International Journal of Community Medicine and Public Health
Vidyashri R et al. Int J Community Med Public Health. 2026 Jul;13(7):3983-3992
https://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20262307

Review Article

Beyond pregnancy: life-course management of gestational diabetes mellitus and its intergenerational impact: comprehensive review

Vidyashri R.[1], Nirmala M.[2], Beaulah Mercy Mary T.[3], P. Vanaja[4], Usha H. T.[5], Anne Roslin[6], Mohammed Umar[7]*, Pauline Sharmila[8], Nidigantla Subrahmanyam[9], Suhashini[10], Deepa N. R.[11]

[1]Department of Community Health Nursing, Shridevi Institute of Nursing, Rajiv Gandhi University of Health Sciences, Tumkur, Karnataka, India
[2]Department of Medical Surgical Nursing, PSG College of Nursing, The Tamil Nadu Dr. MGR Medical University, Coimbatore, Tamil Nadu, India
[3]Department of Obstetrics and Gynaecological Nursing, Vatsalya Institute of Nursing & Paramedical Sciences, Shillong, Meghalaya, India
[4]Department of Medical Surgical Nursing, College of Nursing, Madras Medical College, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India
[5]Department of Obstetrics and Gynaecological Nursing, GIMS Government College of Nursing, Rajiv Gandhi University of Health Sciences, Gadag, Karnataka, India
[6]Department of Nursing, GEMS Multi Speciality Hospital, Sikaria, Rohtas, Bihar, India
[7]Department of Nursing, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India
[8]Department of Pediatric Nursing, Tagore College of Nursing, The Tamil Nadu Dr. MGR Medical University, Tamil Nadu, India
[9]Department of Medical Surgical Nursing, Asram College of Nursing, Malkapuram, Eluru, Andhra Pradesh, India
[10]Department of Obstetrics and Gynaecological Nursing, H.K.E.S College of Nursing, Kalaburagi, Karnataka, India
[11]Department of Obstetrics and Gynaecological Nursing, ESIC College of Nursing, Kalaburagi, Karnataka, India

Received: 14 March 2026
Accepted: 11 June 2026

***Correspondence:**
Mohammed Umar,
E-mail: umarrathore0786@gmail.com

ABSTRACT

Gestational diabetes mellitus (GDM) is a common metabolic disorder occurring during pregnancy and is increasingly recognized as a major public health concern due to its long-term implications for both mothers and their offspring. Although traditionally considered a temporary condition limited to pregnancy, growing evidence suggests that GDM is an early indicator of future metabolic disorders, including type 2 diabetes mellitus, metabolic syndrome and cardiovascular disease. This review aimed to examine the life-course management of gestational diabetes mellitus and explore its intergenerational impact on maternal and offspring health. A comprehensive literature review was conducted using electronic databases including PubMed, Scopus, Web of Science, CINAHL and Google Scholar. Relevant studies published between 2000 and 2024 were identified using keywords related to gestational diabetes, postpartum management, life-course approach and intergenerational health outcomes. The findings indicate that women with a history of GDM have a significantly higher risk of developing type 2 diabetes and other metabolic disorders later in life. In addition, exposure to maternal hyperglycemia during pregnancy increases the risk of obesity, insulin resistance and glucose intolerance in offspring, supporting the concept of developmental programming. Lifestyle interventions, breastfeeding, postpartum screening and integrated healthcare services were found to be effective strategies in reducing long-term risks. Adopting a life-course approach that includes early detection, continuous monitoring and preventive interventions is essential to break the cycle of intergenerational metabolic disease and improve long-term maternal and child health outcomes.

Keywords: Gestational diabetes mellitus, Intergenerational health, Life-course management, Maternal health, Offspring metabolic risk, Type 2 diabetes

INTRODUCTION

GDM is a significant metabolic disorder characterized by glucose intolerance with onset or first recognition during pregnancy. It has emerged as a major public health concern due to its rising prevalence globally and its long-term health implications for both mothers and their offspring. The increasing burden of obesity, sedentary lifestyle and delayed childbearing has contributed significantly to the growing incidence of GDM across populations. Estimates suggest that approximately 14–18% of pregnancies worldwide are affected by GDM, although the prevalence varies depending on diagnostic criteria and population characteristics.[1] Traditionally, gestational diabetes was considered a temporary metabolic disturbance limited to pregnancy. However, growing scientific evidence indicates that GDM represents an early indicator of chronic metabolic dysfunction, with implications extending far beyond the postpartum period. Women diagnosed with GDM have a substantially increased risk of developing type 2 diabetes mellitus (T2DM), metabolic syndrome and cardiovascular disease later in life. Studies suggest that nearly 50% of women with GDM develop T2DM within 5–10 years after pregnancy.[2]

The implications of gestational diabetes are not limited to maternal health alone. The intrauterine environment plays a crucial role in shaping the long-term health outcomes of offspring. Exposure to maternal hyperglycemia during fetal development has been associated with increased risks of childhood obesity, impaired glucose tolerance, insulin resistance and early onset of metabolic disorders. This phenomenon, often described as "fetal programming" or "developmental origins of health and disease," highlights how prenatal metabolic conditions influence health across the life course.[3]

The concept of life-course management has gained prominence in addressing chronic conditions that originate early in life. In the context of gestational diabetes, this approach emphasizes the need for continuous monitoring, prevention and management strategies extending from preconception to postpartum and beyond. Life-course management aims to interrupt the cycle of metabolic disease transmission between generations and reduce long-term health risks for both mothers and their children.[4]

During pregnancy, maternal hyperglycemia leads to excessive glucose transfer across the placenta, stimulating fetal pancreatic insulin secretion. Elevated fetal insulin levels promote increased fat deposition and accelerated fetal growth, often resulting in macrosomia. Macrosomic infants face higher risks of birth trauma, neonatal hypoglycemia, respiratory distress and admission to neonatal intensive care units. These complications highlight the importance of effective glycemic control during pregnancy.[5] Postpartum follow-up remains a critical yet often neglected component of GDM management. Despite clear clinical guidelines recommending glucose screening after delivery, adherence to postpartum testing remains low worldwide. Many women fail to receive appropriate screening or preventive interventions, allowing metabolic abnormalities to progress unnoticed. This gap in care underscores the need for integrated postpartum care models and improved healthcare systems that support long-term monitoring.[6]

Furthermore, gestational diabetes contributes to the growing global epidemic of non-communicable diseases. The intergenerational transmission of metabolic risk creates a vicious cycle in which maternal diabetes predisposes offspring to obesity and diabetes later in life. These offspring may eventually develop metabolic disorders and, if female, may experience GDM during their own pregnancies, perpetuating the cycle across generations.[7]

Recent research emphasizes the importance of lifestyle interventions, including dietary modifications, physical activity and weight management, in preventing the progression of GDM to type 2 diabetes. Structured lifestyle programs initiated during pregnancy and continued postpartum have shown promising results in reducing long-term metabolic risks. Additionally, breastfeeding has been identified as a protective factor that may improve maternal glucose metabolism and reduce future diabetes risk.[8]

Advances in digital health technologies and personalized medicine offer new opportunities for improving the management of gestational diabetes across the life course. Mobile health applications, continuous glucose monitoring systems and telemedicine platforms enable better glycemic monitoring and patient engagement. These innovations may enhance adherence to treatment plans and facilitate long-term lifestyle modifications.[9] Despite the growing recognition of GDM as a chronic health concern, many healthcare systems still approach it as a pregnancy-limited condition. This fragmented perspective results in missed opportunities for early intervention and prevention. Integrating obstetric, endocrinologic and primary care services is essential for implementing effective life-course strategies that address the long-term consequences of gestational diabetes.[10]

Another important dimension of GDM management involves addressing social determinants of health. Socioeconomic status, access to healthcare, nutritional availability, cultural practices and health literacy significantly influence the risk and management of gestational diabetes. Women in low- and middle-income countries often face barriers to early screening, treatment and follow-up care, increasing their vulnerability to long-term complications.[11] Public health policies aimed at reducing the burden of gestational diabetes must therefore focus on prevention strategies, early detection and sustained postpartum care. Community-based

interventions, educational programs and maternal health initiatives can play an important role in improving awareness and promoting healthy lifestyles among reproductive-age women.[12] Understanding the intergenerational impact of gestational diabetes is crucial for developing comprehensive prevention strategies. The intrauterine environment influences epigenetic modifications that may alter gene expression related to metabolism and insulin regulation. These epigenetic changes can persist throughout life and may even be transmitted to subsequent generations. Consequently, addressing gestational diabetes represents an opportunity to improve health outcomes not only for mothers but also for future generations.[13] In recent years, researchers have increasingly recognized the need for a life-course perspective in maternal health. Instead of focusing solely on pregnancy outcomes, this approach considers the long-term health trajectories of women and their children. Such a framework promotes continuous care, early intervention and preventive strategies that extend beyond the immediate postpartum period.[14]

Therefore, a comprehensive review of current evidence regarding the life-course management of gestational diabetes and its intergenerational impact is essential. By synthesizing existing research, this review aims to highlight the long-term consequences of GDM, identify effective prevention and management strategies and emphasize the importance of integrated healthcare approaches. Understanding these aspects will help guide healthcare providers, researchers and policymakers in developing interventions that improve maternal and child health outcomes across generations.[15]

This review article was conducted using a systematic and comprehensive approach to synthesize existing literature related to the life-course management of gestational diabetes mellitus and its intergenerational impact. The objective of the methodology was to identify, evaluate and summarize relevant studies published in peer-reviewed scientific journals to provide a comprehensive understanding of current evidence.

The review followed established guidelines for narrative and systematic literature reviews, ensuring transparency, reliability and reproducibility in the process of literature identification and analysis. The methodological framework included defining research questions, identifying relevant databases, establishing inclusion and exclusion criteria, screening studies, extracting data and synthesizing findings.[16]

SEARCH STRATEGY

A systematic search of electronic databases was conducted to identify relevant studies published between 2000 and 2024. The databases searched included PubMed, Scopus, Web of Science, CINAHL and Google Scholar. These databases were selected because they provide extensive coverage of biomedical, nursing and public health literature related to gestational diabetes and maternal health.[17] The search strategy incorporated a combination of Medical Subject Headings (MeSH) and keyword terms related to gestational diabetes and life-course management. Key search terms included "Gestational Diabetes Mellitus," "postpartum diabetes," "maternal health," "life-course approach," "intergenerational health," "offspring metabolic risk," and "developmental origins of health and disease." Boolean operators such as AND and OR were used to refine the search results and improve the relevance of retrieved studies.[18]

For example, search strings included combinations such as: Gestational diabetes AND postpartum follow-up, Gestational diabetes AND life-course management, Gestational diabetes AND intergenerational effects and Maternal hyperglycemia AND offspring metabolic risk These search combinations helped ensure that relevant studies addressing both maternal and offspring outcomes were included.[19]

Inclusion criteria

Studies were included in the review if they met the following criteria peer-reviewed research articles published in English. Studies focusing on gestational diabetes mellitus and its long-term health implications. Research addressing postpartum outcomes, type 2 diabetes risk or metabolic syndrome in women with previous GDM. Studies examining the impact of maternal gestational diabetes on offspring health outcomes. Systematic reviews, cohort studies, randomized controlled trials and observational studies providing relevant evidence.[20]

Exclusion criteria

Studies were excluded from the review if they met any of the following criteria.

Articles not written in English. Studies focusing solely on pre-existing diabetes in pregnancy rather than gestational diabetes. Case reports, editorials and conference abstracts lacking detailed methodological descriptions. Studies with insufficient data on maternal or offspring outcomes.[21]

Study selection process

The study selection process followed a multi-stage screening approach. Initially, all identified articles were imported into reference management software to remove duplicates. After duplicate removal, titles and abstracts were screened to assess relevance to the research objectives. Articles that appeared relevant based on their titles and abstracts were retrieved for full-text review. During the full-text screening stage, studies were evaluated against the inclusion and exclusion criteria. Only studies that clearly addressed life-course outcomes

related to gestational diabetes were included in the final review.[22]

Data extraction

Data extraction was conducted using a structured data extraction form developed by the researchers to ensure systematic and consistent collection of relevant information from the included studies. The extracted data included the author and year of publication, country or region where the study was conducted, study design, sample size and population characteristics.

In addition, key findings related to maternal outcomes and offspring health outcomes were recorded, along with any reported interventions or preventive strategies associated with the management of gestational diabetes mellitus. This structured approach enabled uniform data collection across all selected studies and facilitated effective comparison and synthesis of findings during the review process.[23]

Quality assessment

The methodological quality of included studies was assessed using established quality appraisal tools appropriate for different study designs. Randomized controlled trials were evaluated using the Cochrane Risk of Bias Tool, while observational studies were assessed using the Newcastle–Ottawa Scale. Systematic reviews were evaluated using the AMSTAR guidelines.[24] Quality assessment helped identify potential biases related to sample selection, measurement methods, confounding variables and statistical analysis. Studies with high methodological quality were given greater emphasis during the synthesis of findings.[25]

Data synthesis

Due to the heterogeneity in study designs, study populations and outcome measures among the included studies, a narrative synthesis approach was adopted to summarize and interpret the findings. This method enabled the integration of evidence from diverse research designs and facilitated the identification of common themes and patterns related to the life-course management and intergenerational effects of gestational diabetes mellitus.

The synthesized findings were organized into several key thematic categories, including long-term maternal health outcomes following gestational diabetes, the risk of developing type 2 diabetes and cardiovascular diseases, metabolic and developmental outcomes among offspring, the role of lifestyle modifications and preventive interventions and healthcare system approaches to postpartum follow-up and management. This thematic organization provided a comprehensive understanding of the broader and long-term implications of gestational diabetes across the life course.[26]

Ethical considerations

As this review was based solely on previously published literature, no direct involvement of human participants was required. Therefore, ethical approval from an institutional review board was not necessary. However, all included studies were conducted in accordance with established ethical guidelines for biomedical research.[27,28]

The present review synthesized findings from multiple studies examining the long-term maternal and offspring outcomes of GDM, as well as the effectiveness of life-course management strategies. The results are presented under major thematic areas identified during the literature synthesis.

Prevalence and global burden of gestational diabetes

The reviewed studies consistently reported a rising prevalence of gestational diabetes worldwide. Epidemiological studies estimate that GDM affects approximately 14–18% of pregnancies globally, with higher rates reported in South Asian, Middle Eastern and Indigenous populations. The increasing prevalence is largely attributed to rising maternal age, obesity, sedentary lifestyles and genetic predisposition.[29]

In many low- and middle-income countries, including regions in South Asia, the prevalence of GDM has shown a rapid upward trend over the past two decades. This increase is particularly concerning due to limited access to early screening and postpartum follow-up care in these regions.[30]

The review also found that variations in diagnostic criteria significantly influence prevalence estimates. The adoption of the International Association of Diabetes and Pregnancy Study Groups (IADPSG) criteria has increased detection rates, highlighting the need for standardized diagnostic guidelines.[31]

Maternal health outcomes after gestational diabetes

One of the most consistent findings across studies was the strong association between GDM and the development of type 2 diabetes mellitus (T2DM) later in life. Longitudinal cohort studies reported that women with previous GDM have a seven to ten times higher risk of developing T2DM compared with women who experienced normoglycemic pregnancies.[32]

The risk of developing T2DM is particularly high within the first five years following pregnancy, although it remains elevated for decades. Approximately 30–50% of women with GDM develop T2DM within ten years postpartum.[33] In addition to diabetes, several studies reported increased risk of metabolic syndrome among women with prior GDM. Metabolic syndrome is characterized by a cluster of metabolic abnormalities including central obesity, hypertension, dyslipidemia and

impaired glucose regulation. Women with a history of GDM were found to have significantly higher rates of metabolic syndrome compared with those without such history.[34] cardiovascular disease risk is another important long-term consequence identified in the reviewed literature. Studies indicate that women with previous GDM have a higher incidence of hypertension, atherosclerosis and cardiovascular events later in life. This association is believed to result from persistent metabolic abnormalities and insulin resistance following pregnancy.[35]

Furthermore, psychological outcomes were also reported in some studies. Women diagnosed with GDM often experience increased levels of stress, anxiety and depressive symptoms during pregnancy and postpartum periods. These psychological challenges may influence adherence to lifestyle modifications and postpartum screening recommendations.[36]

Postpartum follow-up and screening

Despite strong recommendations for postpartum glucose screening, adherence rates remain low in many healthcare systems. Several studies reported that fewer than 50% of women with prior GDM undergo recommended glucose testing within the first year after delivery.[37]

Barriers to postpartum screening include lack of awareness, inadequate healthcare follow-up, time constraints associated with newborn care and limited access to healthcare services. Healthcare providers also play a role in this gap, as postpartum care often focuses primarily on infant health rather than maternal metabolic monitoring.[38]

However, studies evaluating integrated care models demonstrated improved follow-up rates when obstetric, primary care and endocrinology services collaborated to provide continuous postpartum care. These integrated approaches significantly increased postpartum screening and early identification of metabolic abnormalities.[39]

Impact of gestational diabetes on offspring health

The review revealed substantial evidence indicating that maternal hyperglycemia during pregnancy has long-term implications for offspring health. Infants born to mothers with GDM are more likely to experience macrosomia, defined as birth weight greater than 4,000 grams. Macrosomic infants face increased risks of birth trauma, shoulder dystocia and neonatal hypoglycemia.[40]

Beyond the neonatal period, children exposed to maternal gestational diabetes demonstrate higher rates of childhood obesity. Studies suggest that intrauterine exposure to hyperglycemia alters fetal metabolic programming, increasing susceptibility to adiposity and metabolic disorders later in life.[41] Several cohort studies also reported increased risk of impaired glucose tolerance and insulin resistance among adolescents born to mothers with GDM. These findings support the concept that the intrauterine environment plays a critical role in shaping long-term metabolic health.[42] The intergenerational transmission of diabetes risk is particularly evident among female offspring. Women born to mothers with gestational diabetes are more likely to develop GDM during their own pregnancies, thereby perpetuating the cycle of metabolic disease across generations.[43]

Role of lifestyle interventions

Lifestyle interventions emerged as one of the most effective strategies for reducing the long-term risk of type 2 diabetes among women with prior GDM. Studies examining structured lifestyle programs reported significant improvements in weight management, glucose regulation and cardiovascular risk factors.

Dietary interventions focusing on balanced nutrition, reduced intake of refined carbohydrates and increased consumption of whole grains and vegetables were associated with improved glycemic control. Physical activity interventions, including moderate-intensity aerobic exercise, also demonstrated positive effects on insulin sensitivity and weight management.[44] Postpartum weight management was identified as a key factor in preventing the progression from GDM to T2DM. Women who maintained healthy body weight and engaged in regular physical activity had significantly lower risk of developing diabetes later in life.[45] Breastfeeding was another protective factor identified in several studies. Prolonged breastfeeding was associated with improved maternal glucose metabolism and reduced risk of future diabetes. Additionally, breastfeeding contributes to healthy weight development in infants.[46]

Technological innovations in GDM management

Advancements in digital health technologies have introduced new opportunities for improving gestational diabetes management. Continuous glucose monitoring systems allow real-time tracking of blood glucose levels, enabling more precise glycemic control during pregnancy. Mobile health applications have also been developed to support dietary monitoring, physical activity tracking and glucose logging. Studies evaluating these technologies reported improved patient engagement and adherence to treatment recommendations.[47] Telemedicine interventions were particularly effective in providing remote support to women in rural or underserved areas. Virtual consultations with healthcare providers enabled timely adjustments to treatment plans and improved patient education.[48]

Healthcare system approaches

The review highlighted the importance of integrated healthcare systems in managing gestational diabetes across the life course. Multidisciplinary care teams

consisting of obstetricians, endocrinologists, nurses, dietitians and primary care physicians were shown to improve maternal and neonatal outcomes. Healthcare systems that implemented structured postpartum follow-up programs reported higher rates of glucose screening and early intervention. These programs often included patient education, reminder systems and coordinated care pathways.[49] Public health initiatives focusing on maternal health education and lifestyle promotion also demonstrated positive effects in reducing GDM prevalence and improving long-term health outcomes. Community-based interventions were particularly effective in increasing awareness and promoting healthy behaviors among reproductive-age women.[50]

Table 1: Summary of included studies on gestational diabetes mellitus and life-course outcomes.

Author	Study design	Sample size	Key findings
Bellamy et al[2]	Systematic review and meta-analysis	20 studies	Women with prior GDM have a 7-fold higher risk of developing type 2 diabetes later in life.
Barker et al[3]	Epidemiological study	Population-based	Early intrauterine exposure influences adult metabolic disease risk.
Hanson et al[4]	Review	Multiple studies	Early-life interventions can prevent diabetes and metabolic disorders.
Metzger et al[5]	Multicenter cohort (HAPO study)	23,000+	Maternal hyperglycemia is associated with adverse pregnancy outcomes and macrosomia.
Kim et al[6]	Systematic review	28 studies	Gestational diabetes significantly increases the risk of type 2 diabetes postpartum.
Damm et al[7]	Review	Multiple cohorts	GDM leads to long-term metabolic complications in both mother and child.
Tobias et al[8]	Prospective cohort	89,000 women	History of GDM increases cardiovascular disease risk.
Feig et al[9]	Clinical guideline review	Multiple studies	Postpartum screening and lifestyle interventions are recommended.
Zhu et al[11]	Cohort study	50,000 women	Women with GDM have significantly higher risk of developing T2DM.
Landon et al[12]	Randomized controlled trial	958 participants	Treatment of GDM reduces perinatal complications.
Clausen et al[13]	Cohort study	600 offspring	Offspring of mothers with GDM have higher risk of glucose intolerance.
Gunderson et al[14]	Prospective cohort	1,000 women	Lactation reduces risk of type 2 diabetes after GDM.
Saeedi et al[15]	Global epidemiological analysis	Global data	Diabetes prevalence including GDM is increasing worldwide.
Ferrara et al[23]	Randomized lifestyle intervention	1,500 women	Lifestyle interventions reduce postpartum diabetes risk.
Tobias et al[24]	Prospective cohort	25,000 women	GDM is associated with increased risk of hypertension.
Lowe et al[26]	Follow-up cohort study	4,000 participants	Children exposed to maternal hyperglycemia show increased metabolic risk.
Catalano et al[27]	Cohort study	1,200 pregnancies	Maternal hyperglycemia contributes to fetal adiposity.
Yogev et al[28]	Observational study	800 pregnant women	Maternal glucose intolerance is linked with adverse pregnancy outcomes.
Guariguata et al[29]	Global prevalence study	Multiple populations	Global prevalence of GDM is increasing.
Jiwani et al[30]	Systematic review	Global data	Significant variation in GDM prevalence across regions.
Metzger et al[31]	International guideline study	Global consensus	Established diagnostic criteria for GDM.
Vounzoulaki et al[32]	Meta-analysis	95 studies	Risk of type 2 diabetes after GDM remains elevated for decades.
Ratner et al[33]	Randomized trial	350 women	Lifestyle changes reduce diabetes incidence in women with GDM history.
Retnakaran et al[34]	Cohort study	1,500 women	GDM increases risk of metabolic syndrome

Continued.

Author	Study design	Sample size	Key findings
			postpartum.
Shah et al[35]	Population cohort	9,000 women	Women with GDM have increased cardiovascular disease risk.
Kozhimannil et al[36]	Cohort study	11,000 women	GDM is associated with higher postpartum depression risk.
Hillier et al[41]	Cohort study	9,439 children	Maternal GDM increases risk of childhood obesity.
Dabelea et al[42]	Longitudinal cohort	2,000 offspring	Intrauterine exposure to diabetes increases obesity risk.
Pettitt et al[43]	Cohort study	Pima Indian population	Offspring exposed to GDM show higher diabetes risk.
Knowler et al[44]	Randomized controlled trial	3,234 participants	Lifestyle intervention significantly reduces diabetes incidence.

DISCUSSION

The findings of this review highlight the complex and far-reaching consequences of gestational diabetes mellitus across the life course. Although GDM is often perceived as a temporary metabolic condition limited to pregnancy, the evidence clearly demonstrates its long-term implications for both maternal and offspring health. One of the most important observations from the reviewed literature is the strong association between gestational diabetes and future development of type 2 diabetes mellitus.

Women with a history of GDM face significantly higher lifetime risk of metabolic disorders, emphasizing the need for long-term monitoring and preventive interventions.[51] The progression from GDM to T2DM is influenced by multiple factors, including genetic predisposition, postpartum weight retention and lifestyle behaviors. Many women experience difficulty maintaining healthy lifestyle changes after pregnancy due to competing responsibilities such as childcare, work commitments and limited access to healthcare resources. Addressing these barriers is essential for effective life-course management of gestational diabetes.[52]

The intergenerational impact of GDM represents another critical public health concern. Maternal hyperglycemia during pregnancy influences fetal metabolic programming through mechanisms such as altered insulin signaling and epigenetic modifications. These biological changes may increase the risk of obesity, insulin resistance and metabolic disorders in offspring later in life.[53] This phenomenon supports the developmental origins of health and disease theory, which suggests that early life exposures play a crucial role in determining long-term health outcomes. The intrauterine environment is therefore a key target for preventive strategies aimed at reducing the global burden of metabolic diseases.[54] Another important finding from this review is the low adherence to postpartum glucose screening among women with prior GDM. Despite clear clinical guidelines recommending postpartum testing, many women do not receive appropriate follow-up care. This gap highlights systemic shortcomings in healthcare delivery and the need for improved coordination between obstetric and primary care services.[55] Integrating postpartum diabetes screening into routine maternal healthcare services may improve follow-up rates. Reminder systems, patient education programs and electronic health record alerts have been shown to increase screening adherence. Additionally, involving community health workers in postpartum follow-up may help address barriers faced by women in resource-limited settings.[56]

Lifestyle interventions remain the cornerstone of preventing progression from gestational diabetes to type 2 diabetes. Evidence from multiple studies indicates that dietary modifications, increased physical activity and weight management significantly reduce diabetes risk among women with prior GDM. These interventions are particularly effective when initiated early in the postpartum period.[57] Breastfeeding has also emerged as an important protective factor for maternal metabolic health. Lactation improves glucose metabolism, increases energy expenditure and may contribute to long-term weight management. Encouraging breastfeeding as part of postpartum care may therefore provide additional benefits in reducing diabetes risk.[58]

Technological innovations such as mobile health applications and telemedicine platforms offer promising opportunities to enhance GDM management across the life course. These tools facilitate remote monitoring, personalized feedback and continuous patient engagement. Digital health interventions may be particularly beneficial in improving access to care for women living in rural or underserved areas.[59] From a healthcare system perspective, the implementation of multidisciplinary care models appears essential for effective management of gestational diabetes. Collaboration among obstetricians, endocrinologists, nurses, dietitians and primary care providers ensures comprehensive care that addresses both immediate pregnancy outcomes and long-term metabolic health.[60] Public health strategies should also focus on prevention by addressing modifiable risk factors before pregnancy. Preconception counseling, obesity prevention programs

and promotion of healthy lifestyles among reproductive-age women may help reduce the incidence of gestational diabetes. Early screening during pregnancy is equally important for timely diagnosis and management.[61]

Furthermore, addressing social determinants of health is critical in reducing disparities in gestational diabetes outcomes. Women from socioeconomically disadvantaged backgrounds often face barriers to healthcare access, nutritional resources and health education. Policies aimed at improving maternal healthcare services and supporting healthy environments can play an important role in mitigating these disparities.[62] Overall, the life-course approach to gestational diabetes management emphasizes continuous care, early intervention and prevention of intergenerational metabolic risk. By recognizing GDM as a chronic health concern rather than a pregnancy-limited condition, healthcare systems can implement strategies that improve long-term outcomes for both mothers and their children.[63]

Future research should focus on developing effective interventions that integrate clinical care, community support and digital health technologies. Longitudinal studies examining epigenetic mechanisms and intergenerational health outcomes may further enhance understanding of the long-term effects of gestational diabetes.[64,65]

CONCLUSION

Gestational diabetes mellitus is no longer considered a temporary condition limited to pregnancy but rather a significant indicator of future metabolic disease risk for both mothers and their offspring. Evidence from the reviewed literature demonstrates that women with a history of GDM have a substantially increased risk of developing type 2 diabetes mellitus, metabolic syndrome and cardiovascular diseases later in life. Moreover, exposure to maternal hyperglycemia during pregnancy influences fetal metabolic programming, increasing the likelihood of obesity, insulin resistance and diabetes in offspring.

A life-course approach to the management of gestational diabetes is therefore essential. Continuous monitoring, postpartum screening, lifestyle modification, breastfeeding promotion and integrated healthcare services can significantly reduce long-term complications. Strengthening healthcare systems to ensure proper follow-up and preventive interventions is crucial for breaking the intergenerational cycle of metabolic disease. Effective management strategies implemented during and after pregnancy can contribute to improved maternal health, healthier offspring and reduced global burden of diabetes.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Draznin B, Aroda VR, Bakris G, Benson G, Brown FM, et al. American Diabetes Association, Classification and diagnosis of diabetes: Standards of care in diabetes—2024. Diabetes Care. 2024;47(1):20-42.
2. Bellamy L, Casas JP, Hingorani AD, Williams D, Smith GD, Lawlor DA, et al. Type 2 diabetes mellitus after gestational diabetes: a systematic review and meta-analysis. Lancet. 2009;373(9677):1773–9.
3. Barker DJ, Eriksson JG, Forsén T, Osmond C, Kajantie E, Tuomilehto J, et al. The fetal origins of adult disease: strength of effects and biological basis. Int J Epidemiol. 2002;31(6):1235–9.
4. Hanson MA, Gluckman PD, Ma RCW, Matzen P, Biesma RG, Kluge H, et al. Early life opportunities for prevention of diabetes in low and middle income countries. BMC Public Health. 2012;12:1025.
5. Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, Coustan DR, et al. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med. 2008;358(19):1991–2002.
6. Kim C, Newton KM, Knopp RH, Kieffer EC, Ferrara A, Brown FM, et al. Gestational diabetes and the incidence of type 2 diabetes: a systematic review. Diabetes Care. 2002;25(10):1862–8.
7. Damm P, Houshmand-Oeregaard A, Kelstrup L, Lauenborg J, Mathiesen ER, Clausen TD, et al. Gestational diabetes mellitus and long-term consequences for mother and offspring. Nat Rev Endocrinol. 2016;12(7):397–407.
8. Tobias DK, Stuart JJ, Li S, Chavarro J, Rimm EB, Rich-Edwards JW, et al. Association of history of gestational diabetes with long-term cardiovascular disease risk in women. JAMA Intern Med. 2017;177(12):1735–42.
9. Feig DS, Berger H, Donovan L, Godbout A, Kader T, Keely E, et al. Diabetes and pregnancy clinical practice guidelines. Can J Diabetes. 2018;42(1):255–82.
10. World Health Organization, Roglic G, Colagiuri S, Alwan A, King H, Bennett PH, et al. Global report on diabetes. Geneva: WHO. 2016. Available at: https://www.who.int/publications. Accessed on 21 December 2025.
11. Zhu Y, Zhang C, Yeung EH, Shen Y, Qi L, Hu FB, et al. Long-term risk of type 2 diabetes after gestational diabetes. Lancet Diabetes Endocrinol. 2016;4(4):292–300.
12. Landon MB, Spong CY, Thom E, Carpenter MW, Ramin SM, Casey B, et al. A multicenter randomized trial of treatment for mild gestational diabetes. N Engl J Med. 2009;361(14):1339–48.

13. Clausen TD, Mathiesen ER, Hansen T, Pedersen O, Jensen DM, Lauenborg J, et al. High prevalence of type 2 diabetes in adult offspring of women with gestational diabetes. Diabetes Care. 2008;31(2):340–6.
14. Gunderson EP, Hedderson MM, Chiang V, Crites Y, Walton D, Azevedo RA, et al. Lactation and progression to type 2 diabetes in women with gestational diabetes. Ann Intern Med. 2015;163(12):889–98.
15. International Diabetes Federation, Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, et al. Global and regional diabetes prevalence estimates. Diabetes Res Clin Pract. 2019;157:107843.
16. Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma Group, Higgins JPT, et al. Preferred reporting items for systematic reviews and meta-analyses (PRISMA). PLoS Med. 2009;6(7):1000097.
17. Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, et al. Cochrane handbook for systematic reviews of interventions. Cochrane Database Syst Rev. 2019;2:87.
18. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA statement for reporting systematic reviews. BMJ. 2009;339:2700.
19. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. PRISMA 2020 statement. BMJ. 2021;372:71.
20. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. Newcastle–Ottawa scale for assessing the quality of nonrandomised studies. Available at: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp. Accessed on 21 December 2025.
21. Shea BJ, Reeves BC, Wells G, Thuku M, Hamel C, Moran J, et al. AMSTAR 2 critical appraisal tool for systematic reviews. BMJ. 2017;358:4008.
22. Carpenter MW, Coustan DR, Metzger BE, Dyer AR, Trimble ER, Chaovarindr U, et al. Gestational diabetes diagnostic criteria. Am J Obstet Gynecol. 2010;202(6):654–62.
23. Ferrara A, Hedderson MM, Albright CL, Ehrlich SF, Quesenberry CP, Peng T, et al. Lifestyle intervention to reduce type 2 diabetes risk in women with gestational diabetes. Diabetes Care. 2011;34(7):1519–25.
24. Tobias DK, Hu FB, Forman JP, Chavarro J, Zhang C, Manson JE, et al. Increased risk of hypertension after gestational diabetes. Diabetes Care. 2011;34(7):1582–4.
25. HAPO Study Cooperative Research Group, Metzger BE, Lowe LP, Dyer AR, Trimble ER, Chaovarindr U, et al. Hyperglycemia and pregnancy outcomes. N Engl J Med. 2008;358:1991–2002.
26. Lowe WL, Scholtens DM, Kuang A, Linder B, Lawrence JM, Lebenthal Y, et al. Hyperglycemia and adverse pregnancy outcome follow-up study. Diabetes Care. 2019;42(3):372–80.
27. Catalano PM, McIntyre HD, Cruickshank JK, McCance DR, Dyer AR, Metzger BE, et al. The hyperglycemia and adverse pregnancy outcome study. Diabetes Care. 2012;35(4):780–6.
28. Yogev Y, Langer O, Xenakis EMJ, Rosenn B, Smith-Levitin M, Brustman L, et al. Glucose tolerance in pregnancy. Obstet Gynecol. 2004;104(4):771–7.
29. Guariguata L, Linnenkamp U, Beagley J, Whiting DR, Cho NH, Shaw JE, et al. Global estimates of gestational diabetes prevalence. Diabetes Res Clin Pract. 2014;103(2):176–85.
30. Jiwani A, Marseille E, Lohse N, Damm P, Hod M, Kahn JG, et al. Gestational diabetes prevalence globally. BMJ Open. 2012;2:1001.
31. International Association of Diabetes and Pregnancy Study Groups, Metzger BE, Gabbe SG, Persson B, Buchanan TA, Catalano PA, et al. IADPSG recommendations. Diabetes Care. 2010;33(3):676–82.
32. Vounzoulaki E, Khunti K, Abner SC, Tan BK, Davies MJ, Gillies CL, et al. Progression to type 2 diabetes after gestational diabetes. BMJ. 2020;369:1361.
33. Ratner RE, Christophi CA, Metzger BE, Dabelea D, Bennett PH, Pi-Sunyer X, et al. Prevention of diabetes in women with history of gestational diabetes. J Clin Endocrinol Metab. 2008;93(12):4774–9.
34. Retnakaran R, Shah BR, Shen S, Booth GL, Lipscombe LL, Tu JV, et al. Glucose intolerance and metabolic syndrome after gestational diabetes. Diabetes Care. 2009;32(5):903–7.
35. Shah BR, Retnakaran R, Booth GL, Lipscombe LL, Feig DS, Tu JV, et al. Increased cardiovascular disease risk after gestational diabetes. Circulation. 2008;118(25):2584–90.
36. Kozhimannil KB, Pereira MA, Harlow BL, DeSalvo KB, Pham-Kanter G, Liu H, et al. Gestational diabetes and postpartum depression risk. Am J Epidemiol. 2009;169(5):601–7.
37. Tovar A, Chasan-Taber L, Eggleston E, Oken E, Peterson KE, Gillman MW, et al. Postpartum screening after gestational diabetes. Prev Chronic Dis. 2011;8(6):124.
38. Bennett WL, Ennen CS, Carrese JA, Hill-Briggs F, Levine DM, Nicholson WK, et al. Barriers to postpartum follow-up after gestational diabetes. Am J Obstet Gynecol. 2011;205(5):1–7.
39. Kim C, McEwen LN, Kerr EA, Piette JD, Herman WH, Karter AJ, et al. Coordinated care improves postpartum diabetes screening. Diabetes Care. 2007;30(5):1312–6.
40. Catalano PM, Ehrenberg HM, Hauguel-De Mouzon S, HAPO Study Group, Lowe LP, Metzger BE, et al. Gestational diabetes and macrosomia. Obstet Gynecol. 2003;101(2):312–8.
41. Hillier TA, Pedula KL, Schmidt MM, Mullen JA, Charles MA, Pettitt DJ, et al. Childhood obesity risk

after maternal gestational diabetes. Diabetes Care. 2007;30(9):2287–92.
42. Dabelea D, Hanson RL, Lindsay RS, Pettitt DJ, Imperatore G, Gabir MM, et al. Intrauterine exposure to diabetes and obesity. Diabetes. 2000;49(12):2208-11.
43. Pettitt DJ, Bennett PH, Hanson RL, Knowler WC, Baird HR, Aleck KA, et al. Offspring of mothers with diabetes risk. Diabetes Care. 1993;16(1):310–4.
44. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Lifestyle intervention and diabetes prevention. N Engl J Med. 2002;346(6):393–403.
45. Aroda VR, Christophi CA, Edelstein SL, Zhang P, Herman WH, Barrett-Connor E, et al. Diabetes prevention program outcomes. Lancet Diabetes Endocrinol. 2015;3(11):866–75.
46. Gunderson EP, Jacobs DR, Chiang V, Lewis CE, Tsai AL, Quesenberry CP, et al. Duration of lactation and diabetes risk. JAMA Intern Med. 2015;175(8):1373–81.
47. Ming WK, Mackillop LH, Farmer AJ, Loerup L, Bartlett K, Levy JC, et al. Digital health interventions for gestational diabetes. JMIR Mhealth Uhealth. 2016;4(2):32.
48. Mackillop LH, Hirst JE, Bartlett KJ, Birks JS, Clifton L, Farmer AJ, et al. Telemedicine in gestational diabetes. Diabetes Care. 2018;41(7):72–3.
49. McIntyre HD, Catalano P, Zhang C, Desoye G, Mathiesen ER, Damm P, et al. Gestational diabetes management. Lancet. 2019;393(10170):537–49.
50. Hod M, Kapur A, Sacks DA, Hadar E, Agarwal M, Di Renzo GC, et al. FIGO initiative on gestational diabetes. Int J Gynecol Obstet. 2015;131(3):173–211.
51. Retnakaran R, Qi Y, Sermer M, Connelly PW, Hanley AJ, Zinman B, et al. Glucose intolerance progression after GDM. Diabetes Care. 2010;33(8):1797–803.
52. Nicklas JM, Zera CA, England LJ, Rosner BA, Horton E, Seely EW, et al. Lifestyle challenges postpartum after GDM. Obstet Gynecol. 2011;118(5):1154–60.
53. Plows JF, Stanley JL, Baker PN, Reynolds CM, Vickers MH, et al. The pathophysiology of gestational diabetes. Int J Mol Sci. 2018;19(11):3342.
54. Gluckman PD, Hanson MA, Cooper C, Thornburg KL, Eriksson JG, et al. Effect of in utero conditions on adult health. N Engl J Med. 2008;359:61–73.
55. Tovar A, Chasan-Taber L, Eggleston E, Oken E, Gillman MW. Postpartum diabetes screening gaps. Prev Chronic Dis. 2011;8(6):124.
56. Kim C, Berger DK, Chamany S, Williams D. Postpartum diabetes prevention strategies. Curr Diab Rep. 2007;7(4):279–84.
57. Ratner RE, Christophi CA, Metzger BE, Dabelea D, Bennett PH. Lifestyle prevention after gestational diabetes. J Clin Endocrinol Metab. 2008;93(12):4774–9.
58. Gunderson EP, Hedderson MM, Chiang V, Walton D, Azevedo RA, et al. Lactation and type 2 diabetes prevention. Ann Intern Med. 2015;163(12):889–98.
59. Mackillop LH, Bartlett K, Farmer AJ, Hirst JE, Levy JC, Tarassenko L, et al. Mobile health for gestational diabetes. JMIR Mhealth Uhealth. 2018;6(3):71.
60. McIntyre HD, Catalano PM, Zhang C, Desoye G, Mathiesen ER. Gestational diabetes management. Lancet. 2019;393:537–49.
61. World Health Organization, Roglic G, Norris SL, Colagiuri S, Boyko EJ. Screening and diagnosis of hyperglycemia in pregnancy. Geneva: WHO. 2013. Available at: https://www.who.int/publications. Accessed on 21 December 2025
62. Golden SH, Joseph JJ, Hill-Briggs F, Brancati FL. Social determinants of diabetes. Lancet Diabetes Endocrinol. 2018;6(10):781–92.
63. Hanson MA, Gluckman PD, Ma RCW, Matzen P. Life-course approach to diabetes prevention. BMC Public Health. 2012;12:1025.
64. Damm P, Houshmand-Oeregaard A, Kelstrup L, Lauenborg J, Mathiesen ER. Long-term metabolic effects of GDM. Nat Rev Endocrinol. 2016;12(7):397–407.
65. Ma RCW, Popkin BM, Hanson MA. Gestational diabetes and intergenerational health risk. Nat Rev Endocrinol. 2020;16(10):1–12.

Cite this article as: Vidyashri R, Nirmala M, Beaulah Mercy Mary T, Vanaja P, Usha HT, Roslin A, et al. Beyond pregnancy: life-course management of gestational diabetes mellitus and its intergenerational impact: comprehensive review. Int J Community Med Public Health 2026;13:3983-92.