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ORIGINAL RESEARCH

Group B Streptococcus Colonization Among Pregnant Women in Jordan: Prevalence, Outcomes and a Comparison Between Healthcare and Non- Healthcare Providers

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Introduction: Group B Streptococcus (GBS) is a leading cause of neonatal sepsis and maternal infections worldwide While general data on GBS prevalence in the Middle East exist, specific studies investigating GBS colonization and its outcomes among healthcare workers remain limited. This study aimed to determine the outcome of rectovaginal GBS colonization among pregnant women in northern Jordan and to compare maternal and neonatal outcomes between medical and non-medical staff.

Methods: A retrospective cohort study was conducted at King Abdullah University Hospital, including 257 GBS-positive pregnant women who delivered during the study period. Participants were categorized as medical staff (n=37) or non-medical staff (n=220). Maternal demographic, obstetric, and neonatal data were collected from hospital records. Statistical analyses were performed using chi-square and t-tests, with multivariable logistic regression adjusting for maternal age, gestational age, parity, and body mass index.

Results: Maternal age was significantly higher among medical staff (p=0.017), while other baseline variables showed no significant differences. There were no significant differences between medical and non-medical groups in maternal morbidity, neonatal intensive care unit (NICU) admission, or neonatal mortality (all p≥0.05). Adjusted models confirmed that occupation was not significantly associated with NICU admission (aOR 1.37, 95% CI 0.46–4.09, p=0.575) or maternal morbidity (aOR 0.83, 95% CI 0.35–2.00, p=0.685).

Conclusion: Occupational exposure among healthcare workers did not significantly influence GBS-related maternal or neonatal outcomes, and GBS colonization among pregnant women in northern Jordan aligns with global prevalence estimates. Larger, prospective studies are needed to confirm these findings and assess antimicrobial resistance trends in the region.

Keywords: group B streptococcus, pregnant, women, cohort study

Introduction

Group B Streptococcus (Streptococcus agalactiae) is a significant perinatal pathogen associated with severe infections in newborns, including sepsis, meningitis, and pneumonia.[1,2] Maternal rectovaginal colonization during childbirth is the primary risk factor for early-onset neonatal infections, which typically manifest within the first seven days of life.[3,4] Vertical transmission occurs in up to 50% of infected pregnancies, with invasive illness developing in 1% to 2% of exposed neonates.[5] Beyond neonatal complications, GBS colonization has been linked to adverse pregnancy outcomes such as low birth weight, premature labor, and stillbirth.[5,6]

The global burden of GBS is substantial, with maternal colonization rates ranging from 15% to 25% worldwide, showing considerable regional importance.[2,3] While prevalence estimates are somewhat lower in Asia, sub-Saharan Africa and the Americas report higher rates.[7,8] Global estimates indicate approximately 400,000 maternal and newborn

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GBS cases annually, contributing significantly to perinatal morbidity and mortality.[9] The emergence of antimicrobial resistance further complicates intrapartum antibiotic prophylaxis (IAP) strategies, as evidenced by studies in various regions.[6]

Data regarding GBS prevalence in the Middle East remains limited. Previous research in Jordan, reported maternal GBS colonization rates of 18–20%.[10] Consistent with findings from Saudi Arabia (24%)[11] and other Middle Eastern cohorts. However, northern Jordan, particularly the area served by King Abdullah University Hospital (KAUH), lacks published data on GBS prevalence. Furthermore, the potential impact of occupational exposure on GBS colonization rates, particularly among healthcare professionals, is poorly understood.[12,13] This study aimed to determine the outcome of rectovaginal GBS colonization among pregnant women delivering at KAUH and to explore differences in colonization prevalence and associated maternal and neonatal complications between medical and non-medical staff.

Methods and Materials

Patients

This retrospective cohort study included pregnant women who delivered at King Abdullah University Hospital (KAUH) in northern Jordan and were confirmed to have rectovaginal colonization with Group B Streptococcus (GBS). A total of 257 GBS-positive women were identified and included in the final analysis. Participants were categorized into two groups based on occupation: medical staff (n = 37) and non-medical staff (n = 220).

Inclusion criteria encompassed all pregnant women with documented rectovaginal GBS colonization during routine antenatal screening or intrapartum evaluation who subsequently delivered at KAUH within the study period of 2024 (January 1, 2024, to December 31, 2024). Exclusion criteria included incomplete medical records, uncertain GBS culture results, or missing data regarding maternal or neonatal outcomes.

All relevant demographic, obstetric, and neonatal data were obtained from the hospital's electronic medical records. The study protocol was approved by the Institutional Review Board (IRB) of Jordan University of Science and Technology and King Abdullah University Hospital (IRB Approval No.: Feb2025/179-26).

Data Extraction

Data were extracted retrospectively from the electronic medical records of all GBS-colonized pregnant women and their neonates. Collected variables included baseline maternal characteristics such as age, gestational age at delivery, parity, body mass index (BMI), premature rupture of membranes (PROM), diabetes mellitus (DM), hypothyroidism, chorioamnionitis, and antibiotic administration. Occupational status (medical vs non-medical) was identified from hospital employment records.

Neonatal characteristics included birthweight, NICU admission, duration of NICU stay, respiratory complications, and neonatal death prior to discharge. Maternal morbidity was defined as the presence of any obstetric or infectious complication during the peripartum period, including chorioamnionitis or postpartum infection.

All variables were collected using standardized clinical definitions consistent with institutional protocols at KAUH. Data completeness and accuracy were verified by cross-checking electronic records and delivery logs.

Specimen Collection

In accordance with the recommendations of the Centers for Disease Control and Prevention (CDC)[14] and the American College of Obstetricians and Gynecologists, specimens were obtained from the lower third of the vagina and the anorectal area using sterile cotton swabs by the attending midwife. The swabs were promptly delivered to the Microbiology Laboratory at King Abdullah University Hospital. Samples were enriched in broth and incubated at 35–37 °C for 18–24 hours, followed by subculture onto 5% sheep blood agar plates, which were incubated for an additional 18–24 hours in a 5% CO_2 environment. Only cultures with confirmed Group B Streptococcus growth were included in the analysis; samples showing mixed or multiple bacterial isolates were excluded.

Statistical Analysis

Data were entered into a spreadsheet and analyzed using IBM SPSS Statistics for Windows, Version 26.0. Nominal variables were expressed as frequency and percentage, while continuous variables were described using mean (standard deviation) and median (interquartile range). Comparisons between groups were performed using the Chi-square test for categorical variables and the Student's *t*-test for continuous variables. A p-value ≤ 0.05 was considered statistically significant.

Sensitivity Analyses

Penalized logistic regression was utilized to assess the stability of estimates, particularly in cases where standard models encountered convergence issues or had small cell counts. These sensitivity analyses produced point estimates that were consistent with those obtained from the main adjusted models, where both were available. It is important to note that penalized fits, in this implementation, do not provide standard errors. Additionally, sensitivity analyses were conducted to account for incomplete antibiotic data by including antibiotic administration (yes/no/missing) as an additional covariate.

Results

Patient Demographics

A total of 257 (23.1%) Group B Streptococcus (GBS) colonized pregnant women (out of 1113 delivery conducted during the study period) were included in this analysis. Of these, 37 (14.4%) were medical staff and 220 (85.6%) were non-medical staff. The baseline characteristics of these two groups are summarized in Table 1.

Among the baseline characteristics, a statistically significant difference was observed only for maternal age (p=0.017), with medical staff having a slightly higher mean age compared to non-medical staff. All other baseline characteristics, including gestational age (GA), birthweight, parity, BMI, and rates of PROM, antibiotic use, DM, hypothyroidism, treated morbidity, and chorioamnionitis, showed no significant differences between the two occupational groups (all p≥0.05).

The primary analysis focused on comparing key outcomes between medical staff and non-medical staff. Table 2 presents the rates of NICU admission, maternal morbidity, and death for both groups. No statistically significant

Table 1 Baseline Characteristics by Occupation, Reported as Mean (SD); Median (IQR) or n (%)

Characteristic	Medical Staff (n=37)	Non-Medical Staff (n=220)	P-value
Age	33.1 (4.9); 33.0 (29.0–38.0)	30.9 (5.2); 30.0 (27.0–34.0)	0.017
Gestational age	37.2 (1.4); 37.0 (36.0–38.0)	37.0 (2.6); 37.0 (36.0–38.0)	0.563
Birthweight	2.8 (0.5); 2.8 (2.5–3.2)	2.8 (0.7); 2.9 (2.5–3.3)	0.785
Parity	1.4 (1.3); 1.0 (0.0–3.0)	1.7 (1.5); 1.0 (0.0–3.0)	0.273
BMI	32.3 (6.1); 30.0 (30.0–32.0)	30.0 (5); 30.0 (27.5–31.0)	0.151
PROM	8 (21.6%)	59 (26.8%)	0.643
Antibiotics	35 (94.6%)	211 (95.9%)	0.999
DM	2 (5.4%)	23 (10.5%)	0.510
Hypothyroidism	5 (13.5%)	13 (5.9%)	0.184
Morbidity	9 (24.3%)	51 (23.2%)	0.999
Chorioretinitis	2 (5.4%)	6 (2.7%)	0.722

Abbreviations: GA, Gestational Age; BMI, Body Mass Index; PROM, Premature Rupture of Membranes; DM, Diabetes Mellitus.

Table 2 Primary Outcomes by Occupation

NICU admission	**13 (35.1%)**	**96 (43.6%)**	**0.431**
MORBIDITY	9 (24.3%)	51 (23.2%)	0.999
Death	0 (0.0%)	2 (0.9%)	0.999

Abbreviation: NICU, neonatal intensive care unit.

differences were observed for the primary outcomes (NICU admission, maternal morbidity, and death) between medical staff and non-medical staff (all p≥0.05).

However, it is important to note that the relatively small sample size of medical staff (n = 37) may have limited the statistical power of the study to detect subtle but potentially clinically meaningful differences in GBS-related outcomes between occupational groups.

Further analysis of specific maternal outcomes also revealed no significant differences between the two occupational groups. Table 3 details the prevalence of various maternal outcomes.

No maternal outcome showed a statistically significant difference between occupation groups (all p≥0.05). A forest plot of the adjusted odds ratios for NICU admission and maternal morbidity Figure 1.

Neonatal outcomes were also compared between the medical and non-medical staff groups. The Mann–Whitney *U*-test was employed for the duration of days spent in the NICU due to a non-normal distribution of this variable. Table 4 presents a summary of the neonatal outcomes.

Adjusted logistic regression models were fitted for NICU admission and maternal morbidity, controlling for maternal age (AGE), gestational age (GA), parity (PARITY), and body mass index (BMI). The results, presented as adjusted odds ratios (aOR) with 95% confidence intervals (CI), are shown in Table 5.

In the multivariable models, occupation (medical staff) was not significantly associated with NICU admission (aOR 1.37, 95% CI 0.46–4.09, p=0.575) or maternal morbidity (aOR 0.83, 95% CI 0.35–2.00, p=0.685). However, gestational age (GA) was a significant predictor for NICU admission (aOR 0.64, 95% CI 0.53–0.78, p<0.001) and maternal morbidity (aOR 0.84, 95% CI 0.75–0.95, p=0.004). Maternal age (aOR 1.11, 95% CI 1.03–1.19, p=0.004) and parity (aOR 0.72, 95% CI 0.56–0.92, p=0.010) were also significant predictors for maternal morbidity.

Discussion

This study investigated the prevalence of rectovaginal Group B Streptococcus (GBS) colonization among pregnant women delivering at King Abdullah University Hospital (KAUH) in northern Jordan, with a particular focus on comparing outcomes between medical and non-medical staff. To the best of our knowledge, this is among the first studies in the Middle East to specifically evaluate GBS outcomes in these occupational groups. Previous research in the Middle East and North Africa (MENA) region has documented the clinical landscape of Group B Streptococcus colonization. Studies from Jordan,[10] Saudi Arabia,[15] Lebanon,[16] and Iran[17] have primarily focused on establishing

Table 3 Maternal Outcomes by Occupation

Outcome	Medical Staff	Non-Medical Staff	P-value
PROM	8 (21.6%)	59 (26.8%)	0.491
DM	2 (5.4%)	23 (10.5%)	0.245
Hypothyroidism	5 (13.5%)	13 (5.9%)	0.206
Morbidity	9 (24.3%)	51 (23.2%)	0.883
Chorioretinitis	2 (5.4%)	6 (2.7%)	0.499

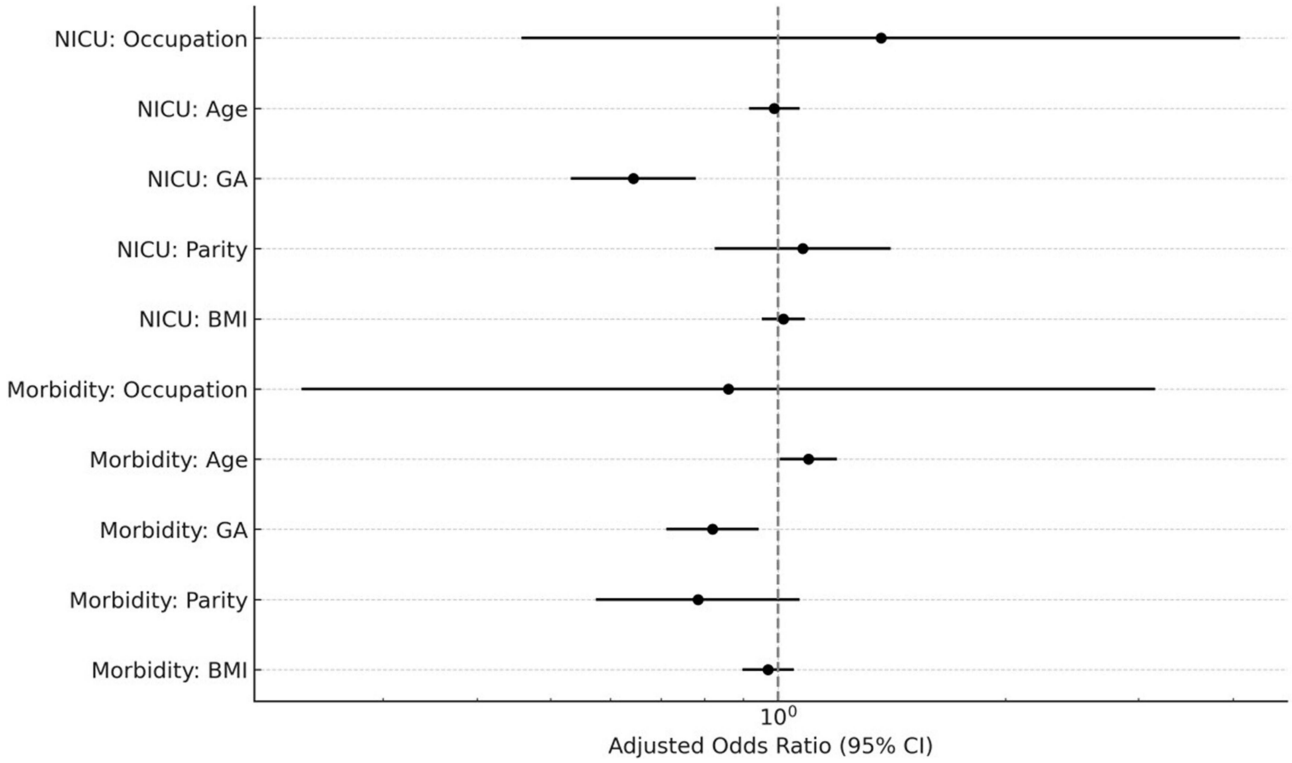

Figure 1 A forest plot of the adjusted odds ratios for NICU admission and maternal morbidity.

prevalence rates, and identifying general clinical risk factors such as maternal age, parity, and gestational diabetes. Unlike these previous regional studies focusing primarily on general GBS prevalence or specific risk factors in the general population, our work uniquely dissects the impact of distinct occupational roles on GBS outcomes, representing a focused novel contribution to the regional literature. This comparison between healthcare and non-healthcare providers is particularly innovative for the Middle Eastern context, highlighting the novel contribution of our study within the regional context. Among 257 GBS-colonized pregnant women, there were no statistically significant differences in primary outcomes, maternal outcomes, or neonatal outcomes between medical staff (n=37) and non-medical staff (n=220), including NICU admission, maternal morbidity, birthweight, duration of NICU hospitalization, respiratory issues, and neonatal death. Multivariable analyses adjusting for confounders such as body mass index, parity, and gestational age, further supported these observations, demonstrating that occupation was not a significant predictor for NICU admission or maternal morbidity. Sensitivity analyses and subgroup stratifications further supported the lack of significant relationships between occupation and key outcomes, reinforcing the robustness of these findings.

Table 4 Neonatal Outcomes by Occupation

Outcome	Medical Staff	Non-Medical Staff	p-value
BIRTHWEIGHT	2.8 (0.5); 2.8 (2.5–3.2)	2.8 (0.7); 2.9 (2.5–3.3)	0.785
NICU	0.4 (0.5); 0.0 (0.0–1.0)	0.4 (0.5); 0.0 (0.0–1.0)	0.330
DURATION DAYS	3.9 (2.4); 3.0 (2.0–4.0)	8.9 (17.3); 3.0 (2.0–5.0)	0.510
RESPIRATORY	1.2 (0.6); 1.0 (1.0–1.0)	1.4 (0.7); 1.0 (1.0–1.0)	0.211
DEATH	0.0 (0.0); 0.0 (0.0–0.0)	0.0 (0.1); 0.0 (0.0–0.0)	0.158

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Table 5 Multivariable Logistic Regression Results (Adjusted ORs)

Variable	aOR	95% CI	p-value
Medical staff (NICU)	1.37	0.46–4.09	0.575
AGE (NICU)	0.99	0.92–1.07	0.776
GA (NICU)	0.64	0.53–0.78	<0.001
PARITY (NICU)	1.08	0.82–1.41	0.583
BMI (NICU)	1.02	0.95–1.09	0.623
AGE (MORBIDITY)	1.11	1.03–1.19	0.004
GA (MORBIDITY)	0.84	0.75–0.95	0.004
PARITY (MORBIDITY)	0.72	0.56–0.92	0.010
BMI (MORBIDITY)	0.97	0.90–1.05	0.422

The overall prevalence of GBS colonization in our cohort aligns with global estimates, which suggest maternal colonization rates range from 15% to 25%.[2,3] A comprehensive meta-analysis reported a global prevalence of maternal GBS colonization at 17.9%.[2] Regionally, data from the MENA demonstrate considerable variability, with reported rates ranging from 1.6% to 32%.[10] A study conducted in Amman, Jordan, found a prevalence of 19.5% among pregnant women, which is very similar to the prevalence observed in our study.[10] This consistency underscores the ongoing burden of GBS in the region and highlights the need for continued surveillance and prevention strategies.

A key aim of our study was to assess whether health professionals differed from non-health staff in terms of GBS colonization and related outcomes. Contrary to the hypothesis that healthcare professionals might have different colonization patterns due to occupational exposure,[12,13] our study found no statistically significant differences in GBS-related maternal or neonatal outcomes between these two groups. This finding is noteworthy, as some earlier studies have suggested a potential link between healthcare occupation and increased risk of GBS colonization. For instance, a study by Stapleton et al (2005) identified healthcare occupation as an independent risk factor for GBS colonization (OR 1.22).[18] Similarly, Yamamura et al (2005) reported a higher prevalence of GBS colonization among healthcare workers (20%) compared to non-healthcare workers (16.5%), with an odds ratio of 1.28.[19]

The discrepancy between our findings and some previous literature could be attributed to several factors. Differences in study populations, geographical locations, GBS screening protocols, and infection control practices within healthcare settings may play a role. Differences in GBS screening methods likely contributed to discrepancies with Stapleton et al.[18] While that study relied on administrative data and ICD-9 codes to identify GBS, our study used direct microbiological screening of rectovaginal samples per CDC guidelines. This culture-based approach provides more accurate detection at delivery and reducing misclassification. The studies by Stapleton et al and Yamamura et al were conducted in the United States, which may have different occupational exposure risks or GBS epidemiology compared to Jordan. Furthermore, the definition of "healthcare worker" and the specific roles within healthcare can vary, influencing exposure levels. It is also possible that improved infection control measures in healthcare settings over time have mitigated some of these occupational risks.In our cohort, health staff were statistically significantly older than non-health participants (mean 33.1 vs 30.9 years). Although large-scale reviews have not consistently found maternal age to be a significant predictor, it has occasionally been linked to GBS colonization and pregnancy outcomes.[2,3] Importantly, in our adjusted models, age emerged as an independent predictor of maternal morbidity, suggesting that physiological and comorbid factors, rather than occupational exposure, may underlie differences in outcomes. Parity also played a role, with higher parity associated with lower morbidity, consistent with population-based studies.[3,12] Our study found no significant differences in maternal outcomes such as premature rupture of membranes (PROM), gestational diabetes (DM), hypothyroidism, or chorioamnionitis between medical and non-medical staff. Similarly, neonatal outcomes, including birthweight, NICU admission,

duration of NICU stay, respiratory issues, and death, did not differ significantly based on maternal occupation. These results are consistent with the understanding that while GBS colonization is a risk factor for adverse maternal and neonatal outcomes, the direct impact of maternal occupation on these outcomes, independent of GBS status, may be limited.[20,21]

Previous research has extensively documented the association between maternal GBS colonization and adverse neonatal outcomes. For instance, early-onset GBS disease (EOGBS) is a leading cause of neonatal sepsis and meningitis, with significant morbidity and mortality.[22,23] The implementation of intrapartum antibiotic prophylaxis (IAP) has dramatically reduced the incidence of EOGBS in countries where universal screening is routine.[14,24] However, the effectiveness of IAP can be challenged by rising antimicrobial resistance, a concern highlighted in various global studies.[6,25] Our study did not directly assess the effectiveness of IAP or antimicrobial resistance patterns, but these are crucial considerations for future research in the region.

Regarding maternal complications, GBS has been implicated in chorioamnionitis, postpartum endometritis, and preterm labor.[26] While our study observed no significant differences in these outcomes between the occupational groups, the overall rates of some complications, such as PROM, were present in both groups, reflecting the general risks associated with pregnancy and GBS colonization. The lack of significant differences between health and non-health staff suggests that, at least in this cohort, occupational factors did not confer an additional measurable risk for these specific complications.Future research should include larger, prospective studies to confirm these findings and explore additional risk factors for GBS colonization in the Jordanian population. A more detailed assessment of occupational exposure, including specific roles, patient contact hours, and adherence to infection control practices, could provide a nuanced understanding of any subtle occupational risks. Furthermore, investigating the serotype distribution of GBS isolates in northern Jordan, as well as their antimicrobial resistance patterns, is essential for guiding empirical antibiotic choices and informing vaccine development strategies. Finally, studies comparing outcomes between GBS-colonized and non-colonized women in the region would provide a more complete picture of the local burden of GBS disease.

This study has several limitations. As a retrospective single-center analysis, findings may not be generalizable to other populations. The small number of medical staff (n=37) may limit statistical power to detect subtle differences. Furthermore, the study was conducted at a single center in northern Jordan, which may limit the generalizability of the findings to other regions or populations. Lastly, detailed information on the specific roles and direct patient contact levels of the medical staff was not available, which could influence the assessment of occupational exposure.

Conclusion

In conclusion, While GBS colonization is a known public health concern, this study found no significant differences in maternal or neonatal outcomes related to GBS colonization between pregnant medical staff and non-medical staff at KAUH in northern Jordan. These findings suggest that occupational exposure as a healthcare worker may not independently increase the risk of adverse GBS-related outcomes in this population. Further prospective studies with larger cohorts and detailed occupational exposure assessments are warranted to confirm these findings and to better understand the epidemiology of GBS in the Middle East, including antimicrobial resistance patterns and the effectiveness of current prevention strategies.

Data Sharing Statement

The datasets used and/or analyzed during the current study are presented in tables and text.

Ethical Approvals

This work was approved by the institutional review board (IRB) committee at Jordan University of Science and Technology and King Abdullah University Hospital. IRB No.: Feb2025/179-26, date: 2/3/2025. The study was conducted in accordance with the Declaration of Helsinki, good clinical practices, and relevant regulatory guidelines. The need for written informed consent was waived due to the retrospective nature of the study. We confirm that the privacy of the participants was saved, and the data was anonymized and maintained with confidentiality.

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Disclosure

The authors declared no conflicts of interest in this work.

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