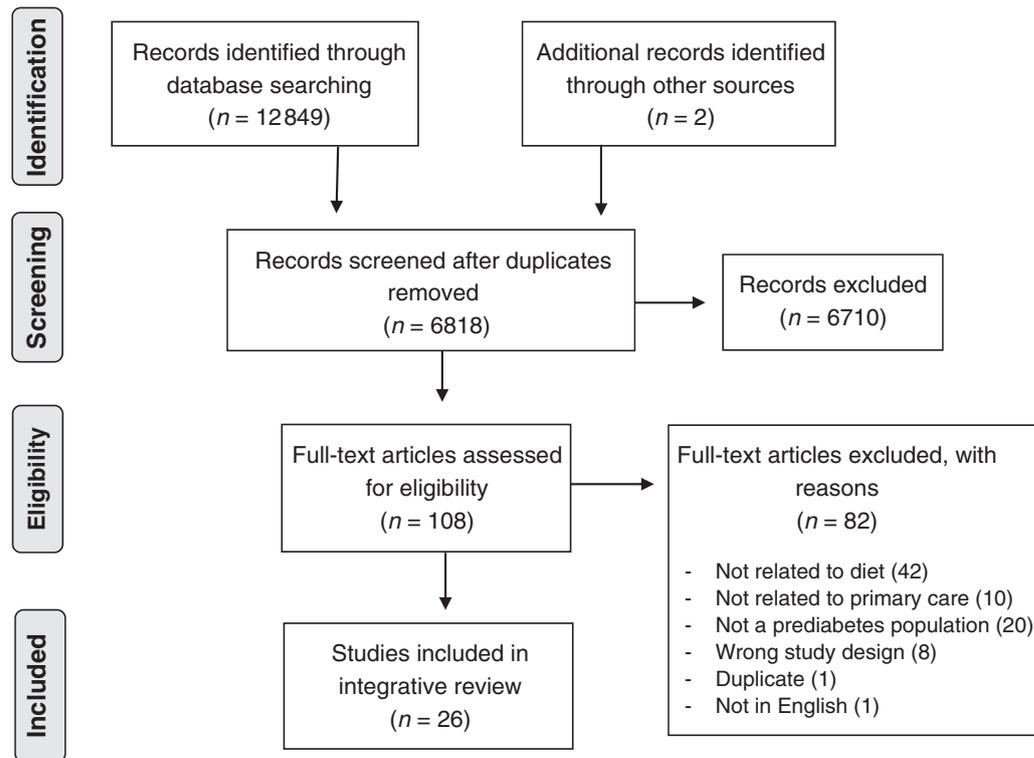


Fig. 1. PRISMA flow diagram.

Nutrition care is preferable to pharmacological treatment

Patients preferred nutrition care, including support for weight management and dietary changes, over pharmacological treatment, and expressed the benefits of improving diet for overall health, not just diabetes prevention (O'Brien *et al.* 2016). HCPs also reported preferring interventions focusing on diet, weight management and exercise over pharmacological intervention (Basavareddy *et al.* 2015; Kandula *et al.* 2018) or recognising the importance of lifestyle modification as the primary approach to prediabetes management (Curran *et al.* 2008; Mainous *et al.* 2016; Hafez *et al.* 2017; Tseng *et al.* 2017). Where nutrition care was the preferred treatment approach, HCPs believed that prediabetes treatment was economically beneficial and that when treated, patients in their clinic returned to normoglycemia (Basavareddy *et al.* 2015). Patients identified a preference for group nutrition education; consistent, structured and accurate nutrition information; and valued HCPs spending time on tasks regarding nutrition more than written material (Troughton *et al.* 2008). Patients requested more individualised support and guidance from HCPs to help make improvements to their diet, with one participant stating 'I find dieting really hard' (Troughton *et al.* 2008). Some suggested introducing a specialist prediabetes service, which would include appropriate nutrition care, along the lines of family planning preventive services (Troughton *et al.* 2008).

Patients report taking action for behaviour change

Patients frequently reported changing their lifestyle behaviours to be in line with recommendations, including attempting to

control or lose weight (Bovier *et al.* 2007; Geiss *et al.* 2010; Dorsey *et al.* 2011; Yang *et al.* 2011; Harris and Chew 2014; Kolb *et al.* 2014; Okosun and Lyn 2015) and making changes to their diet (Bovier *et al.* 2007; Yang *et al.* 2011; Okosun and Lyn 2015). However, long-term success rates were low for some attempted behaviour change (Okosun and Lyn 2015). In one study, investigators suggested the modest findings in terms of behaviour change could be attributed to the lack of behaviour change training received by HCPs (Bovier *et al.* 2007). Several studies reported a positive association between HCP advice to engage in lifestyle modification, such as weight management or dietary changes, and actual patient behaviour (Geiss *et al.* 2010; Yang *et al.* 2011; Okosun and Lyn 2015), especially among individuals attending a preventive care visit with a HCP (Harris and Chew 2014). One study reported no significant association between HCP advice to change lifestyle and patient behaviour (Dorsey *et al.* 2011).

HCPs experience barriers to providing nutrition care

Healthcare providers identified several barriers to providing nutrition care. They reported not having enough time in consultations to provide diet advice (Williams *et al.* 2004; Fearn-Smith *et al.* 2007; Mainous *et al.* 2016; Tseng *et al.* 2017; Kandula *et al.* 2018) and felt that their patients had inadequate access to nutrition programs or resources (Williams *et al.* 2004; Mainous *et al.* 2016; Tseng *et al.* 2017; Kandula *et al.* 2018). In two studies involving HCPs, participants expressed having limited time and resources specifically available in primary care for providing preventive services, including nutrition

counselling for prediabetes (Wylie *et al.* 2002; Williams *et al.* 2004). They felt these practices to be inappropriate for a primary care setting, and saw them as the responsibility of health promotion and societal change (Wylie *et al.* 2002; Williams *et al.* 2004). Other HCPs identified the lack of patients' ability to change (Mainous *et al.* 2016; Kandula *et al.* 2018) or the low levels of patient motivation and self-efficacy as barriers to providing lifestyle advice (Wylie *et al.* 2002; Williams *et al.* 2004; Fearn-Smith *et al.* 2007; Mainous *et al.* 2016; Kandula *et al.* 2018). One study found that HCPs strongly agreed with the statement 'I find that lifestyle changes are hard for patients to maintain in the long run' (Fearn-Smith *et al.* 2007). Participants with prediabetes from two studies also reported challenges to behaviour change, expressing frustration when weight loss or attempts to change diet were unsuccessful (Hindhede 2014; Hindhede and Aagaard-Hansen 2015).

HCPs tend not to refer patients for further nutrition care

The fourth theme revealed that it was not common practice for HCPs to refer patients for individual nutrition counselling, such as to a dietitian or diabetes educator (Strychar *et al.* 2006; Endevelt *et al.* 2009; Cloney *et al.* 2011; Anderson *et al.* 2015; Tseng *et al.* 2017) or to a community behaviour change program (Strychar *et al.* 2006; Hooks-Anderson *et al.* 2015; Hafez *et al.* 2017; Mehta *et al.* 2017; Tseng *et al.* 2017). In fact, in one study, none of the 168 patients with prediabetes were referred to a diabetes educator, despite the fact that one worked at the same site as the HCPs (Anderson *et al.* 2015). Patient and provider characteristics were associated with referral patterns. In one study conducted in the USA, higher rates of referral to diabetes education was associated with being black (Hooks-Anderson *et al.* 2015), while having a BMI $>30 \text{ kg m}^{-2}$ was positively associated with referral for individual nutrition counselling in another USA study (Cloney *et al.* 2011). This study found that non-physician providers referred patients for nutrition counselling more often than physicians, although the difference was not statistically significant (Cloney *et al.* 2011).

Patients and HCPs have opposing reports of receipt and provision of nutrition care

The final theme focuses on the seemingly opposing findings between patients and HCPs regarding nutrition care. HCPs reported providing lifestyle, dietary or weight loss advice to patients often (Strychar *et al.* 2006; Basavareddy *et al.* 2015; Hafez *et al.* 2017; Mehta *et al.* 2017; Tseng *et al.* 2017), while patients stated they seldom received lifestyle, dietary or weight loss advice in consultations (Strychar *et al.* 2006; Geiss *et al.* 2010; Yang *et al.* 2011; Harris and Chew 2014; Mehta *et al.* 2017). At the same time, patients reported high levels of motivation to make lifestyle changes with a prediabetes diagnosis (Troughton *et al.* 2008; Hindhede 2014; Kolb *et al.* 2014; Hindhede and Aagaard-Hansen 2015; O'Brien *et al.* 2016), with some referring to their prediabetes diagnosis as a 'wake-up call' (O'Brien *et al.* 2016). While HCPs recognised the importance of lifestyle change, they reported the weight loss, diet and exercise recommendations were unrealistic for most patients (Kandula *et al.* 2018). Unsurprisingly, some patients expressed frustration because they were motivated to change but received

little or inconsistent advice from their HCP around how to change their diet or lifestyle (Troughton *et al.* 2008). A retrospective evaluation of chart entries in a family practice clinic and an endocrinology clinic revealed that lifestyle advice was often provided during an initial consultation, but follow-up nutrition care was low for all patients, and that specific diet and weight loss advice was offered to less than one-quarter of all patients with prediabetes (Anderson *et al.* 2015).

Some studies found that certain patient or provider characteristics were associated with the provision of nutrition care. Investigators of one cross-sectional study conducted in Israel found patients who receive nutritional counselling from a dietitian tended to be female, aged 45–64 years and were from a high socioeconomic status area (Endevelt *et al.* 2009). A chart audit study comparing the practices of two clinics in rural USA revealed that lifestyle management was provided more often in an endocrinology clinic compared with family practice clinic; however, patients received more specific advice at the family practice clinic (Anderson *et al.* 2015).

While the reports of nutrition care provision differed between HCPs and patients, the specific dietary advice given by HCPs was comparable across all studies. The most common dietary advice given by HCPs was to reduce fat (Geiss *et al.* 2010; Dorsey *et al.* 2011; Yang *et al.* 2011; Basavareddy *et al.* 2015; Okosun and Lyn 2015) and calories (Geiss *et al.* 2010; Dorsey *et al.* 2011; Yang *et al.* 2011). Survey results from one study with various HCP types in India further reported recommendations to reduce carbohydrates and to increase fibre, vegetables and protein (Basavareddy *et al.* 2015).

Discussion

To understand what is happening in primary care practice in terms of nutrition care for prediabetes, 26 articles were critically analysed to reveal five themes that describe the nutrition care for prediabetes from both the perspective of HCPs and patients. By using an integrative review methodology, and synthesising data from both qualitative and quantitative studies, a broad understanding of the topic has been obtained.

The reviewed studies indicate discrepancies between the care experienced by patients and the care reported by HCPs. HCPs' attitudes towards nutrition care and reported provision of nutrition care do not reflect their documented behaviours or the care reported by patients. Previous studies have echoed these discrepancies between the attitudes of HCPs and actual practices around providing nutrition care in practice (Kushner 1995; Wynn *et al.* 2010), including for specific conditions like adolescent obesity (Story *et al.* 2002) and chronic kidney disease (Munuo *et al.* 2016). Barriers to providing nutrition care by HCPs have been reported in the literature (Kushner 1995; Helman 1997; Moore *et al.* 2000) and was a common theme throughout this review. These barriers may contribute to the reported contradictions between how HCPs wish to provide care and how they are actually able to deliver care in practice. This suggests that HCPs would benefit from further support to address these barriers to providing nutrition care so that both their desires and patients' needs are met.

Another concerning result of these discrepancies is that nutrition care for prediabetes may not be patient-centred, which

is defined as ‘providing care that is respectful of, and responsive to, individual patient preferences, needs and values, and ensuring that patient values guide all clinical decisions’ (Institute of Medicine (US) Committee on Quality of Health Care in America 2001). A patient-centred approach, focusing on individualised care, is not only preferred by patients (Ball *et al.* 2014; Endevelt and Gesser-Edelsburg 2014; O’Brien *et al.* 2016; Sladdin *et al.* 2017), but has been shown to improve health outcomes such as reducing blood glucose levels (Parker *et al.* 2014), which is crucial for T2DM prevention. One contradictory theme among the findings of this review that calls into question the patient-centred approach of current healthcare services is that patients reported high levels of motivation to change behaviour based on a prediabetes diagnosis, yet HCPs reported that patients lacked motivation or self-efficacy to make the necessary lifestyle changes. A recent review by Youngs *et al.* (2016) reinforced the fact that patients with prediabetes are highly motivated to change but need individualised, structured support to be successful. Therefore, future strategies that advance patient-centred care may improve patients’ experience of nutrition care for prediabetes and warrant further work, as it would decrease the likelihood of progressing to T2DM and assist to reduce the incidence of T2DM.

The findings of this review also suggest that HCP practices are not in line with current guideline recommendations for T2DM prevention. Both national and international guidelines suggest lifestyle modification be the primary approach for individuals at high risk of developing T2DM (Colagiuri *et al.* 2009; International Diabetes Federation 2012; National Institute for Health and Care Excellence 2015; American Diabetes Association 2018; Diabetes Canada Clinical Practice Guidelines Expert Committee 2018). These guidelines recommend referral to nutrition services and provision of dietary support that is individualised and specific (American Diabetes Association 2018; Diabetes Canada Clinical Practice Guidelines Expert Committee 2018). However, this review found that referral to nutrition care services is low and any dietary advice that was offered by HCPs was general. Low adherence to practice guidelines by HCPs is a commonly documented problem in primary care practice (Cabana *et al.* 1999) and therefore warrants further investigation, particularly around prediabetes management.

The contradictory findings reported in this review may be due to a result of social desirability bias on the part of HCPs and patients, which is common among self-reported research (van de Mortel 2008), or could be a truly discrepant perspective between HCPs and their patients. The supporting evidence around discrepancies in HCP attitudes towards nutrition care and actual practices, combined with the ever-growing prevalence of prediabetes and T2DM (International Diabetes Federation 2017), indicates the latter; that patients are most likely not receiving adequate nutrition care in primary care practice. Further research is needed to understand exactly what patients would like out of their nutrition care experience for prediabetes, and to find out from HCPs how to best address the barriers within the current healthcare system.

A key strength of this review was the study design. An integrative review methodology allows for the inclusion of both qualitative and quantitative studies, and a diverse study

population, resulting in a thorough understanding of the literature. Furthermore, articles were assessed for quality using a validated tool (Pluye *et al.* 2009) by two independent researchers, adding to the methodological rigour of this review process. This study also presented some limitations. Articles published before 2002 were deliberately excluded, so there may be relevant literature that was not captured in our findings. However, a time limit of 2002 was introduced to reflect the current recommendations for prediabetes management and T2DM prevention. Furthermore, the results from the four major longitudinal studies that create the evidence for prediabetes interventions were not published until this time period. Given that 21 of the 26 studies included in this review were published after 2008, it is unlikely this time limit excluded any results. Due to the large quantity of articles screened, it is possible that some articles were overlooked, as perhaps less attention was given for each step of the review process. However, because so many articles were included, the search was comprehensive and likely included all relevant articles.

In conclusion, there are gaps in the nutrition care provided by HCPs to individuals with prediabetes. While both patients and HCPs express similar preferences for prediabetes management, audits do not reflect this in practice. To improve patient outcomes and reduce the burden of T2DM, nutrition care needs to be provided in line with recommendations and with a focus on patients’ needs.

Conflicts of interest

The authors declare no conflicts of interest.

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