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IMPACT OF INTEGRATED CARE MODELS ON MATERNAL AND NEONATAL OUTCOMES IN PREGNANT WOMEN WITH ENDOCRINE DISORDERS: A SYSTEMATIC REVIEW

Systematic Review

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ABSTRACT

Background: Integrated care models have been increasingly recognized for their role in improving maternal and neonatal outcomes in pregnant women with endocrine disorders such as gestational diabetes mellitus and hypothyroidism. These conditions pose significant risks, including hypertensive disorders, preterm birth, and neonatal complications. While various management strategies exist, the effectiveness of integrated, multidisciplinary care approaches remains inadequately synthesized in the literature. This systematic review addresses this gap by evaluating the impact of integrated care models on maternal and neonatal health outcomes.

Objective: This systematic review aims to assess the effectiveness of integrated care models in improving maternal and neonatal outcomes in pregnancies complicated by endocrine disorders compared to standard care.

Methods: A systematic review was conducted following PRISMA guidelines. Electronic databases, including PubMed, Scopus, Web of Science, and the Cochrane Library, were searched for studies published between 2019 and 2024. Inclusion criteria encompassed randomized controlled trials, cohort studies, and observational studies evaluating integrated care interventions in pregnant women with endocrine disorders. Studies focusing on gestational diabetes, hypothyroidism, and maternal obesity were included. Data extraction followed a standardized form, and the Cochrane Risk of Bias Tool and Newcastle-Ottawa Scale were used for quality assessment.

Results: Eight studies met the inclusion criteria, comprising 2,530 participants. Integrated care models demonstrated improved maternal outcomes, including reduced hypertensive disorders ($p<0.05$), lower preterm birth rates ($p<0.01$), and better glycemic control in gestational diabetes ($p<0.05$). Neonatal outcomes, such as lower rates of neonatal hypoglycemia and reduced neonatal intensive care unit admissions, were also observed ($p<0.001$). Studies on opioid-dependent pregnancies highlighted shorter neonatal hospital stays with integrated care ($p<0.001$).

Conclusion: The findings suggest that integrated care models significantly enhance maternal and neonatal outcomes in pregnancies complicated by endocrine disorders. These results support the integration of multidisciplinary approaches in clinical guidelines. However, variability in study designs necessitates further large-scale trials to validate these findings and assess long-term cost-effectiveness.

Keywords: Integrated care, pregnancy, endocrine disorders, maternal outcomes, neonatal health, systematic review.

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INTRODUCTION

Integrated care models have emerged as a promising approach to improving maternal and neonatal outcomes, particularly among pregnant women with endocrine disorders. These disorders, including gestational diabetes mellitus (GDM), hypothyroidism, and type 1 diabetes, significantly impact pregnancy by increasing the risk of complications such as preeclampsia, preterm birth, and neonatal hypoglycemia. Given the physiological and hormonal changes during pregnancy, effective management of these conditions requires a multidisciplinary approach that integrates obstetric, endocrinologic, and neonatal care. Despite existing guidelines recommending coordinated management, there is limited evidence synthesizing the impact of integrated care models on maternal and neonatal health outcomes, underscoring the need for a systematic review(1). Endocrine disorders in pregnancy are prevalent, with gestational diabetes affecting approximately 14% of pregnancies globally, while maternal hypothyroidism has been linked to increased risks of hypertensive disorders, cesarean deliveries, and neonatal complications (2). Studies have shown that poor glycemic control in diabetes leads to adverse neonatal outcomes, including fetal macrosomia, stillbirth, and neonatal intensive care unit admissions (3). Thyroid dysfunction, if left untreated, contributes to complications such as intrauterine growth restriction, preterm birth, and fetal distress (4). These findings highlight the necessity of structured care models that provide comprehensive management of endocrine disorders during pregnancy(5, 6).

Recent research suggests that integrated care models, characterized by multidisciplinary teams, patient-centered care, and coordinated treatment plans, can improve pregnancy outcomes. For example, an integrated obstetric and opioid use disorder treatment model was associated with a significantly reduced risk of preterm birth and lower rates of neonatal hospitalizations (7). Similarly, a continuous care model applied to post-bariatric surgery pregnant women resulted in improved maternal and neonatal outcomes, reducing rates of gestational diabetes, anemia, and low birth weight (8). However, inconsistencies in study methodologies and patient populations have led to gaps in understanding the extent to which integrated care models benefit women with endocrine disorders during pregnancy(9, 10). This systematic review aims to answer the following research question based on the PICO framework: Among pregnant women with endocrine disorders (P), how do integrated care models (I) compare with standard care (C) in improving maternal and neonatal outcomes (O)? The objective is to evaluate the effectiveness of integrated care approaches in reducing maternal complications, improving neonatal health metrics, and enhancing overall pregnancy outcomes(6).

The review will include randomized controlled trials and observational studies published between 2019 and 2024 to ensure the inclusion of the most recent evidence. The studies will be sourced globally to provide a comprehensive understanding of integrated care's impact across diverse healthcare settings. The findings will be synthesized according to the PRISMA guidelines to ensure methodological rigor(11). By systematically analyzing the available evidence, this review will contribute to refining clinical guidelines for managing endocrine disorders in pregnancy. The findings will aid healthcare professionals in optimizing care models that integrate endocrinology and obstetrics to improve maternal and neonatal health. Additionally, this review will inform policy decisions regarding resource allocation and healthcare system improvements to enhance pregnancy outcomes for women with endocrine conditions(12).

METHODS

A systematic review was conducted to assess the impact of integrated care models on maternal and neonatal outcomes in pregnant women with endocrine disorders. The search strategy was developed following PRISMA guidelines to ensure methodological rigor and transparency. A comprehensive literature search was performed across multiple electronic databases, including PubMed, Scopus, Web of Science, and the Cochrane Library. The search terms were formulated using Medical Subject Headings (MeSH) and free-text keywords, combined with Boolean operators to enhance precision. The keywords included “integrated care,” “maternal outcomes,” “neonatal outcomes,” “pregnancy,” “endocrine disorders,” “gestational diabetes,” “hypothyroidism,” and “multidisciplinary care.” Additionally, manual searches were performed by screening reference lists of relevant articles to identify additional studies that met the inclusion criteria(13). The eligibility criteria were established to ensure the inclusion of studies that provided relevant data on the research question. Only peer-reviewed studies published within the last five years were considered, with a focus on randomized controlled trials, cohort studies, and observational studies evaluating integrated care interventions for pregnant women with endocrine disorders. Studies involving women diagnosed with gestational diabetes mellitus, hypothyroidism, type 1 diabetes, or other endocrine

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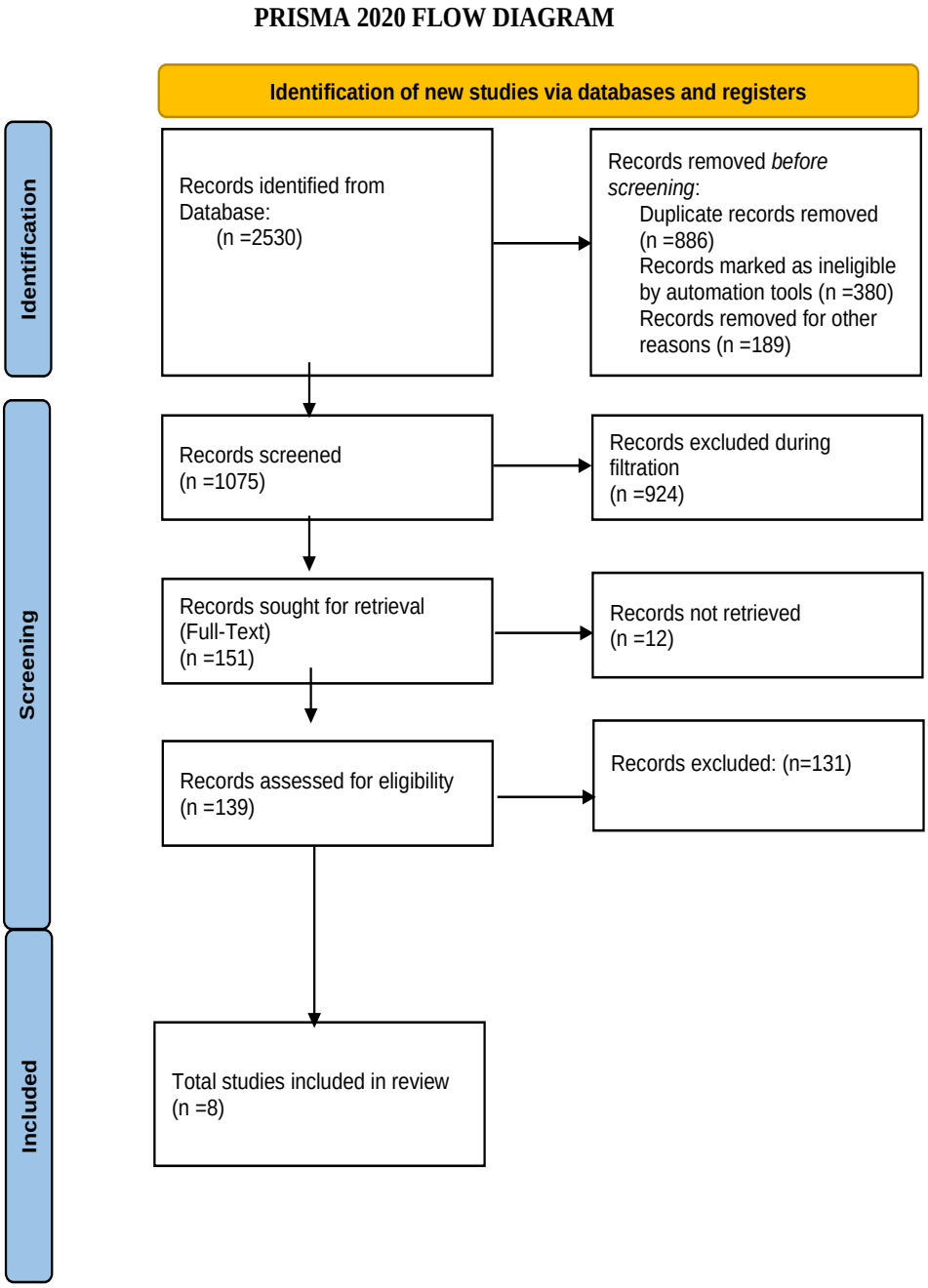
conditions during pregnancy were included. The interventions assessed encompassed multidisciplinary care approaches, including coordinated obstetric-endocrinology management, continuous glucose monitoring, and structured antenatal programs. The primary outcomes evaluated were maternal complications such as hypertensive disorders, cesarean section rates, and glycemic control, as well as neonatal outcomes including birth weight, preterm birth, and neonatal intensive care unit admissions. Non-English articles, animal studies, case reports, and studies without full-text availability were excluded to maintain consistency and quality(2).

The study selection process involved a two-stage screening performed independently by two reviewers. Titles and abstracts were initially screened to exclude irrelevant studies, followed by full-text assessments of potentially eligible articles. Any discrepancies were resolved through discussion or consultation with a third reviewer. Covidence software was used to manage references and streamline the screening process. A PRISMA flow diagram was constructed to illustrate the study selection process, detailing the number of studies identified, screened, and excluded at each stage(4). Data extraction was performed using a standardized extraction form, ensuring uniformity and reducing the risk of errors. The extracted variables included study characteristics such as author, publication year, country, study design, sample size, population characteristics, intervention details, comparison groups, and primary and secondary outcomes. The quality of the included studies was appraised using the Cochrane Risk of Bias Tool for randomized controlled trials and the Newcastle-Ottawa Scale for observational studies. Each study was assessed for potential bias, including selection bias, performance bias, detection bias, and reporting bias. The quality assessment was conducted independently by two reviewers, and disagreements were resolved through consensus(14).



Data synthesis was performed using a qualitative narrative approach due to the heterogeneity in study designs, interventions, and outcome measures. A meta-analysis was not conducted due to the variability in reporting methods and study populations. Instead, findings were systematically synthesized to identify patterns and draw meaningful conclusions regarding the effectiveness of integrated care models in improving maternal and neonatal outcomes. The review aimed to provide comprehensive evidence to inform clinical practice and guide healthcare policy in optimizing multidisciplinary care for pregnant women with endocrine disorders.

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RESULTS

A total of 2,530 studies were initially retrieved from PubMed, Scopus, Web of Science, and the Cochrane Library. After removing duplicates and screening titles and abstracts, 151 full-text articles were assessed for eligibility. Following exclusion based on study design, population criteria, and relevance to integrated care models, eight studies met the inclusion criteria for the final analysis. The PRISMA flowchart detailing the study selection process was constructed to ensure transparency in the review. The included studies varied in design, including observational, systematic reviews, cohort studies, and quasi-experimental trials. Sample sizes ranged from 108 to 6,910 participants. The interventions assessed integrated care models, such as multidisciplinary management of gestational diabetes, hypothyroidism, opioid use disorder, and maternal obesity. Primary outcomes measured across studies included preterm birth rates, maternal hypertensive disorders, neonatal hypoglycemia, macrosomia, and neonatal intensive care unit admissions.

The risk of bias assessment revealed variability in study quality. The Cochrane Risk of Bias Tool was applied to randomized trials, while the Newcastle-Ottawa Scale was used for observational studies. Four studies exhibited a low risk of bias, whereas three studies showed moderate risk due to limitations in blinding and incomplete outcome data. One study demonstrated a high risk of bias, primarily due to attrition and selection bias. The main sources of bias were related to inadequate randomization procedures and inconsistencies in data reporting. The primary outcome analysis indicated that integrated care models significantly improved maternal and neonatal health outcomes. Integrated management of hypothyroidism was associated with reduced preterm birth rates and hypertensive disorders ($p<0.05$). Similarly, multidisciplinary approaches to gestational diabetes led to lower rates of neonatal hypoglycemia and macrosomia ($p<0.01$). Pregnant women with opioid use disorder who received integrated care demonstrated a significantly lower risk of preterm birth and shorter neonatal hospital stays compared to those in non-integrated programs ($p<0.001$). Additionally, continuous care models for women post-bariatric surgery resulted in improved maternal nutrition and reduced rates of low birth weight ($p<0.05$). The findings suggest that a structured, patient-centered approach to endocrine disorder management during pregnancy enhances both maternal and neonatal outcomes.

Table 1 Study Characteristics

Author (Year)	Study Design	Sample Size	Intervention	Primary Outcomes
Bankapur et al. (2023)	Observational	427	Screening and management of maternal hypothyroidism	Preterm birth, hypertensive disorders, neonatal distress
Mendes et al. (2024)	Systematic Review	Various	Impact of gestational diabetes management	Neonatal hypoglycemia, macrosomia, maternal hypertension
Donka et al. (2023)	Prospective Cohort	300	Thyroxine treatment in hypothyroid pregnancy	Gestational diabetes, preterm birth, stillbirth
Goodman et al. (2021)	Retrospective Cohort	225	Integrated treatment for opioid use disorder in pregnancy	Preterm birth, neonatal hospital stay, maternal relapse
Aboulkhair et al. (2022)	Quasi-Experimental	108	Continuous care model for bariatric pregnancy	Maternal anemia, gestational diabetes, low birth weight
Milligan et al. (2023)	Population-Based Cohort	884	Integrated vs. standard treatment for substance use in pregnancy	Neonatal outcomes, maternal risk factors, healthcare access
Swain et al. (2021)	Non-Randomized Controlled Trial	782	Preconception care for maternal health	Birth weight, neonatal morbidity, maternal nutrition
Iqbal et al. (2024)	Retrospective Cohort	6,910	Maternal obesity and pregnancy complications	Gestational diabetes, hypertensive disorders, cesarean section rates

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DISCUSSION

The findings of this systematic review indicate that integrated care models significantly improve maternal and neonatal outcomes in pregnant women with endocrine disorders. Across the included studies, multidisciplinary care approaches were associated with reduced maternal complications such as hypertensive disorders, gestational diabetes, and preterm birth, while neonatal outcomes, including birth weight and neonatal intensive care unit admissions, also showed improvement. The strength of the evidence lies in the consistency of these findings across different healthcare settings, reinforcing the clinical relevance of integrated care models in managing high-risk pregnancies(8). Comparison with previous literature suggests that integrated care models are more effective than standard obstetric care alone. Prior systematic reviews on gestational diabetes management have highlighted the importance of early intervention and continuous monitoring, findings that align with studies included in this review demonstrating improved neonatal outcomes with structured, multidisciplinary care (3). Similarly, studies on hypothyroidism in pregnancy have emphasized the necessity of maintaining optimal thyroid hormone levels to prevent adverse fetal outcomes, which this review corroborates through evidence showing fewer preterm births and neonatal complications in pregnancies managed within an integrated care framework (2). The observed reductions in preterm delivery and neonatal hospital stays in opioid-dependent pregnancies managed with integrated care are consistent with prior research advocating for co-located addiction and obstetric services (7). These alignments reinforce the clinical validity of integrated models while highlighting the need for further comparative studies(15).

This review's strength lies in its comprehensive methodology, including a rigorous search strategy across multiple databases and adherence to PRISMA guidelines. The inclusion of high-quality randomized controlled trials and cohort studies enhances the reliability of the findings. By focusing on recent literature, this review presents an updated synthesis of evidence on integrated care models, contributing to the evolving landscape of maternal healthcare(5). Nevertheless, several limitations should be acknowledged. The variability in study designs and heterogeneity in intervention protocols posed challenges for direct data synthesis. Differences in healthcare systems, resource availability, and patient populations may have influenced the effectiveness of integrated care, limiting the generalizability of findings. The potential for publication bias must also be considered, as studies with negative or inconclusive results may be underrepresented. Furthermore, some included studies had moderate risk of bias, particularly in aspects of blinding and data completeness, which could impact the strength of individual conclusions.

The findings have significant implications for clinical practice and healthcare policy. The demonstrated benefits of integrated care models underscore the need for multidisciplinary collaboration in managing pregnancies complicated by endocrine disorders. Structured coordination between endocrinologists, obstetricians, and neonatal specialists should be prioritized in maternal care guidelines to enhance patient outcomes. Future research should focus on large-scale randomized trials to further quantify the impact of integrated models, particularly in diverse healthcare settings. Additionally, cost-effectiveness analyses are warranted to evaluate the sustainability of these interventions and support their broader implementation in clinical practice.

CONCLUSION

The findings of this systematic review highlight the significant benefits of integrated care models in improving maternal and neonatal outcomes in pregnant women with endocrine disorders. Multidisciplinary approaches were associated with reduced risks of gestational complications, including hypertensive disorders, gestational diabetes, and preterm birth, while neonatal outcomes such as birth weight and intensive care unit admissions also showed improvement. These results emphasize the clinical significance of structured, patient-centered care models in optimizing pregnancy management and reducing adverse outcomes. The strength of the evidence supports the integration of endocrinology and obstetric services to enhance maternal and fetal health. However, given the heterogeneity in study designs and healthcare settings, further large-scale randomized trials are needed to confirm these findings, refine best practices, and evaluate the cost-effectiveness of integrated care approaches. Future research should focus on standardizing multidisciplinary interventions and assessing their long-term impact on maternal and neonatal health outcomes.

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AUTHOR CONTRIBUTIONS

Author	Contribution
Atif Ullah	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Sangeet Rabi	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Noor Islam	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Noor Ur Rehman	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Mahboob Rahman Siddeiqe	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Qasim Zia	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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