Barriers and facilitating factors in the prevention of diabetes type 2 and gestational diabetes in vulnerable groups: A scoping review

Jessica Breuing1,*, Dawid Pieper1, Annika Lena Neuhaus1, Simone Heß1, Lena Lütkemeier1, Fabiola Haas2, Mark Spiller2, Christine Graf2

1 Department for Evidence Based Health Services Research, Department of Medicine, Faculty of Health, Institute for Research in Operative Medicine (IFOM), Witten / Herdecke University, Cologne, Germany, 2 Institute of Movement and Neurosciences, German Sport University Cologne, Cologne, Germany

* jessica.breuing@uni-wh.de

Abstract

Aims

Type 2 diabetes mellitus (T2DM) and gestational diabetes (GDM) are globally on the rise, accompanied by comorbidities and associated health costs. Increased physical activity, healthy nutrition, and weight loss have shown the potential to prevent T2DM/GDM. Despite this, reaching vulnerable groups remains a key challenge. The aim of this scoping review was to identify barriers and facilitating factors in the prevention of T2DM/GDM in vulnerable groups.

Methods

We conducted a systematic literature search in May 2018, updated in September 2019, in several databases (e.g. PubMed, Embase) to identify barriers and facilitating factors in the prevention of T2DM/GDM in vulnerable groups. Two reviewers independently screened the results. Extracted data was charted, categorized, and summarized.

Results

We included 125 articles. Ninety-eight studies were extracted, and eight categories of barriers and facilitating factors were formed. The most common categories of barriers were limited knowledge, family/friends, and economic factors, and the most common categories of facilitating factors were family/friends, social support, and knowledge.

Conclusion

This scoping review identified various barriers and facilitating factors in vulnerable groups. Preventive interventions should consider these barriers and facilitating factors in developing preventive interventions or in adapting existing ones.
Background

The prevalence of type 2 diabetes mellitus (T2DM) and gestational diabetes (GDM) is rising worldwide, and so are the associated health consequences and healthcare costs [1]. Evidence shows that the prevalence of T2DM/GDM is higher in obese or overweight, physically inactive individuals [2, 3]. Increased physical activity, healthy nutrition, and weight loss may prevent or delay T2DM/GDM manifestation [4]. Lifestyle interventions like the Diabetes Prevention Program (DDP) may reduce the risk of T2DM more effectively than antidiabetic drugs such as metformin [5]. However, these preventive interventions typically target patients mostly from the general population, and it is challenging to reach vulnerable groups, including individuals with a migration background and/or low socio-economic status. Such patients are disproportionately affected by T2DM/GDM and diabetes-related complications [6, 7]. Language, cultural perception, and lower health literacy often play important roles in non-participation [8]. Research suggests that behavioral change is possible, but generally requires comprehensive approaches tailored to specific settings and target groups [9]. Therefore, the development of new T2DM/GDM interventions should be informed by evidence of barriers and facilitating factors. This may enhance the willingness of patients to participate in preventive interventions. The aim of this scoping review was to identify and describe barriers and facilitating factors in the prevention of T2DM/GDM in vulnerable groups.

Methods

This project was commissioned by the Federal Centre for Health Education in Germany as part of the "National education and communication strategy on diabetes mellitus". Its protocol was published a-priori [10]. Since the International prospective register of systematic reviews (PROSPERO) does not register scoping reviews, this scoping review is not registered.

The scoping review was conducted following the Arksey and O’Malleys framework [11] and the Joanna Briggs Institute Reviewers’ Manual 2015 [12]. It is reported based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist [13].

Eligibility criteria

Inclusion criteria

• vulnerable patients with, or at risk of, T2DM/GDM
• studies present barriers and facilitating factors for implementing a preventive intervention
• WHO mortality stratum A countries
• publication date ≥ 2008

Exclusion criteria

• indigenous people, children, or people with mental disorders
• no full texts available
• general prevention without any context of T2DM/GDM
• patients on antidiabetic medication

Eligibility criteria were categorized using the Population, Concept, Context (PCC) mnemonic (Table 1). All study types were eligible that present barriers to and facilitating factors for implementing preventive interventions in vulnerable patients with, or at risk of, T2DM/GDM.
GDM. Studies published before January 2008 were excluded, because barriers and facilitators are affected by external factors such as accessibility of care and information. We assume that accessibility has changed substantially compared to 10 years ago due to the increased volume of digital and virtual goods, services, and processes in healthcare. As a result, the barriers and facilitators might have changed, so that there would be a lack of comparability if we chose a longer period.

No language restriction was applied. All full texts published in languages other than English or German were translated by an external agency. We only included studies performed in countries within the low mortality stratum (A) defined by the World Health Organization [14]. By doing so, we ensured that our findings were applicable throughout western industrialized countries. We define vulnerable groups according to Lewis et al. [15], but excluded indigenous people, children, and people with mental disorders. This was done to align our study with the aims of the “National education and communication strategy on diabetes mellitus”. To separate tertiary prevention from therapy, we excluded studies with patients treated with any antidiabetic medication. Furthermore, we excluded studies which could be interpreted as preventing general metabolic risk factors without primary focus on T2DM/GDM prevention, such as studies aiming at weight reduction in obese patients.

**Information sources**

The following electronic databases were searched: PubMed, EMBASE, PsycINFO, PSYNDEX, Social Science Citation Index, and CINAHL. Grey literature was searched on greylit.org and via the homepages of the WHO and international healthcare or public health departments (e.g. Department of Health & Social Care, UK; Agency for Healthcare Research and Quality).
Search

The search strategy was developed by the research team in collaboration with an experienced librarian and checked by a referee according to the Peer Review of Electronic Search Strategies (PRESS) guideline [16]. All initial database searches were conducted in May 2018, while grey literature was searched in July 2018. The initial database searches were updated in September 2019. The initial grey literature search was not updated because the original search was very time-consuming and did not yield any relevant references. The search strategy is presented as S1 Appendix.

Data management

The search results were uploaded and managed using Microsoft Excel.

Study selection

Two reviewers independently screened the titles and abstracts of all search results and assessed full texts of potentially relevant articles against the predefined selection criteria. Any disagreement was resolved by discussion and consensus. The reasons for exclusion of full texts were documented.

Data extraction

A standardized extraction form was developed for this review. Using a sample of five articles, the form was piloted, assessed for completeness and applicability, and modified to ensure all data necessary to address the research questions were obtained. Data were extracted by one reviewer and checked by another. Disagreements were resolved through discussion and consensus.

Data items

The preliminary data extraction categories were derived from our overarching research question. The following data were collected:

- study characteristics (e.g. country, setting, publication date, number of participants, study design/method)
- patient characteristics (e.g. age, gender, allocation to vulnerable group)
- inclusion/exclusion criteria
- barriers
- facilitating factors

Patient allocation to a vulnerable group was made according to the PCC mnemonic. Studies targeting mixed groups were allocated to the new ‘mixed vulnerable group’. We assigned each barrier and facilitating factor to one of the following eight predefined categories: language, economic factors, family and friends, work, social support, religion, culture, and knowledge. We defined these categories based on qualitative thematic analysis. The total number of barriers and facilitating factors within each category is based on the number of identified studies.
which mentioned this barrier or facilitating factor. We did not analyze how often a barrier or facilitating factor is mentioned within each study.

Risk of bias
As this is a scoping review, risk of bias was not assessed. This is consistent with guidance on the conduct of scoping reviews [11].

Data analysis
We used Arksey and O’Malley’s methods [11] and provide a descriptive analysis of the extent, nature, and distribution of the studies included in the review as well as a narrative thematic summary of the data collected. This was achieved by summarizing the literature according to the types of vulnerable groups, comparators, barriers and prohibitive factors, and outcomes identified. We aimed to map the extent, range, and nature of research in this area using visual representations of the data. Data were charted, categorized, and summarized. We reported quantitative (e.g. frequency) and qualitative results. Furthermore, we sought to explore similarities and differences, both within and between studies, to identify patterns and themes and postulate explanations for findings. We focused on barriers and prohibitive factors for preventive interventions in vulnerable patients with or at risk of T2DM/GDM. We also considered the robustness of the included studies by assessing the overall strength and confidence of the findings. Where possible, we stratified our results by vulnerable groups.

Results
Our database search yielded 10,044 articles. An additional 121 references were identified by searching for grey literature and checking reference lists, which led to 7888 articles after deduplication (see Fig 1). A list of excluded full-text articles is available as S2 Appendix. A total of 125 articles (122 studies) were included. Included reviews (n = 24, e.g. systematic reviews, narrative reviews) were used for reference-checking but no data were extracted. The remaining 101 articles (98 studies) were extracted and analyzed.

Characteristics of included studies
Among included studies, n = 77 had a qualitative design (focus groups n = 40, interviews n = 37). Most studies were conducted in the US (n = 65), others in Australia (n = 8), Canada (n = 7), and the UK (n = 8). We identified four studies which focused only on GDM [17–20], and three (four articles) which focused on both T2DM and GDM [21–24]. The most prominent vulnerable groups within these studies were migrants (n = 59), ethnic groups (n = 23) such as Afro-Americans, and people with low socio-economic status (n = 6). Other vulnerable groups identified were older migrants (n = 2), migrants/ethnic groups which could not be sharply delineated (n = 2), homeless people (n = 1), a mixed group of people with a low socio-economic status and homeless people (n = 1), unemployed people (n = 1), migrants with low socio-economic status (n = 1), people with disabilities (n = 1) and older people (n = 1). The characteristics of included studies are listed in S3 Appendix.

Barriers and facilitating factors for implementing a preventive intervention
Various categories of barriers and facilitating factors for implementing a preventive intervention were identified, some of which overlapped within the same study (Table 2). The most common types of barriers are family and friends (44/98), limited knowledge (44/98 studies), and economic factors (40/98). The most widely encountered facilitating factors are family and
The analysis of barriers and facilitating factors in the prevention of diabetes type 2 in vulnerable groups revealed that family and friends (46/98), social support (27/98), and knowledge (15/98) are factors that can influence the implementation of a preventive intervention in either direction. Other barriers could not be assigned to any of the eight categories, and appeared in an insufficient number of studies to justify forming additional categories. These include insufficient time, insufficient skills, insufficient motivation/energy, fear (e.g. of...
needles) in T2DM management or of injuries while being physical active, and travel/transport issues.

T2DM/GDM
Most studies were conducted in a T2DM population (88/98), only four studies in the context of GDM. The most common barriers in GDM studies were economic factors (n = 4) and limited knowledge (n = 3). One important facilitating factor for the prevention of GDM is the wellbeing of the unborn child.

Language
We identified 22/98 studies which describe language barriers. All but one study, performed in an ethnic group [25], were within the vulnerable group of migrants. In most studies, language barriers led to difficulties in understanding either written materials or oral information [26]. In addition, anxiety about dealing with native speakers was reported to be a major barrier to health service access for non-native speakers [27].

Economic factors
Economic barriers included not only the cost of preventive interventions (e.g. nutritional/fitness courses or travel costs), but more importantly the cost of healthy food. Lack of health insurance also constituted an economic barrier [28]. Economic factors were identified only as barriers; possible facilitating factors such as incentives for participating or insurance bonus programs were not reported in the identified studies.

Family and friends
Family and friends can act as both barrier and facilitating factor. This depends on whether they act supportively [29] regarding the preventive intervention or obstruct it. For example, family members may not want to change their dietary habits along with the patient, thus making it hard for the patient to stick to their new diet or force them to prepare two different

| Table 2. Barriers and facilitating factor categories for implementing a preventive intervention for people with or at risk of T2DM/GDM. |
|---------------------------------------------------------------|
| barriers | facilitating factors | both within a study |
| Language | 22 | 0 | 0 |
| economic factors | 40 | 0 | 0 |
| family and friends | 44 | 46 | 22 |
| Work | 28 | 0 | 0 |
| social support | 16 | 27 | 8 |
| Religion | 5 | 8 | 1 |
| Culture | 30 | 0 | 0 |
| knowledge | 44 | 15 | 4 |
| other barriers (e.g. insufficient time, problems with travelling, insufficient motivation) | 9 | n.a. | n.a. |

GDM: gestational diabetes; n.a.: not applicable; T2DM: type 2 diabetes mellitus
The total number of barriers and facilitating factors within each category is based on the number of identified studies which mentioned this barrier or facilitating factor.

https://doi.org/10.1371/journal.pone.0232250.t002
meals [30]. There was also a gender difference in how factors in the family and friends category were perceived. Women often describe family as a barrier because childcare [31] or household chores [32] result in a lack of time to implement preventive interventions.

**Work**
Work creates a lack of time in which to join preventive courses or tutorials [33]. Shift work leads to variable work hours, making it difficult to join courses on a regular basis. Additionally, patients working shifts [34] or nights [34, 35] find it harder to eat regular meals.

**Social support**
This category describes social support as both a barrier and facilitating factor. Social support in this category encompasses government support, along with covers any other type of external help. For example, single mothers listed insufficient childcare opportunities while participating in a preventive intervention as a barrier [36].

**Religion/culture**
Religion and culture were two separate categories of barriers and facilitating factors but overlapped in many ways. For instance, religious festivals often involve a lot of traditional food.

Religious beliefs could be both barrier and facilitating factor. Bhattacharya et al. showed this within the same study [37]. Different options exist on how to interpret God’s will and how to embed T2DM in the religious context. The diagnosis of T2DM could be considered as “God given”, leading believers to “surrender to God’s will” [38, 39]. Another belief was “that not taking care of one’s body goes against (…) self-responsibility” [37]. Some studies demonstrated the importance of rice in many cultures including South Asian, African, and Latino Communities. The preventive diets often referred to western food and therefore gained little acceptance compared to rice-based traditional foods [40].

**Limited knowledge**
Limited knowledge describes the inability to implement given information, e.g. in the diet. Most information about food and cooking was designed based on western diets, and therefore leaves patients with unanswered questions regarding meal preparation and food choices [26]. Some participants described the amount of information on diabetes prevention as overwhelming and unrealistic for their daily lives [23, 24].

**Other barriers**
Another overarching barrier across groups was insufficient time, due for example to managing family-owned businesses with long workhours, or to family commitments such as childcare [41]. Furthermore, studies described problems with travel distance, e.g. to prevention courses or “food outlets” [42], or travel issues due to elevated age [41]. Insufficient personal motivation [23, 24, 36] was another common barrier.

**Vulnerable groups and gender aspects**
Only a single barrier and no facilitating factor was unique for one specific vulnerable group (language barrier for migrants). All other barriers and facilitating factors were identified at least once in each specific vulnerable group. Gender-specific perceptions were identified especially in the category ‘family and friends’. Male T2DM patients see family as a facilitator [43], whereas women more often describe family as a barrier due to childcare issues [36],...
insufficient diet compliance of the other family members [33], or culturally based reasons like shame of being seen in sportswear or going to the gym [36], or husbands not wanting their wives to go to the gym [44].

Discussion

In this scoping review, we were able to identify and categorize various barriers and facilitating factors in the prevention of T2DM/GDM in vulnerable groups. Most studies targeted only one vulnerable group, but some targeted mixed groups like “older migrants”. The three most common vulnerable groups within the 98 identified studies were “migrants”, “ethnic groups”, and “people with low socio-economic status”.

All eight categories of barriers and facilitating factors were identified within each vulnerable group apart from one (language barrier for migrants). The most common facilitating factors (family/friends, social support) are similar in each vulnerable group. The most common barriers were limited knowledge, family/friends, and economic factors. The differences between vulnerable groups with respect to the most common barriers were minimal. Only one category of barrier could be attributed to a single vulnerable group only (language barrier to migrants). Factors including insufficient motivation, cost of healthy food, or work are similar to those found in T2DM/GDM prevention designed for general high-risk population [45]. However, cultural or religious factors seem to be exclusive to vulnerable groups, and are important especially for migrants and ethnic groups.

It appears that barriers and facilitating factors between the vulnerable groups are similar, which should be taken into account when developing T2DM/GDM preventive interventions targeted at vulnerable groups. Still, the religious and cultural background of each vulnerable group needs to be considered separately, which may lead to different approaches for T2DM/GDM prevention in each vulnerable group.

Gender differences in the direction of certain factors require that women and men be approached in different ways for T2DM/GDM prevention. For families, lack of social support such as childcare could act as a barrier for parents to join preventive interventions. This could be addressed by providing childcare as part of the intervention, or by allowing children to join the intervention. Men could be further motivated e.g. by integrating their partners into the preventive intervention.

All barriers and facilitating factors identified to be relevant to vulnerable groups should be accounted for, either by adapting existing programs, or by developing new interventions specifically for vulnerable groups. Examples where this has already been implemented are the adaption of the National Diabetes Prevention Program (NDPP) to men with a low socio-economic status [46], and a culturally adapted lifestyle intervention among Iraqi immigrants in Sweden [47]. Straightforward options to modify existing interventions are translations, or adaptation to alternative food cultures such as rice-based diets. To address more complex aspects, such as the influence of family/friends or gender differences, it may be necessary to develop new preventive interventions for the target population.

Limitations

The publication date of included studies was limited to the past decade, because of the limited time frame available within the “National awareness and prevention strategy on diabetes in Germany”. The effect of this limitation is likely small, because barriers and facilitating factors reported in older studies are likely outdated in view of growing digitization. The eight categories for barriers and facilitating factors were predetermined. Therefore, some factors that did not fit into any category were classified post-hoc as “other barriers”, but it seems possible that
alternative or additional categories, may have been relevant. The richness of the collected data warrants additional analyses (e.g. thematic analysis) that could be undertaken in the future, but were beyond the scope of this scoping review.

Conclusions

We identified various barriers and facilitating factors which should be considered in the development of future preventive interventions and adaption of existing interventions. Some general barriers and facilitating factors should be considered regardless of the presence of vulnerable groups, including economic factors and gender aspects. Religious and cultural factors, in particular, require different approaches for each vulnerable group.

Supporting information

S1 Appendix. Search strategy.
(DOCX)

S2 Appendix. Excluded studies.
(DOCX)

S3 Appendix. Characteristics of the included studies.
(DOCX)

Acknowledgments

We would like to thank Käthe Goossen for copyediting.

Author Contributions

Conceptualization: Jessica Breuing, Dawid Pieper.
Data curation: Jessica Breuing, Annika Lena Neuhaus, Simone Heß, Christine Graf.
Formal analysis: Jessica Breuing.
Funding acquisition: Jessica Breuing, Dawid Pieper.
Investigation: Jessica Breuing.
Methodology: Jessica Breuing, Dawid Pieper.
Project administration: Jessica Breuing, Dawid Pieper, Christine Graf.
Writing – original draft: Jessica Breuing.
Writing – review & editing: Dawid Pieper, Annika Lena Neuhaus, Simone Heß, Lena Lütke-meier, Fabiola Haas, Mark Spiller, Christine Graf.

References

1. Ogurtsova K, d.R.F J., Huang Y, Linnenkamp U, Guariguata L, Cho NH, et al. IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Res Clin Pract, 2017. 128: p. 40–50. https://doi.org/10.1016/j.diabres.2017.03.024 PMID: 28437734

2. Sullivan PW, M E., Ghushchyan V, Wyatt HR, Hill JO, Obesity, inactivity, and the prevalence of diabetes and diabetes-related cardiovascular comorbidities in the U.S., 2000–2002. Diabetes Care, 2005. 28: p. 1599–1603. https://doi.org/10.2337/diabetes.28.7.1599 PMID: 15983307

3. Pu J, Z B., Wang EJ, Nimbal V, Osmundson S, Kunz L, et al. Racial/Ethnic Differences in Gestational Diabetes Prevalence and Contribution of Common Risk Factors. Paediatr Perinat Epidemiol, 2015. 29 (5): p. 436–43. https://doi.org/10.1111/ppe.12209 PMID: 26201385
4. Cefalu WT, B J., Tuomilehto J, Fleming GA, Ferrannini E, Gerstein HC, et al. Update and Next Steps for Real-World Translation of Interventions for Type 2 Diabetes Prevention: Reflections From a Diabetes Care Editors’ Expert Forum. Diabetes Care, 2016. 39(7): p. 1186–201. https://doi.org/10.2337/dc16-0873 PMID: 27631469

5. Knowler W.B.-C E; Fowler SE; Hamman RF; Lachin JM; Walker EA; et al, Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. The New England Journal of Medicine, 2002. 346(6): p. 393–403. https://doi.org/10.1056/NEJMoa012512 PMID: 11832527

6. Connolly V, U N, Sherriff P, Bilous R, Kelly W, Diabetes prevalence and socioeconomic status: a population based study showing increased prevalence of type 2 diabetes mellitus in deprived areas. J Epidemiol Community Health, 2000. 54(3): p. 173–177. https://doi.org/10.1136/jech.54.3.173 PMID: 10746110

7. Schwartz N, N Z., Green MS, The prevalence of gestational diabetes mellitus recurrence—effect of ethnicity and parity: a metaanalysis. Am J Obstet Gynecol, 2015. 213(3): p. 310–7. https://doi.org/10.1016/j.ajog.2015.03.011 PMID: 25757637

8. Patel N., et al., Barriers and Facilitators to Healthy Lifestyle Changes in Minority Ethnic Populations in the UK: a Narrative Review. J Racial Ethn Health Disparities, 2017. 4(6): p. 1–119. https://doi.org/10.1007/s40615-016-0316-y PMID: 27928772

9. Grol R, G J., From best evidence to best practice: effective implementation of change in patients’ care. Lancet, 2003. 11(362(9391)): p. 1225–30.

10. Breuing J.P D; Neuhaus AL; Heß S; Lütkemeier L; Haas F; et al. Barriers and facilitating factors in the prevention of diabetes type II and gestational diabetes in vulnerable groups: protocol for a scoping review. Systematic Review, 2018. 7(245): p. 1–4.

11. Arksey H.a.O.M L., Scoping studies: towards a methodological framework. International Journal of Social Research Methodology, 2005. 8(1): p. 19–32.

12. Institute T.J B.Joanna Briggs Institute Reviewers’ Manual: Methodology for JBI Scoping Reviews. 2015.

13. Tricco A.C.L E; Zarin W; O'Brien K.K; Colquhoun H; Levac D; et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Annals of Internal Medicine, 2018. 169(7): p. 467–473. https://doi.org/10.7326/M18-0850 PMID: 30178033

14. Organization, W.H. List of Member States by WHO region and mortality stratum. 1999; http://www.who.int/whr/2003/en/member_states_182-184_en.pdf.

15. Lewis V., K.L B., McClur g A., Goldman Boswell R., and Fisher E.S., The Promise And Peril Of Accountable Care For Vulnerable Populations: A Framework For Overcoming Obstacles. Health Affairs, 2012. 31(8): p. 1777–1785. https://doi.org/10.1377/hlthaff.2012.0490 PMID: 22869656

16. McGowan J., S M., Salzwedel D.M., Cogo E., Foerster V., Lefebvre C., PRESS Peer Review of Electronic Search Strategies: 2015 Guideline Explanation and Elaboration (PRESS E&E) Journal of Clinical Epidemiology, 2016. 75: p. 40–46. https://doi.org/10.1016/j.jclinepi.2016.01.021 PMID: 27005575

17. Bandyopadhyay M., et al., Lived experience of gestational diabetes mellitus among immigrant South Asian women in Australia. Australian and New Zealand Journal of Obstetrics and Gynaecology, 2011. 56: p. 360–364.

18. Dayyani I., et al., A qualitative study about the experiences of ethnic minority pregnant women with gestational diabetes. Scand J Caring Sci, 2019. 33(3): p. 621–631. https://doi.org/10.1111/scs.12655 PMID: 30653703

19. Marquez D.X., et al., Perspectives of Latina and non-Latina white women on barriers and facilitators to exercise in pregnancy. Women Health, 2009. 49(6): p. 505–21. https://doi.org/10.1080/03630240903427114 PMID: 20013518

20. Roahds-Baeza M.E. and Reis J., An exploratory mixed method assessment of low income, pregnant Hispanic women’s understanding of gestational diabetes and dietary change. Health Education Journal, 2010. 71(1): p. 80–89.

21. Handley M.A., et al., Applying the COM-B model to creation of an IT-enabled health coaching and resource linkage program for low-income Latina moms with recent gestational diabetes: the STAR MAMA program. Implement Sci, 2016. 11(1): p. 73. https://doi.org/10.1186/s13012-016-0426-2 PMID: 27193580

22. Oza-Frank R., et al., Healthcare Experiences of Low-Income Women with Prior Gestational Diabetes. Matern Child Health J, 2018. 22(7): p. 1059–1066. https://doi.org/10.1007/s10995-018-2489-y PMID: 29455383

23. Yee L.M., et al., Social and Environmental Barriers to Nutrition Therapy for Diabetes Management Among Underserved Pregnant Women: A Qualitative Analysis. J Nutr Educ Behav, 2016. 48(3): p. 170–80 e1. https://doi.org/10.1016/j.jneb.2015.11.003 PMID: 26706027
24. Yee L.M., et al., Factors promoting diabetes self-care among low-income, minority pregnant women. J Perinatol, 2016. 36(1): p. 13–8. https://doi.org/10.1038/jp.2015.134 PMID: 26513455

25. Patel V. and Iliffe S., An exploratory study into the health beliefs and behaviours of British Indians with type II diabetes. Primary Health Care Research & Development, 2017. 18: p. 97–103.

26. Alzubaidi H., McNamara K., and Browning C., Time to question diabetes self-management support for Arabic-speaking migrants: exploring a new model of care. Diabet Med, 2017. 34(3): p. 348–355. https://doi.org/10.1111/dme.13286 PMID: 27864988

27. Choi S.E., et al., Spousal support in diabetes self-management among Korean immigrant older adults. Res Gerontol Nurs, 2015. 8(2): p. 94–104. https://doi.org/10.3928/19404921-20141120-01 PMID: 25420183

28. Bernstein A.M., et al., Beliefs About Preventive Care, Individual Health, and Lifestyle Change Among Low-Income African American Women at Risk for Diabetes. Holist Nurs Pract, 2014. 28(1): p. 24–30. https://doi.org/10.1097/HNP.0000000000000006 PMID: 24304627

29. Hempler N.F., et al., Dietary education must fit into everyday life: a qualitative study of people with a Pakistani background and type 2 diabetes. Patient Prefer Adherence, 2015. 9: p. 347–54. https://doi.org/10.2147/PPA.S77380 PMID: 25750523

30. Murrock C.J., Taylor E., and Marino D., Dietary challenges of managing type 2 diabetes in African-American women. Women Health, 2013. 53(2): p. 173–84. https://doi.org/10.1080/03630242.2012.753979 PMID: 23517514

31. Gele A.A., et al., Beyond Culture and Language: Access to Diabetes Preventive Health Services among Somali Women in Norway. J Diabetes Res, 2015. 2015: p. 549795. https://doi.org/10.1155/2015/549795 PMID: 26266267

32. Miller S.T., Marolen K.N., and Beech B.M., Perceptions of physical activity and motivational interviewing among rural African-American women with type 2 diabetes. Womens Health Issues, 2010. 20(1): p. 43–9. https://doi.org/10.1016/j.whi.2009.09.004 PMID: 19944621

33. Njeru J.W., et al., Stories for change: development of a diabetes digital storytelling intervention for refugees and immigrants to Minnesota using qualitative methods. BMC Public Health, 2015. 15: p. 1311. https://doi.org/10.1186/s12889-015-2628-y PMID: 26715465

34. Nam S., et al., Challenges of diabetes management in immigrant Korean Americans. Diabetes Educ, 2013. 39(2): p. 213–21. https://doi.org/10.1177/0145721713475846 PMID: 23427240

35. Rosal M.C., et al., Awareness of diabetes risk factors and prevention strategies among a sample of low-income Latinos with no known diagnosis of diabetes. Diabetes Educ, 2011. 37(1): p. 47–55. https://doi.org/10.1177/0145721710392247 PMID: 21220363

36. Tang J.W., et al., Perspectives on prevention of type 2 diabetes after gestational diabetes: a qualitative study of Hispanic, African-American and White women. Matern Child Health J, 2015. 19(7): p. 1526–34. https://doi.org/10.1007/s10995-014-1657-y PMID: 25421329

37. Bhattacharya G., Spirituality and Type 2 Diabetes Self-Management Among African Americans in the Arkansas Delta. Journal of Social Service Research, 2013. 39(4): p. 469–482.

38. Sohal P.S., Prevention and Management of Diabetes in South Asians. 32, 2008. 3: p. 206–210.

39. Yilmaz-Aslan Y., et al., Illness perceptions in Turkish migrants with diabetes: a qualitative study. Chronic Illn, 2014. 10(2): p. 107–21. https://doi.org/10.1177/1742398513501207 PMID: 23986085

40. Moise R.K., et al., Diabetes Knowledge, Management, and Prevention Among Haitian Immigrants in Philadelphia. Diabetes Educ, 2017. 43(4): p. 341–347. https://doi.org/10.1177/0145721717715418 PMID: 28627321

41. Cha E., et al., Understanding cultural issues in the diabetes self-management behaviors of Korean immigrants. Diabetes Educ, 2012. 38(6): p. 835–44. https://doi.org/10.1177/0145721712460283 PMID: 23019238

42. Chaufan C., Constantino S., and D.M., ‘It’s a full time job being poor’: understanding barriers to diabetes prevention in immigrant communities in the USA. Critical Public Health. 2012. 22(2): p. 147–158.

43. Chlebowy D.O., Hood S., and LaJoie A.S., Facilitators and barriers to self-management of type 2 diabetes among urban African American adults: focus group findings. Diabetes Educ, 2010. 36(6): p. 897–905. https://doi.org/10.1177/0145721710385579 PMID: 20974906

44. Khanam S., Attitudes towards health and exercise of overweight women. The Journal of The Royal Society for the Promotion of Health, 2008. 128(1): p. 26–30. https://doi.org/10.1177/14664207085225 PMID: 18274327

45. Booth A.L C; Dean M; Hunter S.J.; McKinley M.C.;, Diet and physical activity in the self-management of type 2 diabetes: barriers and facilitators identified by patients and health professionals. Primary Health Care Research & Development, 2013. 14: p. 293–306.
46. Gary-Webb T.L., et al., Translation of the National Diabetes Prevention Program to Engage Men in Disadvantaged Neighborhoods in New York City: A Description of Power Up for Health. Am J Mens Health, 2018. 12(4): p. 998–1006. https://doi.org/10.1177/1557988318758788 PMID: 29540131

47. Siddiqui F.W V.; Kurbasic A.; Sonestedt E.; Lundgren K.B.; Lindeberg S.; Nilsson P.M.; et al, Changes in dietary intake following a culturally adapted lifestyle intervention among Iraqi immigrants to Sweden at high risk of type 2 diabetes: a randomised trial. Public Health Nutrition, 2017. 20(15): p. 2827–2838. https://doi.org/10.1017/S136898001700146X PMID: 28738912