Epidemiological analysis of Acute Respiratory Infections in children and adults treated in the emergency rooms of the main hospitals of Maputo city - Mozambique, 2019-2020

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ABSTRACT

Introduction: Acute respiratory infections (ARI) prevent the normal functioning of the upper and lower respiratory tract. Mozambique established sentinel surveillance for ARIs in 2013 to produce consistent data and information for decision-making. The study descriptively analyzed the data from the ARI surveillance system in Maputo city from May 2019 to February 2020. **Methods:** We conducted a retrospective analysis of ARI surveillance data at the five main hospitals in Maputo city from May 2019 to February 2020. The data were collected from the adult (≥ 15 years old) and pediatric (<15 years old) outpatient register books. Variables of interest were the date of diagnosis, health unit, province, gender, age and diagnosis. The different diagnoses were summarized by age group and hospital. **Results:** A total of 43,600 cases of ARI were identified. Most cases (69.3%, 30,227) were aged <15 years old. Fifty-one per cent (22,494/43600) of cases were female. The largest proportion of cases presented in February, with 17.3% (7,544), and the most frequent diagnosis was upper respiratory tract infection with 44.9% (19,569) of cases. **Conclusion:** The spike in the URTIs provided evidence for the country to begin active surveillance for COVID-19 across the country.

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Introduction

Acute respiratory infections (ARI) are a major public health problem and a significant cause of morbidity and mortality in children and the elderly, resulting in 3 to 5 million cases of serious illness per year [1,2]. Respiratory infections are responsible for 1.9 million deaths worldwide and are among the most common causes of disease and mortality in children under 5 years. These infections contribute to 2-4 per cent of under-five deaths in developed countries, and as much as 19-21% of child deaths in the Eastern Mediterranean, Africa and South-West Asia [3,4].

In the 21st century, several outbreaks of respiratory illnesses have been recorded around the world, including severe acute respiratory coronavirus syndrome (SARS-CoV) in 2002, Influenza H1N1 in 2009, Middle East Respiratory Syndrome coronavirus (MERS-CoV) in 2012 and currently the new coronavirus disease 2019 (COVID-19) in 2019 [5].

According to the 2011 Demographic and Health Survey (DHS) in Mozambique, 1.5% of children under 5 years of age had an ARI, of which 1.6% were male and 1.5% female. Urban centres had a higher percentage of ARI (1.7%) than in rural areas (1.5%). The city of Maputo reported 2% of total cases in Mozambique [6].

Due to the current epidemiological situation, in which COVID-19 is a worldwide concern, there was a need to establish surveillance of ARIs in the country to monitor these infections. The National Institute of Health (INS), through the Field Epidemiology and Laboratory Training Program (FELTP), in partnership with the Ministry of Health (MISAU), conducted a retrospective epidemiological assessment of ARIs in the city of Maputo. The study was aimed at strengthening the capacity of the ARI surveillance system during the early phase of COVID-19.

Methods

Study design and population

A descriptive study was conducted, in which all patients who had respiratory infections in the main health facilities during the period from May 2019 to February 2020 were included. During the period under analysis data of 43,600 patients with ARIs from the five health facilities was collected.

Study setting

Maputo city is the capital of Mozambique. It is located in the south-eastern part of the country 120 km from the border with South Africa and 80 km from the border with Swaziland. The city of Maputo comprises five hospitals with more specialized services, four of which are general hospitals (tertiary level) and one central hospital (quaternary level): José Macamo General Hospital (HGJM), Chamanculo General Hospital (HGCH), Mavalane General Hospital (HGM), Polana Caniço General Hospital (HGPC) and Maputo Central Hospital (HCM),. All these hospitals carry out active and passive ARI surveillance, details of which are recorded in outpatient and ward books. The data were collected on time to guide action in case of an emergency.

Data collection

Data were collected from the record books of the main entry points of the study health facilities. These included all adult and pediatric patients who were diagnosed with ARI and treated in hospitals including the emergency rooms. The variables of interest were year and month of visit, health unit, province, gender, age and diagnosis. The ages were divided into two groups of 0-14 years (pediatric) and 15+ for adult patients.

The Health Information System for Monitoring and Assessment (HIS-MA) at the HGM was described in collaboration with the technicians responsible for ARI surveillance, who provided information on the operation of the system and demonstrated its functions.

Description of the ARI surveillance system

In Mozambique, the surveillance of ARI in healthcare facilities occurs in two distinct ways, one based on the collection of data at the healthcare facility level and the other based on the collection of data at the patient level for SIS-MA.

The information is produced to define and monitor the public health policies of all districts in Mozambique. The information is sent to the capital of the country through the provinces, taking into

account a hierarchical organization of the structure of the MISAU [7]. It is an online system.

Technicians collect data daily from the emergency triage record books for pediatrics and adults. The data are recorded by two ARIs surveillance technicians who are assigned to the health unit, on a record sheet in which the diagnosis and age group are captured for the last 24 hours. The unit updates the data weekly in an Excel spreadsheet by the nucleus of statistics and planning (NEP) cumulatively with age, sex, month, province, and diagnosis.

Data collected from the pediatric and adult emergency screening process are not entered in the HIS-MA, instead, these data are used for hospital-wide ARI monitoring (**Figure 1**).

Collection of data from ARI wards

Surveillance technicians collect and record data in the registration books of the pediatric and adult medicine wards. The data collection in the wards of the health units comes from patients who arrive at the hospital at a weekend with a clinical state suggestive of hospitalization.

After attending the triage station, the patients are moved to the observation room and then transferred to the ward, either the pediatric ward for children (0-14) or the adult ward (15+).

The surveillance technicians assigned to the inpatient services use a specific sheet for the collection of data in the wards. Data are entered into HIS-MA using monthly summaries, with the statistical cycle of the health unit closing on the 20th of each month, and from the 21st to the 25th the data are aggregated and sent to the district health services on the 26th of each month.

The technicians perform the statistical update in SIS-MA from the district health services, which is done on the 1st to the 10th of each month by the statistical and planning centre (NEP) or district statistical centre (NED). The system closes on the 11th of each month, and the information is sent to the health directorate in Maputo city (DSCM) where it can be viewed through a server at the Ministry of Health (**Figure 2**).

Data analyses

The data were collected from the collection books of the main entry points of the five health units and then entered into the Microsoft Excel platform and analyzed using Microsoft Excel and SPSS V.20. Age was divided into pediatric age (0-14) and adult age (15+). A descriptive analysis of the data regarding time, person and place was made and is presented as text, graphs and frequency tables.

Ethical considerations

Ethical approval was not required for this study as it was conducted as a component to support evidence gathering on pandemic COVID19 in Mozambique. Adminstrative clearance was provided by the National Institute of Health and the Mozambique Ministry of Health.

Results

Epidemiological data description

Between May 2019 and February 2020, 43,600 cases of ARI were reported in the five study healthcare facilities, 69.3% (30,227) of which were pediatric (<15 years), 30.3% (13,212) adult (≥15) and the remaining 0.4% (161) patients had no age information. The median age was 5 years (IQR=2 - 21) and the female gender accounted for 51.6% (22,494/43,600) of cases. HCM healthcare facility reported the most cases of ARI, 34.3% (14,976) and HGPC the least, with 11.6% (5,078). The highest number of cases, 7,544, was reported in February 2020 with an average of 1,509 cases per week. May 2019 had the lowest number of notifications (2,475) with an average of 495 cases per healthcare facility (**Figure 3**).

During the period analyzed, 15 distinct ARIs were diagnosed in the five health facilities (**Figure 3**). The most frequent diagnoses were upper respiratory tract infections (URTI), tonsillitis, and bronchopneumonia, and the least frequent were external otitis, bronchitis, and influenza. The URTI comprised the largest proportion of cases with 44.9% (19,569), followed by tonsillitis with 20.6% (8,966) (**Figure 3**). Among children, URTI was the most frequent diagnosis, 42.1 per cent (12,712), followed by tonsillitis with 23% (6,957).

For the 15 - 64 age group (adults), the most frequent diagnosis was URTI with approximately 52% (6,534/12,503), followed by bronchopneumonia with 16% (2,034). Of the 709 cases aged 65 years and older, the most frequent diagnosis was bronchopneumonia (42.9%; 304), followed by URTI (38.5%; 273) (Table 1).

Discussion

HCM is the largest quaternary hospital in the country and serves as a reference facility for patients requiring more specialized care. URTI was the most frequent diagnosis among patients <15 years of age, and may be influenced by children being more active and participating in more outdoor activities than adults [8, 9].

Seasonality can affect the development and transmission of certain pathogens and directly influence human behavior, which can also play a role in the transmission of certain diseases [10]. The study presents ARI as most frequent in the summer/cloudy period (October-March) but specifically the month of February (17.3%) contrary to what was found in other studies. For example, the studies made in Cameroon, Kenya, and in the period 2018 experienced the dry season as the peak period of ARI [9,11].

The excessive use of air conditioning in confined spaces and swimming on beaches, together with the fact that people already suffer from other comorbidities, which is a known risk factor for more severe forms of COVID-19, may influence the increase in the number of cases in the country [12]. The results of the study show an increase in cases of ARI during the summer months and therefore surveillance activities should increase during this period. The rising number of cases in February provided the trigger that there might be new organisms and hence the need for the government to institute the right control measures. It also provided evidence of the need to extend COVID-19 testing to other areas and districts in the health system.

Other ARIs like rhinosinusitis, pharyngitis, external otitis and the common cold, were also reported in this study. These ARIs thrive more in warm environments, hence the humid tropical climate in Mozambique is a risk factor that may favour the increase in the number of cases [10].

Knowledge of ARIs' seasonality trends could be a first step in providing information to healthcare providers, thus allowing strategies to be implemented to prevent and minimize transmission and introduce early therapies for high-risk patients [13].

A comparison of the information that is generated in the SIS-MA and the data linked to retrospective surveillance in the five health units was impossible as the two systems capture data in different ways. One of the factors that may have contributed to the lack of comparison of data is that SIS-MA only contains data on pneumonia diagnosis and no other ARI, whereas data collected in the framework of retrospective surveillance show more diagnoses.

We recommend that the National Health System create a standardized process for data collected from emergency services to be entered into the SIS-MA. It is also recommended to continue monitoring and producing information on ARIs at the national level and thus inform public health decision-making. This system could detect possible ARI outbreaks and facilitate a rapid response.

Conclusion

URTIs were the most frequent diagnosis in all health care facilities and they are included in the diagnoses that are part of the active surveillance in the country to identify all patients with symptoms similar to COVID-19. Maputo Central Hospital had the most ARI cases, which may have been influenced by the fact that it is the largest hospital in the country.

The spike in the URTIs provided evidence for the country to begin active surveillance for COVID-19 across the country.

Most ARI cases were reported in February 2019. The largest proportion of cases was under 15 years of age. This could contribute to ARI and COVID-19 transmission because children have more contact with the environment in the summer months.

Strengthening and expanding ARI surveillance at the country level will contribute to a rapid

emergency response to COVID-19 and better strategies to reduce the increase in cases.

The community should be sensitized about ARI and COVID-19 through multiple community communications strategies such as lectures, mass media, and other forms during this COVID-19 emergency period, to avoid panic situations in case of any similar symptomatology.

What is known about this topic

- The seasonality of Acute respiratory infections (ARI) is different in various regions of the world, in tropical countries ARI occurs in the dry and rainy seasons and in countries with a temperate climate occurs mainly in the winter
- Information on ARI in Mozambique is scarce, as the few studies carried out were from rural areas of southern Mozambique

What this study adds

- This study helps us to understand the variation of the Acute respiratory infections (ARI) at the Maputo city level
- The information produced in this study could help to strengthen the ARI surveillance system at the level of health units in the country

Competing interests

The authors declare that they have no competing interests.

Authors´ contributions

Fabião Maússe and Samuel Nuvunga were responsible for the collection, analysis, and interpretation of the data. Auria Banze, Erika Rossetto and Judite Monteiro supervised the elaboration of the study protocol, data collection, analysis and the final report. Cynthia Baltazar and Erika Rossetto were responsible for reviewing the manuscript and approving the final version for submission. The authors would like to thank Carter McCabe and Kristen Heitzinger for their critical revision of the paper.

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Table and figures

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Figure 2: ARIs collection flow in wards in Maputo city health units from May 2019 to February 2020

Figure 3: Distribution of average ARI cases per health unit for the period May 2019 to February 2020

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Table 1: Summary of age distributions and diagnoses of ARI cases by a health facility, Maputo city, Mozambique, May 2019 to February

Diagnosis	Maputo Hospital Central			Mavalane General Hospital			Jose Macamo General Hospital			Chamanculo General Hospital			Polana Canico General Hospital		
	Age groups			Age groups			Age groups			Age groups			Age groups		
	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+
Tonsillitis	4728	307	8	881	831	12	522	232	6	480	270	4	346	295	9
Bronchopneumonia	1950	742	136	675	708	95	754	418	62	62	39	3	119	127	8
Bronchiolitis	160	0	0	76	2	0	26	34	0	1	0	0	0	0	0
Bronchitis	36	9	0	6	3	0	5	47	0	15	0	0	2	2	0
Pharyngitis	971	143	9	125	234	10	63	19	1	61	46	1	41	57	1
Pharyngotonsillitis	84	41	0	136	87	3	121	17	0	48	41	0	28	11	0
URTI	3580	1116	73	3106	2326	95	2745	877	28	1668	1267	51	1613	944	21
Laryngitis	129	0	0	5	1	0	6	0	0	2	1	0	1	0	0
Otitis media	0	0	0	104	69	3	5	3	0	112	53	3	82	50	1
External otitis	0	0	0	20	10	1	4	0	0	0	0	0	0	0	0
Pneumonia	87	5	0	14	18	4	12	10	4	198	41	3	25	16	0
Common cold	496	62	4	39	6	1	19	6	0	322	126	3	0	0	0
Flu	0	0	0	8	11	1	0	0	0	34	63	0	2	12	0
Cough	0	0	0	39	34	5	2	2	0	2274	275	14	193	91	6
Rhinitis	0	0	0	0	0	0	11	1	0	18	14	0	720	220	13
Total	12221	2425	230	5234	4340	230	4295	1666	101	5295	2236	82	3172	1825	59

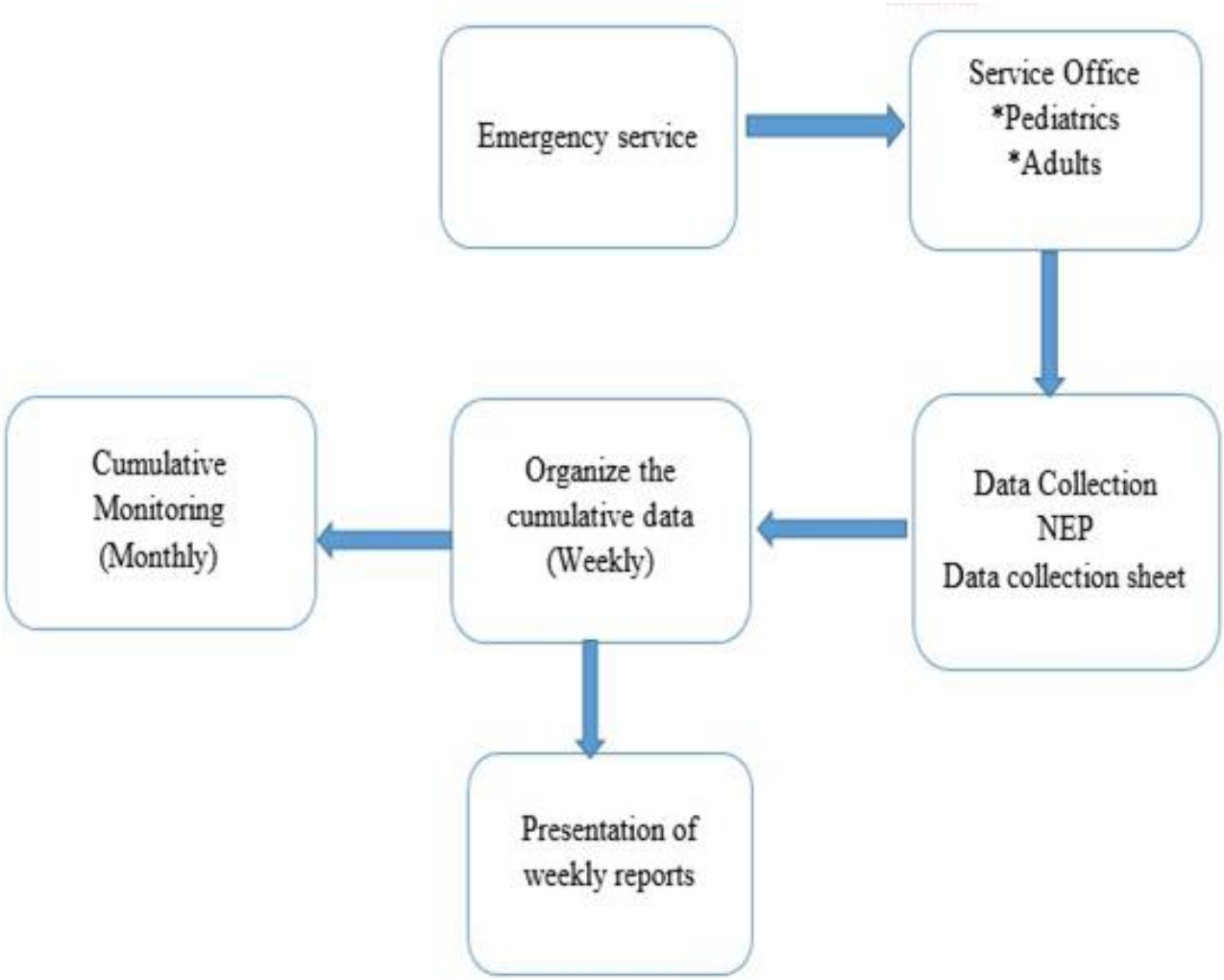

Figure 1: Flow of collection of ARI in pediatric and adult emergencies in Maputo city health units from May 2019 to February 2020

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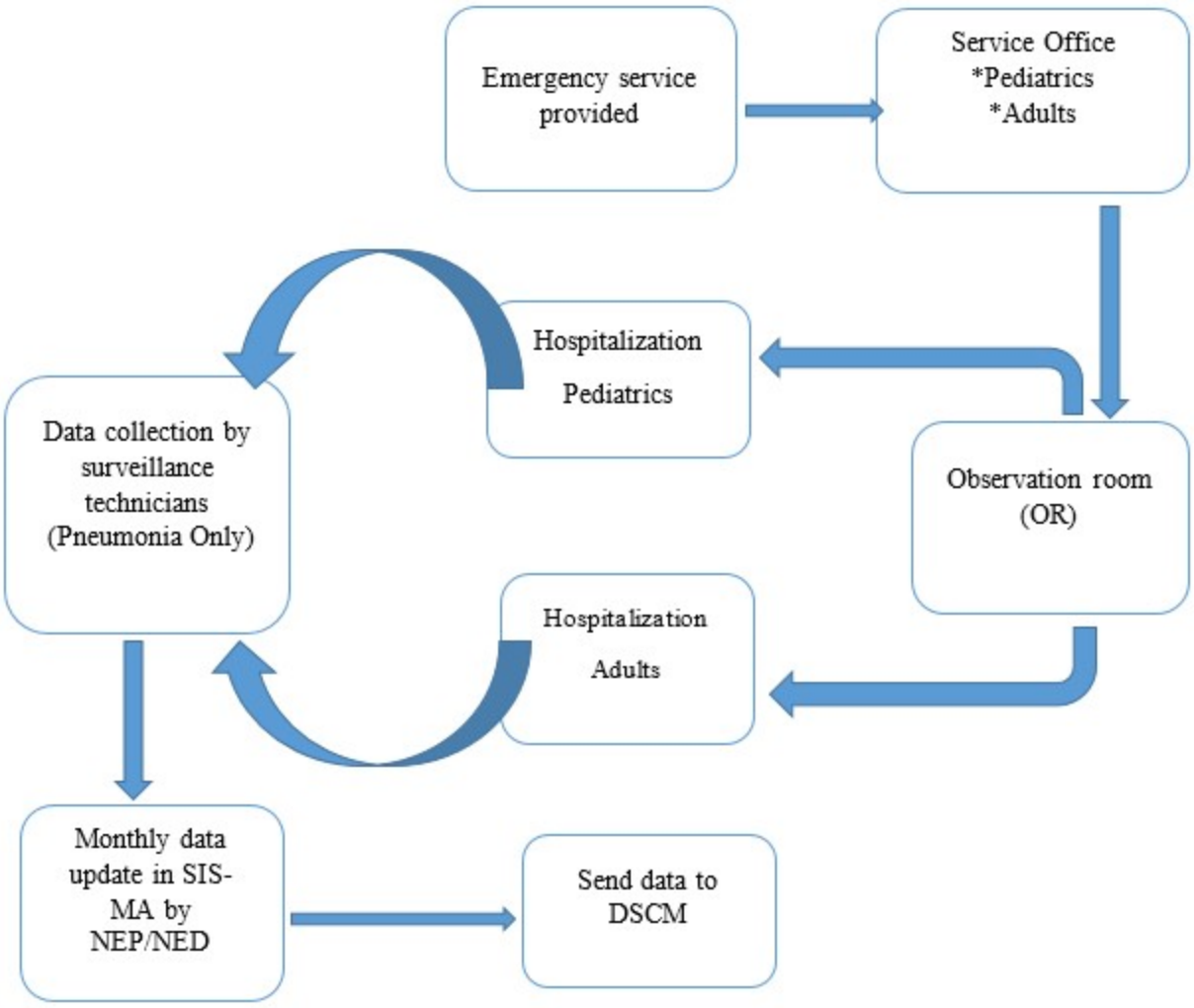

Figure 2: ARIs collection flow in wards in Maputo city health units from May 2019 to February 2020

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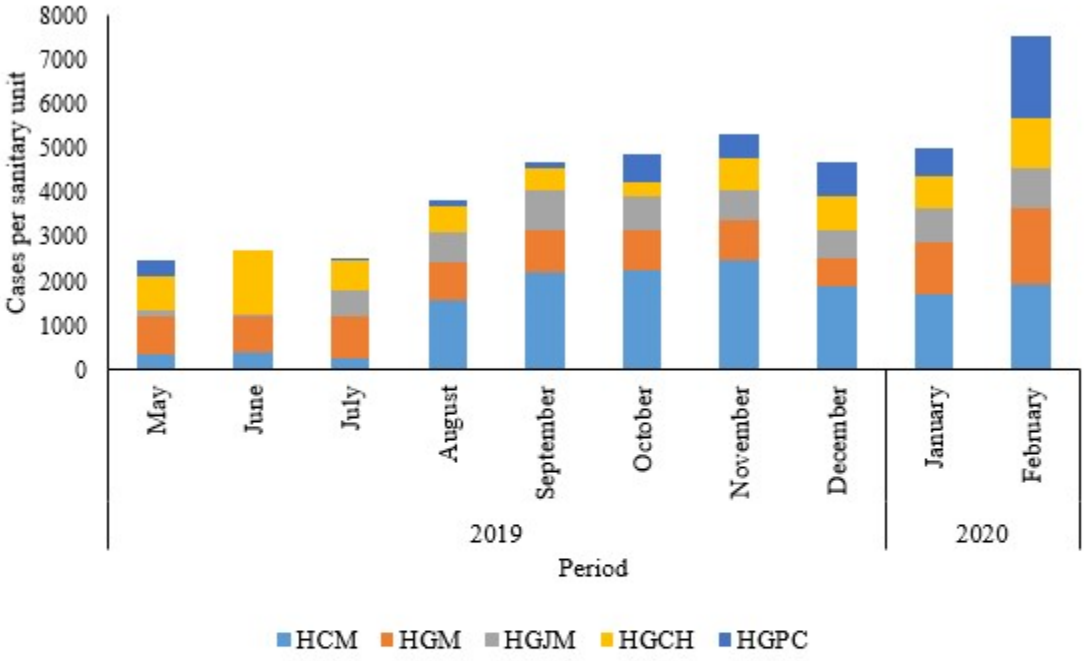

Figure 3: Distribution of average ARI cases per health unit for the period May 2019 to February 2020

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