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Investigating factors affecting the quality of life of women with gestational diabetes: a systematic review and meta-analysis

Mahnaz Kayyal^{1†} , Samira Ahmadi^{2†} , Gholamreza Sadeghi³ , Elham Rasoulzadeh-Barzoki⁴ , Solmaz Norouzi^{5*} , Fatemeh Abdi⁶ and Mohammadamin Jandaghian-Bidgoli⁷

Abstract

Background Gestational diabetes mellitus (GDM) affects a significant proportion of pregnant women, impacting both physical and psychological well-being. This study aimed to investigate the factors influencing quality of life (QoL) in women with GDM.

Methods This systematic review followed PRISMA guidelines and was registered in PROSPERO (ID: CRD42024612587). A comprehensive search was conducted in PubMed, Scopus, ProQuest, Web of Science, and CINAHL, using MeSH terms related to gestational diabetes and quality of life. Eligible studies included adult women with gestational diabetes and assessed factors influencing their quality of life. The included studies were related to various stages including antenatal, during pregnancy or postpartum. Data extraction was performed independently by two authors, and study quality was evaluated using the Newcastle-Ottawa Scale (NOS). Statistical analyses were conducted in STATA, including meta-analysis with a random-effects model.

Findings The findings reveal that women with GDM experience significantly lower QoL compared to healthy pregnant women, with sexual dysfunction being a notable contributor. Women with GDM reported lower sexual desire, satisfaction, and higher pain levels, which were significantly associated with poorer QoL, particularly in mental health and pain domains. Socio-demographic factors such as age, education, income, and marital status were significantly linked to QoL, with younger women and those with lower education or income reporting poorer outcomes. Psychological factors, including stress, depression, and anxiety, negatively impacted QoL, while social support, self-efficacy, and illness acceptance were positively correlated with better QoL outcomes. Additionally, stress was found to be the main predictor of QoL for women over 30, while social relationships were more important for younger women. Treatment with insulin or a combination of insulin and oral hypoglycemic agents was associated with lower QoL compared to dietary management alone.

Conclusion This systematic review identified key psychosocial and medical factors influencing the quality of life in women with gestational diabetes. The findings emphasize the importance of addressing psychological well-being,

[†]Mahnaz Kayyal and Samira Ahmadi contributed equally to this work.

*Correspondence:
Solmaz Norouzi
snorouzi.biostatistics@gmail.com

Full list of author information is available at the end of the article



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social support, and treatment approaches to enhance QoL in these women. Further research is needed to explore interventions targeting mental health and stress management to improve outcomes for women with gestational diabetes.

Keywords Meta-analysis, Systematic review, Women's health, Gestational diabetes, Quality of life

Background

Gestational diabetes mellitus (GDM) is a condition characterized by any level of glucose intolerance that is first detected during pregnancy, commonly diagnosed between 24 and 28 weeks of gestation during the second trimester [1]. It is considered one of the fastest-growing types of diabetes, largely driven by rising rates of obesity and older maternal age globally [2]. According to the most recent statistics from the International Diabetes Federation, approximately 1 in 6 live births worldwide in 2021 were affected by hyperglycemia during pregnancy, with GDM accounting for 80.3% of these cases [3].

GDM presents significant risks and potential complications for both expectant mothers and their babies. For mothers, there is an increased likelihood of experiencing complications such as preeclampsia, hypertension, excessive amniotic fluid, premature rupture of membranes, cesarean delivery, and mental health challenges like depression [4, 5]. Over the long term, women with GDM face a sevenfold higher risk of developing type 2 diabetes and a fourfold increased risk of cardiovascular disease. Additionally, their risk for conditions such as metabolic syndrome, cancer, kidney disease, and eye disorders is elevated [6]. Furthermore, when these women become pregnant again, the recurrence of GDM is seen in 33–69% of cases [7]. For babies born to mothers with GDM, there is a heightened risk of being large for gestational age, experiencing intrauterine growth restriction, hypoglycemia, hyperbilirubinemia, and neonatal respiratory distress syndrome, often requiring a longer stay in the neonatal intensive care unit [8]. In the long term, these infants also face an increased risk of poor health outcomes, including cognitive developmental delays, difficulty maintaining a healthy weight, and a higher likelihood of developing type 2 diabetes, obesity, heart disease, and mental health disorders [9]. As a result, the condition affects not only the physical well-being of women but also has a profound impact on their emotional and psychological health, which ultimately influences their overall quality of life (QoL) [10].

The quality of life for women with gestational diabetes is influenced by a variety of factors, including medical, social, and psychological aspects. In the context of GDM, quality of life refers to the individual's overall well-being, including physical health, mental health, social functioning, and the ability to manage the condition [11]. Women with GDM often face numerous challenges, such as the need for strict dietary modifications, blood

glucose monitoring, regular medical visits, and sometimes insulin therapy [12]. These requirements can lead to increased stress, anxiety, and feelings of frustration, especially when the condition disrupts their daily lives and limits their ability to engage in activities they enjoyed before pregnancy [13]. Furthermore, the emotional toll of managing a pregnancy complication may result in feelings of guilt, fear of unknown outcomes, and concerns about the future health of the baby [14]. Research has indicated that the overall QoL for pregnant women with GDM tends to be moderately low, with approximately 25% of these women reporting poor QoL. Key factors influencing their QoL include individual characteristics such as demographic factors, pregnancy-related issues, disease-related factors, as well as levels of anxiety and depression [15].

While the existing studies on GDM and its impact on QoL of pregnant women provide valuable insights, there are several notable gaps in the current literature. Although the physical health outcomes of GDM have been extensively studied [16, 17], there is a lack of comprehensive research on the broader aspects of quality of life for women with this condition. While latent profile analysis and mixed regression methods have been employed in some studies to explore profiles of QoL among pregnant women with GDM, there is a need for more detailed and varied classifications of QoL profiles that account for diverse factors [15, 16]. This gap highlights the importance of investigating how different combinations of sociodemographic and clinical characteristics influence the QoL of women with GDM, rather than merely categorizing women into broad groups. A more nuanced understanding of these profiles could inform more personalized interventions and support strategies.

The main research question in this study is “what are the key factors that influence the quality of life of women with gestational diabetes mellitus, and what factors are more effective in this regard?”. The purpose of this systematic review is to investigate the factors that affect the quality of life of women with gestational diabetes. By analyzing existing studies, this review aims to provide a comprehensive understanding of the challenges faced by these women and offer insights into potential strategies for improving their overall well-being.

Methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [18]. In addition, the review was registered in PROSPERO (ID: CRD42024612587).

Search strategy

To identify relevant studies, we conducted a systematic search using the following databases: PubMed, ProQuest, Scopus, Web of Science, and CINAHL. The search was performed using Medical Subject Headings (MeSH) terms combined with keywords, along with Boolean operators to increase specificity.

Key MeSH terms and keywords

- **Gestational Diabetes:** “Gestational Diabetes Mellitus” OR “Gestational Diabetes” OR “GDM”.
- **Quality of Life:** “Quality of Life” OR “Life Quality” OR “Health-Related Quality of Life” OR “HRQoL”.
- **Factors:** “Psychosocial Factors” OR “Lifestyle Factors” OR “Physical Health” OR “Emotional Health” OR “Socioeconomic Factors” OR “Support Systems” OR “Stress”.
- **Women:** “Women” OR “Female” OR “Pregnant Women”.

The following search string was applied across all databases to retrieve relevant studies:

(“Gestational Diabetes” OR “Gestational Diabetes Mellitus” OR GDM OR “Pregnancy-related diabetes”) AND (“Quality of Life” OR QoL OR “Health-related quality of life” OR “Life satisfaction” OR “Health outcomes”) AND (“Women” OR “Female” OR “Pregnant women” OR “Expectant mothers”) AND (“Factors” OR “Determinants” OR “Influences” OR “Predictors” OR “Barriers” OR “Outcomes” OR “Psychosocial factors” OR “Mental health” OR “Social support” OR “Stress” OR “Depression” OR “Anxiety” OR “Physical health” OR “Lifestyle factors” OR “Diet” OR “Exercise” OR “Health behavior” OR “Self-management”).

In parallel, the snowball sampling technique was employed to track the reference lists of the selected studies. This approach typically helps reduce the likelihood of overlooking relevant data. As a result, the collected data were imported into EndNote reference management software (version X8).

Figure 1 shows the process of selection of eligible articles.

Eligible criteria based on the PECO framework

The Population for this review included women who were diagnosed with GDM. Eligible studies had to specifically target adult women (usually 18 years and older) who had

been diagnosed with GDM, either through screening or clinical assessment.

The Exposure of interest referred to the factors that might have affected the quality of life in women with gestational diabetes. These factors could have included psychosocial factors (such as stress, anxiety, depression, and social support), physical health factors (e.g., glycemic control, comorbid conditions), lifestyle factors (such as diet, exercise, and self-management), and medical factors (like access to healthcare and clinical interventions). Studies that explored how these factors influenced quality of life in women with GDM were included. The review excluded studies that focused on diabetes in general (such as Type 1 or Type 2 diabetes).

The Comparison in this review pertained to studies that either included a comparison group or examined different groups of women with gestational diabetes to explore variations in quality of life. The comparator for this systematic review was studies that compared the quality of life of women with gestational diabetes to women without the condition (healthy pregnant women) or women with other pregnancy-related conditions. However, comparative studies were not a strict requirement for eligibility. For example, studies that compared women with gestational diabetes to those without GDM, or those comparing different treatment or lifestyle interventions in women with GDM, were included. Studies that did not have a comparison group but still explored factors influencing quality of life in women with gestational diabetes were also eligible. Research that did not include any form of comparison (either internal or external) was excluded if it did not clearly address relevant factors.

The Outcome of interest was the QoL of women with gestational diabetes. Eligible studies had to measure or report on some aspect of quality of life, which might have included physical, emotional, social, or overall well-being. Outcomes could have been measured using validated instruments such as the SF-36 (Short Form Health Survey), WHOQOL (World Health Organization Quality of Life), or other similar scales that assessed health-related quality of life.

Quality assessment of studies

The methodological quality and potential risk of bias in the included studies were assessed by two independent reviewers using the Newcastle–Ottawa Scale (NOS) [19]. The NOS is specifically designed to evaluate the quality of non-randomized studies, including both cohort and case-control studies. It assigns scores based on three key areas: selection of participants, comparability between groups, and either the outcome (for cohort studies) or exposure (for case-control studies).

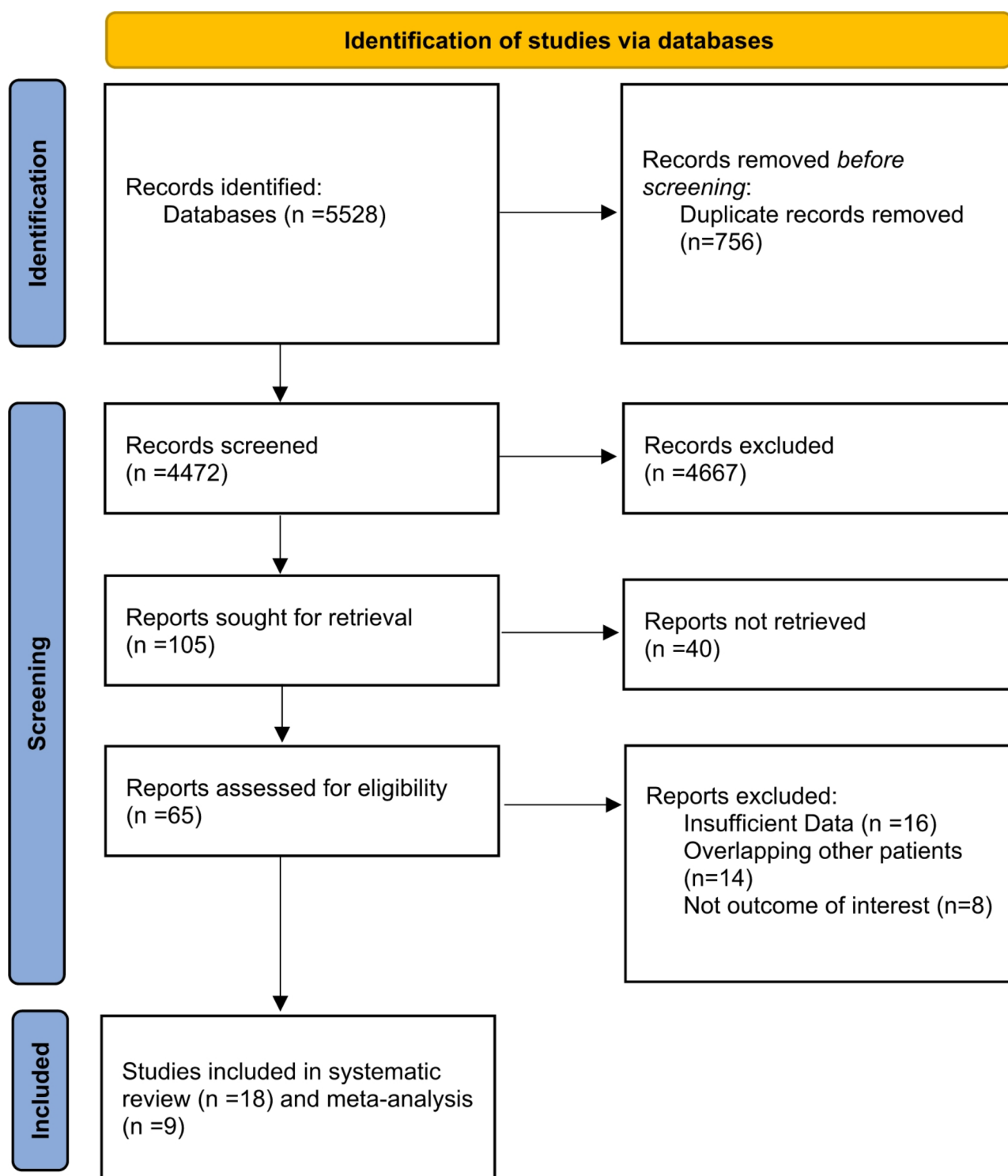


Fig. 1 PRISMA flowchart

Data analysis

The initial screening focused on the titles and abstracts, followed by a thorough examination of the full texts. Two authors independently conducted duplicate data extraction, and the collected data were recorded in an Excel

spreadsheet. All statistical analyses were performed using STATA version 17.0 (STATA Corp., College Station, TX). These analyses included calculating effect sizes, means \pm SD, and 95% confidence intervals (CIs) related to the quality of life of women with gestational

diabetes. Heterogeneity among studies was assessed using I^2 statistics, and subgroup analyses and meta-regression were conducted to explore potential sources of heterogeneity. A random-effects model was used in the meta-analysis to estimate the overall effect size, accounting for both within-study and between-study variability (heterogeneity).

Results

The study selection process followed the PRISMA guidelines, beginning with the identification of 5,528 records through database searches. After removing 756 duplicate records, 4,772 unique studies were screened based on their titles and abstracts, leading to the exclusion of 4,667 studies owing to being irrelevant to the quality of life. A total of 105 reports were sought for full-text retrieval, but 40 could not be accessed. Of the 65 reports assessed for eligibility, 38 were excluded due to insufficient data ($n=16$), overlapping patient populations ($n=14$), or irrelevance to the study's outcomes ($n=8$). Ultimately, 18 studies were included in the systematic review, with 9 also contributing to the meta-analysis.

Overall, 234,912 participants and 18 studies were included in this study for the systematic review. Additionally, 9 studies could be used for the meta-analysis. The studies include both cross-sectional and cohort designs. The average age of participants varies from 27.9 to 32.36 years, with a mix of countries including Brazil, Poland, Malaysia, Iran, China, Belgium, Canada, Australia, Turkey, and Bangladesh. The study designs include cross-sectional studies, retrospective studies, prospective cohort studies, population-based retrospective cohorts, and descriptive studies.

The systematic review presents a comprehensive analysis of various factors influencing sexual function and quality of life (QoL) in women, particularly those with gestational diabetes (GDM), while also considering socio-demographic, psychological, and health-related variables.

Sexual function and quality of life

Women with gestational diabetes (GDM) experienced significantly lower sexual function and quality of life compared to those without GDM. The mean sexual function score in women with GDM was 22.36 ± 0.29 , which was significantly lower than that of healthy pregnant women (25.24 ± 0.64 , $P=0.001$) [20]. Additionally, GDM women reported lower sexual desire, satisfaction, and higher pain levels, which contributed to an overall poorer sexual function. A strong positive relationship was found between marital satisfaction and sexual function, and BMI status also played a significant role in sexual function, particularly in the second trimester. Moreover, 56.5% of women with GDM exhibited sexual dysfunction, with higher rates associated with factors such as

education level, occupation, and place of residence. Sexual dysfunction in GDM women was also significantly linked to lower QoL scores ($P<0.001$), especially in domains like mental health and pain [21, 22].

Socio-demographic influences on quality of life

Several socio-demographic factors were found to significantly affect QoL. Women with higher educational attainment, employed status, and higher family income reported better QoL across various domains. Marital status also emerged as a critical factor, with married women showing higher psychological and environmental QoL scores. Additionally, women in rural areas reported better overall QoL and health outcomes compared to those in urban areas. On the other hand, younger women, those with lower education, or those with less income tended to have poorer QoL. Family history of depression and/or anxiety was strongly associated with poorer QoL, with the odds of having poor-to-moderate QoL being significantly higher among those with a family history of these conditions [23–25].

Psychological and social support

Psychological distress, including depression, anxiety, and stress, had a notable impact on QoL. Perceived stress negatively affected all four QoL domains (physiological, psychological, social, and environmental), with higher levels of stress leading to worse outcomes. Social support, particularly emotional and instrumental support, was positively correlated with better QoL, though support seeking and the need for support showed weaker associations. Women with moderate to high levels of self-efficacy, particularly in managing their condition, reported better QoL outcomes. Additionally, those with a high acceptance of their illness and stronger self-efficacy were more likely to report improved quality of life [26–30]. Depressive symptoms during pregnancy were linked to several factors, including a history of depression, ethnicity, lower education, smoking, and family history of diabetes. The relationship between depression and labor induction was also significant, with depression increasing labor induction rates in non-GDM women but not in those with GDM [27].

Regression and path analysis

Regression analyses highlighted that self-efficacy, illness acceptance, and income were key predictors of QoL, explaining a substantial portion of the variation in scores. For instance, self-efficacy had the strongest impact on QoL across various domains, with higher self-efficacy scores correlating with better health outcomes. Path analysis revealed that age and BMI had direct and indirect effects on QoL, with social support playing a particularly important role in improving QoL [11, 13].

Impact of treatment and diabetes management

The type of diabetes management was also associated with QoL. Women treated with insulin or a combination of insulin and oral hypoglycemic agents (OHA) had lower QoL scores compared to those who only received dietary management. Interestingly, a history of gestational diabetes was linked to better perceived support, suggesting that women who had experienced GDM before may have better coping strategies and social support [26, 31].

The details regarding the characteristics of included studies is available at Table 1.

Sensitivity analyses

The results indicate that no outlier studies are affecting the effect size. This suggests that the findings are stable and reliable across the analyzed literature (Fig. 2).

Publication bias

Egger and begg tests

All tests showed no significant publication bias (p -value > 0.05), indicating that the body of literature reviewed likely represents all relevant studies, regardless of their outcomes. This further supports the reliability of the conclusions.

Heterogeneity of outcomes

Figure 3 displays an assessment of the factors influencing quality of life among women with gestational diabetes, with main findings from subgroup analyses based on age (mean age of participating women).

For women under 30 years, social relationships played a major role in their quality of life, as reflected by an effect size (ES) of 15.19 and a 95% confidence interval (CI) ranging from 14.90 to 15.48. This suggests that strong social support networks are crucial for improving the quality of life in younger women with gestational diabetes.

In contrast, for women over 30 years, stress emerged as the main predictor of quality of life, with an effect size of 27.66 and a 95% CI of 26.05 to 29.27. This underscores the importance of effective stress management to enhance the well-being of older women with gestational diabetes.

More details in this regard is provided in Table 2.

These findings highlight the distinct social and psychological factors influencing the quality of life in women with gestational diabetes. They also emphasize the need for tailored support strategies that account for age-related differences in experiences and challenges.

Two authors independently assessed each study's risk of bias and methodological quality using the NOS tool (Fig. 4), which is as following:

Meta-regression analysis of the impact of age on quality of life in women with gestational diabetes

The results showed a statistically significant positive association between age and quality of life ($\beta = 8.56$, 95% CI: 4.88 to 12.25, $p = 0.001$). However, significant heterogeneity was observed among the studies ($I^2 = 99.60\%$, $p < 0.0001$), suggesting that other factors may also influence quality of life in this population. Further research is needed to explore these factors and to determine the clinical significance of the observed association between age and quality of life.

Discussion

The findings of this study reveal that women with gestational diabetes (GDM) experience significantly poorer sexual function and quality of life (QoL) compared to healthy pregnant women. Sexual dysfunction in women with GDM was characterized by decreased sexual desire, satisfaction, and increased pain. Additionally, lower QoL scores were strongly associated with sexual dysfunction, especially in domains like mental health and pain. Several socio-demographic factors, such as education level, employment, and family income, were found to significantly affect QoL. Furthermore, psychological factors such as perceived stress and depression had a detrimental impact on QoL across all domains. Social support, particularly emotional and instrumental support, was found to have a positive effect on QoL, with women reporting better QoL when they had greater support networks. Self-efficacy, illness acceptance, and income were identified as important predictors of QoL, with self-efficacy having the most substantial effect. Lastly, the type of diabetes management influenced QoL, with those using insulin or oral hypoglycemic agents (OHA) reporting lower QoL compared to those using dietary management alone.

These findings are largely consistent with existing studies. In line with the findings of this study, a research reported that women with GDM tend to have lower sexual function scores than healthy pregnant women, with factors like marital satisfaction and BMI being key contributors to these lower scores [35]. Similarly, other research has established that sexual dysfunction in GDM women negatively affects overall QoL, particularly in mental and physical health domains [36]. This is in line with our findings that sexual dysfunction is associated with lower mental health and pain scores, reinforcing the need for targeted interventions to address sexual health in GDM management.

Socio-demographic factors have long been recognized as strong determinants of QoL. It is shown that women with higher education, employment, and family income report better QoL outcomes [37]. In contrast, women with lower socio-economic status tend to have poorer QoL. Marital status also appears to play a crucial

Table 1 Characteristics of included studies

ID	First author, Year	Sample size	Age	country	Study design	Variables	Scale	Stage	Comparator	Main Findings
1	Ribeiro 2014, [22]	143	32.2 ± 6.6	Brazil	Cross-sectional	Overweight	FSFI	Antenatal	NA	<ul style="list-style-type: none"> - Mean FSFI score was 23.36 ± 8.6; 60.5% of overweight and 41.8% of normal weight women were at risk for sexual dysfunction ($p = 0.038$). - Overweight women had lower desire (3.46 vs. 4.06, $p = 0.007$) and lubrication scores (3.86 vs. 4.56, $p = 0.023$). - Association of higher quality of life with very good financial standing, very good perceived health, moderate self-reported knowledge of diabetes, and also by those only treated with diet and stating that the illness did not interfere with their lives ($p < 0.05$)
2	Bien 2016, [26]	214	30 ± 4.4	Poland	Cross-sectional	General health Physical health Psychological health Social relationships Environment	WHOQOL-BREF	During pregnancy	Acceptance of Illness Scale	<ul style="list-style-type: none"> - Physical QoL had weak correlations with illness acceptance ($\beta = 0.270$, $p < 0.001$) and self-efficacy ($\beta = 0.147$, $p = 0.008$). - Psychological QoL was strongly linked to illness acceptance ($\beta = 0.415$, $p < 0.001$). Social and environmental QoL showed weak correlations with emotional and received support, illness acceptance, and self-efficacy (βs 0.141–0.215, $p < 0.05$).
3	Iwan-owicz-Palus 2019, [33]	339	29.9 ± 4.48	Poland	Retrospective studies	General health Physical health Social relationships Environment	WHOQOL-BREF	During pregnancy	NA	<ul style="list-style-type: none"> - Family history of GDM: Higher odds of poor-to-moderate QOL (AOR = 1.814, 95% CI: 1.185–2.778). - Those who received insulin (with or without OHA) and/or diet modification had higher odds of poor-to-moderate QOL (AOR = 1.955, 95% CI: 1.243–3.074)
4	Lee 2020, [27]	526	32.36 ± 4.89	Malaysia	Cross-sectional	Depression and anxiety	AsianDQoL		NA	<ul style="list-style-type: none"> - Age significantly impacted QoL both directly and indirectly through BMI ($\beta = 0.51$). Social support had the highest direct effect on QoL ($\beta = 1.02$), while self-efficacy had the smallest effect ($\beta = 0.01$). Knowledge, which indirectly influenced self-efficacy, also had a small impact on QoL ($\beta = 0.0045$).
5	Ansar-zadeh 2020, [32]	329	30.93 ± 5.42	Iran	Cross-sectional	Knowledge, attitude, self-efficacy, social support, pregnancy distress, self-management	Researchers-made questionnaires	Postpartum	NA	<ul style="list-style-type: none"> - Perceived stress negatively impacted all QoL domains ($\beta = -0.177$ to -0.274, $p < 0.001$), with indirect effects through self-efficacy in some domains. Self-efficacy and social support mediated stress's impact on QoL, with significant effects on physiological, psychological, and environmental domains ($p < 0.001$).
6	Long 2020, [24]	465	32.36 ± 5.19	China	Observational	Physiological Domain Psychological domain Social relations domain Environmental domain	WHOQOL-BREF	Postpartum	NA	

Table 1 (continued)

ID	First author, Year	Sample size	Age	country	Study design	Variables	Scale	Stage	Comparator	Main Findings
7	Zare, 2021, [21]	300	31.31 ± 0.46	Iran	Cross-sectional	Depression Anxiety Stress Prenatal distress Physical health Mental health Social relations Environmental Health	WHOQOL-BREF FSH FSDS-R PDQ DASS21	During Pregnancy	Low risk pregnant women	<ul style="list-style-type: none"> - Women with gestational diabetes also reported significantly lower sexual desire ($P=0.001$), satisfaction ($P=0.001$), and greater pain ($P=0.004$). - Gestational diabetes showed a negative and significant relationship with sexual function ($P=0.01$).
8	Min-schart 2021, [25]	1843	31.4 ± 5.5	Belgium	Prospective cohort	Depression	SF-36, CESD	Antenatal and Postpartum	Women with normal glucose tolerance	<ul style="list-style-type: none"> - After adjusting for confounders (age, ethnicity, education, smoking, BMI), depression was no longer a significant risk factor for developing GDM (aOR 1.20, $P=0.365$). - A history of depression (defined by antidepressant use) was more common in women with GDM compared to those without (3.0% vs. 0.9%, $P=0.006$). - The association between antenatal DEP-ANX and GDM was strongest for those with no DEP-ANX history (aOR 1.25 [95% CI 1.16–1.35]) and smaller for those with chronic, continuous DEP-ANX (aOR 1.10 [95% CI: 1.04–1.17]).
9	Thiele 2022, [30]	228,144	18–45	Canada	Population-based retrospective cohort	Antenatal depression/anxiety	NA	Antenatal	NA	<ul style="list-style-type: none"> - Women with GDM were significantly older ($p<0.001$) and had higher BMI in the first trimester ($p=0.002$) compared to those without GDM. - There were no significant differences in ethnicity, socioeconomic status, smoking, depression history, antidepressant use, or mental health conditions ($p>0.05$). - No association was found between a history of depression or mental health disorder risk and the development of GDM ($p>0.05$).
10	Pathirana 2023, [28]	1281	27.9 ± 5.1	Australia	Cohort	Socioeconomic status	New Zealand Socioeconomic Index	During pregnancy	Non-GDM	<ul style="list-style-type: none"> - Women with GD had higher CES-D scores in depression and bodily complaints during pregnancy ($p<0.05$), with significant differences in postpartum bodily complaints ($p<0.05$). -- --Healthy women scored higher in physical function and pain during pregnancy and postpartum ($p<0.05$).
11	Doğan 2023, [34]	100	30 ± 6.79	Turkey	Cross-sectional	Depression	SF-36, CESD	During Pregnancy and Postpartum	Healthy Pregnant	<ul style="list-style-type: none"> - Women with GD had higher CES-D scores in depression and bodily complaints during pregnancy ($p<0.05$), with significant differences in postpartum bodily complaints ($p<0.05$). -- --Healthy women scored higher in physical function and pain during pregnancy and postpartum ($p<0.05$).

Table 1 (continued)

ID	First author, Year	Sample size	Age	country	Study design	Variables	Scale	Stage	Comparator	Main Findings
12	Simbar, 2023 [35]	200	31.85 ± 5.34	Iran	Cross-sectional	Support and Concerns about high-risk pregnancy	GDMQ-36	During Pregnancy	NA	Mothers with GDM had a total QOL score of 46.83, with the highest score in support (76.52) and the lowest in pregnancy concerns (31.46). - A history of GDM predicted higher support scores, with a 5.34-point increase for those with prior GDM. 56.50% of women with GDM had sexual dysfunction, influenced by education, occupation, residence, housing, and insurance ($p < 0.001$). BMI was linked to sexual desire ($p = 0.009$). Marital satisfaction positively correlated with sexual function ($p < 0.001$), and together with BMI, explained 27% of the variance in sexual function ($p < 0.001$, $r = 0.002$). - Negative correlation with depression, anxiety, stress (DASS-21), and complications ($p < 0.001$). - Age, BMI, marriage length negatively correlated ($p < 0.05$). - Higher education, employment, income, and economic status linked to better GDMQOL ($p < 0.001$). - GDM women had higher pain and lower mental health scores postpartum ($p < 0.05$). - Worse sleep quality in GDM women, no significant difference in anxiety ($p > 0.05$). - GDM infants had higher birth weights and lower APGAR scores; GDM mothers experienced more incision site pain.
13	Peivandi, 2024, [23]	200	29.75 ± 4.4	Iran	Cross-sectional	mental disorder women's sexual performance	FSFI EMS QHQ	During Pregnancy	With and without sexual dysfunction	
14	Nazarpour (1), 2024, [13]	150	31.44 ± 6.64	Iran	Cross-sectional	Depression Anxiety stress	DASS GDMQOL-36	During Pregnancy	NA	
15	Doğan, 2024, [31]	120	32.4 ± 6.29	Turkey	descriptive and prospective study	Depression	EPDS	Postpartum	Without GDM	
16	Nazarpour (2), 2024, [36]	168	31.79 ± 6.64	Iran	Cross-sectional	FSFI Marital satisfaction	GDMQOL-36 FSFI EMS			- GDMQOL score 115.81 ± 12.49; lowest in "Perceived Constraints" and "Desire"; 62.5% had sexual dysfunction. - Average satisfaction 34.45 ± 9.13, positively correlated with sexual function and GDMQOL.
17	Nahar, 2024, [29]	150	29.48 ± 4.57	Bangladesh	Cross-sectional comparative study	Depression Anxiety Stress	DASS-21		Without GDM	- Depression and stress were more common in women aged 23–27, anxiety in those aged 28–32; stress, anxiety, and depression were higher in urban and nuclear families. - GDM women had significantly higher stress (57.3%), anxiety (46.7%), and depression (61.3%) compared to non-GDM women ($p < 0.001$).

Table 1 (continued)

ID	First author, Year	Sample size	Age	country	Study design	Variables	Scale	Stage	Comparator	Main Findings
18	Fath-nezhad-Kazemi, 2024, [17]	240	32.13 ± 5.98	Iran	Cross-sectional	Illnesses acceptance, Self-efficacy,	SF-12, AIS and Sherer self-efficacy scale		NA	- Mean QoL score was 57.36; physical domain had the greatest impact ($\beta = 0.360$). - Self-efficacy and illness acceptance positively correlated with QoL ($r = 0.457, p < 0.001; r = 0.385, p < 0.001$).

role, as married women have been shown to report better psychological and environmental QoL scores, which is consistent with other studies [38], which emphasized the positive effects of marital stability on mental well-being. The finding that women in rural areas have better QoL than their urban counterparts is interesting and somewhat divergent from other studies, which report no significant differences in QoL based on urban or rural residence [39]. This discrepancy could be due to differences in healthcare access, lifestyle factors, or cultural differences across regions, which warrants further investigation. The influence of psychological factors, particularly stress and depression, is well documented in the literature. A study highlighted that perceived stress negatively impacts QoL, particularly in women with chronic conditions such as GDM [40]. The findings of this study align with these observations, as stress was shown to adversely affect all four QoL domains (physiological, psychological, social, and environmental). Additionally, social support has been shown to be crucial for improving QoL in women with GDM, a result supported by multiple studies that report positive correlations between strong social support networks and better health outcomes [10]. This suggests that interventions aimed at increasing social support may significantly improve the well-being of women with GDM.

Regression analyses from this study highlighted self-efficacy, illness acceptance, and income as significant predictors of QoL, which is consistent with previous research that has shown self-efficacy to be the most robust predictor of health outcomes in individuals with chronic conditions [41]. The findings of another study also support the idea that self-efficacy, particularly in managing diabetes, correlates with better QoL in women with GDM [42]. The impact of diabetes management on QoL was also significant. Women receiving insulin or OHA had lower QoL scores compared to those following dietary management alone. This is in line with other studies, which reported that insulin therapy in GDM is often associated with higher levels of maternal and fetal complications, which in turn affect QoL [43]. Additionally, women with a history of GDM appeared to have better perceived social support, suggesting that prior experience with GDM may lead to better coping strategies. This finding corroborates other research, which suggest that women who have experienced GDM previously may be more adept at managing their condition and have stronger social networks [42].

In terms of statistical reliability, sensitivity analyses confirmed that no outlier studies significantly influenced the overall effect size, indicating that the findings are stable across the analyzed literature. The absence of significant publication bias further supports the validity of the conclusions. Subgroup analyses revealed that social

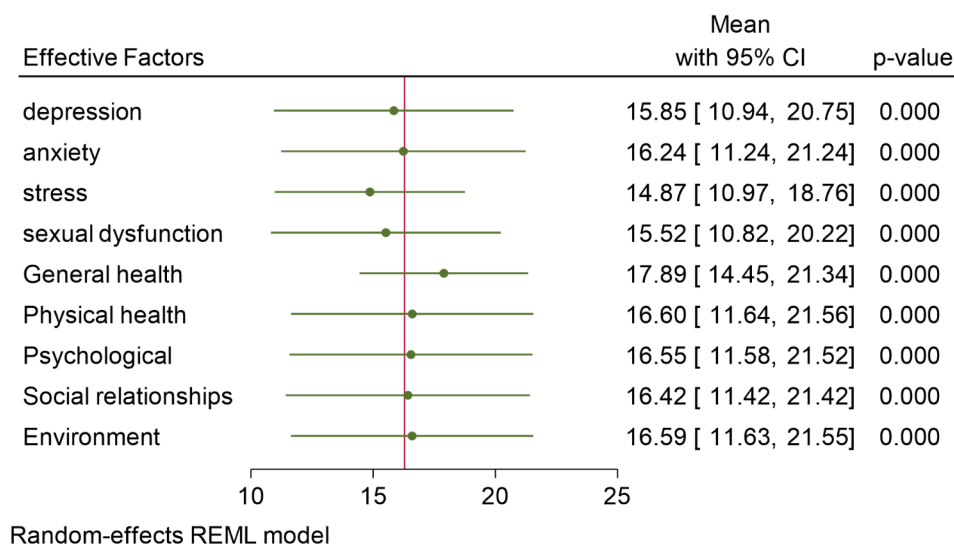


Fig. 2 Sensitivity analysis for 9 factors

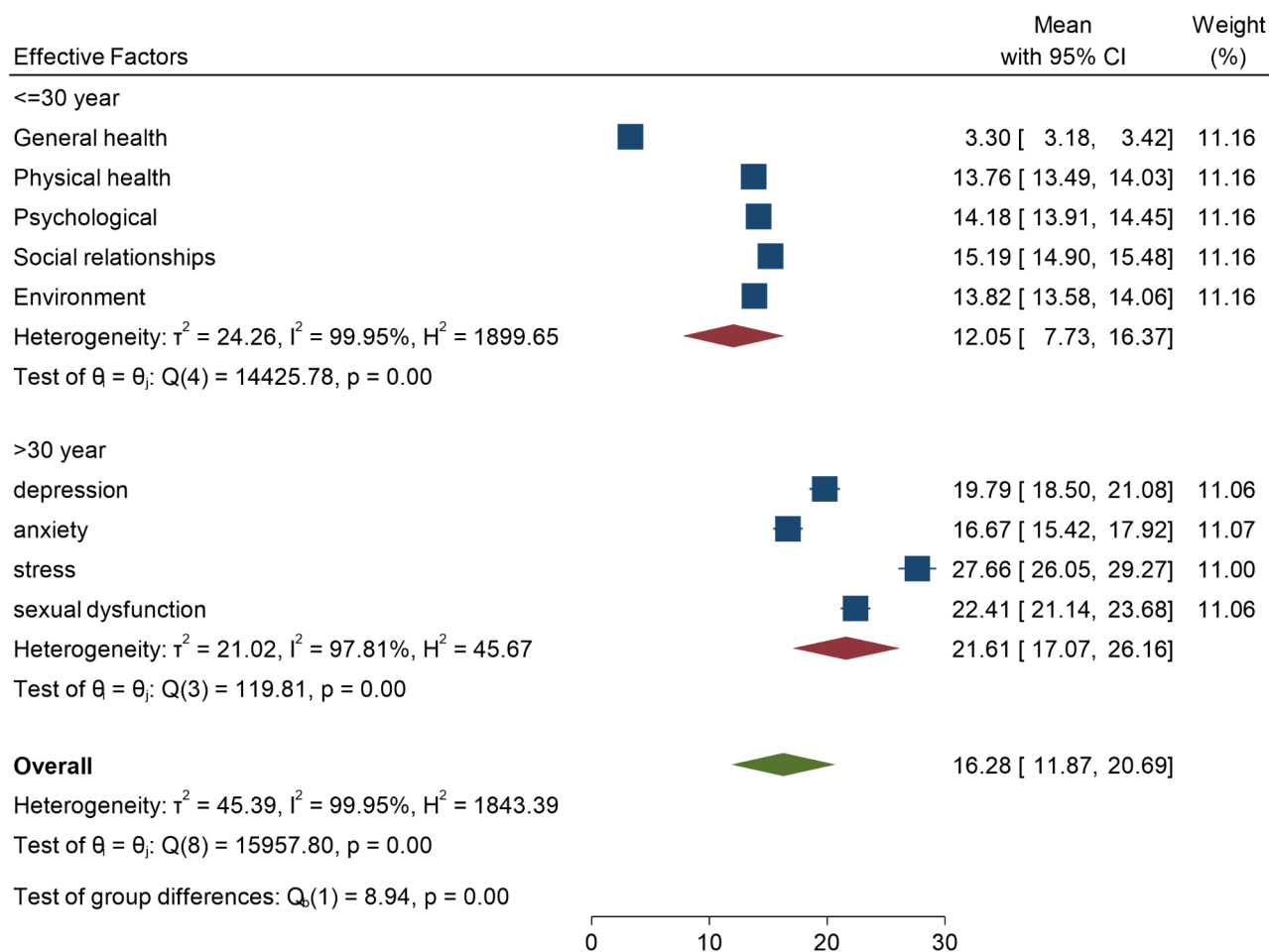
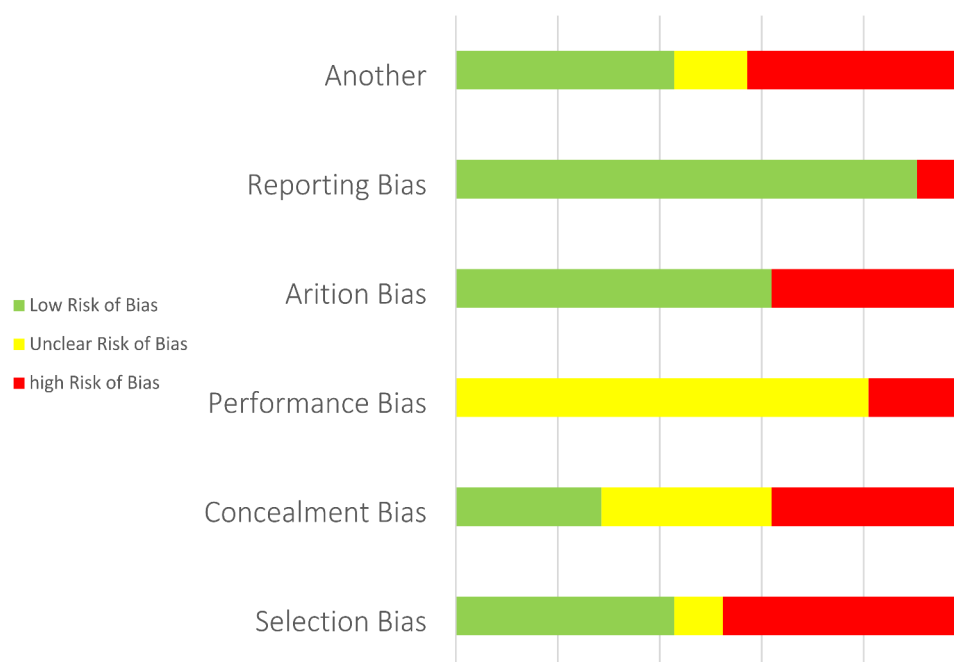


Fig. 3 Forest plot Subgroup analyses using random effects according to the Age group of pregnant women (N=9 factors)

Table 2 Mean score of pregnant women with gestational diabetes ($n=9$ factors)

Effective Factors	Number of studies	Effect size (95% CI)	I ²	Q value (p)
depression	5	16.74 (9.88–23.60)	99.75%	892.30 (< 0.001)
anxiety	3	16.62 (7.79–25.45)	99.67%	550.07 (< 0.001)
stress	3	27.62 (10.24–45.00)	99.91%	3440.97 (< 0.001)
Sexual dysfunction	3	22.51 (19.19–25.83)	95.31%	52.95 (< 0.001)
General Health	2	3.31 (3.05–3.56)	87.84%	8.22 (< 0.001)
Psychological	3	13.76 (12.54–14.98)	98.46%	106.47 (< 0.001)
Physical health	3	13.75 (12.53–14.97)	98.72%	139.98 (< 0.001)
Social relationships	3	15.13 (14.89–15.37)	55.16%	4.47 (0.11)
Environment	3	13.82 (12.43–15.21)	98.93%	270.71 (< 0.001)

CI, confidence interval

**Fig. 4** Risk of bias assessment in 18 studies

relationships were a major predictor of QoL in younger women with GDM, while stress was more significant for older women, highlighting the need for age-specific interventions. These results are consistent with studies that emphasize the importance of social support and stress management in improving health outcomes, particularly in women with chronic conditions like GDM [44].

Limitation

Despite the strengths of this study, some limitations must be acknowledged. Firstly, most of the included studies were cross-sectional and hence, it is an indication of correlations but not causality. Second, the possibility of publication bias cannot be overlooked. Studies with positive or significant findings are more likely to be published, whereas studies with negative or null results may remain unpublished, leading to an overestimation of intervention

effects. Although we attempted to minimize this risk by searching multiple databases and including gray literature where possible, some relevant studies may have been missed.

Also, language restrictions may have influenced the comprehensiveness of the review. While we attempted to include studies published in multiple languages, our primary focus was on English-language publications, which may have led to the exclusion of relevant research published in other languages. Given the high heterogeneity, it is recommended to further investigate the underlying causes. For example, other factors such as socioeconomic status, level of education, and type of diabetes may also influence quality of life.

Conclusion

In conclusion, the study highlights the complex interplay of psychological, social, and physiological factors in shaping the sexual function and QoL of women with GDM. The findings underscore the need for a comprehensive, individualized approach to managing GDM, focusing on psychological support, stress management, social support, and self-efficacy. Future research should continue to explore these factors, particularly in different cultural and socio-economic contexts, to further inform targeted interventions for improving the sexual health and overall well-being of women with GDM.

The findings of this study have important practical implications for the management and care of women with gestational diabetes mellitus (GDM). Healthcare providers should prioritize a holistic approach that not only addresses the physiological aspects of GDM but also focuses on improving sexual health, psychological well-being, and social support to enhance overall quality of life (QoL). Given the significant role of psychological factors such as stress and depression, incorporating mental health screenings and interventions, such as stress management programs and counseling, into routine prenatal care is crucial. Furthermore, addressing socio-demographic disparities by offering tailored support for women with lower education, income, or those residing in rural areas could help improve QoL outcomes. The findings also suggest the importance of fostering self-efficacy and illness acceptance, indicating that educational interventions and support for self-management of GDM could improve both psychological well-being and health outcomes. Additionally, healthcare providers should be aware of the differential impact of sexual dysfunction and stress on QoL in women of different age groups, which may require age-specific strategies. Finally, optimizing diabetes management strategies, particularly for women who require insulin or oral hypoglycemic agents, should be prioritized to improve overall health outcomes and QoL in this population.

Abbreviations

GDM	Gestational Diabetes Mellitus
QoL	Quality of Life
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO	International Prospective Register of Systematic Reviews
MeSH	Medical Subject Headings
CINAHL	Cumulative Index to Nursing and Allied Health Literature
NOS	Newcastle-Ottawa Scale
SF-36	Short Form Health Survey
WHOQOL	World Health Organization Quality of Life
BMI	Body Mass Index
ID	Identification Number
SD	Standard Deviation
FSFI	Female Sexual Function Index
aOR	Adjusted Odds Ratio
CI	Confidence Interval
OHA	Oral Hypoglycemic Agents
CESD	Center for Epidemiologic Studies Depression Scale

DASS21	Depression, Anxiety, and Stress Scale (21 items)
GDMQoL	Gestational Diabetes Quality of Life
EMS	Erectile Dysfunction Morbidity Scale (appears in some contexts for sexual function evaluation)
PDQ	Pregnancy Distress Questionnaire
AIS	Acceptance of Illness Scale
GDMQ 36	Gestational Diabetes Management Questionnaire, 36 items
EPDS	Edinburgh Postnatal Depression Scale

Supplementary Information

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Supplementary Material 1

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Author contributions

M.K. and G.S. and S.N. participated in idea conceptualization, investigation, study methodology design, conducting the meta-analyses, data visualization, writing the original draft of the paper, and project administration. M.J. and S.A. participated in writing the original draft of the paper. S.A. participated in writing the original draft of the paper. E.R.B. and S.N. participated in writing the original draft of the paper. F.A. participated in the critical reviewing and editing of the manuscript and project administration. M.K., M.J., E.R.B. and G.S. participated in idea conceptualization, critical reviewing and editing of the manuscript, project administration, and supervising the project. All authors read and approved the final manuscript.

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Data availability

All the information gained and analyzed during the study, is considered in this article.

Declarations

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Not applicable.

Consent for publication

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Competing interests

The authors declare no competing interests.

Author details

¹Medical Surgical Nursing, Shahid Mostafa Khomeini Hospital of Tabas, Birjand University of Medical Sciences, Birjand, Iran

²Social Determinants of Health Research Center, Health and Metabolic Diseases Research Institute, Zanjan University of Medical Sciences, Zanjan, Iran

³Department of Health Care Management, Faculty of Health, Tehran Medical Sciences, Islamic Azad University, Tehran, Iran

⁴Department of Nursing, Faculty of Nursing, Kashan Branch, Islamic Azad University, Kashan, Iran

⁵Department of Biostatistics, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran

⁶Nursing and Midwifery Care Research Center, Health Management Research Institute, Iran University of Medical Sciences, Tehran, Iran

⁷Ph.D Student of Nursing Department, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran

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