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Retrospective Epidemiological Profiling and Socio-Spatial Clustering of Brought-in-Dead Cases at Nchanga North General Hospital, Copperbelt Province, Zambia

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Abstract

Background

Brought-in-Dead (BID) cases are individuals who die in the community without receiving immediate institutional medical attention, represent a significant, poorly understood public health challenge in Sub-Saharan Africa. Vital registration systems in these settings frequently fail to capture the demographic and socio-spatial determinants driving these out of hospital deaths. This study profiles the sociodemographic, clinical, and logistical determinants of BID occurrences at Nchanga North General Hospital in Chingola, Zambia, to identify systemic gaps in acute healthcare access.

Methods

A retrospective, cross-sectional descriptive study was conducted analyzing 554 consecutive BID cases recorded at Nchanga North General Hospital. Descriptive statistics, measures of central tendency, and bivariate cross-tabulations were compiled using IBM SPSS version 27.0. Geographic data points were stratified into urban housing densities based on local infrastructure parameters.

Results

The sample displayed a distinct bimodal mortality age distribution, with notable spikes among children under 5 years and older adults over 65 years (overall mean age: 47.1 years; median: 47.0 years). A major gender disparity was observed, with males accounting for 59.2% (n = 328) of the cohort; this gap was widest during productive adulthood (18–50 years). Spatial clustering analysis revealed that 64.6% (n = 358) of all cases originated from high-density, low-income neighbourhood (Kapisha, Chiwempala, Soweto, and Maiteneke). Retrospective clinical histories showed that while 95.1% (n = 527) of cases lacked documented comorbidities, 53.8% (n = 298) had visited a healthcare facility within the 3 months preceding death. Crucially, the postmortem autopsy rate was only 5.8% (n = 32), heavily biased toward medicolegal or traumatic arrivals managed by the Zambia Police Service 4.3% (n = 24) or organized community interventions 1.4% (n = 8). Conversely, 100% of the 86.3% (n = 478) of cases escorted by informal family networks were certified directly without pathological verification.

Conclusion

Community mortality in this cohort is driven by socio-economic vulnerabilities, geographical positioning, and critical missed opportunities for intervention during recent healthcare interactions. The low rate of autopsy utilization creates a significant blank spot in public health data, as natural community deaths bypass diagnostic verification entirely. Addressing this challenge requires strengthening community-level

emergency medical services, establishing proactive monitoring for high-risk clinical outpatients, and expanding sentinel autopsy surveillance.

1. Introduction

Brought-in-Dead (BID) individuals, defined as persons who succumb to acute or chronic medical crisis outside institutional clinical environments and are dead upon hospital presentation, present a profound challenge to health systems globally [1]. In high-income countries, community mortalities are largely mitigated by structured Emergency Medical Services (EMS) networks and active out-of-hospital resuscitation protocols [2]. However, across Sub-Saharan Africa, resource constraints, fragmented infrastructure, and financial barriers cause a significant portion of terminal illnesses to end in the community without professional medical attention [3].

In Zambia, as in many rapidly urbanizing Sub-Saharan nations, the true burden and clinical aetiology of BID events remain poorly documented [4]. National vital statistics engines are often undermined by incomplete civil registration and data gaps regarding community deaths [5, 6]. When an individual dies at home, the underlying cause of death is frequently certified through basic external visual inspections by medical officers [7]. This process is highly subjective and prone to diagnostic errors [7]. Consequently, public health policymakers face a substantial blind spot, lacking the precise epidemiological data needed to target preventive health interventions effectively [4, 7].

To develop targeted strategies, we must understand the social, economic, and geographic context of these deaths [8]. Social determinants of health such as housing density, informal transit networks, and gender-specific care-seeking behaviours powerfully shape community survival rates during acute health crises [8, 9]. Chingola, an industrialized mining hub in Zambia's Copperbelt Province, presents a complex social environment where high-density, low-income informal settlements sit directly adjacent to middle- and upper-class urban centers [10].

This study addresses these gaps by presenting a comprehensive epidemiological evaluation of 554 consecutive BID cases presenting to Nchanga North General Hospital. By systematically mapping demographic factors, neighbourhood clusters, past healthcare interactions, and the administrative pathways of arrivals, this paper aims to identify the systemic vulnerabilities driving out-of-hospital mortality. These insights will support data-driven reforms in community emergency care and vital registration protocols region-wide [5, 7].

2. Methodology

2.1 Study Design and Setting

This study was a retrospective, cross-sectional descriptive design. The study was conducted at Nchanga North General Hospital, a major public referral facility in Chingola, Zambia, which serves an expansive mixed urban and peri-urban catchment population.

2.2 Population and Sample Size

The study population comprised all documented BID cases arriving at the institutional mortuary over the specified data-collection window spanning from the fourth quarter of 2022 to the first quarter of 2025. A total of 554 consecutive entries with complete administrative records were extracted from the formal hospital records and mortuary registers, completely eliminating sampling bias by capturing the entire accessible target population pool (N = 554).

2.3 Variables and Adjusted Spatial Stratification

Variables gathered included sex, age, date with time of presentation, family-reported cause of death, person or authority escorting the body, previous healthcare contact within the past 3 months, comorbidity profiles, and postmortem confirmation status. To evaluate geographic clustering, residential addresses were coded and grouped into three housing density tiers based on municipal infrastructure and socio-economic indicators:

1. High-Density: Dense, low-income settlements with poor transit networks (Kapisha, Chiwempala, Soweto, and Maiteneke).
2. Medium-Density: Planned sub-townships with partial infrastructure access (Kabundi, Lulamba, Chikola, and Kasompe).
3. Low-Density: Standard urban residential blocks with optimal infrastructure and road access (Nchanga, Town-centre, Liverside, Gymkhana, and Solwezi Road).

2.4 Data Management and Statistical Analysis

Data were captured from the institutional records and mortuary registers using a standardized abstraction matrix and analyzed using IBM SPSS Statistics version 27. Continuous variables, such as raw age, were evaluated for normality. To observe sample distributions and isolate peak mortality ages, continuous age data were plotted using a histogram with an overlaid normal distribution curve.

To identify sociodemographic and institutional patterns associated with community mortality, patients were stratified into categorical age groups and residential density cohorts. Cross-tabulations were performed to assess demographic interactions (e.g., Age Category by Sex) and social pathway dynamics (e.g., Arriving Escort Authority by Autopsy Status). Descriptive statistics were summarized using frequency counts (n) and valid overall percentages (%).

2.5 Ethical Considerations

The study protocol was reviewed and approved by the Mulungushi University Research Ethics Committee (Ref No: SMHS-MU2-2025-06). Legal and operational clearance to conduct the study, utilize the hospital records was granted by the National Health Research Authority (NHRA) of Zambia. Local facility administrative permission to access the records, mortuary registers was officially granted by the Medical Superintendent at Nchanga North General Hospital.

Because this research utilized completely retrospective, secondary data extracted from historical death registers, the requirement for active patient or next-of-kin informed consent was waived by the ethics committee.

De-identification strategies were strictly maintained throughout the data handling pipeline; all names and direct identifiers were completely omitted during data abstraction and replaced with unique alphanumeric participant codes. The final digital database was password-protected and hosted on a secure server accessible solely to the primary research investigators to preserve data confidentiality.

3. Results

3.1 Sociodemographic Landscapes

Figure 1. Age Distribution Curve

Figure 2. Overall Gender Split

Figure 3. Cross-Tabulated Demographic Interactions

Figure 4: Distribution of BID Cases by Residential Density

3.2: Clinical History and Comorbidities Profile

Figure 5. Comorbidity Distribution Profile

Figure 6. Medical Care Interface

3.3 Analysis of Reported and Certified Causes of Death

Figure 7: Autopsy Utilization Rate

Figure 8: Clinical history Verification

3.4. Social context of Brought-in-Dead (BID)

Figure 9: BID escort profile

4. Discussion

The retrospective profiling of 554 BID cases from fourth quarter of 2022 to the first quarter of 2025 at Nchanga North General Hospital reveals important structural realities regarding out-of-hospital mortality, social geography, and health system gaps in Zambia [1, 4]. These findings show that community deaths are not random events; instead, they are deeply shaped by age, gender, geographic neighbourhood, and institutional investigative practices [1, 8].

The bimodal age distribution observed in this cohort with high mortality spikes in early childhood 13.0% (n = 72) and late adulthood 32.5% (n = 180) reflects typical health vulnerabilities across the human lifecycle in developing health systems [1, 11]. The under-18 spike, mostly consisting of paediatrics under 5, aligns with broader regional challenges in managing acute pediatric conditions like severe pneumonia, diarrheal dehydration, and malaria [12, 13]. In high-density settings, these diseases can progress from mild symptoms to fatal outcomes within hours, often before parents can arrange formal hospital transport [13]. This historical and ongoing challenge reflects patterns noted across sub-Saharan Africa, where a massive proportion of pediatric deaths transpire entirely at home without formal medical attendance [12]. Conversely, the mortality spike in those over 65 represents a breakdown in long-term chronic disease management for non-communicable diseases (NCDs), such as cardiovascular disease and cerebrovascular accidents [14]. In older age groups, these conditions often manifest as sudden community collapses [9, 14].

The significant gender imbalance where males accounted for 59.2% (n = 328) of all cases, nearly doubling female counts of 40.8% (n = 226) during peak productive years points to complex socio-behavioral and occupational dynamics [15, 16]. In many adult BID cohorts globally and regionally, a pronounced male predominance is frequently documented [1]. In the industrial copper-mining environment of Chingola, adult males face distinct environmental and occupational exposures [9, 16]. Furthermore, behavioral data from Sub-Saharan Africa consistently shows that men often delay seeking healthcare for acute or chronic symptoms due to socio-cultural expectations of resilience or fear of stigma [15]. This delay frequently turns treatable conditions into sudden, fatal emergencies at home [15, 16].

A major finding of this study is the strong link between residential location and community mortality risk, with 64.6% (n = 358) of cases clustering in high-density neighbourhoods including Kapisha, Chiwempala, Soweto, and Maiteneke [10]. This spatial concentration highlights how structural inequalities directly impact survival [8]. High-density areas in Chingola are characterized by overcrowded housing, poor sanitation, and unpaved roads that flood during rainy seasons, making physical transit difficult [10, 17].

When an acute medical emergency occurs, such as severe respiratory distress or sudden cardiac arrest, the 3 Delays model of emergency medicine applies directly [18]:

1. The first delay, is delay in deciding to seek care, often due to a lack of emergency awareness or financial concerns [18].
2. The second delay, is delay in reaching a healthcare facility, worsened by the total absence of formal Emergency Medical Services (EMS) or ambulances in our data (0.0%) [3, 17]. Families must rely on informal private transport or taxis, which are difficult to secure at night [17].
3. The third delay, is delay in receiving adequate care, which here manifests as individuals dying during transit and arriving at the hospital as a BID case [3, 18].

This study reveals a critical missed opportunity for intervention: 53.8% (n = 298) of these individuals had visited a healthcare facility within the 3 months preceding death. This contradicts the common

assumption that BID cases happen because individuals are completely disconnected from the healthcare system. Instead, more than half of these patients were actively interacting with clinical staff shortly before dying. This high rate of recent healthcare contact indicates a serious gap in outpatient monitoring and risk screening [19]. Patients with deteriorating chronic conditions or unmanaged infectious diseases such as Tuberculosis, which was confirmed in 1.6% of the overall cohort are likely being discharged into the community without adequate safety-net plans or clear instructions on when to return for urgent care [19]. This matches findings from similar centers across sub-Saharan Africa where a vast number of BID cases display prior interactions with the formal medical ecosystem that failed to mitigate sudden terminal decompensation [1, 3].

Final analysis demonstrates that the extremely low autopsy rate of 5.8% (n = 32) creates a significant blind spot for public health surveillance [20]. Pathological evaluations are not distributed evenly; instead, they are driven by administrative and legal triggers [20, 23]. When the Zambia Police Service 4.3% (n = 24) or organized community groups 1.4% (n = 8) escort a body, a formal postmortem is conducted 100% of the time to rule out foul play or investigate traumatic events like Road Traffic Accidents [7].

However, for the 86.3% (n = 478) of cases brought in by family networks after a natural illness at home, the autopsy rate drops to 0%. Medical officers certify these deaths directly using basic external visual checks and brief family descriptions [7]. This practice introduces substantial diagnostic errors into national mortality databases [7, 20]. This breakdown aligns with wider findings across Zambia, where studies by Hachizovu et al. and Yokobori et al. show that while community deaths account for a massive block of institutional records, their underlying causes are rarely fully verified or scientifically verified via postmortem [4, 7, 21, 22, 24]. Public health systems cannot effectively combat conditions like cardiovascular disease, respiratory failure, or undiagnosed tuberculosis if the vast majority of community deaths are classified based on superficial assumptions rather than definitive pathological data [1, 20].

5. Conclusion and Recommendations

This study demonstrates that Brought-in-Dead occurrences at Nchanga North General Hospital are heavily shaped by sociodemographic disparities, high-density residential clustering, and fragmented medical surveillance. Over half of these individuals had interacted with healthcare providers within the 3 months before their deaths, highlighting clear opportunities for healthcare systems to step in earlier and prevent these outcomes. Additionally, the low rate of autopsy tracking for family-escorted natural deaths limits the quality of national health data.

To address these systemic vulnerabilities, the following targeted interventions are recommended:

Establish Community-Based Emergency Medical Services

Public health authorities should invest in community-based emergency transit networks, such as dedicated motorcycle or a number of 4x4 ambulance stations in high-density areas (Kapisha, Chiwempala, Soweto, and Maiteneke), to reduce transit delays during acute medical crises.

Strengthen Outpatient Safety-Net Protocols

Clinics must improve discharge protocols for high-risk outpatients, particularly adult males with chronic conditions or infectious diseases like Tuberculosis. Providers should use structured risk-assessment tools, arrange proactive community health worker home visits, and give families clear guidelines on emergency symptoms.

Expand Sentinel Autopsy Surveillance

The Ministry of Health should expand postmortem evaluation practices beyond strictly legal or police cases. Implementing a sentinel autopsy program where a random sample of natural community deaths undergoes pathological verification will improve diagnostic accuracy and provide reliable data to inform national disease prevention strategies.

Verbal Autopsy Validation Studies

Implement and evaluate a Standardized Verbal Autopsy (VA) protocol for family-escorted natural deaths. This will help determine probable causes of death where physical autopsies are unavailable and validate the accuracy of these tools against known medical histories.

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Figures

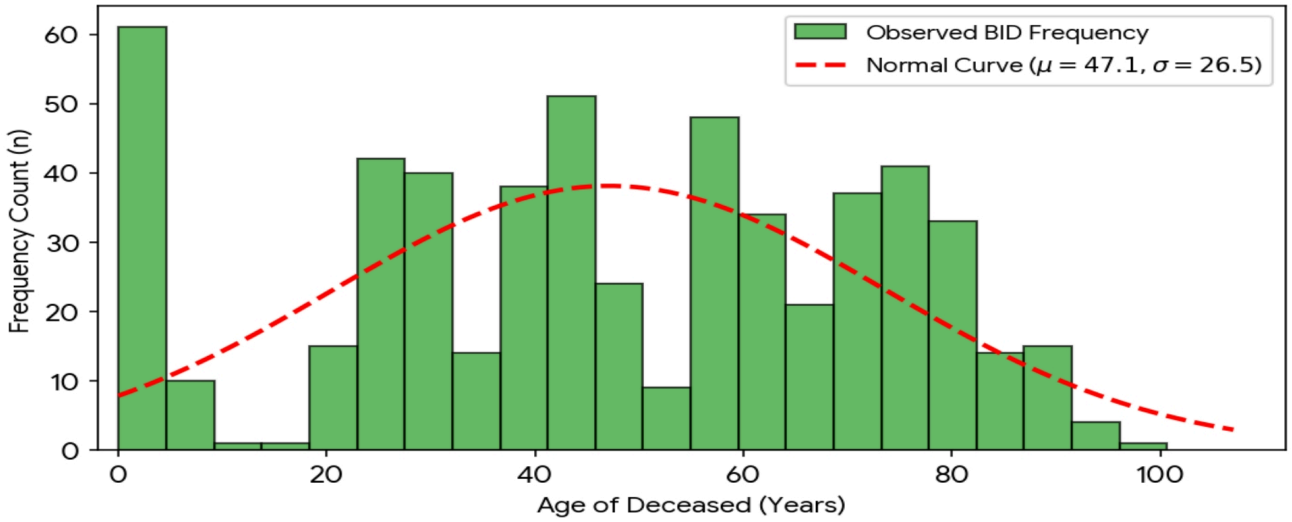


Figure 1

Age Distribution Curve

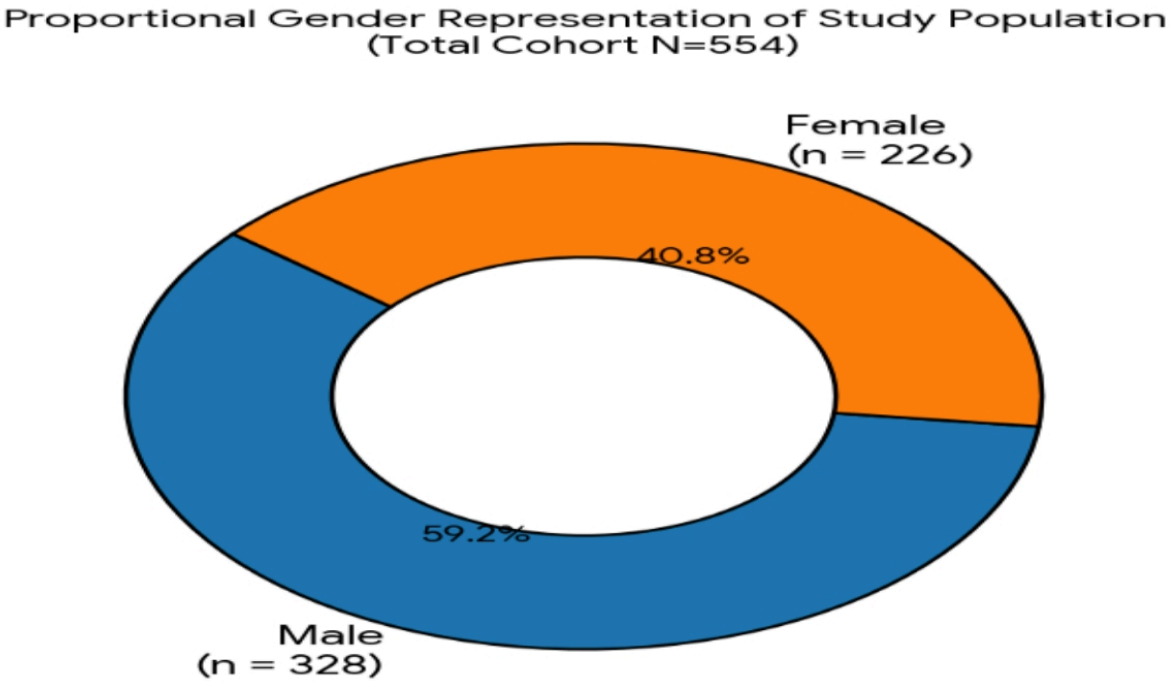


Figure 2

Overall Gender Split

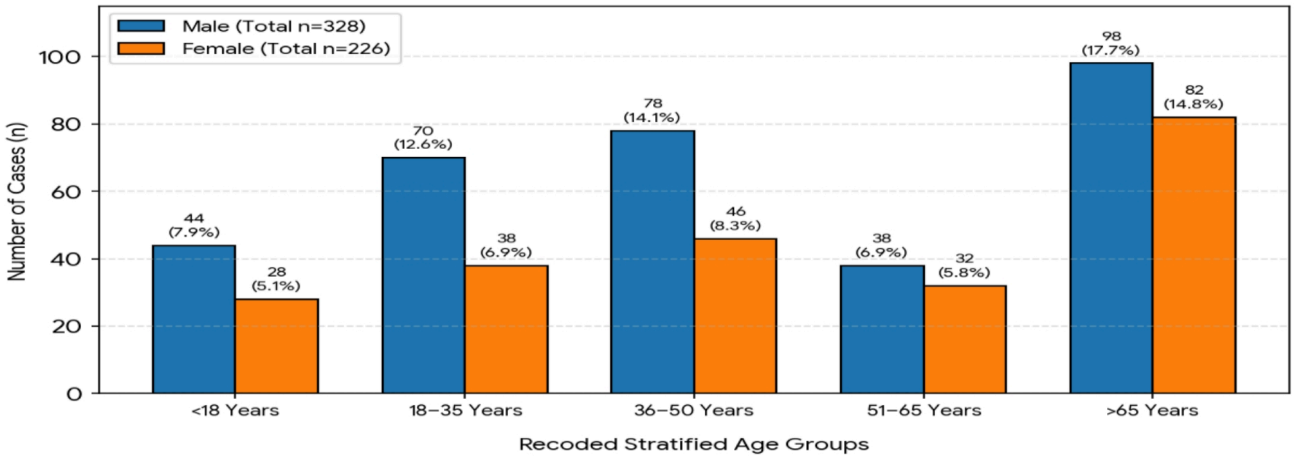


Figure 3

Cross-Tabulated Demographic Interactions

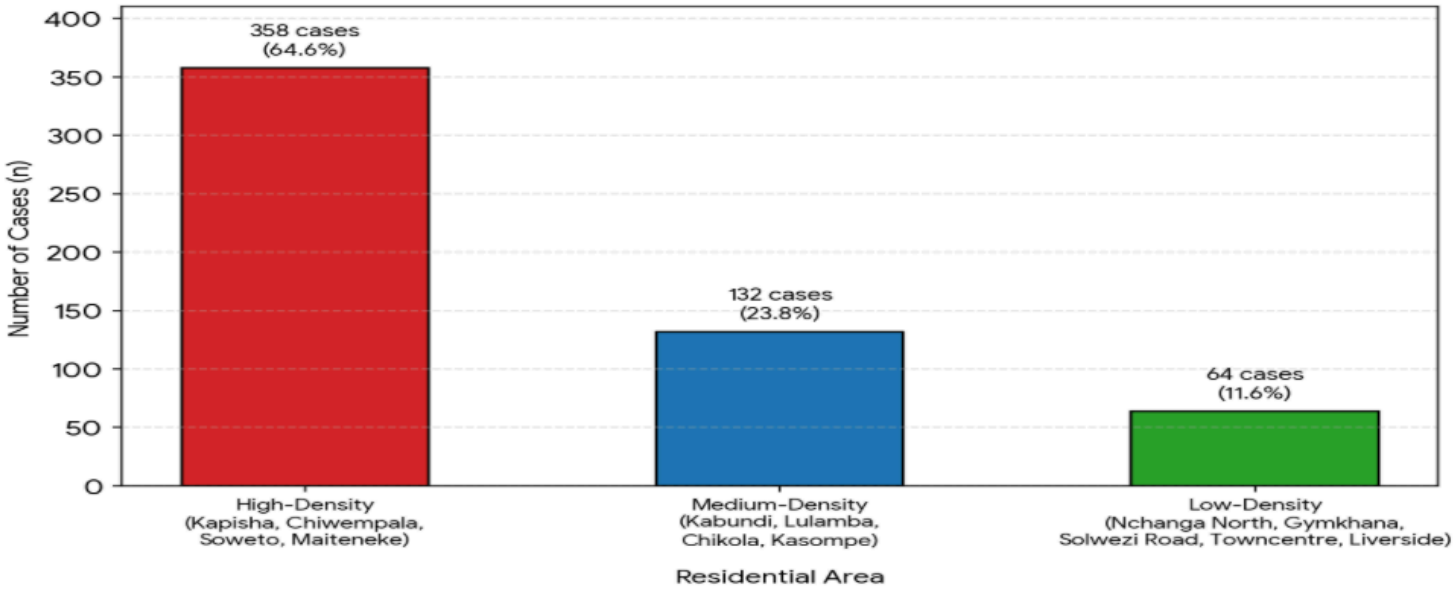


Figure 4

Distribution of BID Cases by Residential Density

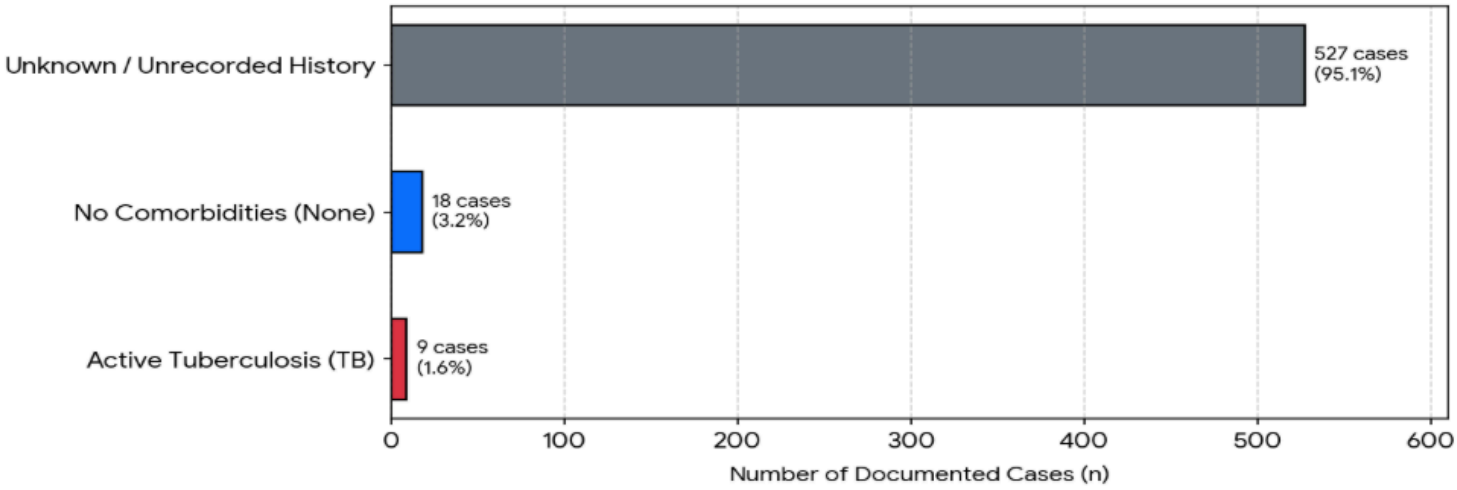


Figure 5

Comorbidity Distribution Profile

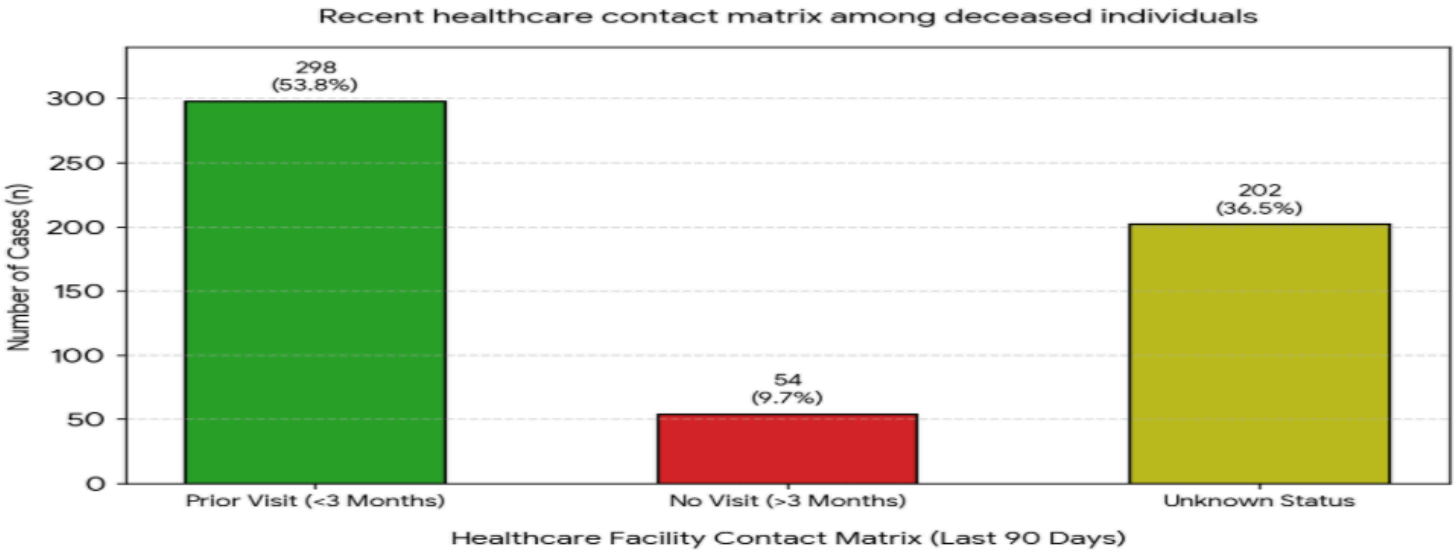


Figure 6

Medical Care Interface

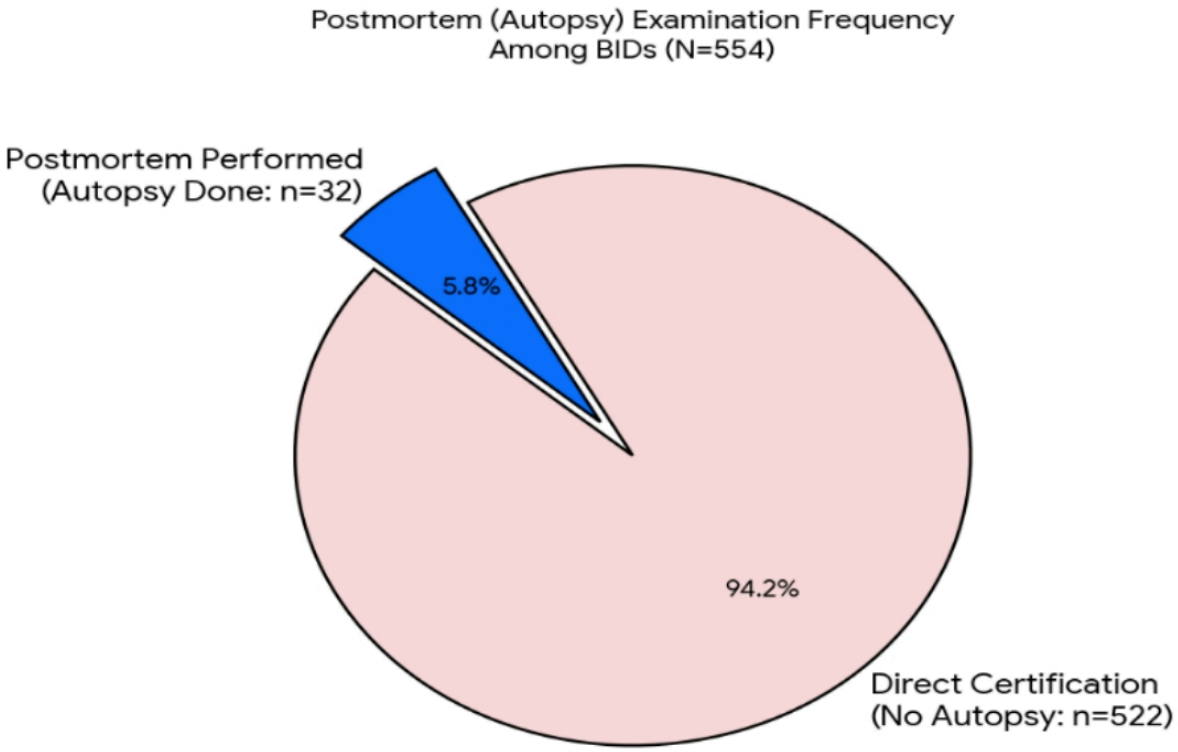


Figure 7

Autopsy Utilization Rate

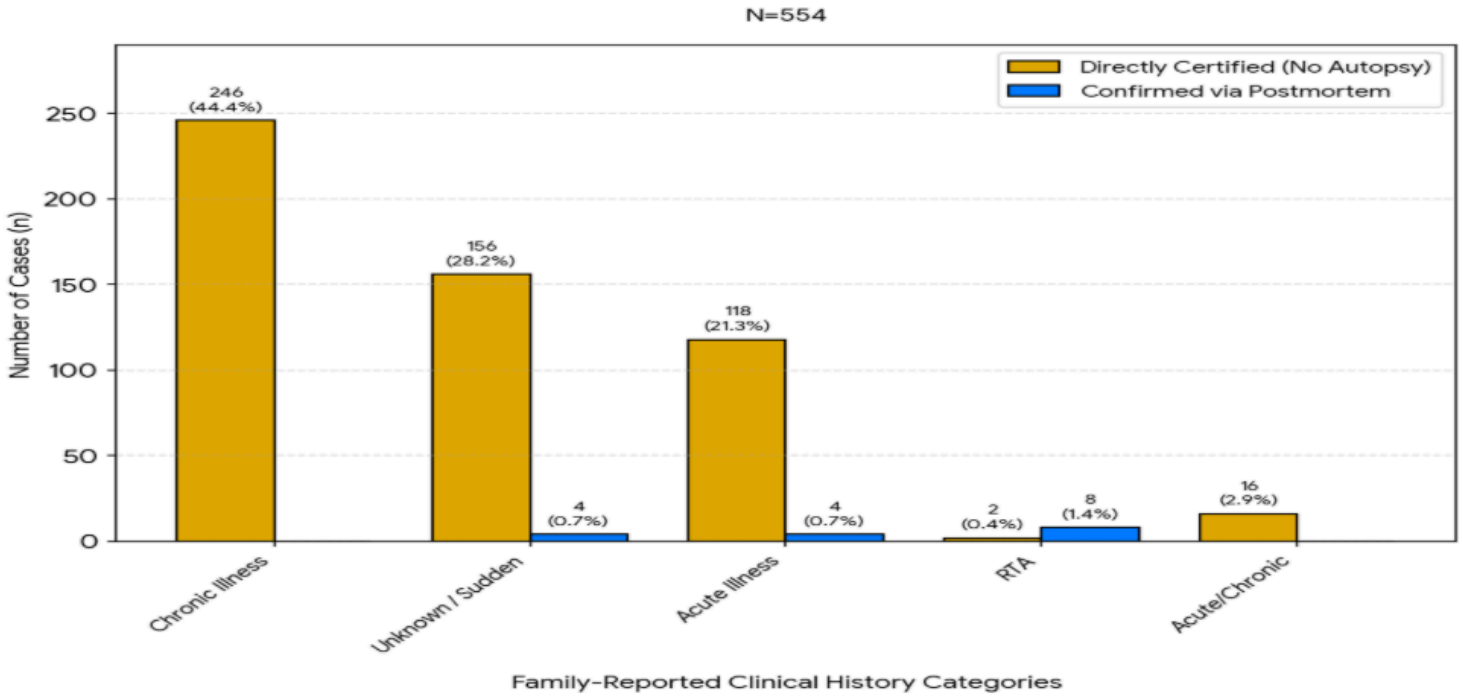


Figure 8

Clinical history Verification

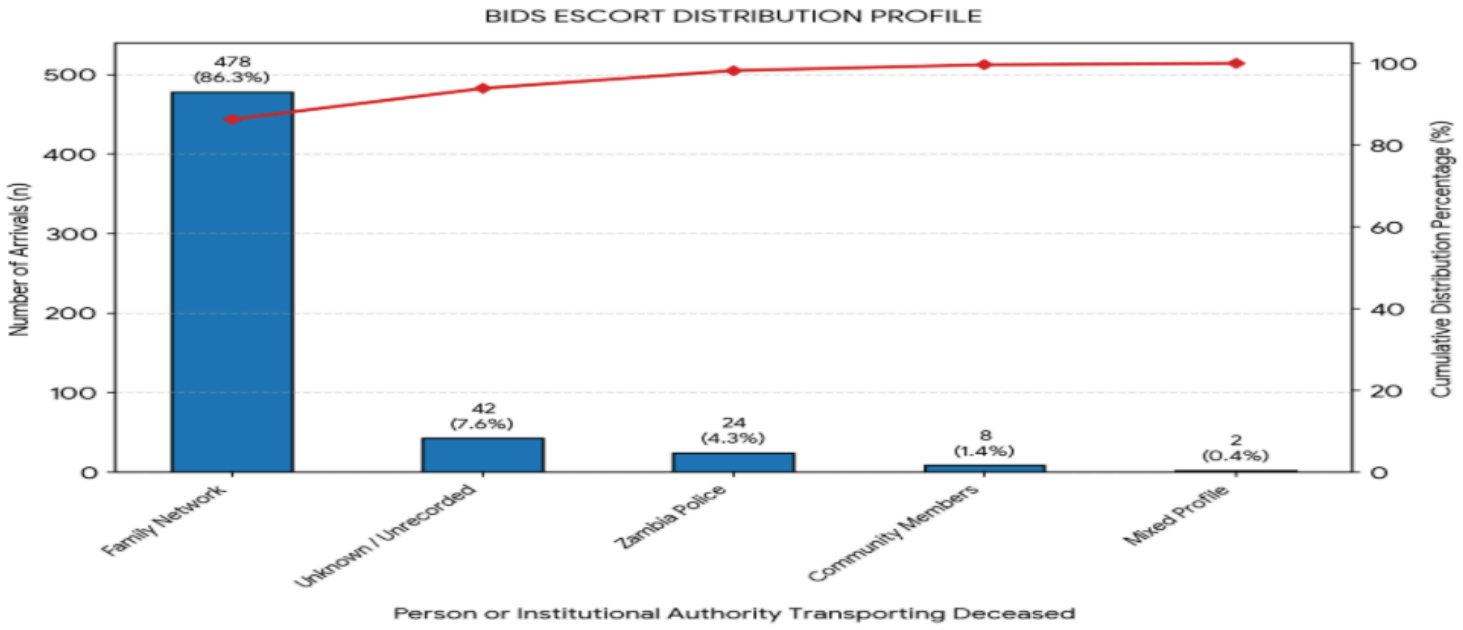


Figure 9

BID escort profile

Supplementary Files

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