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Telemedicine Monitoring of Gestational Diabetes Mellitus: A 5-Year Observational Study on 4,623 Patients and Its Impact on Hospital Resource Utilization

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ABSTRACT

Background: Gestational diabetes mellitus (GDM) requires continuous metabolic monitoring to prevent obstetric and neonatal complications. This traditionally involves a high volume of in-person outpatient visits.

Objective: To evaluate the clinical and organizational impact of a large-scale, structured telemedicine model implemented over a 5-year period at Mestre Hospital.

Methods: A retrospective observational study was conducted on a cohort of 4,623 consecutive patients diagnosed with GDM. The digital protocol integrated LibreView, LifeScan OneTouch Reveal®, and Contour Next platforms for asynchronous remote transmission of glycemic profiles alongside specialist teleconsultations. Crucially, all utilized platforms were fully compliant with data privacy frameworks, ensuring complete data anonymity. Physical appointments were restricted to initial assessments or non-deferrable clinical instability.

Results: The implementation of the digital care pathway induced a 92.0% reduction in physical outpatient visits compared to historical standard care. On the clinical front, 98.4% of patients achieved optimal metabolic targets. Following the diagnosis of GDM, the spontaneous abortion (miscarriage) rate was 1.34% (n = 62). Subsequent major complication rates among progressing pregnancies were remarkably low, with an incidence of fetal macrosomia at 1.9%, a cesarean delivery rate of 27.0%, and neonatal intensive care unit (NICU) admissions at 1.0%.

Conclusions: Large-scale telemedicine for GDM is a highly efficient, safe, and sustainable strategy. It guarantees excellent metabolic control and obstetric-neonatal outcomes in line with international standards, while drastically mitigating pressure on hospital infrastructures through anonymized and secure data ecosystems.

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Introduction

Gestational diabetes mellitus (GDM) is one of the most common metabolic disorders during pregnancy, with a globally rising prevalence [1-7]. Conventional clinical management demands rigorous daily capillary glucose monitoring combined with frequent in-person specialist evaluations to optimize nutritional plans or adjust insulin therapy. This traditional care paradigm exerts significant pressure on healthcare system resources and lowers the quality of life for pregnant women, who face frequent logistical travel and workplace absences [2]. In recent years, digital health and telemedicine have offered novel methodological opportunities [5,8]. However, scientific literature still lacks robust evidence derived from large-scale, long-term cohorts. This study aims to analyze the clinical efficacy, safety, and logistical sustainability of a structured telemedicine program implemented continuously over five years within a high-volume patient population at Mestre Hospital.

Materials and Methods

Study Design and Population: A single-center retrospective observational study conducted over five consecutive years. The analysis included all consecutive women with a formal diagnosis of GDM according to standard IADPSG consensus criteria, who attended the Unit of Endocrine and Metabolic Diseases at Mestre Hospital, Venice (Italy) [9].

Telemedicine Care Model and Technological Platforms: The included patients (n = 4,623) were assigned glucose monitoring devices (SMBG or flash glucose monitoring) based on individual clinical and therapeutic needs. Asynchronous remote data transmission was standardized using three reference digital ecosystems: (1) LibreView (Abbott) for patients on intensive insulin therapy or requiring flash glucose monitoring; (2) LifeScan

OneTouch Reveal® for tracking capillary profiles through cloud-interfaced glucometers; and (3) Contour Next (Ascensia Diabetes Care) for wireless synchronization and management of capillary glucose data. A fundamental prerequisite of the protocol was that all three utilized platforms permitted complete data anonymity, removing any identifiable personal information from cloud servers to fully comply with modern health data security standards. Glycemic profiles were automatically synchronized to a central clinical dashboard, reviewed periodically and systematically by a dedicated multidisciplinary team consisting exclusively of diabetologists and dietitians.

Synchronous teleconsultations (video or phone) conducted by this team were utilized for nutritional counseling, medical therapy adjustments, insulin prescription, and subsequent dose titration, restricting physical access exclusively to the initial intake visit and cases of clinical instability unmanageable from remote. Insulin therapy was introduced if glycemic targets were unmet, utilizing personalized regimens including single basal insulin injections and/or multiple daily basal-bolus injection therapy.

Evaluated Metrics

The primary endpoint was the percentage change in the total number of physical outpatient visits per patient compared to

the historical in-person control arm. Secondary safety endpoints included the percentage of patients reaching metabolic targets (third-trimester HbA1c), the incidence of spontaneous abortion recorded strictly after GDM diagnosis, and subsequent obstetric and neonatal outcomes.

Results

Over the 5-year observation period, a total of 4,623 patients were enrolled and analyzed. The primary organizational impact metric showed a drastic and statistically significant contraction in physical outpatient visits, quantified as a net 92.0% reduction compared to the pre-implementation historical average [2]. Therapeutically, 12.0% of the cohort (n = 555 patients) required the initiation of insulin therapy during pregnancy (either basal monotherapy or multiple daily injections), while the remaining 88.0% were successfully managed with medical nutrition therapy and physical exercise alone.

Regarding clinical outcomes, 98.4% of the total cohort maintained optimal metabolic control within guideline targets [4,5]. Following the clinical diagnosis of GDM, 62 spontaneous abortions occurred, yielding a miscarriage rate of 1.34% [6,7]. Clinical efficacy data and neonatal outcomes are detailed in Table 1.

Table 1: Clinical and Organizational Outcomes of the Telemedicine Program

Clinical / Organizational Parameter	Telemedicine Cohort (n = 4,623)	Reference Target / Guidelines
Reduction in physical outpatient visits	-92.0%	Primary Endpoint
Patients at metabolic target (HbA1c on target)	98.4% (n = 4,549)	> 90.0% [1,4]
Required insulin therapy (Basal / Multiple)	12.0% (n = 555)	Consistent with literature [8]
Spontaneous abortion (Post-GDM diagnosis)	1.34% (n = 62)	Consistent with epidemiologic baselines [6,7]
Fetal macrosomia incidence (> 4,000 g)	1.9% (n = 88)	< 5.0% [4,9]
Cesarean delivery rate	27.0% (n = 1,248)	In line with national reference data [2]
NICU admission rate (Neonatal ICU)	1.0% (n = 46)	< 2.5% [5]

Discussion

The findings of this extensive five-year analysis confirm that telemedicine represents a structural, safe, and sustainable evolution for managing diabetes in pregnancy [5,8]. The 92% collapse in physical visits is an extraordinary metric in healthcare organization: it allowed massive optimization of clinical staff time—specifically for diabetologists and dietitians—who could manage a high-volume cohort with unprecedented efficiency [3]. Critically, the adoption of digital platforms offering complete data anonymity ensured absolute compliance with security regulations without creating technical friction for data triage.

A 98.4% rate of patients meeting metabolic targets demonstrates that digitalization fosters superior treatment adherence [4]. This optimal control directly prevented feto-neonatal complications, as evidenced by low macrosomia (1.9%) and NICU admission (1.0%) rates [5]. Crucially, the protocol successfully minimized clinical risks while ensuring a secure healthcare ecosystem [10,11].

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