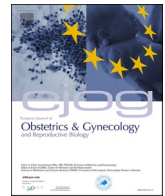


Title	Epidemiology, comorbidity patterns and outcomes of maternal sepsis-related coded discharges in Ireland 2020–2025
Authors	Ravichandran, Nandakumar;Fitzpatrick, Patricia;Hayes, Ellen;Quinlan, Diarmuid;Molloy, Mick;Umana, Etimbuk;Breslin, Tomas;Cotter, Aoife;Cullen, Walter
Publication date	2026-06-19
Original Citation	Ravichandran, N, Fitzpatrick, P, Hayes, E, Quinlan, D, Molloy, M, Umana, E, Breslin, T, Cotter, A & Cullen, W 2026, 'Epidemiology, comorbidity patterns and outcomes of maternal sepsis-related coded discharges in Ireland 2020–2025', European Journal of Obstetrics and Gynecology and Reproductive Biology, vol. 324, 115251, pp. 1. https://doi.org/10.1016/j.ejogrb.2026.115251
Type of publication	Article (peer-reviewed)
Link to publisher's version	https://www.scopus.com/pages/publications/105042136676 - 10.1016/j.ejogrb.2026.115251
Rights	© 2026, authors. Published by Elsevier B.V. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/) - https://creativecommons.org/licenses/by/4.0/
Download date	2026-10-31 02:41:34
Item downloaded from	https://hdl.handle.net/10468/19508



Full length article

Epidemiology, comorbidity patterns and outcomes of maternal sepsis-related coded discharges in Ireland 2020–2025

Nandakumar Ravichandran^{a,*}, Patricia Fitzpatrick^b, Ellen Hayes^c, Diarmuid Quinlan^{c,d}, Mick Molloy^{a,e}, Etimbuk Umana^{a,f}, Tomas Breslin^{a,f}, Aoife Cotter^{a,f}, Walter Cullen^a^a School of Medicine, University College Dublin, Ireland^b School of Public Health, Physiotherapy and Sports Science, University College Dublin, Ireland^c Irish College of General Practitioners, Dublin, Ireland^d Department of General Practice, University College Cork, Cork, Ireland^e Wexford General Hospital, Wexford, Ireland^f Mater Misericordiae University Hospital, Dublin, Ireland

A B S T R A C T

Background: Maternal sepsis remains a leading cause of maternal morbidity and mortality globally. National data on maternal sepsis are limited in Ireland.**Methods:** We conducted a retrospective analysis of the Hospital In-Patient Enquiry (HIPE) database, including all sepsis-related coded hospital discharges from 1 January 2020 to 31 December 2025. Episodes were classified as hospital-onset or community-onset according to whether the associated infection diagnosis was coded as hospital-acquired. Maternal episodes were defined as episodes occurring in individuals from conception to six weeks postpartum. Infection sources and comorbidities were identified using ICD coding and a validated maternal comorbidity index. Univariable logistic regression was used to examine factors associated with critical care admission.**Results:** Among 80,628 sepsis admissions, 2.0% (n = 1645) were maternal. Of them, 73.6% (n = 1,211) were community-onset. Compared to community-onset episodes, hospital-onset episodes were associated with higher rates of critical care admission (22.6% versus 10.4%, p < 0.001). One death was reported among hospital-onset episodes. Among community-onset episodes, presence of one or more underlying comorbidities was strongly associated with critical care admission (adjOR 3.27, 95% CI 2.12–5.07, p < 0.001).**Conclusions:** Maternal sepsis in Ireland is uncommon and associated with low in-hospital mortality but notable critical care admission. Respiratory infections are the major determinants of critical care admission. These findings support continued emphasis on early recognition and risk stratification in maternity care, aligned with national maternity sepsis guidelines and the Irish Maternity Early Warning System for secondary care.

Introduction

Maternal sepsis is the third most common primary cause of maternal death globally [1]. Maternal sepsis is a life-threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post-abortion, or post-partum period [1,2]. Pregnancy-associated physiological, immunological, and mechanical changes predispose women to infections, increasing the risk of sepsis [3,4]. Although mortality from maternal sepsis and related infections has declined globally, the burden remains disproportionately concentrated in low-income settings. Recent global estimates demonstrate a strong inverse relationship between sociodemographic development and maternal infection mortality, with death rates substantially higher in low-development than high-development settings (1.13 versus 0.02 per 100,000 population) [5]. While a single-centre review of maternal sepsis has been

conducted in Ireland, there is no national study examining maternal sepsis [6]. This study provides the first national characterisation of maternal sepsis with a focus on community-onset sepsis in Ireland, integrating infection source and comorbidity burden, and evaluating associations with clinical outcomes including critical care admission, and in-hospital mortality.

Methods

This retrospective study used data from the Hospital In-Patient Enquiry (HIPE) system, a national administrative database capturing discharge records from all acute public hospitals in Ireland. All national HIPE episode records for maternal patients, from conception until 6 weeks (42 days) following the end of pregnancy (including delivery and non-delivery pregnancy outcomes), were included, provided they were

* Corresponding author.

E-mail address: nandakumar.ravichandran@ucd.ie (N. Ravichandran).<https://doi.org/10.1016/j.ejogrb.2026.115251>

Received 25 March 2026; Received in revised form 10 June 2026; Accepted 14 June 2026

Available online 15 June 2026

0301-2115/© 2026 The Author(s). Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

classified as HIPE Admission Type 6 (Maternity). a sepsis-related diagnostic code ([Supplementary file, Table 1](#)) between 1 January 2020 and 31 December 2025. This specific admission type isolates all hospitalisations related to the patient's obstetrical experience across participating Irish acute public hospitals, ensuring the inclusion of all relevant maternal sepsis episodes regardless of the hospital type.

As HIPE does not contain reliable timestamps for infection onset during a hospital stay, conventional time-based definitions of hospital-acquired sepsis was not applied. Instead, consistent with international administrative data methodology, classification was based on the HIPE hospital-acquired diagnosis (HADx) indicator assigned directly to the relevant diagnostic codes [7,8]. A comprehensive diagnostic profile comprising general infectious diseases (Chapters A–B), localised organ-specific infections (Chapters G, J, K, L, N), systemic sepsis/septic shock

(R57, R65), obstetric/neonatal infections (O85–O86, P36), healthcare-associated complications (T80–T88), and the nosocomial infection indicator (Y95) was evaluated using this flag. Community-onset sepsis is defined as episodes where the diagnostic codes establishing the sepsis event or its underlying infection profile were recorded as present on admission, lacking a hospital-acquired flag (HADx = 0). Hospital-onset sepsis is defined as episodes where these diagnostic or complicating codes were explicitly flagged by clinical coders as having developed during the hospital stay (HADx = 1).

While individual administrative codes alone do not establish clinical causality, tracking the presence of HADx = 1 across this specific diagnostic cluster provides a highly plausible, standardised signal linking the onset of the maternal sepsis cascade to healthcare procedures, device exposures, or institutional transmission. This methodology directly aligns with surveillance criteria adapted from the Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN) and the European Centre for Disease Prevention and Control (ECDC). All diagnostic codes were mapped to infection sources and maternal comorbidity index developed by Leonard et al. 2020 [9–11] ([Supplementary file, Tables 2 and 3](#)). Data processing was conducted using Python (Jupyter Notebook, version 3.14).

Chi square tests were used to compare categorical variables and Mann-Whitney *U* test was used to compare continuous variables. Multivariable logistic regression models were constructed using backward stepwise selection. Age and GMS eligibility were included a priori as confounders. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were reported. Analyses were performed using SPSS version 29. Where fewer than 10 outcome events occurred, categories were grouped or analyses limited to univariable models. GMS eligibility provides free access to publicly funded primary and secondary healthcare services in Ireland and was used as an indicator of health service utilisation and financial protection.

Table 1

Characteristics of maternal sepsis episodes.

Characteristics	Hospital-onset (n=434, 26.4%)	Community-onset (n=1211, 73.6%)	p-value
Age group			0.562
16-24 years	58 (13.4)	142 (11.7)	
25-44 years	374 (86.2)	1060 (87.5)	
45-64 years	<5*	9 (0.7)	
GMS eligibility			0.454
GMS	65 (15.0)	200 (16.5)	
Non-GMS	369 (85.0)	1011 (83.5)	
Source of infection*			
Respiratory	30 (6.9)	54 (4.5)	0.046
Urinary	47 (10.8)	117 (9.7)	0.486
Abdominal	42 (9.7)	38 (3.1)	<0.001
Skin/Soft Tissue	32 (7.4)	60 (5.0)	0.06
Nervous System	0 (0.0)	0 (0.0)	N/A
Cardiac/Vascular	<5*	5 (0.4)	0.895
Bone/Joint	0 (0.0)	0 (0.0)	N/A
Device/Procedural	31 (7.1)	7 (0.6)	<0.001
Resistant Organisms	0 (0.0)	0 (0.0)	N/A
COVID-19 infection			0.048
Yes	16 (3.7)	24 (2.0)	
No	418 (96.3)	1187 (98.0)	
Obstetric infections (source)*			
Antepartum/ intrapartum	124 (28.6)	77 (6.4)	<0.001
Postpartum/Puerperal	241 (55.5)	874 (72.2)	<0.001
Early pregnancy loss	11 (2.5)	60 (5.0)	0.033
Antenatal/genital	77 (17.7)	186 (15.4)	0.245
Comorbidity			<0.001
0	241 (55.5)	985 (81.3)	
1	122 (28.1)	175 (14.5)	
2	45 (10.4)	40 (3.3)	
3+	26 (6.0)	10 (0.9)	
Critical care admissions			<0.001
Yes	98 (22.6)	126 (10.4)	
No	336 (77.4)	1085 (89.6)	
Death			N/A
Yes	1 (0.2)	0 (0.0)	
No	433 (99.8)	1211 (100.0)	
Episodes of maternal patients who didn't require critical care admission			
Length of stay (Median (Range))	6.0 (0.5-132.0)	3.0 (0.5-22.0)	<0.001
Episodes of maternal patients who required critical care admission			
Length of stay (Median (Range))	8.0 (1.0-216.0)	7.0 (1.0-162.0)	0.003
Length of critical care stay (Median (Range))	3.0 (1.0-49.0)	3.0 (1.0-75.0)	0.986

*Mutually exclusive events.

Table 2

Comorbidity among maternal sepsis episodes.

Comorbidity	Hospital-onset (n = 434, 26.4%)	Community-onset (n = 1211, 73.6%)
Gestational diabetes	56 (12.9)	45 (3.7)
HIV/AIDS	0 (0.0)	0 (0.0)
Pre-existing diabetes mellitus	11 (2.5)	14 (1.2)
Previous Caesarean birth	0 (0.0)	0 (0.0)
Pulmonary hypertension	0 (0.0)	0 (0.0)
Twin or multiple pregnancy	19 (4.4)	7 (0.6)
Asthma (acute, moderate or severe)	30 (6.9)	54 (4.5)
Bleeding disorder, pre-existing	9 (2.1)	12 (1.0)
BMI over 40 at delivery	0 (0.0)	0 (0.0)
Cardiac disease, pre-existing	12 (2.8)	9 (0.7)
Chronic hypertension	<5	7 (0.6)
Chronic renal disease	<5	<5
Connective tissue or autoimmune	0 (0.0)	<5
Placenta previa, complete or partial	0 (0.0)	0 (0.0)
Pre-eclampsia (severe)	<5	<5
Pre-eclampsia (without severe or gestational hypertension)	48 (11.1)	46 (3.8)
Substance use disorder	12 (2.8)	8 (0.7)
Maternal age (>=45)*	<5	9 (0.7)
Anaemia, preexisting	29 (6.7)	37 (3.1)
Bariatric surgery	0 (0.0)	0 (0.0)
Gastrointestinal disease	56 (12.9)	44 (3.6)
Major mental health disorder	<5	<5
Neuromuscular disease	<5	<5
Placental abruption	<5	<5
Placenta accreta spectrum	<5	<5
Preterm birth	0 (0.0)	0 (0.0)
Thyroiditis	0 (0.0)	0 (0.0)

*Age was excluded from the comorbidity total and analysed separately due to grouped age bands not permitting application of the ≥ 35 -year criterion (Leonard et al., 2020).

Table 3
Characteristics of maternal community-onset episodes (n = 1211 episodes).

Characteristics	Required critical care admission (n=126, 10.4%)	Not required critical care admission (n=1085, 89.6%)	p-value
Age group			0.973
16–24 years	14 (11.1)	128 (11.8)	
25–44 years	111 (88.1)	949 (87.5)	
45–64 years	<5*	8 (0.7)	
GMS eligibility			0.476
GMS	18 (14.3)	182 (16.8)	
Non-GMS	108 (85.7)	903 (83.2)	
Source of infection			
Respiratory	24 (19.0)	30 (2.8)	<0.001
Urinary	19 (15.1)	98 (9.0)	0.03
Abdominal	14 (11.1)	24 (2.2)	<0.001
Skin/Soft Tissue	8 (6.3)	52 (4.8)	0.446
Nervous System	0 (0.0)	0 (0.0)	N/A
Cardiac/Vascular	5 (4.0)	0 (0.0)	<0.001
Bone/Joint	0 (0.0)	0 (0.0)	N/A
Device/Procedural	<5	5 (0.5)	0.114
Resistant Organisms	0 (0.0)	0 (0.0)	N/A
COVID-19 infection			<0.001
Yes	9 (7.1)	15 (1.4)	
No	117 (92.9)	1070 (98.6)	
Obstetric infections (source)			
Antepartum/intrapartum	15 (11.9)	62 (5.7)	0.007
Postpartum/Puerperal	52 (41.3)	822 (75.8)	<0.001
Early pregnancy loss	13 (10.3)	47 (4.3)	0.003
Antenatal/genital	47 (37.3)	139 (12.8)	<0.001
Comorbidity			<0.001
0	66 (52.4)	919 (84.7)	
1	32 (25.4)	143 (13.2)	
2	20 (15.9)	20 (1.8)	
3+	8 (6.4)	<5	
Length of stay (Median (Range))	7.0 (1.0–162.0)	3.0 (0.5–22.0)	<0.001
Length of critical care stay (Median (Range))	7.0 (1.0–162.0)		

Ethical approval

Ethical approval was obtained from the University College Dublin Human Research Ethics Committee (288-LS-LRSD-25-Ravichandran-Cullen). The HIPE dataset is anonymised; therefore, informed consent was not required. All procedures adhered to the Declaration of Helsinki (1975).

Results

Between January 2020 and December 2025, a total of 1645 maternal sepsis discharges were recorded, which contributes to 2.0% of all sepsis discharges during that period (n = 80,628). Of these, 26.4% (n = 434) were hospital-onset and 73.6% (n = 1211) were community-onset.

During the period 2020–2024, the proportion of maternity discharges with a sepsis-related code (n = 1,353) among all maternity discharges (n = 615,625) from HIPE reports, remained approximately 0.22% (Fig. 1) [12–16]. Estimates for 2025 were not calculated because national maternity discharge denominator data were not yet available at the time of analysis.

Overall maternal sepsis discharges fluctuated over the study period, decreasing from 259 episodes in 2020 to 249 in 2021, before increasing to 285 in 2022 and reaching 292 episodes in both 2024 and 2025 (Fig. 1). This trend was driven primarily by community-onset sepsis, which increased from 167 episodes in 2020 to 227 in 2025, despite a temporary decline in 2023 (n = 210). Hospital-onset sepsis accounted for a smaller proportion of cases throughout the study period and showed more modest variation, decreasing from 92 episodes in 2020 to

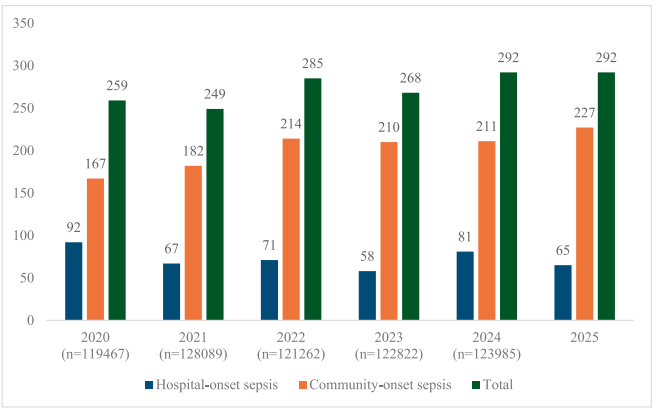


Fig. 1. Distribution of hospital-onset and community-onset maternal sepsis episodes.

58 in 2023, before increasing to 81 in 2024 and declining again to 65 in 2025.

Demographics

Individuals aged 25–44 years accounted for the largest proportion of sepsis episodes in both groups, representing 86.2% (n = 374) of hospital-onset episodes and 87.5% (n = 1060) of community-onset episodes. There was no significant difference between GMS eligibility among hospital-onset (15.0%) compared to community-onset (16.5%) episodes (Table 1).

Sources of infection

Urinary infection (10.8%, n = 47) followed by abdominal infections (9.7%, n = 42) were the most common sources of infection among hospital onset episodes. Urinary infection were the most common sources of infection (9.7%, n = 117), among community-onset episodes.

Obstetric infections

Postpartum/puerperal infections accounted for largest proportion of obstetric infections among both hospital-onset (55.5%, n = 241) and community-onset episodes (72.2%, n = 874).

COVID-19 infection

COVID-19-associated sepsis episodes represented a relatively small proportion of overall maternal sepsis episodes during the study period. Hospital-onset COVID-19-associated sepsis remained uncommon throughout with only one case recorded in 2020, increasing to a peak of eight episodes in 2022, and declining thereafter, with no cases identified in 2023 and three cases recorded in 2024. Community-onset COVID-19-associated sepsis was also infrequent but showed a similar temporal pattern, increasing from one episode in 2020 to a peak of 13 episodes in 2022 before declining to two episodes in both 2023 and 2024 and three episodes in 2025. Overall, these findings indicate that SARS-CoV-2 contributed to only a small number of maternal sepsis episodes nationally and was not a major driver of the overall sepsis burden during the study period.

Clinical outcomes

The total critical care admission rate (including coronary, high-dependency and intensive care units) was 13.6% (n = 224). Critical care admissions were substantially higher in hospital-onset episodes (22.6%, n = 98) compared to community-onset episodes (10.4%, n =

126) ($p < 0.001$). There was one death recorded during the study period, which was a hospital-onset episode.

Length of stay

Among episodes that did not require critical care admission, the median hospital length of stay for hospital-onset episodes was 6.0 days (range 0.5–132.0) compared with 3.0 days (range 0.5–22.0) in the community-onset episodes ($p < 0.001$). Similarly, among episodes requiring critical care admission, the median hospital length of stay for hospital-onset episodes was 8.0 days (range 1.0–216.0) compared with 7.0 days (range 1.0–162.0) in the community-onset episodes ($p = 0.003$). The median length of critical care stay was 3.0 days in both groups, although the range was wider among community-onset episodes (1.0–49.0 days) than in the hospital-onset episodes (1.0–75.0 days). There was no significant difference in critical care length of stay between groups ($p = 0.986$).

Comorbidity

Most community-onset episodes had no comorbidities (81.3%), compared to 55.5% in the hospital-onset episodes. Among hospital-onset sepsis episodes, the most common comorbidities were gestational diabetes (12.9%), gastrointestinal disease (12.9%), pre-eclampsia without severe features or gestational hypertension (11.1%), asthma (6.9%), and pre-existing anaemia (6.7%). Among community-onset sepsis episodes, the most common comorbidities were asthma (4.5%), pre-eclampsia without severe features or gestational hypertension (3.8%), gestational diabetes (3.7%), gastrointestinal disease (3.6%), and pre-existing anaemia (3.1%) (Table 2).

Comorbidity requiring critical care admission

Among hospital-onset sepsis episodes, the most common comorbidities requiring critical care admission were gastrointestinal disease (15.3%), asthma (15.3%), gestational diabetes (11.2%), pre-eclampsia without severe features or gestational hypertension (10.2%), pre-existing anaemia (10.2%) and cardiac disease (9.2%). Among community-onset sepsis episodes requiring critical care admission, the most common comorbidities were asthma (19.0%), gastrointestinal disease (15.1%), pre-existing anaemia (8.7%), gestational diabetes (8.7%) and pre-eclampsia without severe features or gestational hypertension (6.3%),

Characteristics of community-onset episodes required critical care admission versus not required critical care admission

Community-onset episodes requiring critical care admission ($n = 126$) differed significantly from those not requiring critical care ($n = 1085$) across several clinical and demographic variables. There was no significant difference in age distribution ($p = 0.973$) or GMS eligibility status ($p = 0.476$) between groups. However, significant differences were observed in infection source, with respiratory, urinary, abdominal, cardiac/vascular and obstetric infections more frequently associated with critical care admission. Within the obstetric infection category, antepartum/intrapartum and postpartum/puerperal infections were proportionally more common among episodes requiring critical care admission.

COVID-19 infection was significantly more frequent among those requiring critical care (7.1% vs 1.4%, $p < 0.001$). Patients admitted to critical care also had a higher burden of comorbidity, with a greater proportion having multiple comorbid conditions ($p < 0.001$). The median hospital length of stay was significantly longer in the critical care group (7.0 days vs 3.0 days, $p < 0.001$), reflecting increased illness severity (Table 3).

Predictors of critical care admission among maternal community-onset episodes ($n = 126$ admissions)

Age group and GMS status was not significantly associated with critical care admission among maternal community-onset episodes. Respiratory source of infection had the highest odds of critical care admission among these episodes (adjOR 4.39 95% CI 2.33–8.29, $p < 0.001$) followed by abdominal (adjOR 3.20 95% CI 2.12–5.07, $p = 0.003$). Compared to those with no comorbidity, the critical care admission increased 3-fold among episodes with more than one comorbidity (adjOR 3.27, 95% CI 2.12–5.07, $p < 0.001$) (Table 4).

Discussion

This study provides the first national characterisation of maternal sepsis in Ireland to date, demonstrating that while maternal episodes represent a small proportion of overall sepsis admissions (2.0%), they are associated with substantial critical care utilisation (13.6%). No deaths recorded among community-onset episodes and one death recorded among hospital-onset episodes, suggesting favourable outcomes within the acute hospital setting. These findings should be interpreted within the context of significant national policy developments in maternal sepsis recognition and management. Following the death of Savita Halappanavar in 2012, Ireland introduced a number of national maternity safety initiatives, including the National Clinical Guidelines in Obstetrics and Gynaecology and the implementation of the Irish Maternity Early Warning System (IMEWS) for secondary care [17–19]. IMEWS is a bedside monitoring tool designed specifically for pregnant and postpartum women, incorporating physiological parameters such as respiratory rate, heart rate, blood pressure, temperature and neurological status to facilitate early recognition of clinical deterioration and prompt escalation of care [20].

The findings highlight the importance of infection source in determining severity. Respiratory infections were associated with the highest odds of critical care admission, followed by abdominal and urinary sources. This aligns with existing literature indicating that non-genital tract infections, particularly respiratory infections, may be associated with more severe disease trajectories in maternal populations [21,22].

Although comorbidity burden is less in this population, the presence of multimorbidity was strongly associated with increased risk of critical care admission. Notably, gestational diabetes was the most frequently observed, consistent with its known role in increasing susceptibility to infection and adverse outcomes [23,24].

The absence of recorded in-hospital mortality among community-onset episodes needs further investigation. It may reflect effective early recognition and management but could also be influenced by the relatively young age profile, low comorbidity burden, or limitations inherent to administrative data, including potential under coding of severity where episodes were recorded as the source of infection rather than sepsis. Further research is required to better characterise sepsis

Table 4

Multivariable regression model of critical care admission in maternal community-onset sepsis episodes ($n = 126$ admissions).

Variables	Odds Ratio OR [95% CI]	p-value	Adjusted OR [95% CI]	adjusted p-value
25–64 years (Ref: 16–24 years)	1.07 [0.59–1.92]	0.821	0.93 [0.50–1.73]	0.820
GMS status	0.83 [0.49–1.39]	0.477	0.89 [0.51–1.55]	0.673
Infection source: Respiratory	8.28 [4.66–14.69]	<0.001	4.39 [2.33–8.29]	<0.001
Infection source: Abdominal	5.53 [2.78–10.99]	<0.001	3.20 [1.51–6.81]	0.003
Comorbidity	5.03 [3.42–7.41]	<0.001	3.27 [2.12–5.07]	<0.001

severity across the gestational and postpartum period to inform targeted interventions. Although no maternal deaths were observed in this cohort, confidential enquiry reports from the UK continue to identify opportunities for improvement in the recognition and management of maternal infection and clinical deterioration [25]. These reports also highlight persistent inequalities in maternal outcomes, with substantially higher mortality rates among women from Black ethnic backgrounds and elevated risks among some Asian ethnic groups compared with White women [25]. Future research should examine whether similar disparities exist in maternal sepsis incidence, severity, management, and outcomes in Ireland.

Strengths of this study include the use of a comprehensive national dataset and standardised case definitions, enabling population-level insights. Including both hospital-onset and community-onset cases enabled comparison of epidemiological trends and clinical outcomes between hospital and community settings. The application of standardised coding systems and validated maternal comorbidity indices improved the reliability and consistency of the analysis.

Maternal sepsis was identified using administrative diagnostic codes rather than clinical review. Consequently, episodes should be interpreted as sepsis-coded maternal admissions rather than confirmed Sepsis-3 cases. As an administrative database study, findings depend on the accuracy and completeness of coding practices, and variation in sepsis documentation between hospitals may have resulted in misclassification or under-ascertainment. The HIPE database also lacks detailed clinical information including physiological observations, microbiological findings, laboratory markers, illness severity scores, and timing of therapeutic interventions, limiting assessment of clinical pathways and disease severity in maternal admissions.

Importantly, classification of hospital-onset and community-onset sepsis in maternal admissions relied on administrative hospital-acquired diagnostic flags associated with infection diagnoses rather than precise clinical timestamps for sepsis onset. As a result, episodes in which infection was present on admission, but organ dysfunction and sepsis developed later during hospitalisation, may have been classified as community-onset. This approach may therefore have overestimated the burden of community-onset maternal sepsis and underestimated hospital-onset maternal sepsis. Similarly, some hospital-acquired infections in pregnant or postpartum patients may not have been fully captured through coding alone.

The dataset also captured sepsis episodes rather than individual patients and therefore could not account for repeat admissions or multiple sepsis episodes occurring in the same woman over time. In addition, reliance on hospital discharge data may underestimate the true burden of maternal sepsis nationally, as women who deteriorated and died before hospital presentation, or who experienced severe infection managed exclusively in community settings, would not have been captured. Although Leonard et al. (2020) include maternal age ≥ 35 years within their baseline comorbidity score, this variable could not be directly operationalised in our dataset due to age being recorded in broad categories (25–44 and ≥ 45 years). Consequently, age was excluded from the automated index calculation and analysed separately as a categorical variable.

Conclusion

Maternal sepsis in Ireland is characterised by low mortality but more critical care admissions, with infection source as key predictors of severity. These findings support continued emphasis on prevention, early recognition and risk stratification in maternity care, aligned with national maternity sepsis guidelines in Ireland.

CRediT authorship contribution statement

Nandakumar Ravichandran: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project

administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Patricia Fitzpatrick:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Investigation. **Ellen Hayes:** Writing – review & editing, Writing – original draft, Validation, Supervision, Investigation. **Diarmuid Quinlan:** Writing – review & editing, Writing – original draft, Validation, Supervision, Investigation. **Mick Molloy:** Writing – review & editing, Writing – original draft, Validation, Supervision, Investigation. **Etimbuk Umana:** Writing – review & editing, Writing – original draft, Validation, Supervision, Investigation. **Tomas Breslin:** Writing – review & editing, Writing – original draft, Validation, Supervision, Investigation. **Aoife Cotter:** Writing – review & editing, Writing – original draft, Validation, Supervision, Investigation. **Walter Cullen:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Resources, Project administration, Investigation, Funding acquisition, Conceptualization.

Funding

The authors didn't receive any funding for this work.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We thank the Health Pricing Office for granting access to the data used in this study. We sincerely appreciate the support provided by University College Dublin (UCD) School of Medicine, College of Health and Agricultural Sciences and the UCD/HSE Dublin and South East GP Research Network.

The data used in this study were obtained from the Healthcare Pricing Office through the Hospital In-Patient Enquiry scheme. Due to the sensitive nature of patient-level administrative health records and data protection regulations (GDPR), the raw dataset cannot be made publicly available. Requests for access to the data may be directed to the Healthcare Pricing Office at HIPEData.Requests@hse.ie, subject to the standard data application and ethical approval processes of the Health Service Executive.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ejogrb.2026.115251>.

References

- [1] World Health Organization. Maternal sepsis [Available from: [https://www.who.int/teams/sexual-and-reproductive-health-and-research-\(srh\)/areas-of-work/maternal-and-perinatal-health/maternal-sepsis](https://www.who.int/teams/sexual-and-reproductive-health-and-research-(srh)/areas-of-work/maternal-and-perinatal-health/maternal-sepsis)].
- [2] Filetici N, Van de Velde M, Roofthoof E, Devroe S. Maternal sepsis. *Best Pract Res Clin Anaesthesiol* 2022;36(1):165–77.
- [3] Chen L, Wang Q, Gao Y, Zhang J, Cheng S, Chen H, et al. The global burden and trends of maternal sepsis and other maternal infections in 204 countries and territories from 1990 to 2019. *BMC Infect Dis* 2021;21(1):1074.
- [4] Chou D, Tunçalp Ö, Firoz T, Barreix M, Filippi V, von Dadelszen P, et al. Constructing maternal morbidity - towards a standard tool to measure and monitor maternal health beyond mortality. *BMC Pregnancy Childbirth* 2016;16:45.
- [5] Cao J, Xue D, Gao D, Zhang G. Maternal sepsis and other maternal infections: Global Burden from 1990 to 2021. *BMC Pregnancy Childbirth* 2025;25(1):612.
- [6] McCormick C, Gryson R, Tikriti S, Eogan M, Drew R. Maternal sepsis: a 5-year single center review. *Ir Med J* 2025;118:134.
- [7] OECD. Measuring Patient Safety. Paris: Opening the Black Box; 2018.
- [8] Garland A, Gershengorn HB, Marrie RA, Reider N, Wilcox ME. A practical, global perspective on using administrative data to conduct intensive care unit research. *Ann Am Thorac Soc* 2015;12(9):1373–86.

- [9] European Centre for Disease Prevention and Control. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals. 2024.
- [10] Seymour CW, Liu VX, Iwashyna TJ, Brunkhorst FM, Rea TD, Scherag A, et al. Assessment of clinical criteria for sepsis: for the third international consensus definitions for sepsis and septic shock (Sepsis-3). *J Am Med Assoc* 2016;315(8):762–74.
- [11] Leonard SA, Kennedy CJ, Carmichael SL, Lyell DJ, Main EK. An expanded obstetric comorbidity scoring system for predicting severe maternal morbidity. *Obstet Gynecol* 2020;136(3):440–9.
- [12] Healthcare Pricing Office. Activity in Acute Public Hospitals in Ireland Annual Report, 2020. Dublin: Health Service Executive; 2021.
- [13] Healthcare Pricing Office. Activity in Acute Public Hospitals in Ireland Annual Report, 2021. Dublin: Health Service Executive; 2022.
- [14] Healthcare Pricing Office. Activity in Acute Public Hospitals in Ireland Annual Report, 2022. Dublin: Health Service Executive; 2023.
- [15] Healthcare Pricing Office. Activity in Acute Public Hospitals in Ireland Annual Report, 2023. Dublin: Health Service Executive; 2024.
- [16] Healthcare Pricing Office. Activity in Acute Public Hospitals in Ireland Annual Report, 2024. Dublin: Health Service Executive; 2025.
- [17] Authority HIAQ. Investigation into the safety, quality and standards of services provided by the Health Service Executive to patients, including pregnant women, at risk of clinical deterioration, including those provided in University Hospital Galway, and as reflected in the care and treatment provided to Savita Halappanavar. 2013.
- [18] Royal College of Physicians of Ireland. Institute of Obstetricians and Gynaecologists. National Clinical Guidelines in Obstetrics and Gynaecology [Available from: <https://www.rcpi.ie/Faculties-Institutes/Institute-of-Obstetricians-and-Gynaecologists/National-Clinical-Guidelines-in-Obstetrics-and-Gynaecology>].
- [19] Nair S, Spring A, Dockrell L, Mac CS. Irish maternal early warning score. *Ir J Med Sci* 2020;189(1):229–35.
- [20] Department of Health. Irish Maternity Early Warning System (IMEWS) V2, National Clinical Guideline No. 4.
- [21] Dauby N, Flamand V. From maternal breath to infant's cells: Impact of maternal respiratory infections on infants' immune responses. *Front Pediatr* 2022;10:1046100.
- [22] Laibl V, Sheffield J. The management of respiratory infections during pregnancy. *Immunol Allergy Clin North Am* 2006;26(1):155–72. viii.
- [23] Kurian S, Mathews M, Divakaran B, Reshmi VP, Ajith S. Impact of diabetes on the severity of COVID-19 infection in pregnant women – a single-center descriptive study. *Diab Metab Syndr: Clin Res Rev* 2021;16:102362.
- [24] Yefet E, Bejerano A, Iskander R, Zilberman Kimhi T, Nachum Z. The Association between gestational diabetes mellitus and infections in pregnancy-systematic review and meta-analysis. *Microorganisms* 2023;11(8).
- [25] Freedman RL, Lucas DN. MBRACE-UK: saving lives, improving mothers' care - implications for anaesthetists. *Int J Obstet Anesth* 2015;24(2):161–73.