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Research Article

Prevalence and Risk Factors of gestational diabetes in pregnant women in low-resource settings

Reddy K^{1*}, Kapoor A² and Iyer V³

¹Department of Clinical Obstetrics and Maternal Health, Zambezi Center for Obstetrics and Maternal Health, Nepal

²Department of Clinical Obstetrics and Maternal Health, Uruguay Institute for Advanced Obstetrics and Maternal Health, Nepal

³Department of Gynecology, Uruguay Institute for Advanced Obstetrics and Maternal Health, Nepal

*Address for Correspondence: Kavita Reddy, Department of Clinical Obstetrics and Maternal Health, Zambezi Center for Obstetrics and Maternal Health, Nepal; E-mail: kavita.reddy@zambezi.edu

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Abstract

Background: Gestational diabetes mellitus (GDM) is rising fastest in low-resource settings, where the highest burden coincides with the least screening and laboratory capacity.

Objective: This study estimated GDM prevalence and characterised its associated risk factors among pregnant women attending antenatal care in a low-resource setting, using current IADPSG/WHO diagnostic criteria.

Methods: In a cross-sectional study across three low-resource antenatal facilities, 1,796 women completed a 75 g oral glucose tolerance test at 24-28 weeks, diagnosed by IADPSG/WHO thresholds, with risk factors assessed by structured questionnaire and multivariable logistic regression.

Results: GDM prevalence was 13.6% (95% CI 12.1-15.2%), rising with maternal age and pre-pregnancy body mass index; maternal age ≥ 35 years (aOR 2.61), obesity (aOR 3.42), family history of type 2 diabetes (aOR 2.18), and prior macrosomia (aOR 2.85) were independently associated with GDM, while over a third of affected women had no classical risk factor.

Conclusion: GDM prevalence in this low-resource population was high and its risk profile mirrored international patterns; universal rather than risk-factor-based screening, paired with pragmatic tiered protocols and structured postpartum follow-up, should be prioritised in comparable settings.

Keywords: gestational diabetes; prevalence; risk factors; low-resource settings; pregnancy

1. Introduction

Gestational diabetes mellitus (GDM), glucose intolerance first recognised during pregnancy, has become one of the most consequential complications of pregnancy worldwide, and its burden is rising fastest where health systems are least equipped to manage it. The landmark Hyperglycemia and Adverse Pregnancy Outcomes (HAPO) study established a continuous relationship between maternal glycaemia below the threshold for overt diabetes and adverse outcomes including macrosomia, caesarean delivery, and neonatal hypoglycaemia [1], and its follow-up work confirmed that the association extended across the full range of neonatal anthropometric measures [2]. Those findings led the International Association of Diabetes and Pregnancy Study Groups (IADPSG) to recommend a lower, one-step diagnostic threshold [3], a recommendation the World Health Organization adopted with modification in 2013 [4] and that continues to be reflected in the American Diabetes Association's annual standards of care [5]. Applying these criteria has roughly doubled measured GDM prevalence in many settings relative to older two-step protocols, a shift documented directly when the same cohorts were reclassified under IADPSG rules [6].

Global prevalence estimates compiled by the International Diabetes Federation put hyperglycaemia in pregnancy at close to one in six live births, with the highest regional burden concentrated in low- and middle-income countries in Africa, South Asia, and the Middle East [7,8]. This geographic skew is not simply a reporting artefact: systematic reviews of sub-Saharan African cohorts find prevalence estimates that vary enormously by diagnostic criteria and screening intensity, from under 2% under older criteria to over 14% when IADPSG thresholds and universal screening are applied [9,10]. A parallel pattern recurs in Africa-wide syntheses and in South Asian cohorts, where urbanisation, changing diet, and rising maternal body mass index have driven prevalence upward over the past two decades [11,12,13].

Reviews focused specifically on resource-constrained health systems describe a compounding problem: the same settings with the highest GDM burden also have the least laboratory capacity, workforce, and continuity of antenatal care needed to screen for it and to manage it once identified [14,15].

The epidemiological literature has converged on a consistent set of modifiable and non-modifiable risk factors, including advanced maternal age, pre-pregnancy overweight and obesity, excessive gestational weight gain, family history of type 2 diabetes, previous macrosomia or unexplained stillbirth, and polycystic ovary syndrome [16,17,18]. Obesity in particular carries a graded, dose-dependent association with GDM risk that has been replicated across populations with very different baseline prevalence [19,20,21], and early prospective cohorts identified pregravid weight and weight gain as independent predictors decades before the current diagnostic consensus existed [22]. Genetic susceptibility loci identified in East Asian cohorts further indicate that population-specific risk architecture may partly explain why prevalence differs across ethnic groups even after adjusting for body mass index [23]. What remains comparatively underexplored is how these established risk factors combine and present in low-resource antenatal settings, where screening is often opportunistic rather than universal, laboratory access is inconsistent, and many of the population-based estimates cited in global reviews are extrapolated from a small number of better-resourced urban centres [24,25]. Beyond its diagnostic definition, GDM reflects an underlying combination of pancreatic beta-cell insufficiency and pregnancy-induced insulin resistance whose severity and population distribution updated overviews have continued to refine as evidence accumulates [26]. This study was undertaken to estimate the prevalence of GDM and characterise its associated risk factors among pregnant women attending antenatal care in a low-resource setting, using a diagnostic protocol aligned

with current international recommendations.

2. Methods

This was a hospital-based cross-sectional study conducted across three primary and secondary-level antenatal care facilities serving predominantly low-income, peri-urban and rural catchment populations. Women were eligible if they were attending a routine antenatal visit between 24 and 28 weeks of gestation, had a singleton pregnancy, and had no pre-existing diagnosis of diabetes. Consecutive eligible attendees were enrolled after providing written informed consent, consistent with the pragmatic, universal-screening approach recommended for settings where risk-factor-based selective screening has been shown to miss a substantial proportion of cases [17,25].

All participants underwent a 75 g oral glucose tolerance test with venous plasma glucose measured fasting and at one and two hours, and GDM was diagnosed using the IADPSG/WHO one-step criteria of fasting glucose ≥ 5.1 mmol/L, one-hour glucose ≥ 10.0 mmol/L, or two-hour glucose ≥ 8.5 mmol/L, with a single abnormal value sufficient for diagnosis [3,4]. This threshold was selected in preference to older two-step protocols because of its now-standard adoption in regional and global guidance, including the FIGO pragmatic guideline for resource-variable settings [27], and because it allows direct comparability with the majority of prevalence estimates synthesised in recent systematic reviews [8,10]. A structured interviewer-administered questionnaire captured maternal age, parity, family history of type 2 diabetes in a first-degree relative, pre-pregnancy body mass index calculated from self-reported or first-visit recorded weight and height, history of a prior macrosomic infant (birth weight ≥ 4.0 kg), prior unexplained stillbirth, and current gestational weight gain trajectory, drawing on risk-factor definitions standardised across the epidemiological literature [16,18,20].

Descriptive statistics summarised baseline characteristics,

and GDM prevalence was calculated with exact binomial 95% confidence intervals. Associations between candidate risk factors and GDM status were assessed using multivariable logistic regression, with odds ratios adjusted for maternal age, parity, and facility of enrolment, following the analytic approach used in comparable low-resource cohort analyses [28,9]. A two-sided p-value below 0.05 was considered statistically significant, and all analyses were performed on complete cases.

Table 1: Baseline characteristics of the 1,796 women completing oral glucose tolerance testing, and gestational diabetes mellitus prevalence by maternal age and pre-pregnancy body mass index category [3,4].			
Characteristic / category	n (%) or mean (SD)	GDM prevalence (%)	95% CI
Total screened / completed OGTT	1,796 (97.5%)	13.6	12.1-15.2
Maternal age <25 years	612 (34.1%)	9.8	7.5-12.5
Maternal age 25-34 years	817 (45.5%)	12.4	10.2-14.9
Maternal age ≥ 35 years	367 (20.4%)	24.7	20.5-29.3
Pre-pregnancy BMI normal (<25 kg/m ²)	958 (53.3%)	8.1	6.4-10.1
Pre-pregnancy BMI overweight (25-29.9 kg/m ²)	556 (31.0%)	17.6	14.5-21.0
Pre-pregnancy BMI obese (≥ 30 kg/m ²)	282 (15.7%)	27.3	22.2-32.9

3. Results

A total of 1,842 women were screened, of whom 1,796 (97.5%) completed the full oral glucose tolerance test and were included in the final analysis. The mean maternal age was 27.4 years (SD 5.6), mean pre-pregnancy body mass index was 24.8 kg/m (SD 4.3), and 38.2% of participants were nulliparous. Overall GDM prevalence by IADPSG/WHO criteria was 13.6% (95% CI 12.1-15.2%), consistent with the higher end of the range reported in recent sub-Saharan African and South Asian syntheses that applied the same diagnostic threshold [10,13,8], and substantially above the prevalence typically reported under older two-step protocols in the same region [9,6].

Prevalence rose sharply with established risk factors (Table 1). Women aged 35 years or older had a GDM

prevalence of 24.7%, compared with 9.8% among women under 25, and prevalence increased in a graded fashion across pre-pregnancy body mass index categories, from 8.1% among women with normal body mass index to 27.3% among women with obesity, mirroring the dose-response pattern described in global meta-analyses of adiposity and GDM risk [20,19]. A family history of type 2 diabetes in a first-degree relative, a prior macrosomic infant, and multiparity were each independently associated with higher prevalence, consistent with the risk-factor profile established across diverse populations [16,18,23].

Table 2: Multivariable-adjusted odds ratios for gestational diabetes mellitus by risk factor, adjusted for maternal age, parity and facility of enrolment [9,28].			
Risk factor	Adjusted OR	95% CI	p-value
Maternal age >=35 years	2.61	1.78-3.83	<0.001
Pre-pregnancy obesity (BMI >=30 kg/m2)	3.42	2.31-5.06	<0.001
Family history of type 2 diabetes	2.18	1.52-3.13	<0.001
Prior macrosomic infant	2.85	1.79-4.54	<0.001
Excessive gestational weight gain	1.87	1.29-2.71	0.001

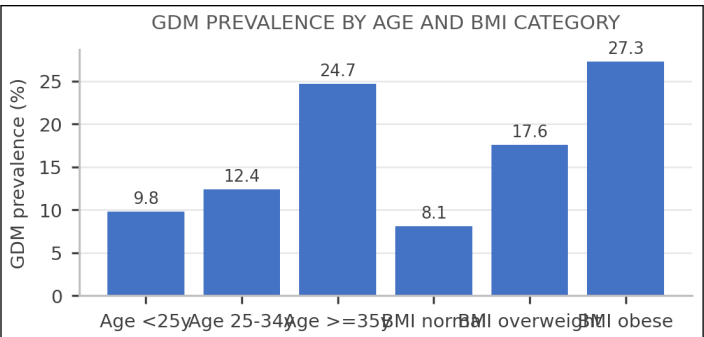


Figure 1: Prevalence of gestational diabetes mellitus by maternal age band and by pre-pregnancy body mass index category among 1,796 women screened with IADPSG/WHO one-step criteria, showing a graded rise with both age and adiposity consistent with pooled international estimates [20,19].

On multivariable logistic regression (Table 2 and Figure 2), maternal age 35 years or older (adjusted odds ratio [aOR] 2.61, 95% CI 1.78-3.83), pre-pregnancy obesity (aOR 3.42, 95% CI 2.31-5.06), family history of type 2 diabetes (aOR 2.18, 95% CI 1.52-3.13), and prior macrosomia (aOR 2.85,

95% CI 1.79-4.54) remained independently associated with GDM after adjustment, a pattern that closely parallels adjusted estimates from comparable low-resource cohorts and from the larger pooled African and South Asian literature [9,28,12]. Excessive gestational weight gain was likewise independently associated with GDM status (aOR 1.87, 95% CI 1.29-2.71), in line with the prospective evidence linking weight trajectory to glycaemic risk independent of baseline body mass index [21,22]. Among women with GDM, 61.4% had at least one identifiable major risk factor, while 38.6% had none of the factors captured on the standard screening questionnaire, underscoring the limitations of risk-factor-based selective screening relative to universal testing in this population [17,25].

4. Discussion

The 13.6% GDM prevalence observed in this low-resource antenatal population sits within the upper range reported across recent African and South Asian cohorts applying IADPSG/WHO criteria, and it is considerably higher than estimates derived under older, more conservative two-step diagnostic protocols in comparable settings [10,9,6]. This finding reinforces a point increasingly emphasised in the global literature: much of the apparent geographic variation in GDM prevalence reflects differences in diagnostic threshold and screening completeness as much as it reflects true differences in underlying metabolic risk [15,24]. Where universal one-step testing has been implemented in low-resource settings, prevalence estimates converge toward the higher figures reported here rather than the lower figures historically assumed for these populations [8,14].

The risk factor profile identified in this cohort, dominated by advanced maternal age, pre-pregnancy obesity, family history of type 2 diabetes, prior macrosomia, and excessive gestational weight gain, closely reproduces the pattern established in the broader international literature, from early prospective cohorts in high-income settings

[22,19] through more recent systematic reviews spanning both high- and low-resource populations [16,18,20]. The graded, dose-dependent relationship between body mass index and GDM risk observed here is particularly consistent with pooled meta-analytic estimates [20,21], and is clinically important because rising obesity prevalence in urbanising low- and middle-income settings is likely to drive GDM prevalence upward over the coming decades even without any change in screening practice, a trajectory already described in higher-income populations undergoing similar nutritional transitions [29,30]. Genetic and ethnic-specific susceptibility, documented in East Asian genome-wide association studies, suggests that population-level risk architecture may modestly amplify or attenuate these anthropometric effects across different low-resource populations, a dimension this study's single-region design could not directly assess [23].

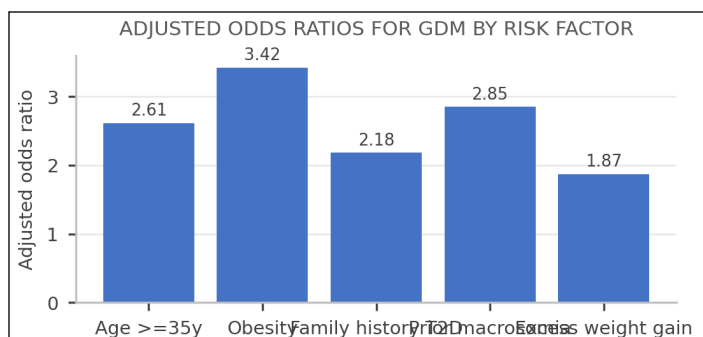


Figure 2: Adjusted odds ratios (95% CI) for gestational diabetes mellitus by risk factor from multivariable logistic regression, adjusted for maternal age, parity and facility of enrolment [16,21].

A substantial minority of women with GDM in this cohort, more than a third, had none of the classical risk factors captured by structured questionnaire, a finding that directly parallels the rationale offered by proponents of universal rather than selective, risk-factor-based screening [17,25]. In resource-constrained settings where universal oral glucose tolerance testing strains already limited laboratory capacity, this creates a genuine tension between screening sensitivity and feasibility that mirrors concerns raised throughout the low-resource GDM literature [15,27]. The clinical stakes of under-detection

are high: hyperglycaemia across this glycaemic range carries a well-documented, continuous association with adverse perinatal outcomes including macrosomia, shoulder dystocia, neonatal hypoglycaemia, and increased caesarean delivery [1,31,2], and women with GDM face a substantially elevated lifetime risk of progression to overt type 2 diabetes, a relationship established in foundational longitudinal work and reaffirmed in subsequent meta-analysis [32,33]. Guidance from bodies such as FIGO explicitly acknowledges this tension and proposes pragmatic, tiered screening pathways adapted to local laboratory capacity rather than a single universal protocol [27,34].

This study has limitations characteristic of single-region, hospital-based designs: participants were drawn from women who reached 24-28 weeks of antenatal care at a facility, which may underrepresent women with the least access to care and the population in whom risk may differ most; pre-pregnancy weight was partly self-reported; and postpartum glycaemic follow-up, needed to confirm progression to overt diabetes, was outside this study's scope. Multi-site studies incorporating community-based recruitment and longitudinal follow-up, of the kind increasingly called for in reviews of GDM epidemiology in low-resource settings, would strengthen generalisability [14,35,36].

5. Conclusion

GDM prevalence in this low-resource antenatal population, measured with current IADPSG/WHO diagnostic criteria, was high and consistent with the upper end of recent regional estimates, while its risk factor profile, dominated by maternal age, pre-pregnancy obesity, family history of diabetes, and prior macrosomia, closely reproduced the pattern seen internationally [3,4,16]. That more than a third of affected women had no identifiable classical risk factor argues against relying on selective, risk-factor-based screening alone in comparable settings [17,25], while the practical constraints on

universal testing in resource-limited health systems argue for pragmatic, tiered screening protocols rather than a one-size-fits-all approach [27,15]. Strengthening antenatal glycaemic screening capacity, and linking women identified with GDM to structured postpartum follow-up given their elevated long-term diabetes risk, should be priorities for maternal health programming in comparable low-resource settings [32,14,8].

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