Gestational Diabetes and International Migration

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Abstract

In many countries, immigrant women constitute a substantial proportion of women giving birth. With gestational diabetes being one of the most common complications in pregnancy, understanding gestational diabetes in the context of international migration becomes increasingly relevant. Here, we examine the current evidence related to international migration and gestational diabetes, including short- and long-term adverse outcomes and the experiences of immigrant women with gestational diabetes care and long-term follow-up. Existing evidence focuses on immigrants in high-income countries, and has mainly examined differences in the risk of developing gestational diabetes, or on the experiences of immigrant women diagnosed with gestational diabetes. Studies suggest that the risk of gestational diabetes may be influenced by migration and that immigrant women likely experience particular barriers to care and follow-up. Current research on perinatal outcomes is inconclusive and studies on long-term outcomes are practically absent. Future research should include data on country of origin and examine the role of premigration and postmigration factors in developing gestational diabetes and its associated short- and long-term outcomes. Understanding these factors will provide useful insights into improving the health and health care needs of migrating populations and enable inclusion of culturally appropriate health care practices, thereby improving the health of our current and future generations.

Key Words: gestational diabetes, migration, pregnancy outcomes, type 2 diabetes, mini-review

Gestational diabetes is a temporary form of diabetes diagnosed during pregnancy. It is associated with increased risk of various adverse maternal and neonatal outcomes, such as large for gestational age (LGA) birth weight, cesarean section, and pre-eclampsia [1,2], as well as subsequent type 2 diabetes and cardiovascular disease development [3,4]. Globally, the prevalence of gestational diabetes has been increasing substantially in recent decades; yet there is considerable variation in the reported prevalence rates across world regions [5]. Some of this variation may be explained by differences in screening and diagnostic approaches, but evidence also indicates that gestational diabetes is more common in certain ethnic groups [6].

Recent decades have also seen a rise in international migration [7]. While there is no universally accepted definition, international migration involves moving from one’s place of usual residence across an international border. People migrate for a variety of reasons, such as work, education, and asylum, and they can live in their country of destination on legal or illegal terms. Women account for almost half of all international migrants, and about half of female migrants are estimated to be of reproductive age, corresponding to around 66 million [8]. Consequently, in many countries, immigrant women constitute a substantial proportion of women giving birth. With gestational diabetes being one of the most common complications in pregnancy, understanding gestational diabetes in the context of international migration becomes increasingly relevant. Therefore, the aim of this paper is to review the current evidence related to international migration and gestational diabetes, including short- and long-term adverse outcomes and the experiences of migrant women with gestational diabetes care and long-term follow-up.

Methods

We searched the PubMed database for articles written in English or any of the Scandinavian languages. The search was conducted in March 2022 using the following search terms: (Gestational diabetes OR GDM OR [Diabetes AND pregnancy]) AND ([Migration OR Migrant OR Immigration OR Refugee] OR [Nativity OR Native OR Foreign-born OR Foreigner] OR [Ethnicity OR Ethnic]). There were no restrictions on publication date, and we included both quantitative and qualitative original research articles as well as meta-analyses. The search yielded a total of 2076 citations, which were initially independently screened and assessed by the authors (K.K.N. and E.D.) based on title and abstract. In the next step, the full texts of the remaining articles were examined. We included articles that focused on gestational diabetes specifically among women with a migrant background, defined as women with their own migration experience. We excluded articles where findings on the migrant population could not be separated from the population born in the recipient country or comparison group. Except for a few studies...
Screening and Testing for Gestational Diabetes

The screening approaches and diagnostic criteria for gestational diabetes vary across settings [9, 10]. At diagnosis, it can also be a challenge to distinguish it from pre-existing diabetes first detected during pregnancy. In some countries, all pregnant women are tested for gestational diabetes, whereas in others only women with specific risk factors are offered a test. The tests and the cut-off values used to diagnose gestational diabetes also differ from country to country, and changes in diagnostic criteria may influence diagnostic rates differently according to the women’s country of origin [11]. Moreover, ethnicity is a risk factor eliciting testing for gestational diabetes in some but not all countries [9, 12], and it is also well documented that there are ethnic differences in risk factors for gestational diabetes. For instance, Asian populations develop type 2 diabetes and gestational diabetes at lower body mass index values than Europeans or those of European descent [13, 14]. Likewise, women migrating from countries with low diabetes detection rates may underreport family history of diabetes—another risk factor commonly used in selective screening approaches—simply because their family members with diabetes have not been diagnosed [15].

In addition, immigrant women may experience additional barriers to accessing and navigating the health system. Barriers identified by immigrant women include language and communication barriers [16–20], as well as cultural barriers [21, 22]. Interestingly, qualitative studies from Australia and Denmark have found that immigrant women with gestational diabetes report incongruities between the recommendations regarding gestational diabetes, including screening and diagnostic practices, they received from their country of origin and the information provided in the receiving country [16, 17, 23, 24]. Bandyopadhyay also found that South Asian women living in Australia questioned the diagnostic practices and were concerned about pregnancy being overmedicalized in Australia [23]. Thus, the inconsistency in screening and diagnostic criteria for gestational diabetes between countries may also affect how women migrating from one country to another perceive and value these practices.

A handful of studies, mainly hospital based, have examined or reported on differences in screening for gestational diabetes between the population born in the recipient country and immigrant groups [25–28]. They all suggest lower screening rates among immigrants than in pregnant women who were born in the recipient country. Two studies from Turkey documented that screening for gestational diabetes was significantly lower among Syrian refugee women than women who were Turkish citizens [25, 27]. Weiss and colleagues evaluated the extent to which immigrant women participate in the mandatory 75-g oral glucose tolerance test (OGTT) conducted at 25 to 28 weeks of gestation in Austria [26]. Only 5.4% of Austrian-born women did not complete the OGTT compared with 10.5% of immigrant women. However, when the authors further subdivided according to country of origin, they found substantial variation in completion rates (2.9–24.4%). Moreover, a study from Israel compared both completion of the glucose challenge test and the prevalence of gestational diabetes among Israeli residents and nonresidents delivering at a hospital in Tel Aviv [28]. Nonresidents did not have full health insurance for routine pregnancy follow-up, and while 93% of Israeli residents completed the test, only 62% of nonresidents underwent the test. The fact that nonresidents in the study did not have full health insurance coverage for antenatal care could suggest a financial barrier in this context. Unfortunately, no studies have systematically examined barriers to screening and testing for gestational diabetes among immigrant women.

Furthermore, hospital-based studies may be prone to selection bias. Seghieri and colleagues had access to regional health data on all deliveries in Tuscany, Italy, and found similar rates of OGTT testing among Italian women and immigrant women [29]. A selective screening approach was employed in the study period with being born outside Europe as one of the risk factors triggering an OGTT, which may at least partly explain the high uptake among immigrant women in the study.

Risk of Developing Gestational Diabetes

Most studies addressing international migration and gestational diabetes have looked at differences in prevalence rates and risk of gestational diabetes. Gagnon and colleagues conducted a meta-analysis in 2011 showing that the majority of migrant women in the included studies had higher risks of gestational diabetes than women from the receiving countries [30]. Yet, as noted by the authors, a large majority of the included studies were not population based; therefore, there is a risk of recruitment bias. Since then, a vast number of population based studies from the United States [31, 32], Canada [33], Australia [34–38], and Europe [29, 39–44] have investigated whether immigrant women compared with women born in the recipient country have a different risk of developing gestational diabetes. Overall, these studies document that compared with pregnant women from the recipient countries, immigrants, particularly women from Asian countries, have a higher risk of gestational diabetes [33–37, 39, 40, 44]. Yet, the exceptions seem to be women migrating from West/ Central Europe, and potentially also from the Americas, who in several studies did not have a higher risk than women from the recipient country [33, 34, 38, 39, 44]. These studies were all conducted in high-income countries. Little evidence is available from low- or middle-income countries, but a study from Chile, including a little more than 1000 women, found that the prevalence of gestational diabetes was significantly higher among women born in Chile than in immigrant women (8.7% vs 4.4%) [45]. Consequently, it has been suggested that it is region of origin/ethnicity rather than immigrant status per se that is associated with gestational diabetes [46]. However, studies, mainly from the United States, have sought to examine the impact of migration status by comparing women who were born in the United States with foreign-born women with the same ethnic background. The studies include various ethnic groups, and for most of the ethnic groups they find that being foreign born is associated with an increased risk of gestational diabetes [47–53], although this may not to apply to all women of East Asian ethnicity [47, 50, 52, 54]. Thus, existing evidence suggests that migration does influence gestational diabetes risk, but that it is likely modified by country of origin.

A key challenge in existing research on gestational diabetes risk in immigrants is the broad categorization of immigrants...
into a dichotomous variable (immigrant yes/no) or region of origin. This may be due to lack of statistical power or detailed information to allow for more specific subgroup analyses; however, studies with data on the country of origin level suggest that there may be considerable differences between countries often grouped together. Hederson and colleagues studied the influence of migration status among various ethnic groups in the United States and found that being born outside the United States substantially increased the risk of gestational diabetes for Filipina and Chinese women, but was associated with a decreased risk among Japanese and Korean women [54]. A nationwide registry study from Denmark likewise found substantial differences in gestational diabetes risk estimates among women originating from Afghanistan, Pakistan, India, and Sri Lanka—countries often grouped together as “South Asia” [39]. This suggests that a much more complex set of mechanisms is at play than merely immigrant status or ethnicity. Premigration and postmigration factors, including socioeconomic status are likely important as well. Yet, limited evidence is available in this regard. Gibson-Helm et al showed that immigrant women of refugee background from Middle and East Africa had significantly higher risks of gestational diabetes (OR 3.5; 95% CI 1.8–7.1) than immigrant women without a refugee background originating from the same regions [55]. Residency within an ethnic enclave in the recipient country may also influence the risk of gestational diabetes among immigrants [56]. Other studies have looked at whether length of stay in the recipient country influences the risk of gestational diabetes among immigrants. Although findings from studies in Denmark, Norway, and Belgium suggest that immigrants who have a longer length of residency in these countries have higher risk of gestational diabetes than more recent immigrants [39, 40, 57], the opposite was found in a study from Canada [58]. The European studies included all immigrants regardless of area of origin, whereas the Canadian study focused on South Asian and Chinese immigrants only. Whether these observed differences are linked to the studied immigrant populations, conditions in the recipient countries, or a combination remains unclear.

**Adverse Maternal and Neonatal Outcomes**

It is recognized that gestational diabetes increases the risk of adverse maternal and neonatal outcomes. The landmark Hyperglycemia and Adverse Pregnancy Outcomes study documented a continuous relationship between higher maternal glucose levels and increased risk of various maternal and neonatal outcomes [1]. The Hyperglycemia and Adverse Pregnancy Outcomes study was a multisite study and included centers in 9 countries with varying ethnicities. The identified associations did not differ among centers [59]. However, other studies have reported ethnic differences in perinatal outcomes among women with gestational diabetes [6]. Importantly though, ethnic differences in perinatal outcomes have also been observed in general pregnant populations as well [60–62], and there are a number of important aspects to consider in order to better understand potential differences.

On the one hand, some immigrant women may experience various barriers to health care, healthy foods, and affordable and safe areas to be physically active. In addition, they may be exposed to certain premigration or postmigration factors that put them at increased risk of poorer glycemic control, timely treatment, and adverse outcomes. Qualitative studies investigating immigrant women’s experiences with care in relation to gestational diabetes in Denmark, Australia, and Canada have found that the women report a lack of culturally tailored dietary recommendations and that it can be a challenge to eliminate foods, such as rice and white bread, which are otherwise common in a culture-specific diet [21, 23, 63–65]. Specific recommendations regarding physical activity, dietary restrictions, and reduced weight gain during pregnancy may also be considered appropriate in some but not other cultures, which then may lead to confusion, worry, or mistrust among women originating from cultures with contradicting customs and perceptions to what is recommended in the recipient country [22, 23, 65]. Consequently, lack of culturally tailored recommendations may hamper immigrant women’s opportunity and motivation to follow the recommendations in their receiving country if they are in opposition to social norms in their country of origin [24]. This may in turn affect the achievement of glucose targets. Indeed, studies suggest that compared with women born in the recipient country, immigrant women with gestational diabetes more often require insulin treatment [66–68].

On the other hand, some studies have also suggested that some immigrant women experience better perinatal outcomes than women born in the recipient country, a phenomenon often attributed to the “healthy migrant” effect [69, 70].

A number of studies have been conducted among women with gestational diabetes to elucidate if immigrant women have different rates of adverse perinatal outcomes. All studies had been conducted in high-income countries and, in general, found that immigrants with gestational diabetes had rates of pre-eclampsia/hypertensive disorders, preterm delivery, cesarean section, and shoulder dystocia similar to or lower than women with gestational diabetes who were born in the recipient country [66, 67, 71–76]. Some studies suggest that the risk of delivering an LGA baby may differ. A study from Italy found that immigrants from Eastern Europe with gestational diabetes had higher frequency LGA than both women born in Italy and immigrants from other regions [66], whereas studies from Denmark and Australia found lower odds of LGA among certain immigrant women with gestational diabetes, particularly those originating from Asian countries [71, 72].

Yet, differences in LGA occurrence have also been documented among deliveries not affected by gestational diabetes [29, 71, 72]. If immigrant women in general have better perinatal outcomes than women born in the recipient country, it is necessary to also include women without gestational diabetes to shed light on whether the condition affects immigrant women differently from women born in the recipient country. A couple of recent studies have done exactly so. Seghieri and colleagues compared women from so-called “High Migration Pressure Countries (HMPC)” with women born in Italy and found no interaction between having gestational diabetes and belonging to the HMPC group [29]. The HMPC group combined immigrants from diverse countries in Africa, Asia, Latin America, and Eastern Europe, which again may be too crude a categorization considering the diverse ethnic backgrounds and the plethora of reasons for migrating that exist among these populations. The few available studies that have looked at specific countries of origin suggest that there may be some differences in terms of the effect of gestational diabetes on perinatal outcomes. Thus, Wan et al studied data from 73 517 deliveries and found that while
Australian-born women of European descent with gestational diabetes were at higher risk of a range of adverse perinatal outcomes than their counterparts without gestational diabetes, Chinese-born women with and without gestational diabetes had comparable perinatal outcomes [72]. In addition, Nielsen and colleagues studied all deliveries in Denmark from 2004 to 2015 (n = 710,413) and were able to categorize migrants according to their country of origin [71]. They found that gestational diabetes had similar effects on the risk of pre-term delivery and both planned and emergency cesarean section regardless of immigrant status and country of origin; however, there was significant interaction between gestational diabetes and country of origin for pre-eclampsia, LGA and small for gestational age. Hence, while gestational diabetes increased the risk of pre-eclampsia, with 28% among Danish-born women, it was associated with a 2- to 3-fold higher risk among women with gestational diabetes from Lebanon and Morocco than women originating from these countries without gestational diabetes. Similar findings applied to size for gestational age outcomes. Among most of the study population, including women born in Denmark, gestational diabetes was associated with a roughly 2-fold higher risk of LGA, but women from Sri Lanka had a more than 4-fold increased risk if they had gestational diabetes. Interestingly, similar substantially elevated risks were not found among women from India and Pakistan. This indicates that the impact of gestational diabetes on perinatal outcomes may vary among different immigrant groups. As mentioned, Sri Lanka, India, and Pakistan are often grouped together under a “South Asia” or similar category in existing research. However, women living in Denmark originating from these 3 countries have very different migration backgrounds, histories, and experiences, which further highlights that the pathways linking migration, gestational diabetes, and perinatal outcomes appear to be complex.

**Long-term Outcomes and Postpartum Follow-up After a Gestational Diabetes–Affected Pregnancy**

It is well documented that a history of gestational diabetes is associated with an increased risk of later type 2 diabetes and cardiovascular disease [3, 4, 77]. It has also been shown that migrant populations in general are at increased risk of developing these conditions [77, 78]. While a number of studies have investigated the role of ethnicity on later risk of type 2 diabetes in women affected by gestational diabetes, very few studies have investigated the risk of long-term outcomes like type 2 diabetes and cardiovascular disease specifically in immigrant women with a history of gestational diabetes. One exception is a study by Khan and colleagues in which over 40,000 women with gestational diabetes in Canada were followed [76]. They found a 23% increased risk of developing postpartum type 2 diabetes in refugee women, while other immigrants had a 6% increased risk compared with Canadian-born women with gestational diabetes [76]. A cohort study on 5470 women with gestational diabetes in the United States found that women with Asian origin had a 2-fold risk of developing type 2 diabetes compared with women of European descent, but did not specify to which extent women of Asian origin were immigrants or born in the United States [79]. An increased risk of type 2 diabetes following gestational diabetes specifically among women of Asian origin has also been reported in 2 studies from Australia and 1 study from the United Kingdom, but again it was not specified to which extent these women were immigrants or born in Australia/United Kingdom [80–82]. Thus, there is very limited evidence on the long-term consequences of gestational diabetes in migrant populations. We identified only 1 study that specifically addressed the role of migration in later risk of type 2 diabetes in women affected by gestational diabetes [76], and no studies investigated later risk of cardiovascular disease. Similarly, no studies focusing on the impact of migration on long-term outcomes of offspring exposed to gestational diabetes in utero were identified.

Due to the increased risk of subsequent diabetes and cardiovascular disease, it is recommended that women with a history of gestational diabetes attend regular follow-up and diabetes testing; yet, adherence to postpartum follow-up for diabetes in women with gestational diabetes is generally low [83]. A recent study from Italy confirmed this, and found that adherence was particularly low among immigrant women in Italy [84]. Lack of awareness and risk perception are commonly mentioned individual level barriers for adherence to postpartum follow-up programs after gestational diabetes [83]. A study from Canada found that almost half of all women with gestational diabetes underestimated their future risk of diabetes, and women with Asian, African, Latin American, and Middle Eastern ethnic backgrounds had a 2-fold likelihood of underestimating future diabetes risk [85]. Adjusting for immigration status attenuated but did not fully explain this association. Thus, while immigrant status may associate somewhat with underestimating future diabetes risk in women diagnosed with gestational diabetes, ethnicity was a stronger predictor [85].

Several qualitative studies have investigated the mechanisms behind underlying increased risk of gestational diabetes and associated outcomes in migrating populations. Sharma and colleagues found that South Asian women living in Norway expressed substantial guilt, if they prioritized engaging in health-promoting behaviors as this could be seen as prioritizing themselves above their children [22]. Similar findings were observed among nonimmigrant women as well, but Sharma and colleagues noted that it seemed more pronounced among the South Asian women [22]. The women in the study by Sharma and colleagues also described feeling obliged to respect the use of traditional South Asian recipes, with a high daily intake of rice and bread. Other studies have shown that immigrant women express a sense of abandonment postpartum and request more information on recommendations for postpartum health behaviors and risk of type 2 diabetes [18, 22, 65, 86]. Studies from Scandinavia suggest that immigrant women may worry more about their increased risk of type 2 diabetes postpartum, as they perceive it to be more serious based on experiences where late diagnosis or unregulated type 2 diabetes have led to serious complications or even death in their immediate family [19, 64, 87]. Importantly, Bagger and colleagues documented that some women with refugee background may also be dealing with traumatization and other consequences of war or persecution [64]. In this context, the potential development of type 2
diabetes may take second place in comparison with more immediate and pressing issues in everyday life [64].

**Future Directions and Avenues for Research**

The currently available literature leaves much room for uncertainty to say the least. Much remains unclear about the pathways linking international migration and gestational diabetes and its associated adverse outcomes. Nonetheless, it seems fair to say that it is not so much migration per se, but rather the myriad factors involved in the migration process that are likely to influence the association with gestational diabetes and associated outcomes.Asserting that it is merely a question of ethnic phenotype or genetics also appears too reductionistic. To further disentangle the complex web of influencing factors, future studies should preferably include data on origin at the country level rather than regional level and use country level as the unit of analysis. Using a dichotomous categorization of immigrant yes/no should be avoided. Our understanding of the association between international migration and gestational diabetes and its associated adverse outcomes would also be widened if researchers were able to combine data and analyze the impact of the receiving country. Data on pre-migration and postmigration factors are also highly warranted. This should include, but not be limited to, data on reasons for migration, such as work or refugee status; acculturation, including length of stay in recipient country; legal status; language proficiency; discrimination; social support and cohesion; socioeconomic status; diet and food availability; and health system utilization and navigation, including screening and testing both during and after pregnancy. It would also be relevant to compare pregnancies before and after migration. Furthermore, studies suggest that women with immigrant backgrounds have higher prevalence of psychological distress, such as depression and/or anxiety symptoms [88,89]. Recent studies have suggested that there is a bidirectional link between depression and gestational diabetes [90,91]. Examining the links between migrant status, psychological distress, and gestational diabetes would likely shed additional light on the mechanisms at play.

Furthermore, the lack of studies on long-term outcomes following gestational diabetes among migrants is glaring. A prior diagnosis of gestational diabetes is associated with substantially elevated risk of type 2 diabetes and cardiovascular disease [3,4]. Identification of high-risk groups and effective, feasible, and acceptable interventions are thus of the utmost importance. Studies focusing on the risk trajectories and needs of women with immigrant backgrounds and a history of gestational diabetes should be encouraged. Similar points should be stressed for studies on offspring of migrant women with gestational diabetes.

Finally, it is also an important limitation of current evidence that the great majority has been conducted in high-income countries. We have little knowledge about gestational diabetes among immigrant women living in other countries or among women who are internally displaced.

**Conclusions**

While existing evidence suggests an increased risk of gestational diabetes among immigrants, this does not apply to all immigrant groups and may depend on several factors related to the recipient country, the country of origin, and the migration process. The picture becomes substantially more blurred when assessing the associated perinatal outcomes. Though some studies suggest that immigrant women with gestational diabetes have perinatal outcomes similar to or better than women with gestational diabetes born in the recipient country, it is important to take into consideration that differences also exist between immigrant and women born in the recipient country without gestational diabetes, and there are some indications that gestational diabetes may have a more profound impact on the risks of specific perinatal outcomes among certain immigrant groups. More studies are needed to investigate this further. The very limited studies available on the long-term outcomes following gestational diabetes leave little ground for conclusions. Future efforts should also be directed towards follow-up studies examining this. Further investigations into these factors and outcomes will provide useful insights into improving the health and health care needs of migrating populations and enable inclusion of culturally appropriate health care practices, thereby improving the health of our current and future generations.

**Author Contributions**

K.K.N. and G.S.A. conceived the study. E.D. performed the literature search. K.K.N. and E.D. screened the identified citations. All authors contributed to the data extraction. K.K.N., E.D., and G.S.A. all wrote first drafts of parts of the manuscript. All authors provided critical revisions and approved the final version of the manuscript.

**Conflict of Interest**

All authors are employed at Steno Diabetes Center Copenhagen, a public hospital and research institution under the Capital Region of Denmark, which is partly funded by a grant from the Novo Nordisk Foundation. GSA own shares in Novo Nordisk A/S.

**Data Availability**

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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