The Review Of
DIABETIC
STUDIES OPEN ACCESS

Synergistic Pathways In Health Sciences: An Interdisciplinary Research Team In Nursing, Midwifery, Pharmacy, Nutrition, And Medical Administration

Abdalelah Helyyel Homod Alharbi[1],Jafar Hualyyil H. Alharbi[2],Abdulmajeed Mohammed Almutairi[3], Asem Hamdan Aljehany[4], Abdullah Abdulkarim Zaidan Al-Shammari[5], Ayed Raja Ayed Alshammari[6], Mohammed Matrouk Mashid Alshammari[7], Mahli Mahga Matar Al-Armani[8],Najah Atiah Alamrani[9], Naji Salem Raja Alolyuni, Nurse[10], Faisal Mohammed Alharbi[11],Abdulaziz Abdullah Sanad Alhamyani[12]

[1]Pharmacy Technician, King Abdullah Medical Complex, Jeddah, Saudi Arabia.
[2]Pharmacist, King Abdullah Medical Complex, Jeddah, Saudi Arabia.
Pharmacist, King Abdullah Medical Complex, Jeddah, Saudi Arabia.
[4]Pharmacy Technician, King Abdullah Medical Complex, Jeddah, Saudi Arabia.
[5]Medical Secretarial Technician, Medical Coordination and Treatment Eligibility Department, King Khalid Hospital, Hail Health Cluster, Hail, Saudi Arabia.
[6]Medical Secretarial Technician, Medical Appointments & Referrals Coordination Department, Hail Health Cluster, Hail, Saudi Arabia.
[7]Clinical Nutrition Specialist, Mawqaq General Hospital, Hail Health Cluster, Hail, Saudi Arabia.
[8]Medical Secretarial Technician, Emergency Reception Department, Hail General Hospital, Hail Health Cluster, Hail, Saudi Arabia.
[9]Advanced Nursing Practice Specialist, Tabuk Health Cluster, Tabuk, Saudi Arabia.
[10]Erada and Mental Health Complex, Saudi Arabia.
[11]Pharmacy, King Fahad Hospital, Madinah Health Cluster, Saudi Arabia.
[12]Pharmacy Technician, Taif, Makkah Region, Saudi Arabia.

Abstract

The contemporary landscape of global health, particularly within the Middle East and North Africa (MENA) region, is characterized by a rapidly escalating burden of non-communicable diseases (NCDs) and complex maternal-fetal conditions. This systematic review investigates the operational efficacy, clinical impact, and economic viability of interdisciplinary research and clinical teams comprising nursing, midwifery, pharmacy, nutrition, and medical administration. Anchored in the specific epidemiological context of MENA region, the report synthesizes evidence regarding Gestational Diabetes Mellitus (GDM) and pre-eclampsia—two conditions that serve as critical stress tests for health systems. The analysis reveals that the integration of these distinct disciplines into "Synergistic Pathways" creates a total effect greater than the sum of its parts, significantly reducing adverse outcomes such as cesarean sections, neonatal hypoglycemia, and long-term metabolic dysfunction. However, the realization of this synergy is frequently obstructed by administrative fragmentation, resource disparities between urban and rural sectors, and a lack of unified clinical protocols. This report argues that the transition from siloed practice to collaborative, team-based care models is not merely an enhancement of quality but a fundamental necessity for the sustainability of healthcare systems facing modern epidemiological challenges.

1. Introduction: The Imperative for Interdisciplinary Synergy

1.1 The Shifting Paradigm of Clinical Care

Historically, medical practice has operated within a hierarchical, physician-centric model, where allied health professionals function as peripheral support rather than central partners in decision-making. However, the rising complexity of patient needs, driven by the dual burden of infectious diseases and a burgeoning crisis of chronic metabolic conditions, has rendered this singular model insufficient. The

concept of "Synergistic Pathways" in health sciences suggests that optimizing health outcomes requires the synchronized expertise of diverse fields—nursing, midwifery, pharmacy, nutrition, and medical administration [1].

This review posits that synergy is an emergent property of well-structured interdisciplinary teams (MDTs). When a midwife's continuous monitoring is informed by a pharmacist's medication review, supported by a dietitian's nutritional strategy, and enabled by robust medical administration, the result is a comprehensive safety net that prevents morbidity and mortality [2]. The integration of these disciplines facilitates a holistic approach that addresses not just the physiological markers of disease, such as blood glucose or blood pressure, but the behavioral, psychological, and systemic factors that influence health [3].

1.2 The Focus on Maternal-Metabolic Health

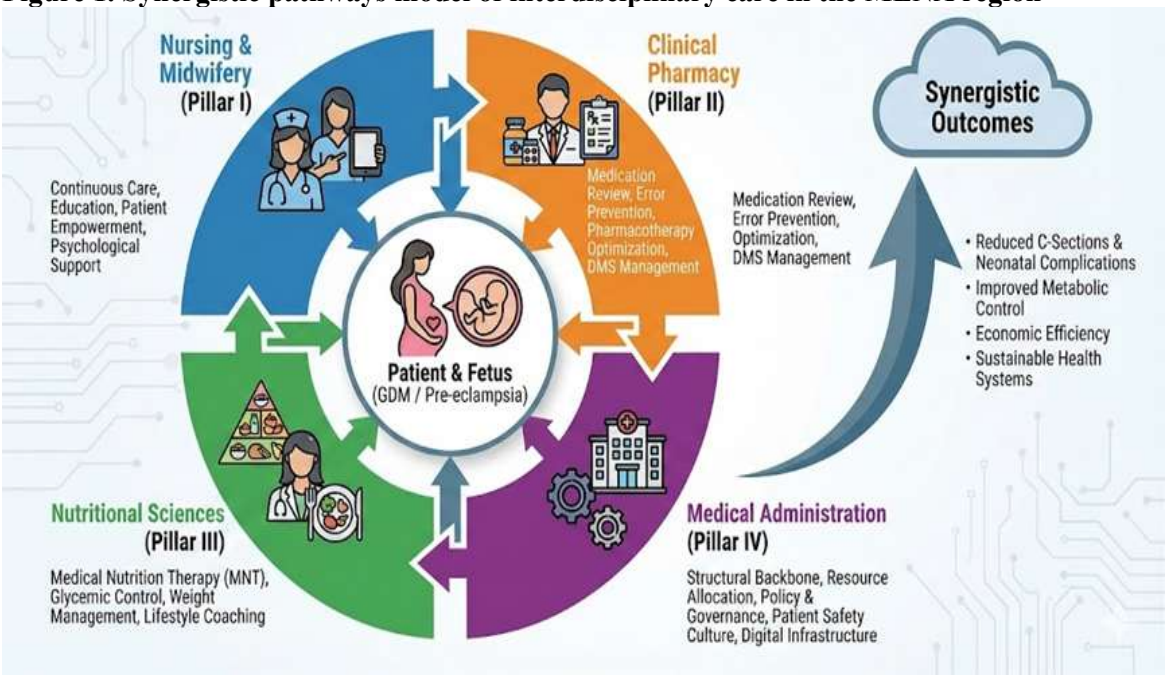
To provide a concrete evaluation of these synergistic pathways, this report focuses on the management of high-risk pregnancies, specifically those complicated by Gestational Diabetes Mellitus (GDM) and pre-eclampsia. These conditions are ideal case studies for interdisciplinary research because their management cannot be contained within a single specialty.

- **GDM** requires intensive lifestyle modification (Nutrition), rigorous monitoring (Nursing), potential insulin therapy (Pharmacy/Medicine), and long-term follow-up to prevent Type 2 Diabetes (Medical Administration) [4, 5].
- **Pre-eclampsia** requires early detection of subtle signs (Midwifery), management of complex medication regimens to prevent seizures (Pharmacy), and rapid, coordinated emergency response protocols (Administration) [6].

1.3 The Geographic and Cultural Context

The analysis is deeply rooted in the context of the MENA region. This region faces unique challenges, including some of the highest diabetes prevalence rates globally, rapid urbanization leading to lifestyle shifts, and a healthcare infrastructure that struggles with fragmentation and resource allocation **[7]**. By examining how interdisciplinary teams function (or fail to function) in this specific environment, the report highlights the critical role of context in the implementation of health science research. The "Synergistic Pathways" explored here are not theoretical abstractions but practical necessities for a healthcare system under significant pressure.

Figure 1. Synergistic pathways model of interdisciplinary care in the MENA region



2. The Epidemiological Imperative: Metabolic and Hypertensive Disorders in the MENA Region

2.1 The Diabetes Epidemic

The necessity for a robust, team-based approach is driven primarily by the sheer scale of the metabolic crisis. The International Diabetes Federation (IDF) lists the MENA region among the world's top areas for the number of patients with diabetes, with the prevalence of Type 2 Diabetes Mellitus (T2DM) estimated at around 15.2% among adults [7]. This background prevalence directly influences maternal health, as the risk factors for T2DM—obesity, physical inactivity, and dietary habits—are the same drivers for GDM.

2.1.1 Rising Prevalence of Gestational Diabetes

Recent prospective cohort studies indicate a worrying trend. The prevalence of GDM has risen from approximately 10.6% in studies conducted prior to 2009 to 14.0% in those conducted post-2010 [8]. In some cohorts, depending on the diagnostic criteria used, prevalence has been reported as high as 18.9% to 24.2%, figures that rival or exceed those found in the Gulf Cooperation Council (GCC) countries like the UAE and Qatar [7].

This statistical variability points to a systemic issue: the lack of unified diagnostic criteria. Some centers utilize the Diabetes in Pregnancy Study Group India (DIPSI) guidelines, while others adhere to the International Association of the Diabetes and Pregnancy Study Groups (IADPSG) criteria. The DIPSI method, being non-fasting, is considered simpler and more economical for low-resource settings like El-Minya, yet the IADPSG criteria are generally more sensitive [8]. This lack of standardization complicates national surveillance and underscores the need for Medical Administration research teams to establish unified protocols.

2.1.2 Unique Risk Factors

The epidemiology of diabetes is complicated by unique local risk factors that require specialized interdisciplinary attention.

- **Hepatitis C Virus (HCV):** A high burden of HCV, which is independently associated with insulin resistance and diabetes [9].
- **Environmental Exposures:** The widespread use of pesticides in the agricultural sector has been identified as a potential contributor to the rising incidence of diabetes [9].
- **Lifestyle and Culture:** Sedentary lifestyles and "bad cultural habits" regarding diet are pervasive. These are not medical problems that can be solved with a pill; they are behavioral issues requiring the intervention of nutritionists and nurses skilled in health promotion [9].

2.2 The Burden of Pre-eclampsia

Parallel to the metabolic burden is the persistent challenge of hypertensive disorders of pregnancy. Pre-eclampsia affects 6–8% of all pregnancies, but in specialized tertiary care centers, this rate climbs to 15% due to the referral of high-risk cases [6]. It remains a leading cause of maternal mortality and morbidity, contributing significantly to preterm births and admission to neonatal intensive care units (NICUs).

Crucially, studies reveal a profound knowledge gap among women regarding the early signs of pre-eclampsia. A significant portion of women, particularly those with lower levels of education or from rural areas, fail to recognize symptoms like severe headache or vision changes until the condition becomes critical [10]. This gap represents a failure of antenatal education, a primary responsibility of the nursing and midwifery workforce.

3. Pillar I: Nursing and Midwifery – The Continuity of Care

In the synergistic model, nurses and midwives provide the "connective tissue" of the healthcare team. While physicians may direct the medical plan, it is the nursing staff who ensure its execution, monitor the patient's daily status, and bridge the gap between clinical jargon and patient understanding.

3.1 Educational Interventions and Patient Empowerment

The management of GDM and pre-eclampsia relies heavily on patient self-efficacy. Women must monitor their blood glucose, adjust their diets, administer insulin, and watch for danger signs. This transfer of responsibility from provider to patient is facilitated through structured nursing education.

3.1.1 Bridging the Knowledge Gap

Research conducted in primary health care settings demonstrates the transformative power of nursing education. A study in Giza showed that a structured educational session significantly improved nurses' own knowledge regarding GDM, which in turn enabled them to better educate patients on diet, fetal movement counting, and exercise [11]. Before such interventions, knowledge gaps among antenatal caregivers were identified as a critical barrier to effective care.

Furthermore, interventions based on theoretical frameworks such as the BASNEF Model (Beliefs, Attitudes, Subjective Norms, and Enabling Factors) have shown robust results. In a randomized controlled trial at El-Shatby Hospital in Alexandria, women who received BASNEF-based education from nursing teams showed significant improvements in knowledge ($p < 0.001$), personal beliefs, and behavioral intentions regarding self-care [12]. This confirms that nursing care moves beyond simple instruction to addressing the psychosocial drivers of health behavior.

3.1.2 Psychological Support and Anxiety Reduction

The diagnosis of a high-risk pregnancy is a significant psychological stressor. Multidisciplinary nursing care has been shown to alleviate this burden.

- **Anxiety Reduction:** Continuous care models led by MDTs differ significantly from routine nursing in their impact on mental health. Studies show that SAS (Self-Rating Anxiety Scale) scores decrease significantly in women receiving MDT care compared to routine groups [4].
- **Group Education:** Women participating in group education sessions report high levels of satisfaction (91.8% satisfied with group size), finding comfort in shared experiences. This format, often facilitated by nurses or midwives, helps normalize the condition and reduces the sense of isolation [13].

3.2 Clinical Impact of Midwifery-Led Care

The presence of a skilled midwife or specialized nurse on the team translates directly into improved hard clinical outcomes.

- **Reduction in Operative Deliveries:** A randomized controlled trial in Tunisia demonstrated that a tailored-care education program implemented by midwives significantly reduced the rate of cesarean sections ($p=0.002$) and preterm labor ($p=0.002$) [14].
- **Neonatal Health:** The same study found significant reductions in newborn respiratory complications ($p=0.01$) and hypoglycemia ($p=0.000$). By ensuring women maintained tighter glycemic control through education, midwives directly protected the neonates from the adverse metabolic effects of maternal hyperglycemia [14].
- **Immune Function:** Interestingly, some research suggests that the improved glycemic control achieved through MDT continuous care correlates with better immune function in newborns, specifically higher IgG levels and optimized T-cell subsets (CD3, CD4) [4].

4. Pillar II: Clinical Pharmacy – Optimizing Pharmacotherapy

The role of the pharmacist in the MENA region is undergoing a vital transformation. Historically viewed as dispensers, pharmacists in interdisciplinary teams are now acting as clinical interventionists, medication safety officers, and educators.

4.1 Medication Review and Error Prevention

In the complex environment of a hospital, particularly in departments managing high-risk pregnancies or comorbidities like cardiac disease, medication errors are a latent threat. A prospective study in general hospital highlighted the critical safety role of the clinical pharmacist.

- **Intervention Rates:** Pharmacists in the study recorded between 241 and 519 interventions per month, identifying prescribing errors and administration errors [15].
- **Team Dynamics:** The study revealed a high level of synergy between nurses and pharmacists, with nurses accepting nearly all interventions aimed at reducing administration errors. However, physician resistance remained a challenge, with a 21% resistance rate to pharmacist recommendations, highlighting an area where Medical Administration needs to foster a more collaborative culture [15].

4.2 Diabetes Management Systems (DMS)

For GDM management, the clinical pharmacist is pivotal in the titration of insulin and the management of oral hypoglycemic agents (where applicable).

- **Superior Control:** Trials comparing pharmacist-led Diabetes Management Systems (DMS) against conventional care have found the pharmacist-led model to be more feasible and effective in improving blood glucose control [16]. By taking ownership of the glycemic targets, pharmacists free up obstetricians to focus on fetal monitoring and maternal obstetrical health.
- **Community Engagement:** Pharmacists are often the most accessible healthcare professionals. However, studies suggest that community pharmacists' knowledge regarding diabetes management during specific cultural periods, such as Ramadan, varies [17]. This indicates a need for structured, ongoing training programs to ensure that the advice given at the community pharmacy counter aligns with the specialized care plans generated in the hospital.

4.3 Economic Impact of Clinical Pharmacy

Beyond safety, the clinical pharmacist contributes to the economic efficiency of the health system. By preventing adverse drug events (ADEs) and optimizing medication choices (e.g., using the most cost-effective insulin regimens), they reduce the overall cost of care. While specific cost-saving figures require further study, global data supports the cost-effectiveness of pharmacist interventions in diabetes care [18].

5. Pillar III: Nutritional Sciences – The First Line of Defense

In the management of Gestational Diabetes, Medical Nutrition Therapy (MNT) is not an adjunct; it is the primary therapeutic intervention. The goal is to achieve euglycemia and appropriate gestational weight gain (GWG) without compromising fetal development.

5.1 Efficacy of Nutritional Counseling

Systematic reviews and randomized trials consistently demonstrate that when GDM is managed with robust nutritional counseling, outcomes improve dramatically.

- **Prevention of Hypertension:** Dietary interventions have been associated with a statistically significant lower incidence of gestational hypertension (Odds Ratio 0.28) and GDM itself (Odds Ratio 0.33) compared to standard care [19].
- **Weight Management:** Women receiving nutritional counseling at health centers demonstrate a lower hazard ratio for abnormal gestational weight gain. This is critical, as excessive weight gain is a strong predictor of macrosomia and future obesity for both mother and child [20].
- **Glycemic Targets:** It is estimated that 70-90% of women diagnosed with GDM can achieve targeted glycemic goals with lifestyle modification and nutrition therapy alone, sparing them the need for insulin injections [21].

5.2 Cultural and Structural Barriers to MNT

Despite its proven efficacy, the implementation of nutritional science faces significant structural hurdles.

- **Workforce Shortage:** A major limitation identified in GDM studies is the "lack of structured dietitians" to explain the role of MNT. In many settings, this task falls to overworked physicians who may lack the time or specialized training to provide detailed dietary coaching [22].
- **Cultural Habits:** "Bad cultural habits" and changing eating patterns are cited as primary drivers of the diabetes epidemic [9]. Dietary counseling in this context cannot be generic; it must be culturally tailored. It requires a deep understanding of local foods, cooking methods, and social norms around eating (e.g., communal meals, feasting during holidays).
- **Compliance:** Without the ongoing support of a nutritionist, compliance with dietary recommendations is often low. Women may struggle to understand the nuances of glycemic index or portion control without practical, hands-on guidance [22].

6. Pillar IV: Medical Administration – The Structural Backbone

While clinical practitioners deliver care, Medical Administration creates the environment in which that care is delivered. In the MENA region, administrative challenges are often the rate-limiting step in the

quality of healthcare.

6.1 Governance, Policy, and Resource Allocation

The disparity in healthcare resources between urban centers and rural areas is a profound administrative challenge.

- **Resource Imbalance:** High-quality medical resources are often concentrated in university hospitals, leaving rural areas with scarce infrastructure. This "imbalanced allocation" hinders the achievement of universal health coverage and exacerbates health inequities [23].
- **Referral Systems:** A critical failure point is the lack of formal referral systems within the Ministry of Health delivery system. Diabetic patients often drift between private clinics and public hospitals without a cohesive care plan, leading to fragmented management [24]. Administrators are responsible for building the "bridges" between primary care and specialized centers.
- **Policy Support:** Implementation of evidence-based Clinical Practice Guidelines (CPGs) is often stalled by a "lack of policymaker support" and a lack of motivation among staff. Administrators serve as the change agents who must drive the adoption of new protocols [25].

6.2 Patient Safety and Institutional Culture

Administrative leadership defines the culture of a hospital. This impacts everything from patient safety to patient satisfaction.

- **Staff Identification:** Ensuring that all medical staff are properly identified is a basic safety standard, yet compliance can be an issue in hospitals without strict administrative oversight [26].
- **Patient Experience:** Qualitative research reveals that administrative failures manifest in "bad behavior" by staff. Women have reported being shouted at or treated with disrespect, which acts as a significant barrier to accessing antenatal care [27]. A synergistic team cannot function if the institutional culture tolerates disrespect.
- **Safety Culture:** The "medical administrator" is pivotal in establishing a culture where safety is paramount, ensuring that nurses and pharmacists feel empowered to speak up about errors without fear of retribution [26].

6.3 Digital Infrastructure and Information Management

The future of synergistic care relies on data sharing. Administrators are the custodians of this infrastructure.

- **Data Security:** Nurses and administrators must navigate the complex ethical and legal landscape of sharing patient information among team members while maintaining confidentiality. Robust access management protocols are required to prevent data breaches [28].
- **Digital Fatigue:** As hospitals digitize, administrators must also be wary of "digital fatigue" among staff, which can lead to burnout. Effective administration involves selecting user-friendly systems that augment rather than hinder clinical workflows [29].

7. Synergistic Mechanisms: Integrated Care Pathways (ICPs)

Synergy is not automatic; it must be engineered. Integrated Care Pathways (ICPs) and the Chronic Care Model (CCM) provide the structural framework that binds the disciplines of nursing, pharmacy, nutrition, and administration together.

7.1 The Chronic Care Model (CCM) in Action

The CCM shifts the focus from acute, reactive care to proactive, planned management. In the context of GDM, this model has shown significant promise.

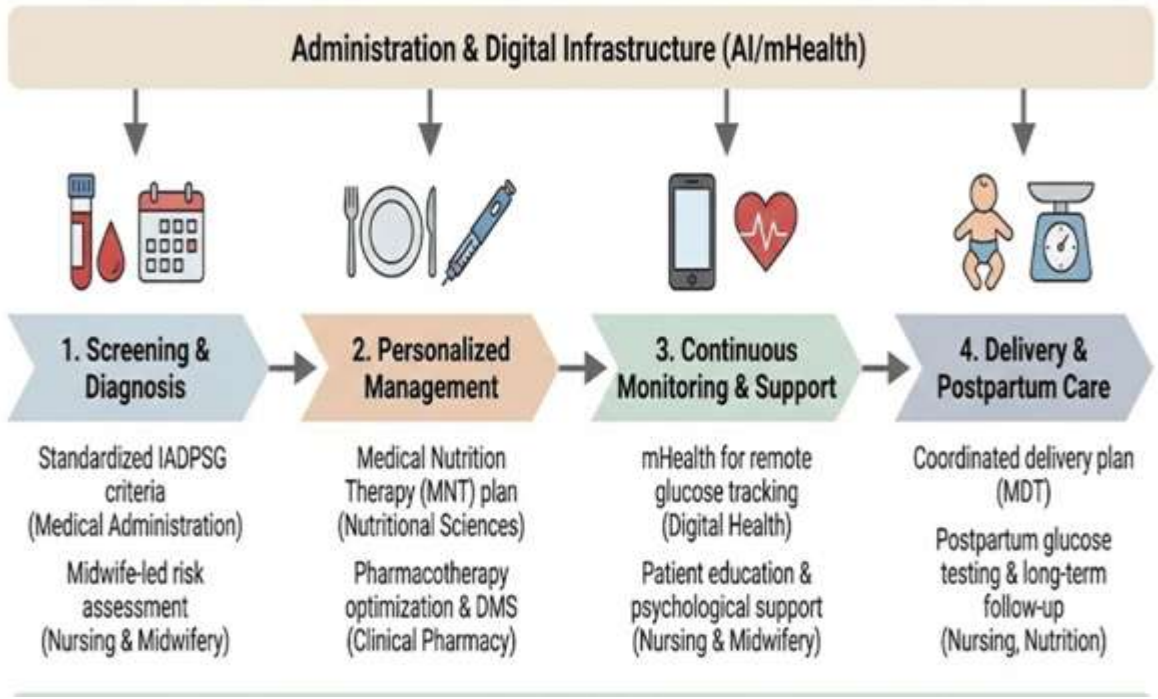
- **Continuous Care:** Studies employing "MDT continuous care" based on CCM principles report significantly better outcomes than routine care. This involves regular, scheduled follow-ups where the patient sees multiple team members in a coordinated visit [4].
- **Holistic Approach:** The model integrates community resources, self-management support (Nursing), delivery system design (Administration), and decision support (Medical protocols). This structure ensures that no aspect of the patient's health is overlooked [30].

7.2 Team Dynamics and "Synergy"

Qualitative research on healthcare teams in the region sheds light on what makes these collaborations work—and what breaks them.

- **Facilitators:** Mutual respect and clear role definition are the bedrock of synergy. When team members understand and value each other's contributions, patient care becomes "easier and more professional" [31]. The synergy is also enhanced by "enabling processes" at the interpersonal level, such as effective communication and conflict resolution mechanisms [32].
- **Barriers:** Hierarchy remains a persistent barrier. The "medical" (physician) perspective often dominates, potentially silencing the valuable inputs of nurses or dietitians. "Lack of effective communication" is frequently cited as a barrier to guideline implementation [33].
- **Configuration Analysis:** Drawing from broader research on synergistic pathways, it is evident that no single factor (e.g., just adding a pharmacist) is sufficient. It is the configuration of multiple factors—resources, leadership, and team competency—that leads to high-quality outcomes. This "configurational" view helps explain why simply hiring more staff doesn't always improve care if the administrative structures aren't in place to support them [29].

Figure 2. Integrated care pathway for GDM management in the MENA region



8. Economic Analysis: The Value of Multidisciplinary Care

In resource-constrained settings, every healthcare pound must be justified. The economic evidence overwhelmingly supports the MDT model for diabetes and GDM management.

8.1 Cost-Effectiveness of GDM Interventions

- **Global Comparisons:** Studies from diverse economic settings, including India (Low-Middle Income) and Israel (High Income), suggest that GDM interventions are highly cost-effective. The cost per Disability-Adjusted Life Year (DALY) averted can be as low as $1,626, well within World Health Organization standards for cost-effectiveness [34].
- **Treating Mild GDM:** Even treating mild cases of GDM is cost-effective (approx. $20,412 per Quality-Adjusted Life Year or QALY), primarily because it prevents expensive neonatal intensive care unit (NICU) admissions and long-term maternal complications [35].
- **Early Diagnosis:** Recent secondary analyses of the TOBOGM study indicate that diagnosing and treating GDM early (before 20 weeks) is not only cost-effective but potentially cost-saving. It reduces composite adverse pregnancy outcomes by 5.6%, saving the health system the costs associated with managing these complications [36].

8.2 Long-Term Economic Benefits

The most compelling economic argument lies in the prevention of chronic disease.

- **Complication Costs:** Predictive models show that MDT care, by improving glycemic control (reducing HbA1c by 1%), can result in average incremental cost savings of $22,869 per diabetic patient over a lifetime. This is due to the prevention of costly complications such as retinopathy, renal failure, and cardiovascular events [37].
- **Preventive Cardiology:** Investing in "preventive cardiology" within the diabetes team is expected to significantly cut morbidity and mortality. Given that current spending on diabetes is relatively low ($116 per patient per year), increasing upfront investment in MDTs could yield massive downstream savings by preventing the progression to end-stage renal disease and blindness [9].

9. Future Directions: Digital Health and Artificial Intelligence

The "Synergistic Pathway" of the future will be paved with digital tools. Technology offers the potential to bridge the resource gaps identified in rural areas and to augment the capabilities of the human team.

9.1 mHealth and Telemedicine

Mobile health (mHealth) applications are emerging as a critical facilitator of continuous care.

- **Remote Monitoring:** mHealth allows for the transmission of blood glucose data from the patient's home directly to the clinical team. This enables "virtual rounds" where the nurse and pharmacist can review data and adjust therapy without a hospital visit [38].
- **Patient Preference:** Surveys indicate a strong preference among women for smartphone apps that integrate testing, education, and communication. These tools can deliver the "nursing education" pillar in a scalable, on-demand format [39].

9.2 Artificial Intelligence (AI) in the MDT

AI is poised to transform the administrative and diagnostic aspects of the team.

- **Job Augmentation:** In interdisciplinary professions, AI acts as a powerful augmenting tool. It can handle routine data analysis (e.g., scanning glucose logs for patterns), allowing human practitioners to focus on complex problem-solving and interpersonal empathy [26].
- **Risk Prediction:** AI models are being developed to predict which women with GDM are at highest risk of developing T2DM or pre-eclampsia, allowing the team to stratify risk and allocate scarce resources to those who need them most [40].

10. Conclusion

The management of complex health challenges in the 21st century—exemplified by the rising tide of Gestational Diabetes and pre-eclampsia in the MENA region—demands a fundamental restructuring of clinical practice. The "Synergistic Pathways" model, integrating Nursing, Midwifery, Pharmacy, Nutrition, and Medical Administration, offers a proven solution to the limitations of fragmented, physician-centric care.

10.1 Synthesis of Findings

The evidence synthesized in this review demonstrates that:

1. **Clinical Synergy is Real:** The integration of these disciplines leads to statistically significant reductions in cesarean sections, neonatal hypoglycemia, and macrosomia. It improves maternal knowledge and self-care behaviors significantly more than routine care.
2. **The Human Element is Key:** The educational and psychological support provided by nurses and midwives is not a "soft" extra; it is a clinical necessity that drives compliance and satisfaction.
3. **Administration is the Enabler:** Without strong governance, resource allocation, and a culture of safety, clinical teams cannot function. The disparity between urban and rural resources remains a critical administrative challenge.
4. **Economic Viability:** The model is highly cost-effective, offering a path to sustainable healthcare financing through the prevention of chronic disease complications.

10.2 Recommendations

For health systems in the MENA region, the path forward involves:

- **Standardization:** Adopting unified national criteria for GDM screening (IADPSG) to ensure consistent data and care.
- **Workforce Investment:** Formally recognizing and funding the roles of clinical pharmacists and dietitians in antenatal care.
- **Administrative Reform:** investing in leadership training for medical administrators to foster a culture of interdisciplinary respect and safety.
- **Digital Adoption:** aggressively deploying mHealth solutions to extend the reach of the specialized team to rural and underserved populations.

By embracing these synergistic pathways, the health sciences community can transform the challenge of the NCD epidemic into an opportunity for comprehensive, patient-centered excellence.

Data Summary Tables

Table 1: Comparative Outcomes of MDT vs. Routine Care in Gestational Diabetes

Outcome Parameter	Routine Care Risk / Incidence	MDT Intervention Impact	Statistical Significance	Source
Cesarean Section	Higher baseline (Risk Ratio ~1.35 w/ GDM)	Significantly Reduced	$p < 0.05$	[4]
Macrosomia	Higher incidence	Significantly Reduced	$p < 0.05$	[4]
Neonatal Hypoglycemia	Higher incidence	Significantly Reduced	$p < 0.05$	[14]
Gestational Hypertension	Standard risk	Odds Ratio 0.28	Significant	[19]
Self-Care Knowledge	Low (<50% high proficiency)	Increased to >70%	$p < 0.001$	[41]
Patient Satisfaction	Variable	High (91.8% satisfied)	N/A	[13]

Table 2: Economic Implications of GDM Management

Intervention Strategy	Cost-Effectiveness Metric	Economic Outcome	Source
GDM Screening/Treatment	Cost per DALY averted	~$1,626 (India) to $1,830 (Israel)	[34]
Treating Mild GDM	Cost per QALY	~$20,412	[35]
Early Diagnosis (<20 wks)	Composite Adverse Outcomes	Cost-saving (5.6% reduction in adverse outcomes)	[36]
HbA1c Reduction (1%)	Lifetime Cost Savings	~$22,869 per patient	[37]

References

[1] Sallinen, E., Mikkola, L., Fox, S., and Parviainen, H., From leader to peer–specializing physicians' understanding of their multiple positions in interprofessional health care teams. Medical Education Online, 30(1). 2534058 (2025).

[2] Bendowska, A. and Baum, E., The Significance of Cooperation in Interdisciplinary Health Care Teams as Perceived by Polish Medical Students. Int J Environ Res Public Health, 20(2) (2023).

[3] McLaney, E., Morassaei, S., Hughes, L., Davies, R., Campbell, M., and Di Prospero, L. A framework for interprofessional team collaboration in a hospital setting: Advancing team competencies and behaviours. in Healthcare management forum. 2022. SAGE Publications Sage CA: Los Angeles, CA.

[4] Qi, S. and Dong, Y., Effect of Multidisciplinary Team Continuous Nursing on Glucose and Lipid

Metabolism, Pregnancy Outcome, and Neonatal Immune Function in Gestational Diabetes Mellitus. Dis Markers, 2022. 7285639 (2022).
[5] Abdullah, A.R., Seliem, M.A., Khidr, E.G., Sobhy, A.M., El-Shiekh, R.A., Hafeez, M.S., and El-Husseiny, A.A., A comprehensive review on diabetic cardiomyopathy (DCM): histological spectrum, diagnosis, pathogenesis, and management with conventional treatments and natural compounds. Naunyn-Schmiedeberg's Archives of Pharmacology. 1-41 (2025).
[6] Moustfa, S.A., Mohamed, F.G., and Mohamed, A.F., Effect of Continuous Care Model on Lifestyle Modification and Pre-eclampsia Control among Pregnant Women. International Egyptian Journal of Nursing Sciences and Research, 5(1). 1-16 (2024).
[7] Agarwal, M.M., Gestational Diabetes in the Arab Gulf Countries: Sitting on a Land-Mine. Int J Environ Res Public Health, 17(24) (2020).
[8] Eltoony, L., Khalifa, W., Mobarkout, H., Ahmad, N., Elhadidy, K., Mashahet, M., Salem, E., Abbas, A., Shaaban, O., Yousef, H., and Din, U., Universal screening of gestational diabetes mellitus in Upper Egypt: Prospective cohort study of the prevalence, risk factors, and short-term outcomes. Urology & Nephrology Open Access Journal, 11. 79-83 (2023).
[9] Abouzid, M.R., Ali, K., Elkhawas, I., and Elshafei, S.M., An Overview of Diabetes Mellitus in Egypt and the Significance of Integrating Preventive Cardiology in Diabetes Management. Cureus, 14(7). e27066 (2022).
[10] Ahmed Mohamed, E.M., Youness, E.M., and Hasab Allah, M.F., Impact of self-Care guidelines on women's awareness and identification of early signs and symptoms of preeclampsia. Minia Scientific Nursing Journal, 12(1). 2-9 (2022).
[11] Afefy, N., Effect of Structured Educational Session about Gestational Diabetes on Maternity Nurse's Knowledge at Selected Primary Health Care Hospitals, Egypt. Vol.8, No.17, 2017 (2018).
[12] Lamadah, S.M., Ibrahim, H.A., Elgzar, W.T., El-Sayed, H.A., Sayed, S.H., and El-Houfey, A., Gestational Diabetes Self-Care Behavior: An Empowerment Educational Intervention Based on BASNEF Model. Iran J Nurs Midwifery Res, 27(6). 538-546 (2022).
[13] Minschart, C., Amuli, K., Delameillieure, A., Calewaert, P., Mathieu, C., and Benhalima, K., Multidisciplinary group education for gestational diabetes mellitus: a prospective observational cohort study. Journal of clinical medicine, 9(2). 509 (2020).
[14] Chahed, S., Lassouad, L., Dardouri, M., Mtiraoui, A., Maaroufi, A., and Khairi, H., Impact of a tailored-care education programme on maternal and neonatal outcomes in pregnant women with gestational diabetes: a randomized controlled trial. Pan Afr Med J, 43. 128 (2022).
[15] Sabry, N.A. and Abbassi, M.M., Impact of a clinical pharmacist in the general hospital: an Egyptian trial. Pharmacology & Pharmacy, 5(6). 577-587 (2014).
[16] C Ji, C.J. and LJ Sun, L., Impact of clinical pharmacist intervention on blood glucose control and perinatal outcomes in gestational diabetes mellitus through a diabetes management system. (2020).
[17] Amin, M.E. and Chewning, B., Community pharmacists' knowledge of diabetes management during Ramadan in Egypt. International journal of clinical pharmacy, 36(6). 1213-1221 (2014).
[18] Bakhsh, H.T., Impact of Pharmacist Interventions on Health Outcomes of Patients with Type 2 Diabetes Mellitus in the Middle East: A Systematic Review. Integr Pharm Res Pract, 14. 85-98 (2025).
[19] Madhuvrata, P., Govinden, G., Bustani, R., Song, S., and Farrell, T.A., Prevention of gestational diabetes in pregnant women with risk factors for gestational diabetes: a systematic review and meta-analysis of randomised trials. Obstet Med, 8(2). 68-85 (2015).
[20] Zare, M., Olyaeemanesh, A., Torabi, P., Dolati, S., Fallah, H., Zabihi, M., Jafari, M., Kavoosi, E., Baghban, F., Shahsavani, Z., Maharat, M., Esmaillzadeh, A., Farshidi, H., Tabaeifard, R., and Azadbakht, L., Effectiveness of nutrition counseling in managing gestational weight gain and infant outcomes: a retrospective cohort study. BMC Nutr, 11(1). 53 (2025).
[21] El Sayed, H.A.E. and sobhy El Sayed, D.M., The Effect of Nutritional Program on the Health of Woman with Gestational Diabetes and Their outcome at Benha City. (
[22] El Toony, L.F., Omaima, E.-G.M., Khalifa, W.A., and Rowyda, E.-S.G., Screening and diagnosis of gestational diabetes mellitus in a primary health-care center in Assiut. Egyptian Journal of Obesity, Diabetes and Endocrinology, 5(1) (2020).
[23] Zhao, L., Du, J., Liu, W., Xu, Q., and Zhang, Y., How to strengthen primary health care? An exploratory study on the policy of vertical integration of high-quality medical resources based on symbiosis theory. Frontiers in Public Health, 13. 1578712 (2025).

[24] Ebid, A.I., Mobarez, M.A., Ramadan, R.A., and Mahmoud, M.A., Impact of a Clinical Pharmacist Intervention Program on the Follow-up of Type-2 Diabetic Patients. Hosp Pharm, 57(1). 76-82 (2022).
[25] Almazrou, S.H., Almoajil, H., Alghamdi, S., Althenyan, G., Alqahtani, A., and Amer, Y.S., Assessing barriers and facilitators for implementing clinical practice guidelines in middle Eastern and North African region: Delphi study. Journal of Clinical Medicine, 12(15). 5113 (2023).
[26] Medical Staff Identification Compliance in Egyptian Hospitals: An Analysis of Standards, Challenges, and Implications for Patient Safety. 2025.
[27] Akter, S., Davies, K., Rich, J.L., and Inder, K.J., Barriers to accessing maternal health care services in the Chittagong Hill Tracts, Bangladesh: A qualitative descriptive study of Indigenous women's experiences. PLoS One, 15(8). e0237002 (2020).
[28] Ibrahim, A.M., Abdel-Aziz, H.R., Mohamed, H.A.H., Zaghamir, D.E.F., Wahba, N.M.I., Hassan, G.A., Shaban, M., El-Nablaway, M., Aldughmi, O.N., and Aboelola, T.H., Balancing confidentiality and care coordination: challenges in patient privacy. BMC Nurs, 23(1). 564 (2024).
[29] Dong, Y., Wang, M., Liu, E., and Xing, L., Causes of digital fatigue among hotel employees in the digital age: configuration study based on fsQCA. Asia Pacific Journal of Marketing and Logistics, (2025).
[30] Shahzad, M., Upshur, R., Donnelly, P., Bharmal, A., Wei, X., Feng, P., and Brown, A.D., A population-based approach to integrated healthcare delivery: a scoping review of clinical care and public health collaboration. BMC public health, 19(1). 708 (2019).
[31] Heredia, M., Improving Preeclampsia Education and Assessment Frequency Among Nurses and Patients With Non-Severe Features in a Postpartum Unit. (2023).
[32] Loban, E., Scott, C., Lewis, V., Law, S., and Haggerty, J., Activating Partnership Assets to Produce Synergy in Primary Health Care: A Mixed Methods Study. Healthcare (Basel), 9(8) (2021).
[33] Almazrou, S., Almoajil, H., Alghamdi, S., Althenyan, G., Alqahtani, A., and Amer, Y., Assessing Barriers and Facilitators for Implementing Clinical Practice Guidelines in Middle Eastern and North African Region: Delphi Study. Journal of Clinical Medicine, 12. 5113 (2023).
[34] Marseille, E., Lohse, N., Jiwani, A., Hod, M., Seshiah, V., Yajnik, C.S., Arora, G.P., Balaji, V., Henriksen, O., Lieberman, N., Chen, R., Damm, P., Metzger, B.E., and Kahn, J.G., The cost-effectiveness of gestational diabetes screening including prevention of type 2 diabetes: application of a new model in India and Israel. J Matern Fetal Neonatal Med, 26(8). 802-10 (2013).
[35] Ohno, M.S., Sparks, T.N., Cheng, Y.W., and Caughey, A.B., Treating mild gestational diabetes mellitus: a cost-effectiveness analysis. Am J Obstet Gynecol, 205(3). 282.e1-7 (2011).
[36] Haque, M., Tannous, K., Herman, W., Immanuel, J., Hague, W., Teede, H., Enticott, J., Cheung, N., Hibbert, E., Nolan, C., Peek, M., Wong, V., Flack, J., McLean, M., Sweeting, A., Gianatti, E., Kautzky-Willer, A., Harreiter, J., Mohan, V., and Simmons, D., Cost-effectiveness of diagnosis and treatment of early gestational diabetes mellitus: economic evaluation of the TOBOGM study, an international multicenter randomized controlled trial. eClinicalMedicine, 71. 102610 (2024).
[37] Alshowair, A., Altamimi, S., Alruhaimi, F.A., Alshahrani, S., Alsuwailem, F., Alkhaldi, M., Abdalla, H., Alkhuraiji, F.H., Alaqeel, M.S., and Almureef, S.S., Cost-Savings Associated with Multi-Disciplinary Team Approach for Reducing Macrovascular and Microvascular Complications in Patients with Type 2 Diabetes: A Predictive Model. ClinicoEconomics and Outcomes Research. 211-223 (2024).
[38] Wei, H.X., Yang, Y.L., Luo, T.Y., and Chen, W.Q., Effectiveness of mobile health interventions for pregnant women with gestational diabetes mellitus: a systematic review and meta-analysis. Journal of Obstetrics and Gynaecology, 43(2). 2245906 (2023).
[39] Hewage, S., Audimulam, J., Sullivan, E., Chi, C., Yew, T.W., and Yoong, J., Barriers to gestational diabetes management and preferred interventions for women with gestational diabetes in Singapore: mixed methods study. JMIR Formative Research, 4(6). e14486 (2020).
[40] Eltoony, L., Ibrahem, A., Hafez, M., Ali, O., and Elsewify, W., Prevalence and Risk Factors for Gestational Diabetes in Aswan, Egypt According to International Association of the Diabetes and Pregnancy Study Groups (IADPSG). The Egyptian Journal of Hospital Medicine, 82. 701-707 (2021).
[41] Tawfik, M.Y., The Impact of Health Education Intervention for Prevention and Early Detection of Type 2 Diabetes in Women with Gestational Diabetes. J Community Health, 42(3). 500-510 (2017).