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National Surveillance Trends in Registered Healthcare-Associated Infections in Georgia, 2020–2025: A Retrospective Registry-Based Analysis

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ABSTRACT

BACKGROUND. Healthcare-associated infections (HAIs) present a critical global public health challenge, imposing significant socioeconomic and structural pressures on healthcare infrastructure. In Georgia, the clinical burden of HAIs is amplified by the dissemination of multidrug-resistant (MDR) bacterial strains within intensive care environments and high rates of unregulated outpatient antibiotic use.

OBJECTIVES. To conduct a nationwide retrospective evaluation of the registered notification trends, chronological dynamics, and structural distribution of major HAIs in Georgia from 2020 to 2025 to provide a basis for optimizing infection control policies.

METHODS. A retrospective epidemiological analysis was conducted utilizing official surveillance registry data from the National Center for Disease Control and Public Health (NCDC) of Georgia between January 2020 and December 2025. A total cohort of N = 13,365 cases was analyzed across four legally mandated HAIs (BSI, VAP, UTI, and SSI) according to NCDC Georgia national clinical and laboratory definitions. 95% confidence intervals (CI) were calculated using the Poisson distribution to evaluate the stability of notification rates.

RESULTS. The absolute number of registered HAIs escalated from 382 cases in 2020 to 3,412 cases in 2025. Low counts in 2020–2021 reflect pandemic-related institutional underreporting. The subsequent surge likely reflects improved surveillance sensitivity and reporting compliance; however, in the absence of patient-day and admission denominators, a true increase in HAI burden cannot be excluded. The registered notification rate for 2025 was 91.9 per 100,000 population. Preliminary 2026 data (975 cases over four months) annualizes to approximately 2,925 cases, suggesting a potential stabilization compared to the 2025 peak.

CONCLUSIONS. The 2020–2025 upward trend demonstrates improved administrative surveillance sensitivity but underscores the need to continue strengthening local infection prevention and control (IPC) standards. National strategies should transition from punitive enforcement toward supportive, quality-based funding models. Key interventions include independent IPC audits, antimicrobial stewardship programs, enhanced molecular diagnostics, and strengthened regulatory oversight of outpatient antibiotic circulation.

KEYWORDS. Georgia; Healthcare management; Healthcare-associated infections (HAIs); Hospital surveillance; Infection control; Registered notification analysis.

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BACKGROUND

Healthcare-associated infections (HAIs) constitute a significant global public health challenge rather than isolated clinical complications, presenting substantial socioeconomic and structural pressures to healthcare delivery platforms. According to the World Health Organization (WHO), effective infection prevention and control practices can prevent a significant proportion of these cases. [1] According to the World Health Organization (WHO), effective infection prevention and control practices can prevent a significant proportion of these cases. [1]

Approximately 7 out of every 100 hospitalized patients in high-income countries acquire an HAI, whereas this baseline escalates to 15 per 100 hospitalizations in low- and middle-income nations. 1Data from the United States Centers for Disease Control and Prevention (CDC) indicate that HAIs account for an estimated 1.7 million infections and 99,000 associated fatalities annually in the US. [2] Furthermore, the European Center for Disease Prevention and Control (ECDC) Point Prevalence Survey confirms that HAIs and concomitant antimicrobial use impose a substantial clinical burden on acute care hospitals across the European Union. [3]

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In Georgia, this challenge has acquired particular urgency during contemporary healthcare infrastructure modernization and the implementation of international institutional accreditation standards. [4] The post-pandemic landscape demonstrated the acute vulnerability of the domestic hospital sector to the rapid dissemination of resistant bacterial strains. [4] Routine surveillance by the National Center for Disease Control and Public Health (NCDC) confirms that nosocomial infections remain a major public health impediment in the country. [4] This situation is highly pronounced within intensive care units, where clinical studies have identified a significant prevalence of carbapenem-resistant *Enterobacteriaceae*, *Acinetobacter* spp., and *Pseudomonas aeruginosa*. [5,6] Additionally, antimicrobial resistance dynamics in Georgia are heavily compounded by high rates of unrationed, self-administered outpatient antibiotic consumption within the general population. [5,6]

The systemic ramifications of HAIs within the Georgian healthcare architecture encompass distinct economic, clinical, and professional dimensions.[4] Within the framework of the state-funded Universal Healthcare Program, which covers the primary share of hospital financing, HAIs generate severe fiscal strains. [4,7,8] Each nosocomial case prolongs hospitalizations, redirecting public resources away from primary diagnoses toward managing secondary institutional complications, thereby driving up medical costs and reducing bed-capacity efficiency. [1,7,8]For patients, HAIs culminate in diminished quality of life, persistent disability, or irreversible organ dysfunction, causing profound distress and eroding public trust. [1,7]

Despite these challenges, a critical knowledge gap remains: Georgia currently lacks denominator-based national HAI trend data, and while registered notifications have increased over time, the relationship between true disease burden and reporting compliance remains uncertain. [4] Therefore, HAI management in Georgia has become a significant healthcare management priority requiring data-driven interventions. [1,4] The fundamental objective of this study is to perform a retrospective evaluation of the registered notification trends and structural characteristics of primary HAIs in Georgia from 2020 to 2025. [4] Specific research questions aim to: (i) evaluate the annual chronological dynamics of recorded HAI cases; (ii) analyze the structural distribution of the four leading hospital HAIs (BSI, VAP, UTI, and SSI); and (iii) identify surveillance-system challenges to optimize national infection control policies. [1,4]

METHODS

Study design and data source

A retrospective, registry-based epidemiological analysis was conducted utilizing national surveillance data from the National Center for Disease Control and Public Health (NCDC) of Georgia. [4] The study analyzed the trends of registered healthcare-associated infections (HAIs) over six years, from January 1, 2020, to December 31, 2025, with an additional comparative analysis of preliminary data from January to April 2026. [4]

Legal reporting framework: The analysis is based on the national mandatory notification framework, which requires all healthcare facilities in Georgia to report four specific HAI categories: bloodstream infection (BSI), ventilator-associated pneumonia (VAP), urinary tract infection (UTI), and surgical site infection (SSI). [4]

Case definitions: Cases were identified and validated based on the NCDC Georgia national clinical and laboratory definitions. [4] HAIs were defined as infections manifesting at least 48 hours after hospital admission (for BSI, VAP, and UTI) or within defined post-operative windows for SSI (30 or 90 days depending on the procedure). BSI includes primary and secondary hospital-acquired bloodstream infections; VAP requires clinical and radiological evidence after ≥48 hours of mechanical ventilation; UTI includes all hospital-associated urinary tract infections; and SSI covers superficial, deep incisional,

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and organ/space infections. The specific clinical and laboratory criteria for each infection category are summarized in **TABLE 1** below.

TABLE 1. Standardized case definitions for monitored HAIs

Category	Operational Definition	Laboratory Requirement	Time Threshold
BSI	Primary or secondary hospital-acquired bloodstream infection	Positive blood culture criteria per national protocols	≥ 48 hours after hospital admission
VAP	Pneumonia occurring in a patient on mechanical ventilation	Positive respiratory culture + clinical and radiological signs	≥ 48 hours after initiation of ventilation
UTI	All hospital-associated urinary tract infections	Positive urine culture + specific clinical symptoms	≥ 48 hours after hospital admission
SSI	Superficial, deep incisional, or organ/space infection	Clinical wound criteria and/or microbiological confirmation	Within 30- or 90-days post-surgery

Study population and unit of analysis: The cumulative study cohort for 2020–2025 consists of N=13,365 registered HAI notifications. [4] Annual totals were reconciled to ensure internal consistency with this cumulative cohort (2020: 382; 2021: 800; 2022: 2415; 2023: 3079; 2024: 3277; 2025: 3412). [4] To address the unit of analysis, each registered HAI was counted as a separate clinical event; therefore, multiple infections occurring in a single patient during one hospitalization were recorded as distinct notifications. Provisional data for January-April 2026 (n=975) were analyzed separately to evaluate reporting stabilization trends.

Data limitations and reframing: Due to the structure of the national aggregate registry, certain granular denominators - including hospital-level participation counts per year, patient-days, admission volumes, and device-days (ventilator/catheter days) - were unavailable. Consequently, this study is framed as a descriptive analysis of registered HAI notifications rather than a true incidence or prevalence density study.

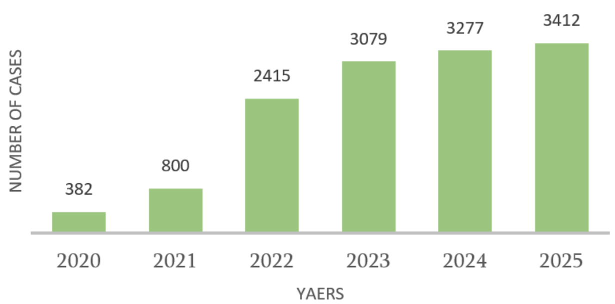
Statistical analysis: Data were stratified by year and month. To provide a macro-level baseline, the registered HAI notification rate per 100,000 population was calculated using 2025 national census metrics. To assess the statistical stability and uncertainty of these annual rates, 95% confidence intervals (CI) were calculated using the Poisson distribution. Comparative analysis between the first four months of 2025 and 2026 utilized absolute differences and relative percentage change metrics.

Ethics and data governance: The study used fully anonymized aggregate data provided by the NCDC.[4] As the research involved a secondary analysis of de-identified public health surveillance data without hospital-level or patient-level identifiers, the analysis complied with national legislation on health data and international ethical standards. Formal ethics committee approval was waived in accordance with data governance protocols for institutional registry research.

RESULTS

Annual chronological dynamics (2020-2025): The retrospective analysis of the national registry confirms a substantial escalation in the absolute volume of registered healthcare-associated infection (HAI) notifications in Georgia. The reconciled study cohort for the period of 2020-2025 comprises a total of N=13,365 registered cases. [4] Annual notifications increased more than eightfold, rising from 382 cases in 2020 to a peak of 3,412 cases in 2025 (**FIG.1**).

FIGURE 1. Annual chronological dynamics of registered healthcare-associated infections in Georgia (2020–2025)



To assess the statistical stability and uncertainty of these trends, annual notification rates per 100,000

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population were calculated with 95% confidence intervals (CI) based on a Poisson distribution. The notification rate rose from 10.29 (95% CI: 9.26–11.32) in 2020 to 91.90 (95% CI: 88.82–94.98) in 2025. The non-overlapping confidence intervals between 2021 and 2022 indicate a statistically significant increase in reporting sensitivity following the peak of the COVID-19 pandemic (**TAB.2**).

TABLE 2. Annual registered HAI notification rates per 100,000 population with 95% confidence intervals (2020–2025)

Year	Registered Cases (n)	Rate per 100,000	95% Confidence Interval (CI)
2020	382	10.29	[9.26 – 11.32]
2021	800	21.55	[20.06 – 23.04]
2022	2,415	65.05	[62.46 – 67.64]
2023	3,079	82.93	[80.00 – 85.86]
2024	3,277	88.26	[85.24 – 91.28]
2025	3,412	91.9	[88.82 – 94.98]

Structural distribution by HAI category: The dataset is structurally dominated by four legally mandated HAI categories: ventilator-associated pneumonia (VAP), bloodstream infection (BSI), urinary tract infection (UTI), and surgical site infection (SSI). Throughout the study period, VAP remained the most frequently reported condition, accounting for 50.3% of categorized notifications in 2025.

Notably, in 2020, only 138 out of 382 cases (36.1%) were specifically categorized, reflecting significant operational fragmentation and registry under-reporting during the initial phase of the pandemic. In contrast, from 2021 onwards, reporting consistency improved significantly. In the peak year of 2025, the annual sum of specific HAI events (3,424) slightly exceeded the total number of unique patient notifications (3,412), reflecting instances where a single patient experienced multiple concurrent or sequential infection events during a single hospitalization (**TAB.3**).

TABLE 3. Structural distribution of registered healthcare-associated infection notifications by category (2020–2025)

Year	BSI	VAP	UTI	SSI	Total
2020	21 (5.50%)	89 (23.30%)	14 (3.66%)	14 (3.66%)	138
2021	177 (22.13%)	503 (62.88%)	77 (9.63%)	45 (5.63%)	802
2022	406 (16.81%)	1520 (62.94%)	342 (14.16%)	155 (6.42%)	2423
2023	546 (17.73%)	1770 (57.49%)	533 (17.31%)	232 (7.53%)	3081
2024	609 (18.58%)	1713 (52.27%)	675 (20.60%)	283 (8.64%)	3280
2025	634 (18.58%)	1722 (50.47%)	717 (21.01%)	351 (10.29%)	3424

Note: The sum of specific events may differ from unique patient counts due to multiple infections per patient or incomplete categorization in 2020

Provisional 2026 stabilization trends: Provisional data for the first four months of 2026 (January–April) recorded 975 cases. [4] A comparative monthly analysis between 2025 and 2026 reveals a localized stabilization and a relative contraction in reporting intensity, with an overall relative decline of 23.6% for the four months. (**TAB.4**)

TABLE 4. Comparative monthly distribution of registered HAI cases (January–April, 2025–2026)

Month	2025	2026	Absolute difference	% change
January	464	307	-157	-33.8%
February	263	266	3	+1.1%
March	296	252	-44	-14.9%
April	254	150	-104	-40.9%
Total	1277	975	-302	-23.6%

The most significant reductions were observed in January (-33.8%) and April (-40.9%). If current reporting intensity remains similar, the January-April 2026 count annualizes to approximately 2,925 cases, suggesting that the 2026 annual total may stabilize below the 2025 peak.

DISCUSSION

The longitudinal analysis of healthcare-associated infections (HAIs) in Georgia from 2020 to 2025 reveals critical structural and operational patterns within the national epidemiological surveillance network. [4] The sharp, non-linear escalation from 382 cases in 2020 to 3,412 cases in 2025 must not be interpreted as a primary deterioration of clinical safety profiles. [1,4]

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Instead, this statistical trajectory reflects enhanced surveillance sensitivity, regulatory reporting compliance, and state-driven institutional inspections initiated in the post-pandemic era.[4] However, in the absence of hospital-level denominators such as patient-days, admission volumes, and device-days, a true increase in the underlying HAI burden cannot be excluded.[4]

Reporting sensitivity and pandemic recovery: The severely deflated registration metrics during 2020 and 2021 (382 and 800 cases, respectively) demonstrate the operational fragmentation caused by the COVID-19 pandemic.[4] During this period, clinical facilities disproportionately prioritized pandemic response mechanisms at the expense of routine nosocomial notification protocols.[4] The subsequent surge from 2022 onwards aligns with the reactivation of routine monitoring and the implementation of more rigorous reporting mandates. This interpretation is further supported by the provisional 2026 data, which show a 23.6% relative decline in notifications compared to the same period in 2025, suggesting a potential stabilization of reporting practices after the initial post-pandemic surge.[4]

Structural vulnerabilities and AMR dynamics: The structural dominance of ventilator-associated pneumonia (VAP), which accounted for over 50% of categorized notifications in 2025, underscores a profound clinical vulnerability in critical care environments.[1,4] This distribution is consistent with global data from the WHO and ECDC, which identify invasive device utilization as a primary vector for institutional transmission.[1,3] In Georgia, the management of these infections is severely complicated by localized antimicrobial resistance (AMR) dynamics, specifically the documented prevalence of carbapenem-resistant *Enterobacteriaceae* and *Acinetobacter* spp. in intensive care units.[5,6] These dynamics are intensely exacerbated by high rates of unregulated, non-prescription outpatient antibiotic use, which facilitates the selection of resistance genes before patients even enter the hospital system.[5,6]

Economic strain and policy implications: From a healthcare management perspective, the rising volume of HAI notifications generates immense systemic strain.[1,4] Within the framework of Georgia's state-funded Universal Healthcare Program, prolonged hospitalizations and the management of secondary complications directly deplete public fiscal reserves and reduce bed-capacity efficiency.[4,7,8] To address these challenges, national health policies must transition from historically punitive administrative models toward supportive, quality-based funding incentives that tie institutional reimbursement to verified infection prevention and control (IPC) performance indicators.[1,4]

Study limitations: A major limitation of this study is the historical absence of a national Point Prevalence Survey (PPS) and the lack of granular denominators (e.g., ventilator-days, catheter-days) within the central registry, which restricts the capacity to compute definitive incidence density metrics.[4] Additionally, while the N=13,365 cohort is now internally consistent, the lack of hospital-level granularity prevents a definitive distinction between true national burden and the expansion of reporting coverage.[4]

CONCLUSIONS

Registered healthcare-associated infection (HAI) notifications in Georgia increased markedly between 2020 and 2025, reaching a cumulative cohort of N=13,365 cases. This trend most likely reflects improved administrative surveillance sensitivity and reporting compliance following pandemic-related underreporting in 2020-2021. However, the absence of admission, patient-day, device-day, and microbiological denominators limits the definitive interpretation of true HAI incidence. To ensure the long-term sustainability of the national healthcare model, Georgia's next surveillance phase should prioritize:

1. Implementation of denominator-based reporting (e.g., patient-days, ventilator-days).
2. Standardization of case definitions and integration with antimicrobial resistance (AMR) data.
3. Transition from punitive administrative models toward supportive, quality-based financing mechanisms that tie hospital reimbursement directly to verified infection prevention and control (IPC) indicators.

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4. Strengthening of clinical laboratory infrastructure for rapid molecular pathogen identification.

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