

Emergency Department Respiratory Presentations at Muhimbili National Hospital Amidst the Early COVID-19 Years: A Cross-Sectional Analysis

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Abstract

Respiratory diseases remain a leading cause of death worldwide, claiming around 10 million lives annually. The COVID-19 pandemic further intensified this global health challenge, particularly affecting both low- and high-income countries. This study investigated the occurrence and trends of respiratory conditions among patients attending the emergency department at Muhimbili National Hospital in Tanzania and explored whether hospital-based data could support early detection of outbreaks in settings with limited diagnostic resources. We analyzed two years of electronic health records from the Emergency Medical Department (EMD), including all patients who presented with respiratory complaints between 2020 and 2021. The analysis employed descriptive statistics and visual trend assessments to quantify the burden of disease and compare it to national COVID-19 case patterns. Of the 24,942 patients seen during the study period, respiratory conditions accounted for roughly one-quarter of visits, averaging 1,039 cases per month. Patients had a median age of 34.7 years (IQR 21.7–53.7), and 52% were male. Pneumonia (52%) and upper respiratory tract infections (31%) were most prevalent, followed by asthma (4.8%) and suspected COVID-19 (2.5%). Temporal analysis revealed four peaks in respiratory presentations, coinciding with the four waves of COVID-19 reported nationally. These results indicate a significant and fluctuating burden of respiratory illness in the hospital's emergency department, mirroring national pandemic trends. The findings suggest that real-time monitoring of hospital presentations could serve as a practical tool for early warning of respiratory outbreaks and other public health emergencies in contexts where diagnostic testing is limited.

Keywords: Curcuma longa, Anti-neuroinflammation, BV2 microglial cells, Nuclear factor kappa B, Mitogen-activated protein kinases, Heme oxygenase-1

Introduction

Respiratory diseases represent a significant global health challenge, accounting for 10 million deaths worldwide in 2017 [1, 2]. The most prevalent respiratory conditions globally include acute respiratory infections, chronic obstructive pulmonary disease (COPD), asthma, and lung cancer, tuberculosis [1, 2]. In Tanzania, and specifically in Africa, the most common respiratory illnesses are pneumonia, HIV-associated respiratory diseases, and

tuberculosis [3, 4]. Between 2005 and 2015, respiratory diseases were responsible for approximately 13% of all deaths in Tanzania [5, 6]. Since 2020, the COVID-19 pandemic has led to a notable increase in respiratory illnesses, becoming a major contributor to respiratory-related mortality and morbidity [7]. Although the overall impact of COVID-19 in Africa has been reported to be lower than in other regions, it has still placed considerable strain on healthcare systems and economic structures, disrupting social and daily life [8].

Despite advances such as expanded childhood immunizations, improved diagnostic capabilities, and strengthened healthcare infrastructure in Tanzania, mortality from respiratory diseases has been rising over the past decade [6]. In many low- and middle-income countries (LMICs), including Tanzania, comprehensive and systematic data on respiratory disease burden and trends are often lacking, and existing surveillance

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systems are not always capable of providing real-time monitoring. The COVID-19 pandemic has highlighted the vulnerability of health systems to public health emergencies and the limitations of surveillance in resource-limited settings. In such contexts, hospital-based databases offer a practical approach to understanding disease burden and may serve as early-warning systems to inform timely responses [9–11]. Similar to other LMICs, hospital-based surveillance in Tanzania is limited and often unable to deliver rapid alerts to policymakers and health authorities. The primary objective of this study was to assess the burden of respiratory conditions among patients presenting to the Emergency Medical Department (EMD) at Muhimbili National Hospital. Secondary objectives included examining temporal trends in respiratory conditions over a two-year period and comparing these patterns with national COVID-19 data to evaluate whether hospital-based surveillance could serve as a useful tool for detecting outbreaks and guiding public health responses in settings with constrained diagnostic capacity.

Materials and Methods

This study drew on clinical records collected routinely from patients who visited the Emergency Medical Department (EMD) at Muhimbili National Hospital (MNH) between January 1, 2020, and December 31, 2021. MNH, Tanzania's national referral hospital with 1,500 beds, is located in Dar es Salaam, the country's main commercial city, home to around 4 million people [12]. Tanzania, a lower-middle-income nation in East Africa, has a population of approximately 62 million and a GDP per capita of USD 1,076 [12, 13]. Although the direct health impact of COVID-19 in Tanzania was reportedly lower than in some neighboring countries, the pandemic still generated notable mortality, illness, and socio-economic disruption [14].

The Muhimbili EMD is supported by a team of emergency specialists and nurses trained in critical care, and the department is well-equipped with essential medications, medical devices, and supplies to manage acute and emergency cases [15]. Each year, the EMD receives roughly 63,800 patients. Patient encounters are documented using an electronic system that captures registration information, laboratory and imaging results, prescriptions, and patient disposition, including transfers, admissions, or discharge. Staff are trained to routinely input complete and accurate data, including clinical

diagnoses. For this study, the relevant anonymized records were extracted from the electronic database for analysis.

Exclusion criteria and Study inclusion, population

The study included all individuals who attended the Muhimbili EMD with respiratory-related conditions during the designated period. A respiratory condition was classified if the patient met any of the following: presenting with respiratory symptoms, receiving a respiratory-related diagnosis in the EMD, or exhibiting an abnormal respiratory rate at triage. Respiratory symptoms considered included cough, shortness of breath, difficulty breathing, chest pain, chest tightness, or coughing up blood. Respiratory diagnoses encompassed a broad spectrum of conditions, including pneumonia, upper respiratory tract infections (URTI), tuberculosis, lung cancer, chronic obstructive pulmonary disease (COPD), asthma, bronchitis, bronchiolitis, tonsillitis, pharyngitis, sinusitis, laryngitis, rhinitis, emphysema, pyothorax, pneumothorax, influenza, and suspected COVID-19.

The designation of suspected COVID-19 was only applied from March 20, 2020, onward, following the first reported case in Tanzania. This determination relied on clinical presentation supported by laboratory and imaging findings (chest X-ray), as confirmatory testing was not routinely available. In cases where multiple diagnoses were recorded, the first-listed diagnosis was used for this study.

Abnormal respiratory rates were defined differently by age: for patients aged 5 years and older, a rate below 8 or above 25 breaths per minute was considered deranged. For children, the thresholds were age-specific: over 60 breaths per minute for infants under 2 months, over 50 for those aged 2–11 months, and over 40 for children aged 1–5 years [16]. Although elevated respiratory rate may result from non-respiratory conditions, respiratory illness is the most common underlying cause, and this criterion was included to ensure comprehensive capture of cases, as patient-reported complaints can be subjective and initial diagnoses in the EMD are provisional. Patients who were dead upon arrival were excluded from the analysis.

Data analysis, extraction and management

Data for all patients meeting the inclusion criteria were anonymized and exported from the hospital's electronic records into STATA 17 (StataCorp) for processing. The

dataset underwent thorough cleaning and validation to ensure accuracy and completeness. Demographic information was summarized using descriptive measures such as percentages, counts, medians, and interquartile ranges.

The study visualized respiratory disease patterns over the two-year period using multiple graphical approaches. Pie charts illustrated the distribution of common respiratory diagnoses, while temporal trends for pneumonia, URTI, asthma, and suspected COVID-19 were depicted using line graphs. To explore potential correlations with national trends, monthly peaks in EMD respiratory cases were compared against confirmed COVID-19 data for mainland Tanzania from March 2020 to December 2021, sourced from the Ministry of Health COVID-19 Situation Report No. 25, published on 4th March 2022 [14]. This allowed a direct comparison between hospital-level respiratory illness trends and nationwide COVID-19 case patterns.

Ethical considerations

The study received ethical clearance from the Institutional Review Board of Muhimbili University of Health and Allied Sciences (approval numbers:

DA.282/298/06/C/767 and MUHAS-REC-4-2020-217) as well as from the National Institute for Medical Research (approval number: NIMR/HQ/R.8a/Vol.IX/3752). Permission to retrieve and use patient records was granted by Muhimbili National Hospital (permission number: MNH/TRCU/IRB/Perm/2021/082). Because this research involved only de-identified retrospective data, individual informed consent could not be obtained, and the ethics committees accordingly exempted the study from this requirement.

Results and Discussion

Burden of respiratory conditions

Between 2020 and 2021, a total of 24,942 patients presenting with respiratory conditions were recorded in the Muhimbili EMD and included in the analysis (**Figure 1**). This accounted for approximately one-quarter (24.5%) of all EMD visits during the study period. On a daily basis, the department received an average of 34 patients with respiratory complaints, translating to roughly 1,039 cases per month.

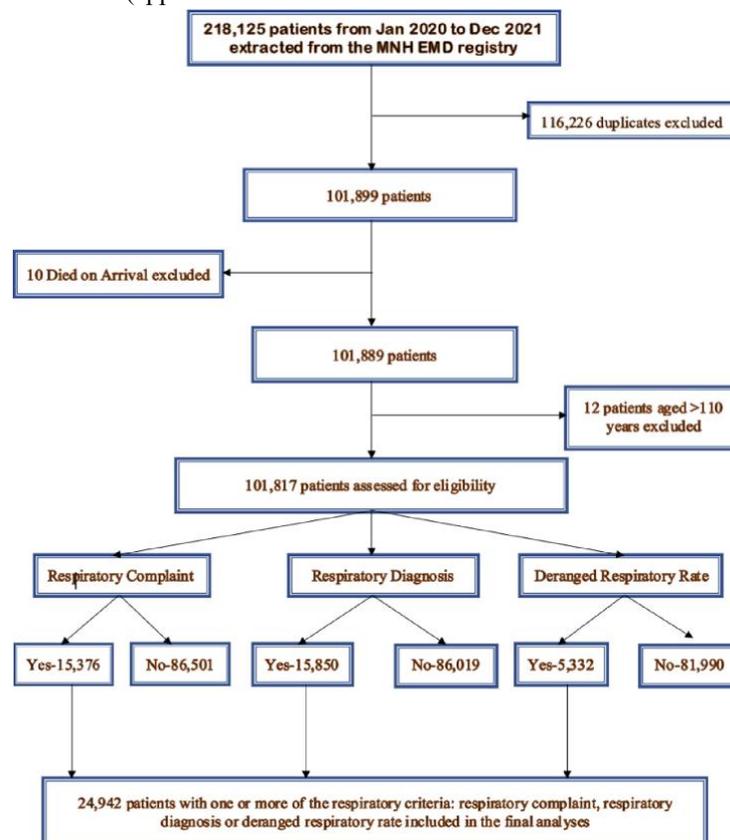


Figure 1. Diagram illustrating the patient selection process for the study.

Among the enrolled individuals, more than half—12,999 (52.12%)—were male. Patient ages varied widely, from as young as 2 days to 110 years old, with a median of 34.7 years (interquartile range: 21.7 to 53.7).

Approximately 25% of the cohort was under 15 years of age. The majority (75%) of cases originated from the Dar es Salaam region (**Table 1**).

Table 1. Baseline profile of individuals seeking care for respiratory illnesses at the Emergency Medicine Department of Muhimbili National Hospital during 2020–2021.

Characteristic	Category	n	%
Age	Median age (IQR)	34.7 (21.7–53.7)	-
Age groups (years)	0–<15	6,369	25.54
	15–<30	4,149	16.63
	30–<45	4,878	19.56
	45–<60	4,390	17.60
	60–<75	3,650	14.63
	75–<90	1,368	5.48
	90+	138	0.55
Sex	Male	12,999	52.12
	Female	11,939	47.87
	Unknown	4	0.01
Admitting unit/ward	Pediatric	2,819	20.95
	Infectious and Respiratory Diseases Unit	3,438	25.54
	Medical Unit 1	3,639	27.04
	Surgery	2,862	21.27
	Intensive Care Unit (ICU)	700	5.20
Region of residence	Dar es Salaam	18,606	74.60
	Other regions of Tanzania Mainland	5,267	21.12
	Zanzibar	190	0.76
	Outside Tanzania	26	0.10
	Unknown	853	3.21

¹Includes: Oncology, Psychiatry, Neurology, Nephrology, Hematology, Gastroenterology, Endocrinology, Dermatology, and Cardiology.

²Includes: Urology, Surgery, Ophthalmology, Obstetrics, Gynecology, Orthopedics, Neurosurgery, Dental, ENT, and Burns.

The weekly trend of respiratory conditions 2020–2021

During the observation period from January 1, 2020, to December 31, 2021, the weekly pattern of respiratory

conditions showed considerable variation, with certain weeks recording as low as 140 cases and others reaching up to 410 cases (**Figure 2**).

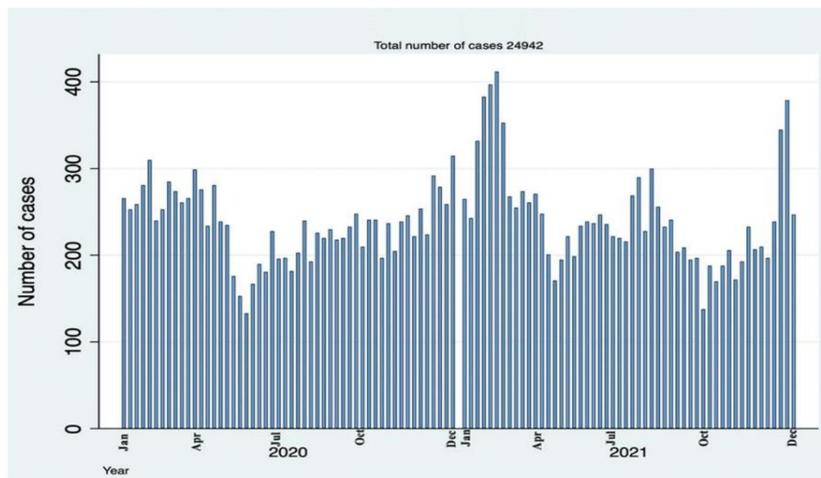
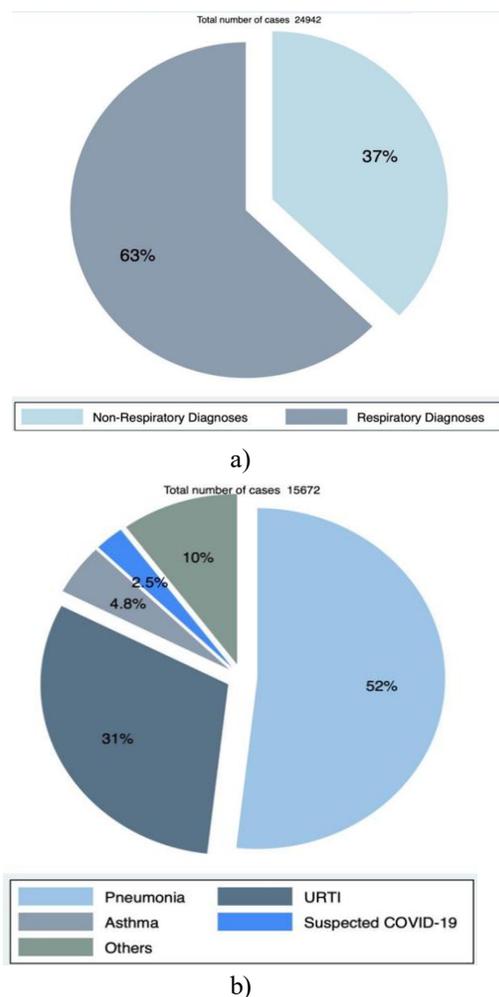


Figure 2. Weekly counts of respiratory cases at a National Hospital in Tanzania.*Patterns and diagnoses of respiratory conditions at muhimbili emd*

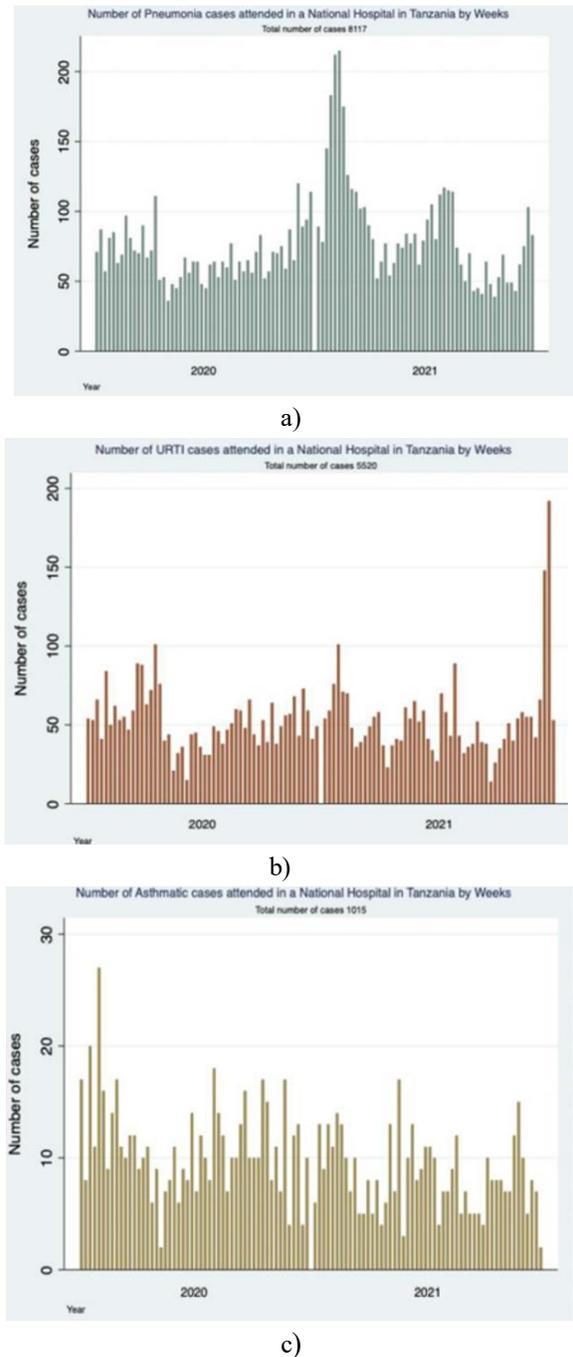
In this study, 63% of patients were ultimately diagnosed with a respiratory condition (**Figure 3a**). The rest exhibited respiratory symptoms or abnormal breathing rates but were diagnosed with non-respiratory illnesses in the EMD. Among those with respiratory diagnoses, pneumonia accounted for about half of the cases, while upper respiratory tract infections made up roughly 31% (**Figure 3b**). The remaining 10% included less common conditions such as tuberculosis, COPD, lung tumors, and emphysema.

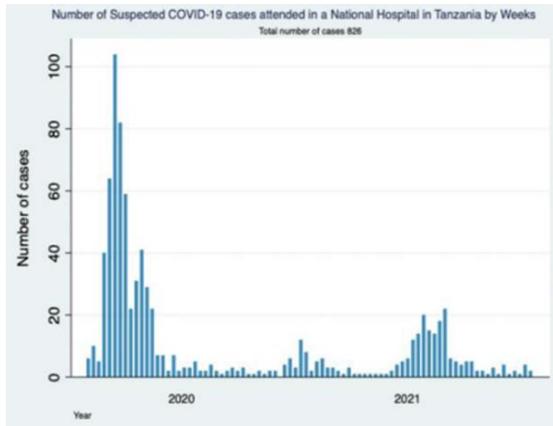


Others include: Tuberculosis, COPD, Lung tumor and emphysema

Figure 3. Diagnoses among patients presenting with respiratory conditions at Muhimbili National Hospital.
Respiratory Condition Trends

Figure 4 illustrates the weekly trends of the most frequently diagnosed respiratory conditions at the EMD, including upper respiratory tract infections (URTI), pneumonia, suspected COVID-19 and asthma.





d)

Figure 4. Frequency of major respiratory diagnoses at a Tanzanian National Hospital.

Respiratory patterns and their relation to covid-19 waves
When examining the trends of infectious respiratory illnesses—such as pneumonia, URTIs, and suspected COVID-19—four periods of heightened activity stand out: April 2020, February 2021, August 2021, and December 2021 (Figure 5). These intervals correspond closely with the four national COVID-19 waves recorded in official statistics (Figure 6). Interestingly, in both the hospital data and national reports, case numbers began rising several weeks before each peak, suggesting an early increase in respiratory presentations ahead of confirmed COVID-19 surges.

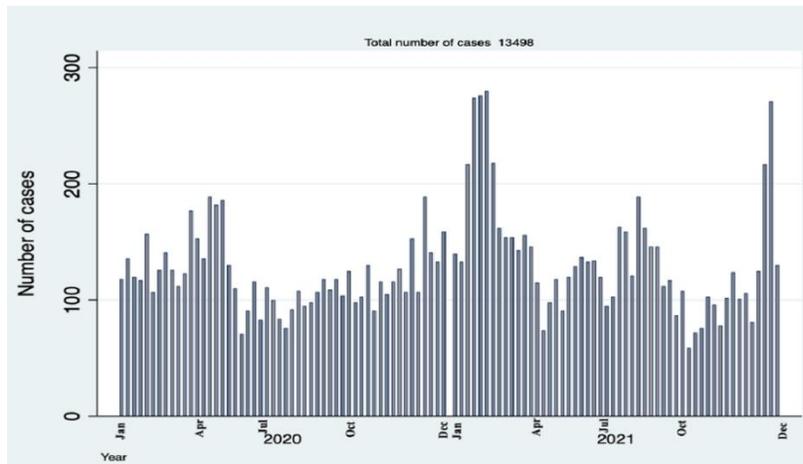


Figure 5. Weekly counts of pneumonia, suspected COVID-19 cases and upper respiratory tract infections, at a National Hospital in Tanzania.

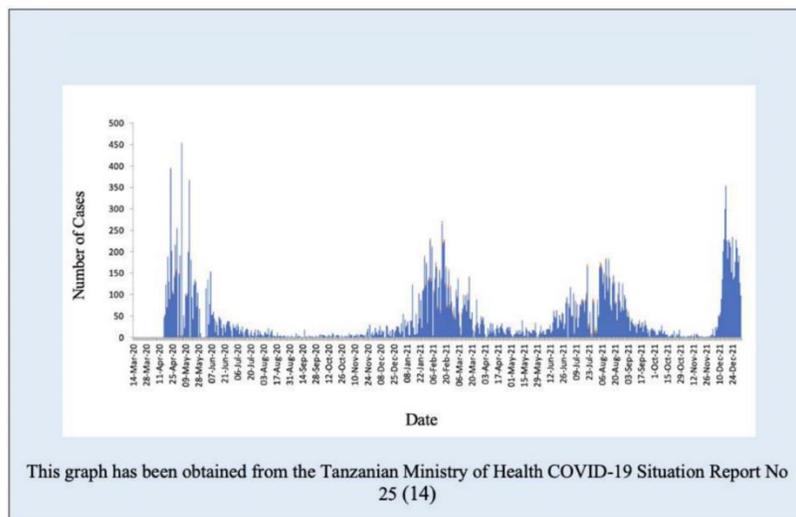


Figure 6. Confirmed COVID-19 cases in mainland Tanzania between March 2020 and December 2021.

Outcomes in the emergency department

Regarding patient outcomes in the study, nearly half—12,311 individuals (49%)—required hospital admission, while 10,989 patients (44%) were sent home after treatment. In total, 400 patients (1.6%) died within the EMD (**Figure 7**).

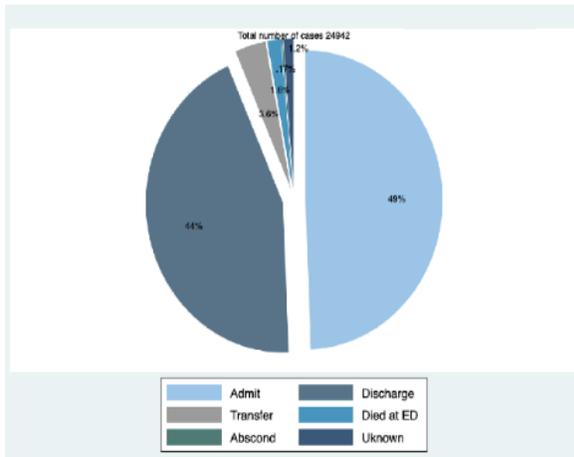


Figure 7. Patient outcomes for respiratory cases managed at a National Hospital in Tanzania.

This study reveals that each month, more than 1,000 patients—approximately one in every four—seek care for respiratory conditions at the emergency department of a national hospital in Tanzania. These findings underscore the significant contribution of respiratory illnesses to the overall disease burden in the country. Similar observations have been made internationally, where respiratory conditions account for a substantial proportion of healthcare visits, including in the United States [17] and emergency departments in Canada [18]. High burdens of chronic respiratory diseases have also been reported in countries such as India [19]. In 2019, Tanzania ranked among the countries with the highest incidence of acute lower respiratory infections, with nearly one in three children under five presenting to healthcare facilities with respiratory infections [5]. Globally, respiratory diseases are recognized by the World Health Organization as the second leading cause of death, after cardiovascular conditions [20], imposing a considerable strain on health systems—an effect that has been intensified during the COVID-19 pandemic.

The analysis was conducted within the context of the COVID-19 pandemic. Peaks in patient presentations with respiratory complaints between 2020 and 2021 coincided with the four waves of COVID-19 in Tanzania, suggesting a likely link to the pandemic. However, this

association could not be definitively confirmed due to limited diagnostic testing and lack of access to laboratory-confirmed cases. By 26 December 2021, over 278 million COVID-19 cases and nearly 5.4 million deaths had been reported globally [21]. During the same period, COVID-19 was the most frequent diagnosis in emergency departments in the United Kingdom, surpassing other respiratory conditions [22].

Interestingly, increases in respiratory presentations in this study began approximately four weeks before the peaks observed both in hospital data and in national COVID-19 statistics. This early rise highlights the potential value of monitoring respiratory trends for public health purposes. Even without laboratory confirmation, clinical surveillance can provide an early warning of emerging waves, allowing timely interventions by health authorities and communities [9–11, 23]. A similar phenomenon was observed in South Korea, where cases of URIs and pneumonia were noted 1–2 weeks before COVID-19 was officially recognized or routine testing was established [11, 24]. Other countries, including the United States, have implemented respiratory surveillance systems that have proven effective in detecting early disease trends [25, 26].

Pneumonia was the most frequent respiratory diagnosis, affecting half of all patients in this cohort, suggesting it is likely the predominant cause of respiratory illness in this setting. These results align with studies from other regions that have identified pneumonia as a leading contributor to respiratory disease [27, 28]. Prior to the pandemic, pneumonia followed by tuberculosis was the most common respiratory condition in Africa [3, 4], and a ten-year survey in Tanzania found pneumonia accounted for over half of deaths from respiratory illnesses [6]. Other studies have highlighted asthma, chronic obstructive pulmonary disease, acute respiratory infections, tuberculosis, and lung cancer as major causes of respiratory morbidity [1, 2]. It is important to note that this study relied on preliminary EMD diagnoses before confirmatory testing; pneumonia may have been recorded as a pragmatic working diagnosis while awaiting laboratory results.

This is the first study in Tanzania to evaluate respiratory disease trends in relation to COVID-19 waves. It analyzed a large dataset of more than 20,000 patients at the country's largest hospital, which serves a nationwide patient population. The data were prospectively collected as part of routine clinical care. Nonetheless, several limitations exist. The study involved retrospective

analysis of clinical data, limiting the scope of available variables. While the hospital receives patients from across Tanzania, the majority of cases were from Dar es Salaam, potentially limiting generalizability. Additionally, the focus of emergency care is on stabilizing life-threatening conditions rather than establishing definitive diagnoses, so the respiratory diagnoses recorded are pragmatic and may vary according to the clinician's experience.

Conclusion

Respiratory illnesses placed a significant strain on the Muhimbili EMD during the first two years of the COVID-19 pandemic, accounting for approximately one in four patient visits. The timing of the observed increases, which coincided with Tanzania's four COVID-19 waves, indicates that these cases were likely driven by the pandemic. In settings with limited diagnostic capacity, continuous hospital-based monitoring of respiratory presentations can provide an important early-warning system for emerging disease outbreaks and other public health threats.

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Ethics Statement: None

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