



Graduate Study Program

School of Public Health

**Magnitude and associated factors of influenza like illness cases among
influenza like illness sentinel sites in Addis Ababa**

Adane Woldeab (Bsc, Msc)

**A Thesis submitted to the school of public health, St. Paul's Hospital
Millennium Medical College in Partial Fulfilment of the Requirements for
the Degree of Master's in Public Health**

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among influenza-like illness sentinel surveillance sites in Addis Ababa**

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Abbreviations

ALRI...Acute Lower Respiratory Infection

ARI... Acute Febrile Infection

CBRF...Case Based Reporting Format

CBS... Community Based Surveillance

CDC... Center for Disease Control

EBS... Event Based Surveillance

EPHI...Ethiopian Public Health Institute

DALYS... Disability Adjusted Life Years

HICs...High Income Countries

IHR... International Health Regulation

ILI... Influenza Like Illness

LMICs...Low and Middle-Income Countries

LRIs... Lower Respiratory Infections

PHEM...Public Health Emergency Management

SARI... severe acute respiratory syndrome

SPHMMC.... St. Paul Hospital Millennium Medical College

PCR ...Polymerase Chain Reaction

RNA...Ribonucleic Acid

Abstract

Background: In the middle- and low-income countries, Acute respiratory infections constitute a major cause of morbidity and mortality. Despite this, there is limited information on influenza-related magnitude and associated risk factor studies in Ethiopia.

Objectives: The main objective of the study was to assess the magnitude and factors associated with influenza-like illness cases among influenza- like illness surveillance sentinel sites in Addis Ababa, Ethiopia.

Methods: An institutional-based cross-sectional study was conducted. Virologic, throat swabs sample and epidemiological data were collected. The sample were tested using molecular amplification method. Descriptive statistics was employed to describe variables. A multivariable logistic regression model was applied to estimate the adjusted odds ratios (AOR) and 95% confidence interval for factors associated with influenza. A P value of < 0.05 was used for statistical significance. All statistical analyses were performed using SPSS version 25 software. Data was presented using table, graphs and charts.

Result: Among 422 enrolled ILI cases seeking medical attention, 50.5% were male. Runny nose (69.4%), headache (58.5%), and sore throat (35.8%) were the most frequent symptoms. Influenza A (83.3%) predominated over B (17%), with all A subtypes being AH1N1. Logistic regression for adults over the age of 18 identified significant associations with influenza for sex (AOR 3.13, 95% CI: 1.346-7.197), marital status (AOR 2.614, 95% CI:1.023-5.68), comorbidity category (AOR 2.881, 95% CI:1.056-7.860), antiviral drug use (AOR 0.077, 95% CI: 0.011-0.553) and close contact (AOR 0.216, 95% CI:0.063-0.736). The variables under the study were not significantly associated with influenza for children under the age of eighteen years.

Conclusion and recommendations: High influenza (15.6%) found in Addis Ababa ILI cases, affecting young females (<15) most. Both A and B types present. Sex, pre-existing medical conditions, recent exposure, and close contact linked to influenza for adults over the age of eighteen. The increased morbidity in this season should inform the government to prepare vaccinations at least for

high-risk groups, studying other similar viruses and education are crucial.

Keywords : Influenza, Sentinel Sites, Surveillance, Addis Ababa, Ethiopian.

1. Introduction

1.1. Background

Influenza is an acute viral respiratory tract disease in humans caused by the influenza virus, a single-stranded RNA virus belonging to the Orthomyxoviridae family (1). The Hemagglutinin and Neuraminidase found on the surface of the influenza virus are used to categorize the virus' subtypes. The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) define influenza-like illness (ILI) as an acute respiratory infection with the onset of symptoms within the last 10 days and manifested as cough and a measured temperature of $\geq 38^{\circ}\text{C}$ as well as cough and/or sore throat (2)

Seasonal influenza epidemics sweep across the globe, leaving a trail of illness and death in their wake. With an estimated 1 billion cases each year, of which 3-5 million are severe, and a death toll ranging from 290,000 to 650,000, the impact of influenza cannot be ignored. Young children, the elderly, and people with underlying medical conditions are particularly at risk. Recognizing the urgency of the situation, the WHO emphasizes the need for robust influenza surveillance networks to track and map the ever-changing landscape of these rapidly circulating viruses. (4–6).

According to the latest Ethiopian public health emergency management (PHEM) guideline, Influenza virus is one of the priority diseases that should be reported immediately under the public health surveillance system (7). The disease is included in the list of conditions that have high epidemic potential and diseases or conditions that are required internationally under the International Health Regulations (IHR), 2005 (8,9) . As a result, Ethiopia established a sentinel surveillance system in 2008 that will allow it to create a conducive environment to early identify, promptly report, and respond to the condition.

1.2. Statement of the problem

Influenza, a highly contagious viral infection of the respiratory system, represents a significant global public health burden. Studies consistently demonstrate a correlation between seasonal influenza outbreaks and influenza-like illnesses (ILIs) with increased emergency department visits and hospitalizations. This surge in healthcare utilization underscores the significant morbidity and mortality associated with influenza, with an estimated 4.5 million annual deaths worldwide. (8,10)

Sub-Saharan Africa bears the brunt of global influenza, with the highest incidence rates despite facing a pre-existing crisis of acute lower respiratory infections (ALRI) in young children. These ALRI cases, a major cause of illness and mortality for this vulnerable age group, are further complicated by the frequent occurrence of influenza, posing a significant public health challenge. (11)

In Ethiopia, acute respiratory illness accounts for 10% of all deaths per year, (12). Acute respiratory distress syndrome and pneumonia, which can be either primary viral or secondary to a bacterial coinfection, are the two main reasons for hospital admission due to influenza.

Beyond the familiar fever and chills, influenza's hidden burden lies in its potential to amplify existing health problems. Studies show the virus can exacerbate chronic conditions, increase vulnerability to secondary infections, trigger cardiovascular events, and accelerate functional decline, particularly in individuals with pre-existing heart disease. In these cases, influenza infection can escalate into life-threatening complications and even death.(8–10).

For low- and middle-income countries that includes Ethiopia, influenza is not just a health concern, it's a financial one. Households face the immediate burden of medical bills, while businesses contend with lost work hours and decreased productivity. At the national level, the wider economy can suffer from weakened workforce participation and potential disruptions in essential services.

Confronting the dual threat of influenza's health impact and its economic burden demands research paving the way for impactful interventions. These interventions, informed by studies on the disease's magnitude and risk factors, should aim to lower mortality and morbidity while minimizing the associated economic and social costs. Prioritizing such research empowers countries to effectively combat the challenges posed by influenza.

Information on the magnitude of influenza in tropical and subtropical regions like Ethiopia is rather scarce. Public health officials do not fully understand the true burden of the influenza disease as a result of the lack of information on its epidemiology (13).

despite the establishment of influenza surveillance sentinel sites, there is limited information regarding influenza-related magnitude and associated factors studies in Ethiopia, particularly at the Addis Ababa influenza-like illness sentinel sites(14).Therefore, this study tried to assess the magnitude and associated factors of influenza-like illness cases among the influenza surveillance sentinel sites in Addis Ababa.

1.3. Significant of the study

As influenza virus is one of the priority diseases that should be reported immediately under the public health surveillance system of Ethiopia, active surveillance and response to the situation will decrease the social, economic, and public health impacts. The process of developing interventions benefits the elderly, the young, pregnant mothers, and people with underlying comorbidities, irrespective of their age.

In terms of disease burden as determined by DALYs, respiratory infectious diseases are the most common (15). These infections are responsible for the worldwide emergence and reemergence of pandemics, and ILI is the most common cause of influenza-positive cases among common respiratory infections.

Studies are needed to better characterize the geographical burden, the associated factors, and the circulating types and subtypes of influenza. Also, as they create policies and initiatives, the findings are crucial for policymakers and public health experts to take into account and consider strategies for the influenza-like illness sentinel surveillance system in Ethiopia. Furthermore, this study will serve as a baseline for other researchers interested in intervening on this specific topic of interest.

2. Literature Review

Every year, influenza casts a long shadow over global health, infecting an estimated one billion people. Of these, 3-5 million cases become severe, and tragically, 290,000 to 650,000 lives are lost to influenza-related respiratory deaths. Seasonal outbreaks expose the vulnerability of health systems worldwide, particularly in low- and middle-income countries, where the impact is often amplified. Beyond the human cost, the economic strain is significant, encompassing direct medical expenses and indirect losses due to work absences. (13,15,16).

While primarily infecting birds, influenza viruses pose a potential threat to humans, as rare mutations can allow them to jump species. This concern was amplified by the discovery of the H5N1 avian influenza virus in humans in 1997 and its resurgences, prompting intensified pandemic preparedness efforts. A(H5N6) and A(H9N2) are further examples of such zoonotic avian influenza viruses circulating in poultry, with documented, albeit infrequent, human infections ranging in severity. (15)

2.1. Magnitude of influenza like illness

Studies in South Africa show influenza viruses are a major cause of illness, especially among young people. Among patients with influenza-like illness (ILI), severe acute respiratory illness (SARI), and severe chronic respiratory illness (SCRI), influenza was responsible for 86-93% of cases. Notably, over half of ILI and SARI cases in surveillance programs were children under 15. Additionally, HIV infection was prevalent in 16% of ILI cases). A study in Tunisia found that about 3% of all outpatient visits were linked to influenza-like illness (ILI). In Senegal and Ghana, research shows a high rate of ILI among children under five, with estimated incidences of 9.9 and 3,448 cases per 100 children per year, respectively. Studies elsewhere in Africa highlight similar patterns, with a Malawian study reporting an impressive 24 ILI cases per 100 pregnant women annually. (16–19)

A large study in Ethiopia aimed to understand the burden and seasonal patterns of influenza. Over 5,700 patients suspected of having influenza were enrolled, with nearly 80% experiencing typical flu symptoms (ILI) and about 20% exhibiting more severe signs (SARI). Of these individuals, a quarter, or roughly 1,130, tested positive for the influenza virus. Nearly two-thirds of these

confirmed cases were caused by influenza A, with the seasonal subtypes H3N2 and H1N1pdm09 as the main culprits. On average, around 160 out of every 100,000 Ethiopians experience flu-like illness each year, with the highest rate striking individuals between the ages of 15 and 44. This age group saw over five times more cases compared to children from 5 to 14 years old (20).

2.2. Associated factors of influenza like illness

2.2.1. Demographic and socioeconomic risk factors

Studies in Japan have shed light on factors influencing influenza-like illness (ILI) in schoolchildren. Research conducted in Kasugai City revealed that larger family size acted as a risk factor for contracting ILI. Interestingly, the same study found that more space per student in classrooms reduced the likelihood of falling ill. Another Japanese study identified easily inflamed tonsils as a risk factor for developing ILI. These findings suggest that both social and environmental elements can play a role in the spread of influenza among children. (23).

A study conducted in Malawi revealed that women were significantly more likely to test positive for influenza compared to men. Several factors could contribute to this, including biological differences: Hormonal variations between genders might influence immune response to influenza viruses. Social and behavioral factors: Women may have increased exposure to potential sources of infection due to caregiving roles within families or communities. And Occupational factors: Gender disparities in certain professions could lead to differences in exposure risks. (22).

A cross-sectional study in rural Ethiopia investigated factors associated with acute respiratory infection (ARI) in children. They found that several factors across different categories increased the likelihood of a child suffering from ARI. These factors are Demographic, Socioeconomic, Nutritional Health related and Environmental factors. The Demographic factors are related to living in a poor household, Children from poorer families were more likely to have ARI. This could be due to limited access to quality healthcare, nutritious food, and hygienic living conditions. The Socioeconomic factors are related to Mother's lack of education, Children whose mothers had no education were more susceptible to ARI. This could be related to limited knowledge about hygiene

practices, healthcare access, and proper nutrition.

The Nutritional factors are related to Not receiving vitamin A, Children who did not receive vitamin A supplements were more prone to ARI. Vitamin A plays a crucial role in immune function, making children more vulnerable to infections when deficient. The health factors are related to no history of diarrhea: Surprisingly, the study found that children who had not experienced diarrhea had a lower risk of ARI. This may indicate a complex interplay between different infectious agents and their impact on the respiratory system. The environmental factors are related to no access to improved water sources, Children using unimproved water sources were more likely to develop ARI. This highlights the importance of clean water for preventing respiratory infections (21).

2.2.2. Underlying comorbidities

A study in Italy highlighted a concerning association between comorbidities and ILI. Subjects with more than one comorbidity showed a marked increase in ILI prevalence, ranging from 23.49% to 59.92%, and this risk further amplified with age. Notably, the overall ILI incidence rate (6.73/1000 person-years) doubled routine data estimates. Interestingly, cardiovascular and cancer were the most common comorbidities, while renal failure and bronchopulmonary diseases exhibited the highest ILI rates. These findings underscore the need for targeted interventions to protect individuals with multiple comorbidities, especially older adults, from the impact of ILI (24).

A Japanese study offers valuable insights into factors influencing severe ILI risk. Residents of Kasugai City with easily inflamed tonsils or a history of asthma were much more likely to experience severe ILI, while higher education, frequent milk consumption, and prior vaccination played a protective role. These findings underscore the importance of targeted interventions for vulnerable individuals and promoting protective behaviors like vaccination to mitigate the impact of severe ILI outbreaks.

A comprehensive study across 27 African countries shed light on this hidden threat, revealing the crucial role comorbidities play in influenza's impact. In HIV infection the weakened immune systems due to HIV make individuals more susceptible to influenza complications, leading to a fivefold increase in hospitalization risk. The Chronic lung damage from tuberculosis leaves individuals vulnerable to severe influenza pneumonia, with a threefold higher risk of hospitalization. Diabetics creates Impaired immune function and chronic inflammation associated with diabetes contribute to a twofold increase in influenza-related death risk. Chronic respiratory diseases Conditions like asthma or COPD compromise lung function, making individuals more susceptible to influenza complications and a doubled risk of hospitalization. The study found that individuals over 65 years old were four times more likely to be hospitalized due to influenza.(23)

In South Africa, influenza viruses were the culprit behind a vast majority of ILI, SARI, and SCRI cases, with influenza detected in 92.6%, 87.4%, and 86.2% of patients respectively. This strong link suggests that influenza is a prime suspect in these respiratory illnesses. Notably, the prevalence of influenza among ILI patients varied across studies, with a Tunisian estimate at 3.16% and studies in Senegal and Ghana citing higher rates (9.9 and 3448 per 100,000 respectively). Further, a Malawian study revealed a significant burden among pregnant women, with an annual incidence of 24 per 100 person-years. These findings highlight the diverse impact of influenza across populations and underscore the need for specific surveillance and prevention strategies (16).

2.2.3. Circulating influenza viruses among ILI cases

A seven-winter study in Lombardy, Northern Italy, revealed a significant burden of RSV among children suffering from influenza-like illness (ILI). Nearly 19% of pediatric ILI cases were attributed to RSV, highlighting its impact on this age group. Notably, the risk of RSV infection was almost twice as high for individuals under 15 years old compared to older individuals. This study employed sentinel surveillance of ILI, a valuable tool for monitoring and understanding the dynamics of respiratory viruses like RSV and influenza. It offered crucial insights into Identifying children as particularly susceptible to both RSV and influenza infections, Defining the start, duration, peak, and overall intensity of RSV and influenza circulation within the community

and demonstrating the potential of sentinel surveillance for continuously tracking RSV activity and its associated health impacts. The study's findings underscore the importance of RSV as a major contributor to respiratory illness in children, particularly in Lombardy. The use of sentinel surveillance for ILI provides a valuable approach for ongoing monitoring of RSV circulation and informing public health interventions to protect vulnerable populations (25)

Study revealed a clear pecking order among respiratory viruses causing illness. The respiratory syncytial virus (RSV) and enteroviruses reigned supreme, jointly claiming 41.5% of cases. Influenza trailed significantly behind at 15.8%, followed by a group of other contenders including adenovirus, parainfluenza, coronavirus, and human metapneumovirus, all hovering around 5-10%. Bringing up the rear was human bocavirus at a modest 2%. This ranking shed light on the major causes behind respiratory infections, with RSV and enteroviruses standing out as the most likely suspects(26) .

2.3. The Conceptual framework

The conceptual framework guiding this study on influenza-like illness (ILI) infection posited that a combination of factors interacts to influence individual susceptibility to ILI. These factors were categorized into four main domains: demographic and socioeconomic factors, health and related factors, knowledge factors, and environmental factors. The figure below visually depicts the proposed relationships between these independent variables and the dependent variable, ILI infection.

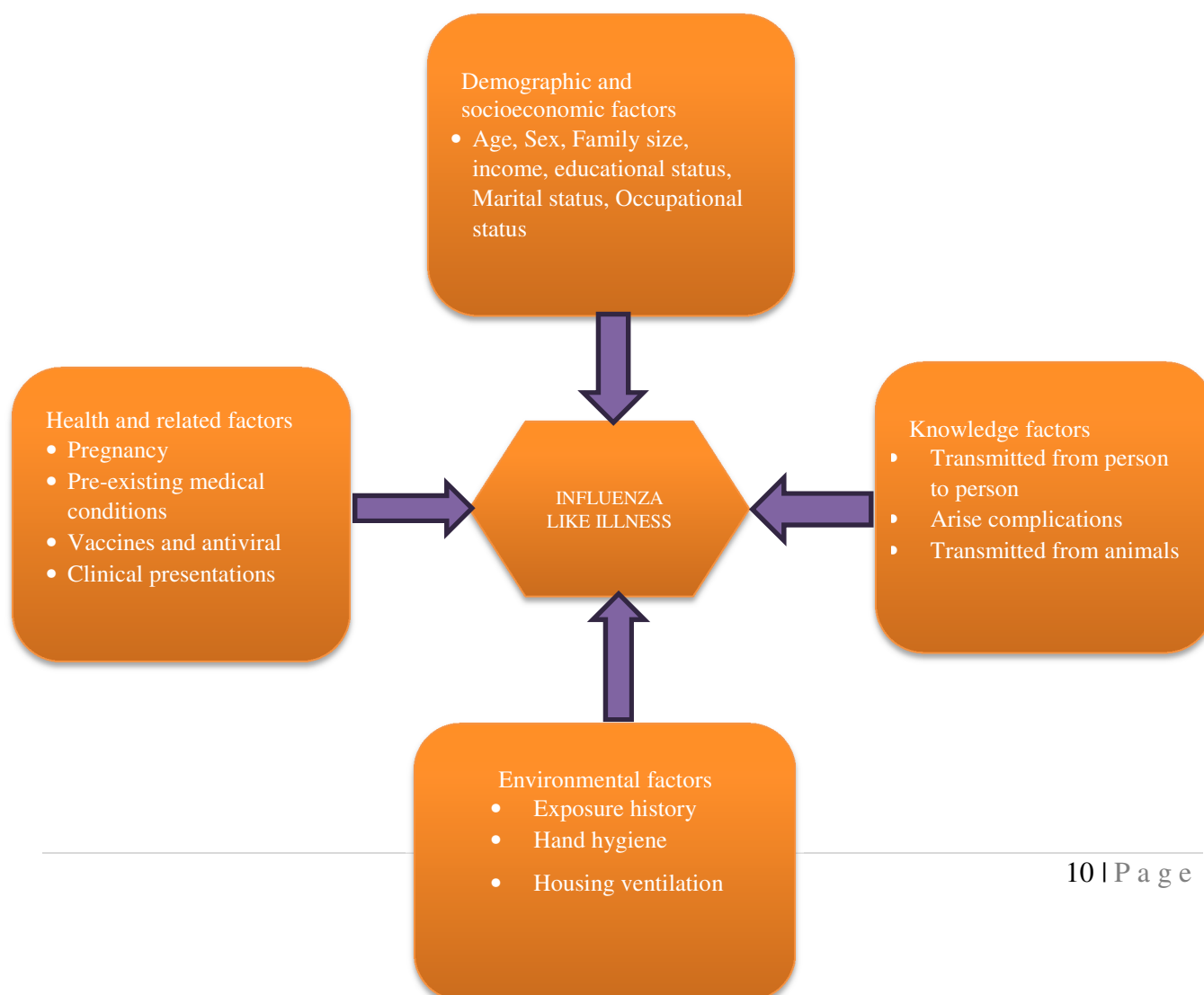


Figure. The conceptual framework if influenza and independent variables among the ILI sentinel sites in AA, 2023.

3. Objectives of the study

3.1. General Objective:

To assess the magnitude and associated factors of influenza-like illness cases among influenza- like illness surveillance sentinel sites in Addis Ababa, Ethiopia, 2023.

3.2. Specific objectives:

- To assess the magnitude and circulating influenza virus among influenza surveillance sentinel sites in Addis Ababa, Ethiopia, 2023.
- To identify the factors associated with influenza-like illness at influenza surveillance sentinel sites in Addis Ababa, Ethiopia, 2023.

4. Methods and materials

4.1. Study setting and period

This study took place between February and May 2023 at four designated influenza surveillance sentinel sites in Addis Ababa, Ethiopia. These strategically located health centers (HCs) served as vital outposts for monitoring influenza activity within different sub-cities of the capital. Akaki HC in Akaki Kaliti sub-city, Kolfe HC in Kolfe Keranyo sub-city, Dilfire HC in Bole sub-city, and Shiromeda HC in Gullele sub-city were chosen to capture a diverse cross-section of the Addis Ababa population, ensuring broader representation and more accurate data collection. The focus of the study was on individuals suspected of having influenza-like illness (ILI), identified based on the rigorous case definition established by the World Health Organization (WHO). This stringent definition ensured consistency and accuracy in identifying potential influenza cases, providing a solid foundation for reliable results.

Established in 2008, Ethiopia's influenza surveillance sentinel sites stand as watchful guardians against the ever-shifting trend of the influenza viruses. This robust network of strategically placed health facilities serves as the eyes and ears of the national public health system, relentlessly tracking the disease's trajectory. The objective of the sentinel surveillance network is uncovering new influenza strains, map its ever-evolving characteristics, and chart its seasonal patterns. Through tireless epidemiological and virological data collection, these sentinel sites provide invaluable insights into the burden, severity, and seasonal patterns and flow of the disease. Armed with this real-time surveillance, national authorities can swiftly tailor prevention and control strategies, shielding Ethiopia's population from the full force of influenza's burden (12)

4.1.1. Sentinel surveillance system

While detecting individual cases and triggering immediate outbreak control may seem like the ultimate goal of surveillance, influenza sentinel systems play a more subtle but crucial role. Instead of focusing on every single case, they act as sensitive "early warning towers," strategically placed within communities to capture a representative sample of respiratory illnesses like influenza-like illness (ILI), acute respiratory infections (ARI), and severe acute respiratory infections (SARI). These samples undergo testing for influenza and SARS-CoV-2, providing vital insights into the circulation patterns and virologic characteristics of these viruses within the community.

Unlike event-based surveillance, which reacts to reported outbreaks, or contact tracing, which meticulously maps individual cases, sentinel surveillance offers a broader, ongoing picture. It's like continuously taking the community's temperature, revealing shifts in viral activity before they spiral into full-blown outbreaks. This timely intelligence empowers public health authorities to proactively implement targeted interventions like immunization campaigns, isolation protocols, and resource allocation, preventing outbreaks from gaining momentum.

Furthermore, sentinel surveillance boasts several advantages compared to its counterparts. Its strategic sampling approach requires fewer resources than comprehensive surveillance, making it particularly feasible in resource-constrained settings. Additionally, its ongoing nature provides continuous data, essential for understanding long-term trends and seasonal variations in virus circulation. This combination of early warning, resource efficiency, and comprehensive data collection makes sentinel surveillance a preferred tool for WHO and national public health authorities around the world (27).

4.2. Study design

An institutional-based cross-sectional study design was employed.

4.3. Population

4.3.1. Source population

Addis Ababa's four influenza-like illness sentinel sites offered a representative cross-section of the city's population, providing the study's source pool throughout the research period. For the purpose of analysis, the study participants were categorized into two. Adults over the age of eighteen and children eighteen years and younger.

4.3.2. Study population

Adhering to the WHO's established case definition for influenza-like illness, individuals seeking care at the sentinel sites during data collection were eligible for inclusion in the study.

4.3.3. Study unit

The study units were randomly selected individuals who fulfilled the WHO influenza-like illness case definition and were present at the sentinel sites during the actual data collection period, from whom epidemiological and virological data were collected.

4.4. Eligibility criteria

4.4.1. Inclusion criteria

Individuals who attended the sentinel sites in the actual data collection period and fulfilled the WHO case definition for influenza-like illness.

4.4.2. Exclusion criteria

- Individuals who attended the sentinel sites and be hospitalized for influenza.
- Individuals who present with signs and symptoms of influenza-like illness with an onset of more than 10 days.

4.5. Sample size determination and sampling technique

4.5.1. Sample size determination

The sample size for the first objective was calculated according to a study conducted in Ethiopia to assess the burden and seasonality of medically attended influenza-like illnesses. Since we were interested in knowing the proportion of influenza cases among outpatient visits to the influenza-like illness sites in Addis Ababa, a formula to calculate the sample size for a single population proportion was applied to get the sample size for this objective. The formula to calculate the sample size was stated as follows,

$$n = \frac{(z_{\alpha/2})^2 p(1-P)}{d^2}$$
 where p is proportion of influenza-like illness cases and was taken from similar or previous study, a 95% confidence interval and assumed 5% margin of error. $Z_{\alpha/2} = 1.96$, P from previous study is 25%, (20) the sample size was calculated as,

$$n = \frac{(1.96)^2 (0.25)(0.75)}{(0.05)^2} = 288, \text{ adding 10\% non-response rate, the final sample size for this}$$

objective was 317 samples.

Similarly, different researchers conducted in this area were used to estimate the sample size for the second objectives under the study (22,28–30). Fifty percent is taken for a variable with unknown proportion. The four sentinel sites outpatient load of the previous year was used to proportionally allocate the sample size in each ILI site for final sample size to be collected in each Site. The final sample size after adding the 10% non-response rate was 422.

Table 4.1. Sample size calculation based on the objectives of the study at ILI sentinel sites in Addis Ababa, 2023

Variables	Prevalence from previous studies (%)	Minimum sample size	Nonresponse (10%)	Final sample size
Magnitude of influenza like illness among ILI cases	25%	288	10	317
Risk factors for influenza like illness				
Sex(M/F)	17.9%	222	22.2	244
Age (< 15 years/over 60 years)	50%	384	38.4	422
Poor house ventilation or condition	14%	185	18.5	204
Occupational status(unemployed)	19.8%	244	24.4	368
Educational status (No)	21.5%	259	25.9	285
Current smoker	3%	44	4.4	48.4
Travel and contact history	50%	384	38.4	422
Underline comorbidity (cardiovascular diseases and cancer)	41.7%	374	37.4	411
Presence of Pregnancy	42%	374	37.4	411
Circulating influenza cases among ILI cases				
SARS COV 2	5.6%	81	8.1	89
Influenza	16.8%	215	21.5	237
RSV	19%	236	23.6	260

4.5.2. Sampling technique and procedures

Following the WHO case definition, the study enrolled participants exhibiting influenza-like illness (ILI) symptoms. Recruitment occurred solely during outpatient visits at the sentinel sites, from Monday to Friday during regular business hours, throughout February to May 2023. To select individuals, a systematic sampling scheme was employed. The overall sample size was proportionally allocated across the four sites based on their ILI caseload documented in the SARI/ILI Sentinel Site National Report from the Ethiopian Public Health Institute (EPHI). The proportional allocation formula was used to calculate the sample size for each sentinel sites based on the last four months ILI consultations using the formula:

$$n_j = \frac{n}{N} * N_j \text{ where,}$$

n_j is the sample size for each sentinel sites,

n is the total sample size of this study,

N is the total ILI consultation at the sentinel sites in the last four months (January to April/2022) and

N_j is the ILI consultations for each sentinel sites.

Table 4.2 Proportional allocation of the samples size for each sentinel site, Addis Ababa

Strata/ the sentinel sites	ILI consultations (N_j)	Sample size(n_j)
Shiromeda HC	560	128
Kolfe HC	488	111
Akaki HC	425	97
Dilfire HC	374	86
Total	1847(N)	422(n)

Once the overall sample size was allocated to each sentinel site, participants were randomly selected for data collection. This selection employed a systematic sampling strategy, with the interval determined by dividing the average daily ILI consultations from the previous four months by the allocated sample size for each site. At Shiromeda Health Center, where the average daily ILI consultations were 560 and the allocated sample size was 128, a new participant was selected for data collection every four patients meeting the WHO definition. (See the below schematic representation).

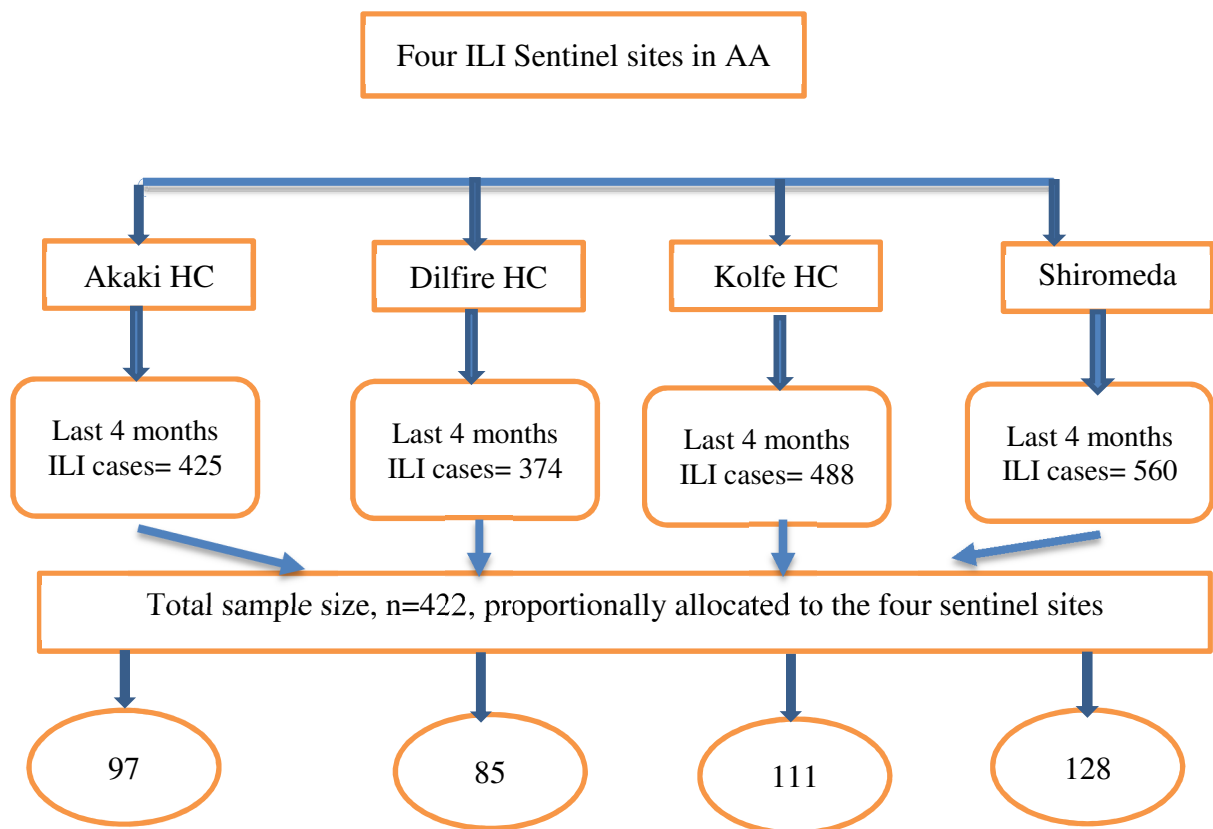


Figure 4.1. Schematic representation of sample technique and procedure of the ILI sentinel surveillance sites

4.6. Study variables

4.6.1. Dependent variable

The dependent variable in the study is Presence of ILI. The magnitude of influenza-like illness was measured through the testing of virological samples collected from individuals fulfilling the WHO influenza-like illness case definition. The presence or absence of influenza in the collected samples was used to measure the disease burden in this study.

4.6.2. Independent variables

Demographic and socioeconomic factors: Age, Sex, Family size, income, educational status, Marital status, Occupational status,

Health and Health related factors: Pregnancy, Pre-existing medical conditions, Vaccines and antiviral, Clinical presentations.

Environmental factors: Exposure history, hand hygiene, close contact, housing ventilation.

4.7. Operational definitions

4.7.1. Knowledge of influenza: knowledge of influenza in this study is defined as the ability to explain one or more of the ARI signs and symptoms and or awareness of the possible risk factors for acute respiratory infection and or the awareness of the difference between influenza and common cold.(31–33)

4.7.2. Contact history: contact history is operationalized in this study as the presence of direct and or indirect contact with ARI cases and or any form of contact with bird species in the last 10 days before developing the signs/symptoms.

4.7.3. Travel history: traveling in/outside of the current residency area regardless of traveler characteristics, duration of travel, purpose of travel, destination, or season of year.

4.7.4. Comorbidity category: study participants were assigned or categorized in comorbidity category if they reported at least one comorbidity, unless they were categorized as having no comorbidity.

4.8. Data collection tool, methods and procedures

The epidemiological and virological data were collected from February to May 2023 from patients who fulfilled the World Health Organization's case definition for ILI.

4.8.1. Case definition for ILI

In alignment with the World Health Organization's (WHO) global epidemiological surveillance standards for influenza, Influenza-Like Illness (ILI) is defined as a sudden onset of acute respiratory illness (ARI) characterized by two key symptoms, measured fever of at least 38°C (100.4°F) that signifies a significant elevation in body temperature, indicating a possible inflammatory response associated with infection. And Cough: This persistent respiratory symptom further reinforces the suspicion of an underlying respiratory illness. Importantly, both symptoms must appear within the preceding 10 days to fulfill the ILI case definition. This timeframe helps track and monitor potential outbreaks of respiratory illnesses like influenza.

Data on ILI cases were meticulously collected at sentinel sites designated for disease surveillance. The standard case-based reporting form, originally used for data collection, was meticulously converted into the Kobo humanitarian toolkit ([https://kobo.humanitarianresponse.info /#/forms](https://kobo.humanitarianresponse.info/#/forms)). This digital platform significantly enhanced data capture, management, and analysis capabilities, offering real-time insights into ILI case trends and facilitating prompt public health interventions.

4.8.2. Laboratory Sample collection and transportation

Individuals meeting the ILI case definition underwent throat or nasopharyngeal swabbing. These swabs, crucial for identifying the causative agent, were immediately immersed in viral transport medium (VTM) – a nutrient-rich solution that preserves viral particles. To further protect their integrity, the swabs were kept at a chilly 4°C until transportation.

Within 72 hours of collection, these precious samples embarked on a carefully controlled journey to the Ethiopian Public Health Institute's National Influenza Center (NIC). A reliable cold chain

system, akin to a refrigerated relay race, ensured consistent low temperatures throughout the transit. Triple packaging, an extra layer of security, prevented any potential spills or contamination.

Upon arrival at the NIC, the viral RNA, the genetic fingerprint of the culprit, was extracted from the swabs. This vital step paved the way for identification. Next, these RNA extracts were subjected to real-time PCR amplification, a sensitive molecular technique that exponentially replicates specific viral targets.

To ensure the results' trustworthiness, each PCR run was accompanied by a battery of controls. Positive and negative controls served as benchmarks, guaranteeing the test's specificity and preventing false positives or negatives. Finally, the cycle threshold (Ct) values, signifying the number of amplification cycles needed to detect the virus, were analyzed in the context of these controls.

For samples testing positive for influenza A, the quest for deeper understanding continued. Using subtype-specific oligonucleotide primers, molecular detectives at the NIC zeroed in on the precise influenza A subtype responsible for the illness. This detailed information is crucial for public health measures and vaccine development(27).The epidemiological data and laboratory results (virological data) were linked by using a unique identifier.

4.9. Data quality control

To ensure accurate and comprehensive data collection, several meticulous steps were taken. The questionnaire, initially drafted in English, was translated into Amharic and then back to English by two independent, bilingual Ethiopian public health experts. This "double-blind" translation and verification process aimed to eliminate any discrepancies or ambiguities in terminology, ensuring cultural and linguistic accuracy for the target population.

The Kobo Kit software, chosen for its user-friendly interface and data management capabilities, was built with both English and Amharic language options, catering to the diverse language landscape of the study participants. This bilingual approach further minimized potential

misunderstandings and facilitated seamless data collection. The Data collection employed both the English and Amharic versions of the questionnaire, with responses synchronized into a single system. This bilingual approach offered flexibility for participants and fostered inclusivity within the study population.

Prior to the actual data collection, a crucial pretesting phase was conducted involving 10% of the intended sample size who met the ILI case definition. This careful approach allowed for fine-tuning the questionnaire, identifying any areas of confusion, and ensuring clarity and consistency in data capture. Amendments were made throughout the entire data collection process, spanning the pretest, actual data collection, and data cleaning and analysis phases. This iterative approach ensured ongoing data quality improvement.

Data collection was entrusted to a well-trained team of public health professionals familiar with the influenza surveillance system and the Kobo Kit platform. This expertise combined with meticulous training in questionnaire administration minimized data collection errors and enhanced overall data integrity. Furthermore, the principal investigator maintained an active and vigilant presence throughout the data collection period, providing real-time guidance and addressing any potential challenges in the field. This proactive approach further strengthened data quality control and ensured adherence to the study protocol.

By emphasizing pretesting, data collector training, and the utilization of an electronic data collection tool like Kobo Kit, the study prioritized data completeness and accuracy. This proactive approach minimized the risk of missing or inconsistent data, ultimately fostering robust and reliable research findings.

4.10. Data processing and analysis.

Following data collection in the Kobo Toolkit, the data was exported to SPSS (version 26) for comprehensive analysis. Prior to delving into the specifics, a crucial data cleaning was conducted. scanning for inconsistencies, invalid entries, and missing values were done. To guarantee accuracy, double data entry by two independent investigators served as a rigorous quality control measure. Any discrepancies unearthed were reviewed and corrected in the original data.

Missing variables, those silent gaps in the narrative, were addressed meticulously at the analysis stage. If their absence constituted less than 5%, they were gently dismissed from the dataset. However, for more impactful missingness, imputation techniques stepped in. Depending on the variable and data distribution, either the mean, median, or mode were strategically chosen to fill the void, ensuring a statistically sound foundation for analysis.

With the data cleansed and prepped, the quest for patterns unfolded. The magnitude of influenza-like illness, along with a tapestry of sociodemographic and other relevant patient characteristics, were illuminated through descriptive statistics. This initial exploration painted a vivid picture of the study population and the magnitude of ILI.

Detailed analysis was employed using logistic regression analysis. This technique meticulously combed through the data; pinpointing factors associated with ILI across all independent variables. For the purpose of analysis, the study participants were categorized into two. Adults over the age of eighteen and children eighteen years and younger.

Finally, the suspects with significant ties to ILI were apprehended and brought to light. These key findings, the fruits of the analysis, were presented in various formats – clear text, informative tables, and insightful figures – to effectively communicate the story revealed by the data.

4.11. Ethical considerations

Prioritizing ethical conduct throughout the research, the necessary clearances were meticulously obtained. The directorate of research and community service at Saint Paul Hospital, Millennium Medical College, granted official ethical clearance for the study. To ensure community-level support, a permission letter was secured from the Addis Ababa City Administration and Health Bureau. Additionally, prior to data collection, support letters were obtained from the participating health institutions, fostering collaboration and trust.

Respecting the autonomy of individuals, informed consent was the cornerstone of participant involvement. After a detailed and transparent explanation of the study's objectives, procedures, and potential risks and benefits, participants were empowered to make informed decisions about their participation. Only those who freely gave their written consent were enrolled in the study, ensuring voluntary participation.

Personal identifying details were carefully omitted from data collection and analysis, protecting individual confidentiality throughout the research process.

5. RESULTS:

5.1. Demographic and socioeconomic characteristics of the study participants

During a four-month period (February-May 2023), 422 individuals meeting the WHO's influenza-like illness (ILI) case definition were recruited from four designated influenza like illness sentinel surveillance sites in Addis Ababa for participation in this study.

Among the study participants, 213 (50.5%) were male. One hundred and eighty-five (43.8%) were children less than fifteen years old; 161 (38.2%) of the recruited individuals were between the age range of 15 and 24. The large proportion, 66.4% of study participants were orthodox Christians, followed by protestants and Muslims, 18% and 15%, respectively. Over two third (69.7%) of the study participants attended school. The employment status of the study participants showed that more than half of them (79.6%) comprise currently employed. Furthermore, the occupation status of respondents showed that two-third (35.5%) are office workers, 73 (32%), are students, 41 (18%) are daily laborers, and the remaining 25 (14%), were housewives and factory workers. Family dynamics also emerged with more than half (57%) of the participants are married or live together with their spouse. At the time of this study, only two women were pregnant.

Table 5.1. Sociodemographic characteristics of respondents, ILI sentinel surveillance sites, AA, February–May 2023

variables	Category	Frequency(N=422)	Percent (%)
Sex of respondents	Male	213	50.5
	Female	209	49.5
Age group of respondents	Less than 15	185	43.8
	15-24	161	38.2
	25-54	54	12.8
	55-64	15	3.60
	Greater than 64	7	1.70
Religion of respondents	Orthodox	280	66.4
	Protestant	76	18.0
	Muslim	66	15.6
School attendance	Yes	294	69.7
	No	128	30.3
Employment status(n=225)	Employed	179	79.6
	Unemployed	46	20.4
Occupational status(n=228)	Office work	81	35.5
	Daily laborer	41	18.0
	Student	73	32.0
	House wife	16	7.00
	Factory worker	17	7.50
Marital status(n=225)	Not Married	97	43.1
	Married or living together	128	56.9
Pregnancy(n=119)	Yes	2	1.70
	No	117	98.3

5.2. Knowledge of ILI

The study explored several key areas related to influenza-like illness (ILI) among participants in Addis Ababa. This included their understanding of transmission, potential complications, awareness of risk factors, and overall knowledge about ILI and other acute respiratory infections (ARIs).

As shown in Table 5.2, the overall, 385 (91.2%) of the study participants say that influenza-like illness can be transmitted from person to person, and 322 (76.3%) say that it cannot be transmitted by animals. A significant number, 145 (34.4%) of the study participants, don't believe that influenza-like illnesses can cause complications such as pneumonia or cardiovascular diseases. Two hundred and forty (56.7%) do not feel they are well informed about influenza. Participants who said there are risk factors for influenza were 282 (66.8%), and 48 (11.4%) of the respondents reported that acute respiratory infection cannot be prevented. The reported risk factors are summarized in Fig. 1. The frequently reported risk factors for influenza were, contact with infected people, animals, and objects is reported by 82 (29%), Lack of Personal hygiene by 79 (28%), and Lack of Environmental sanitation by 72 (25.5%) of the study participants.

According to the analyzed data, knowledge of influenza among the study participants and the operational definition set, study participants are knowledgeable of the acute respiratory infections in general and influenza like illness in particular.

Table 5.2. Acute respiratory infection knowledge of respondents at ILI sentinel surveillance sites, AA, February–May 2023

Variables	Response category	
	Yes, n (%)	No, n (%)
ARI transmit from person to person	385 (91.2)	37(8.8)
ILI infection cause complications	277 (65.5)	145 (34.4)
ARI transmitted by animals	100 (23.6)	322 (76.3)
feel well informed about influenza	182 (43.1)	240 (56.9)
There is a risk factor for ARI	282 (66.8)	140 (33.2)
ARI can be prevented	374 (88.6)	48 (11.4)

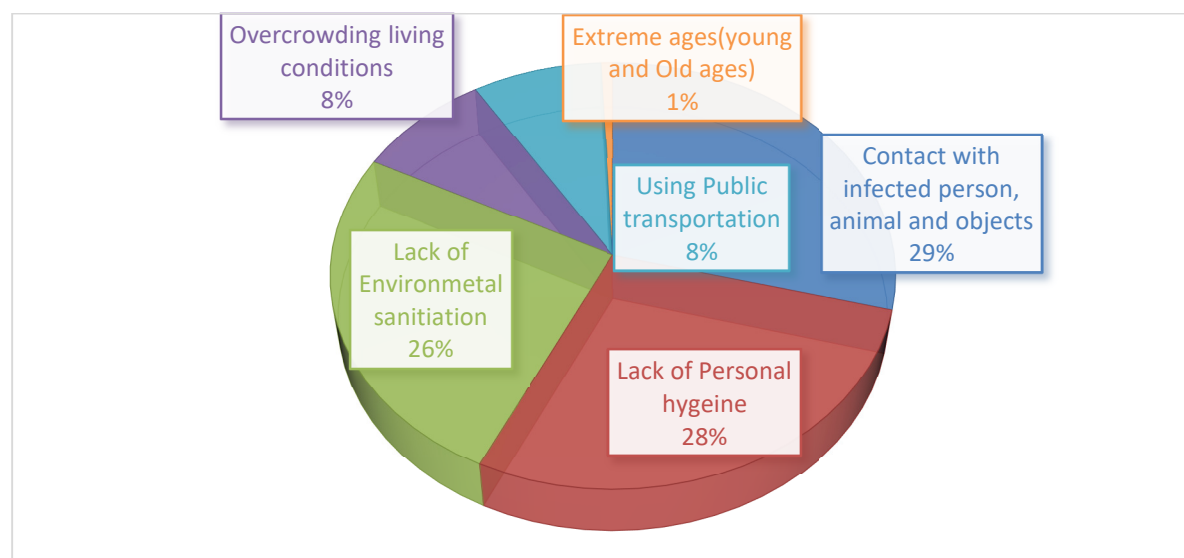


Fig. 5.1: Perceived risk factors for influenza-like illness among respondents at ILI sentinel surveillance sites, AA, February–May 2023

Notably, participants displayed diverse experiences with influenza-like illness symptoms. While nearly all reported a runny nose (89.1%), significant portions had no fever (32.9%) or cough (12.6%). Difficulty breathing (68.5%) and headache (69%) were also prevalent, while vomiting was less common (8.9%).

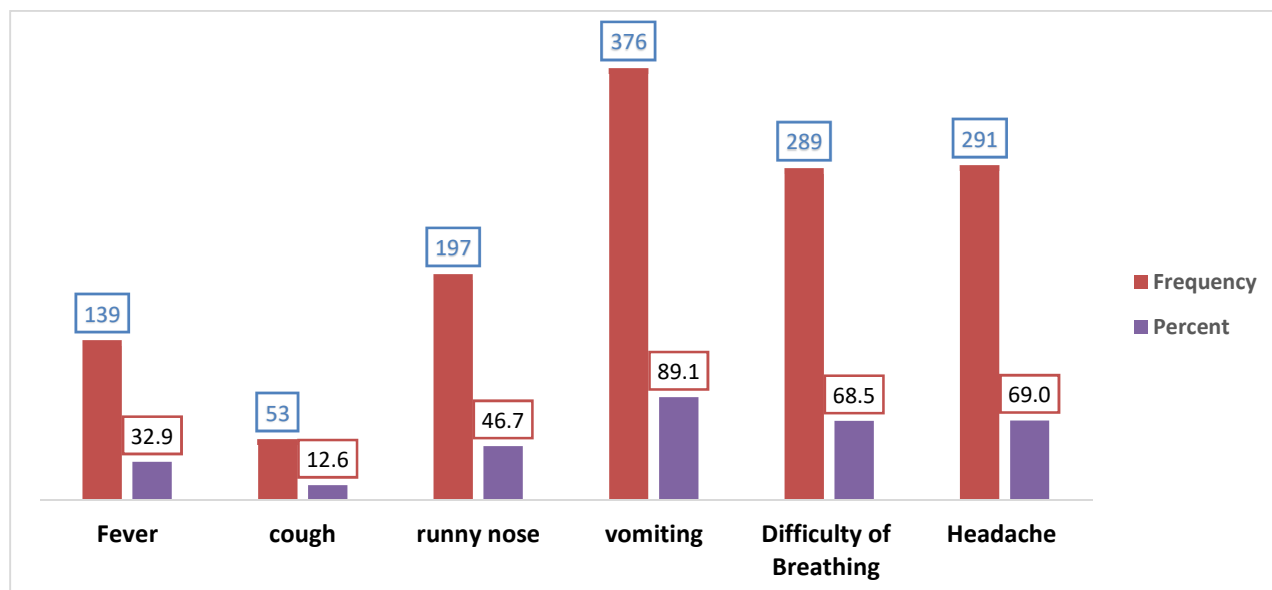


Fig. 5.2: Sign/symptoms for influenza-like illness among respondents at ILI sentinel surveillance sites, AA, February–May 2023

5.3. Clinical Presentation (symptoms)

The clinical presentations in the last seven days from the eligible participants that fulfilled the ILI case definition and from whom epidemiological and virological data were collected were assessed. Accordingly, 293 (69.4%) reported the presence of a runny nose. 248 (58.5%) reported a headache, 151 (35.8%) a sore throat, 97 (23%), arthritis or joint pain, 24 (7%) vomiting, 7 (1.7%) difficulty of breath, and 2 (.5%) skin rash.

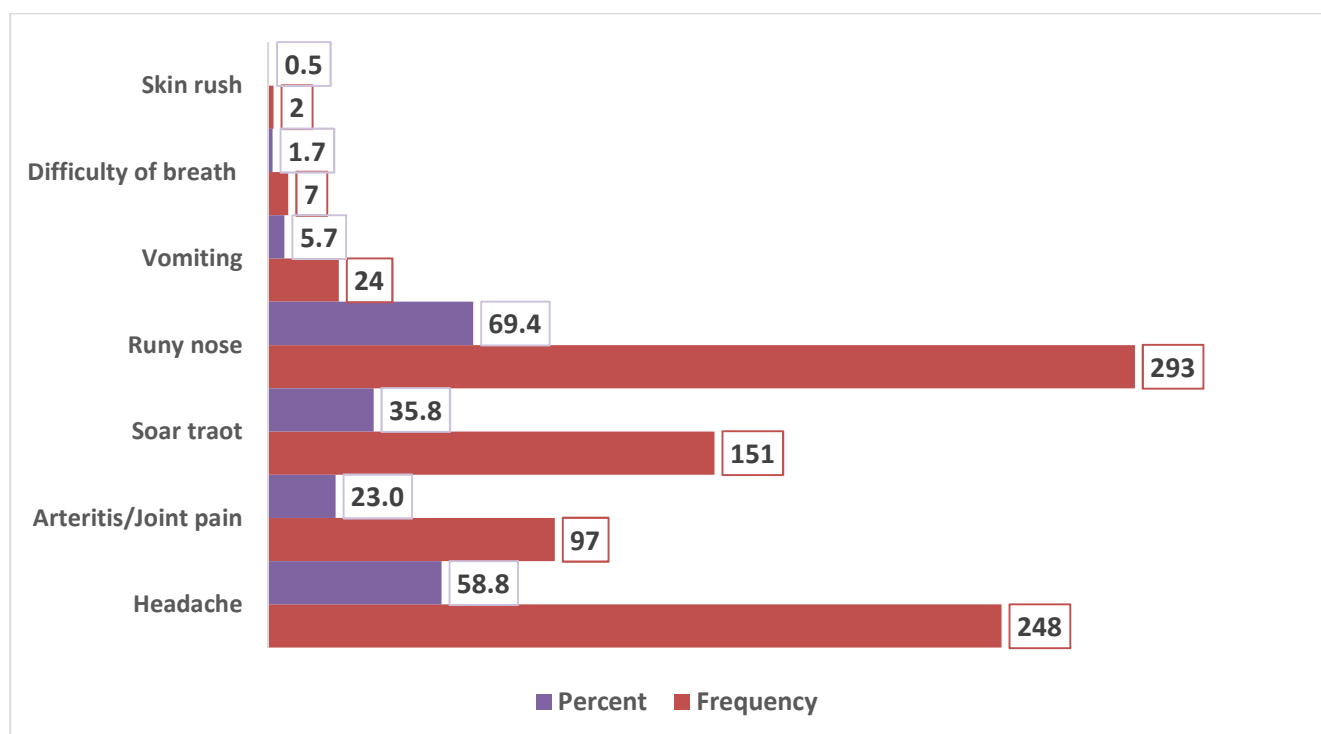


Fig. 5.3: The clinical presentations in the last seven days among respondents at ILI sentinel surveillance sites, AA, February–May 2023

5.4. Pre-Existing Medical Condition

The preexisting medical conditions of the study participants were also assessed. Accordingly, diabetes was found in 15 (3.6%), headache and asthma were found in 10 (2.4%) and 10 (2.4%) of them, chronic lung disease was found in 4 (0.9%), immunocompromised in 3 (0.7%), chronic hematologic disorder in 2 (0.5%), chronic neurological disease was found in 1 (0.2%), and neuromuscular dysfunction was found in 1 (0.2%) of the respondents.

Table 5.3: The preexisting medical conditions of the study participants at the ILI sentinel surveillance sites, AA, February–May 2023

preexisting medical conditions	Response category	
	Yes, n (%)	No, n (%)
Heart Disease	10 (2.4)	412 (97.6)
Asthma	10 (2.4)	412 (97.6)
Chronic Lung Disease	4 (0.9)	418 (99.1)
Liver Disease	3 (0.7)	419 (99.3)
Diabetes	15 (3.6)	407 (96.4)
Chronic Hematologic disorder	2 (0.5)	420 (99.5)
Chronic Neurological Disease	1 (0.2)	421 (99.8)
Neuromuscular Dysfunction	1 (0.2)	421 (99.8)
Immune Compromised	3 (0.7)	419 (99.3)

5.5. Magnitude of Influenza cases

The total number of samples obtained at each sentinel site and the total number of laboratory-confirmed influenza-positive cases were combined to determine the influenza magnitude. Therefore, the magnitude of influenza among the sentinel surveillance sites for influenza-like illness was 15.6%. At the Shiromeda Health Centre, Akaki Kality Health Centre, Dilfire Health Centre, and Kolfe Health Centres, respectively, the influenza prevalence was 19.6%, 17.4%, 15.6%, and 6.3% among the individual sentinel sites.

Table 5.4: The magnitude of influenza at ILI sentinel surveillance sites, AA, February–May 2023

ILI Sites	Sample size	Influenza positive cases	Positivity rate
Akaki health center	97	19	19.6%
Kolfe health center	111	7	6.3%
Shiromeda health center	128	25	19.5%
Dilfire health center	86	15	17.4%
Total	422	66	15.6%

5.6. Type of circulating influenza virus among ILI patients

To gain a comprehensive understanding of the circulating respiratory viruses, all collected samples were analyzed. For laboratory-confirmed influenza cases, further identification of specific influenza types and subtypes was performed.

Of the total four hundred twenty-two ILI suspected cases, sixty-six were laboratory-confirmed influenza positive cases, yielding an influenza positivity rate of 15.6%. The influenza cases and the positivity rate among the sentinel sites are: Akaki Health Centre accounts for 19 (19.6%), Shiromeda Health Centre accounts for 25 (19.5%), Dilfire Health Centre accounts for 15 (17.4%), and Kolfe Keraniyo Health Centre accounts for 7 (6.3%).

Out of the sixty-six laboratory-confirmed influenza-positive cases, the circulating influenza viruses were identified accordingly. Influenza type A accounts for 55 cases (83%), and influenza type B accounts for 11 cases (17%) of the total influenza-positive cases. SARS-COV-2 is identified in 35 (8.3%) of the total positive cases. The other virus identified in this study was RSV, which accounts for 9 (2.1%) of the ILI cases.

Table 5.5: The types of circulating respiratory viruses among respondents at ILI sentinel surveillance sites, AA, February–May 2023

Health facility	Influenza A and B n (%)	Respiratory syncytial virus n (%)	SARS_COV_2 n (%)
Akaki kality health center	19 (19.6)	5 (5.2)	18 (18.6)
Kolfe keraniyo health center	7 (6.3)	0 (0)	1(0.9)
Shiromeda health center	25 (19.5)	2 (1.6)	6 (4.7)
Dilfire health center	15 (17.4)	2 (2.3)	10(11.6)
TOTAL	66 (15.6)	9 (2.1)	35(8.3)

As shown in figure 5.4, the subtypes of influenza types A and B, the number of influenza A subtype AH1N1 seasonal cases is 55, and influenza subtype B accounts for 11(15%) of the cases. Influenza subtype AH3N2 and influenza A HINI pdm09 were not identified among the positive cases.

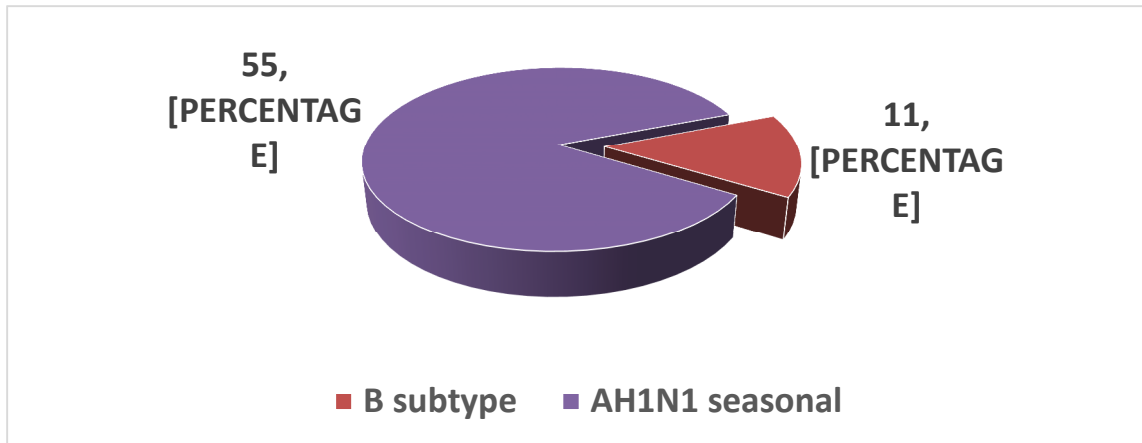


Fig 5.4: The types of circulating influenza subtypes at the ILI sentinel surveillance sites, AA, February–May 2023

5.7. Types of specimens collected

Among the total samples of 422 enrolled influenza-like illness cases in this study, 326 (77%) of them were collected using a nasopharyngeal swab, and 96 (23%) were collected using a throat swab collection.

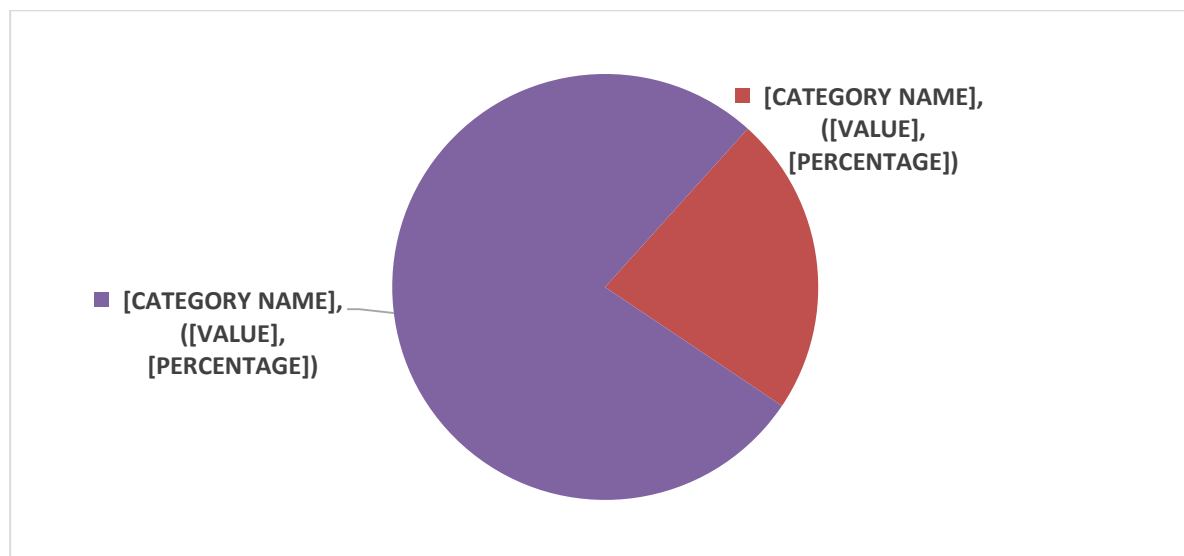


Fig 5.5: The types of specimens collected at the ILI sentinel surveillance sites, AA, February–May 2023

Participants enrolled in this study were assessed to see if they were exposed to influenza or other antiviral drugs during the last 14 days, and it was revealed that 7 (1.7%) were exposed to influenza or other antiviral drugs, and the rest 415 (98.3%) of the participants were not exposed during the last 14 days before the date of sample collection. On the other hand, 28 (6.6%) respondents took the SARS-COV-2 vaccination in the current season, and the rest, 394 (93.4%), did not take the vaccine in the current season. Moreover, 30 (7.1%) of the participants reported that they had close contact with a person with severe acute respiratory syndrome or COVID-19 symptoms, and 392 (92.9%) reported they had no close contact with a person with SARI or COVID-19 symptoms.

Table 5.6: Exposure to drugs, vaccination, and contact and travel histories of respondents at the ILI sentinel surveillance sites, AA, February–May 2023

Variables	Response category	
	Yes, n (%)	No, n (%)
Exposed to influenza or other antiviral drugs the last 14 days	7 (1.7)	415 (98.3)
Vaccination for Influenza	—	422 (100)

SARS-COV-2 Vaccination in current season	28 (6.6)	394 (93.4)
Close contact with person with SARI or COVID-19 symptoms	30 (7.1)	392 (92.9)
Close contact with or handled sick or dead poultry	–	422 (100)
Travel history in past two weeks around any epidemic suspected area	–	422(100)

5.8. Factors associated with influenza-like illness

Multiple binary logistic regression was employed to see if there was a significant relationship between the dependent variable, influenza, and the listed independent variables. In the binary logistic regression analysis for adults over 18 years of age, sex, marital status, comorbidity category, exposure to influenza or antiviral drugs during the last 14 days, and close contact with a person with SARI or COVID-19 symptoms were significantly related to influenza-like illness cases among the sentinel surveillance sites in Addis Ababa. Thus, the findings are summarized below in the final multiple binary logistic regression model table 5.7.

Out of the total 225 adult samples collected and tested, the number of influenza-positive cases was 36. Females have the highest positivity rate, 26 (11.5%), with a COR of 2.800(95% CI: 1.280–6.127) and an AOR of 3.13 (95% CI: 1.346–7.197) with a P value of 0.008. The age groups under 15 years contribute the highest prevalence of 29 (44%) followed by 15–24 yrs., 25–54 yrs., and 55–64 yrs. And >64 yrs. With 25 (38%), 9 (14%), 2 (3%), and 1 (1.5%), respectively.

The prevalence of influenza among married individuals was 27(21%), and among nonmarried

individuals it was 9 (9.2%). The crude and adjusted odds ratios of marital status were 2.614 (95% CI: 1.167-5.856) and 2.410 (95% CI: 1.023-5.681).

Respondents who were positive for influenza and had at least one comorbidity been 8(27.5%) The COR influenza for at least one comorbidity was found to be 2.286 (95% CI: 1.106–5.663), and the AOR was found to be 2.881 (95% CI: 1.056–7.860). Individuals who were confirmed for influenza and were exposed to influenza antiviral drugs during the last 14 days were 3 (57%), and those who were not exposed to influenza antiviral drugs during the last 14 days and were positive for influenza were 33 (15%) with a COR of 0.118 (95% CI: 0.019–0.731) and an AOR of 0.077 (95% CI: 0.011–0.553) and a p value of 0.011. Among the study participants, those individuals that said they had close contact with someone with SARI or COVID-19 symptoms and were positive for influenza were 6(40%) with a COR of 0.250(0.083–0.753) and an AOR of 0.216(0.063–0.736) at a significance level of 0.014.

Table 5.7. Multivariable logistics regression model of influenza in sentinel surveillance sites in Addis Ababa, 2023. (Adults over 18 years old, n=225)

Predictor variables	Response category	Influenza		COR (95%CI)	AOR (95%CI)	P value
		YES	NO			
Sex	Male	10	98	1	1	
	Female	26	91	2.80(1.280-6.127)	3.13(1.346-7.197)	0.008
Marital status	Not married	9	88	1	1	
	Married	27	101	2.614(1.167-5.856)	2.410(1.023-5.681)	0.044
Comorbidity category	No comorbidity	28	168	1	1	
	At least one comorbidity	8	21	2.286(1.106-5.663)	2.881(1.056-7.860)	0.039
Exposure to antiviral drugs during the last 14 days	Yes	3	2	1	1	
	No	33	187	0.118(0.019-0.731)	0.077(0.011-0.553)	0.011
Close contact with person	Yes	6	9	1	1	

with SARI or COVID-19 symptoms	No	30	180	0.250(0.083-0.753)	0.216(0.063-0.736)	0.014
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In addition, the investigator run the binary logistic regression analysis for children under 18 years of age, and showed that the variables under the study were not significantly associated to influenza-like illness cases among the sentinel surveillance sites in Addis Ababa.

Out of the total 197 samples collected and tested for children under the age of eighteen, the number of influenza-positive cases was 30. Females have the highest positivity rate, 17 (8.6%). Respondents who were positive for influenza and had at least one comorbidity been only 1(5%). Those individuals that said they had close contact with someone with SARI or COVID-19 symptoms and were positive for influenza were 4(26.6%)

6. Discussion

This study aimed at Characterizing the burden and circulating respiratory pathogens of influenza-like illness (ILI), and identifying factors associated with the presence of influenza cases among the influenza-like illness sentinel surveillance sites found in Addis Ababa, Ethiopia, from February to May 2023. ILI patients were assessed for further analysis using multivariable binary logistic regression. Crude odds ratio (COR) and adjusted odds ratio (AOR), 95% confidence interval, and a P-value of less than 0.05 were used for statistical significance.

During the study period, the magnitude of influenza among the sentinel surveillance sites was found to be 15.6%. This finding is similar to the findings of a study conducted in fifteen African countries and the risk factor assessment in South Africa, which were reported at 15.7% and 15.8%, respectively. (34,35). The positivity rate obtained in this study is lower than in a study conducted in Ethiopia 10 years ago, where the recorded positivity rates of influenza among influenza-like illness episodes were 25% and 53% ((14,36). The magnitude of influenza in this study is also higher as compared to other studies conducted in Ghana, which was 3.3%. (37). This can be justified by the seasonal variations and the lesser severity of the disease as compared to hospitalized or severe acute respiratory infections or the circulating types and subtypes of influenza among the study groups. The distribution of influenza

among the four sentinel surveillance sites is almost similar, with positivity rates of 19.6%, 18%, 15.1%, and 7%, which clearly indicate the burden and transmission pattern in the city administration of Addis Ababa.

Regarding information about influenza, two hundred and forty (56.7%) respondents don't feel they are well informed about influenza. And the other significant number, 145 (34.4%) of the study participants, don't believe that influenza-like illnesses can cause complications such as pneumonia, cardiovascular diseases, or even death. This finding is in congruence with the influenza KAP study conducted in South Africa, which reported that many respondents did not think that people could die from influenza (38). This underestimation of disease severity in the general public may undermine its importance as a public health issue.

The clinical presentation of study participants was also assessed and revealed: 293 (69.4%) reported the presence of a runny nose, 248 (58.5%) reported a headache, 151 (35.8%) a sore throat, 97 (23%), arthritis or joint pain, 24 (7%) vomiting, and 7 (1.7%) difficulty of breath. The clinical presentation findings from this study were lower as compared to a study that assessed the etiology, clinical characteristics, and risk factors of influenza-like illness cases, which reported it as a runny nose. 1833 (82%) reported a headache, 1751 (78%) a sore throat, 1816 (81.2), vomiting, 636 (28.4), and 471 (21.1) difficulty of breath (39). Again, the etiologic agent and the type and subtype of the circulating variants justify the difference in the clinical classification.

Both influenza type A and B variants circulate among the participants in this study. Out of the 66 laboratory-confirmed influenza-positive cases, the circulating influenza viruses were identified as influenza type A in 55 cases (83.3%), and influenza type B was reported in cases (16.6%). Influenza type A is the predominant type in this study. It is similar to the other study, which reported that, among the 277 episodes of ILI, 99 (35.7%) were caused by influenza viruses, mostly influenza A (79.9%), and according to a recent CDC surveillance report, influenza A positivity in the US last year was 97.3% (40,41). The last one-year Ethiopia Public Health Institute influenza surveillance data also reported that influenza type A was the predominant type in Ethiopia (88%). Another study reported that influenza type B predominates influenza type A in some seasonal increments of influenza, like illness cases and hospitalizations. (42)

The number of influenza A subtype AH1N1 seasonal cases was found to be fifty-Five (83.3%). The

other common subtypes of influenza type A, which are influenza subtype AH3N2 and influenza A H1N1 pdm09, were not identified among the positive influenza samples in this study. A study conducted in Ethiopia in the years 2012–2017 disagrees with the findings of this study due to the fact that the predominantly circulating influenza subtypes were seasonal influenza AH3N2, 455 (60%) and influenza AH1N1pdm09, 293 (38.81%). Seasonal influenza A (H3N2) remains the predominant circulating influenza subtype (14). In the present finding, the dominant circulating virus subtype was AH1N1. The result shows the change in variant characteristics and dominance over the years.

The subtype AH1N1 finding of this study is similar to what is found in other studies that reported fifty-three (73%) cases of AH1N1 (43), and the predominancy of type A and subtype H1N1 is consistent with other studies conducted in other countries in the Middle East and North Africa region (24–26,44). On the contrary, studies reported that H1N1pdm09 was the predominant influenza type A subtype circulating globally in the post-pandemic period (37,45). Moreover, influenza type B accounts for 11 cases (17%) of the total influenza-positive cases. This finding is similar to a study that identified respiratory pathogens in 139 episodes of influenza-like illness and reported influenza cases of 20 (14.4%) (40) and lower than a study conducted during the 2018/2019 season in Yemen, which was 110 (27%), (30,36). The national influenza center at the time of sample collection was only capable of characterizing the viruses as type A and B and subtypes of type A.

The result of the multiple binary logistic regression analysis model predicted Sex, marital status, comorbidity category, exposure to influenza or antiviral drugs during the last 14 days, and close contacts with people with SARI or COVID-19 symptoms were significantly related to influenza-like illness cases for adults over the age of eighteen and variables in the study were not significantly associated to influenza-like illness cases for children under the age of eighteen among the sentinel surveillance sites in Addis Ababa.

Adults over the age of 18

Being female is significantly associated with the risk of developing influenza among the study participants, with an AOR of 3.13 (95% CI: 1.346–7.197) and $p = 0.008$. The finding of this study is in agreement with research findings that assess the incidence and risk factors of influenza-like illness in the UK with an OR of 1.52 (95% CI 1.33–1.73) and a $p = 0.03$ (30). Another study, on the other hand, found that male sex is significantly associated with the risk of developing influenza with OR of 2.1

(95% CI: 1.3-3.5) and p value of 0.005. The difference in odds of risk factor among these studies can be justified by the fact that the later study enrolled only comorbid individuals in the study, whereas this study includes participants that fulfil the ILI case definition irrespective of their comorbidity status.

This study's finding that married individuals were 3.13 times more likely to contract influenza than non-married individuals (95% CI: 1.346-7.197, $p = 0.008$) presents a complex and surprising twist in understanding influenza transmission. While further research is crucial to dissect the underlying mechanisms, several potential explanations warrant exploration which includes, Married individuals typically have extensive social networks, potentially increasing their exposure to others with influenza during daily interactions, work, or gatherings. This heightened community engagement may lead to a higher risk of viral transmission compared to non-married individuals with potentially smaller social circles. On the other hand, spouses often share healthcare plans and resources, which could lead to delayed or differential access to medical care for one partner experiencing influenza symptoms. This delay in seeking treatment or preventive measures could inadvertently increase the risk of transmission to the other spouse. And also, couples often share living spaces, meals, and household activities, creating a more conducive environment for viral transmission within the home. Additionally, similar lifestyles in terms of hygiene practices, stress levels, or occupational exposures could further amplify the shared risk of contracting influenza.

Participants with at least one comorbidity are threefold more at risk of getting influenza than those without comorbidity, with an adjusted odds ratio of 2.881 (95% CI: 1.056-7.860) and $p = 0.039$. This finding is in agreement with other similar studies having an AOR for diabetes of 7.5 (CI 95%: 1.7–32.8) and $p = 0.007$; diabetes (OR = 7.0), hypertension (OR = 7.3), chronic heart disease (OR = 7.3), chronic renal diseases (OR = 2.9), and chronic respiratory diseases (OR = 6.2) (18,36,49). In contrast, a study that assessed the burden of medically attended influenza-like illness cases reported that comorbidities such as diabetes mellitus, renal disease, and neuromuscular disorders were not significantly associated with influenza(50). This difference may be due to the fact that the cases reviewed were from a single center, which cannot reflect the actual burden of influenza in the community.

This study revealed a compelling connection between close contact with individuals exhibiting severe acute respiratory infection (SARI) or COVID-19 symptoms and the likelihood of contracting influenza. Participants who reported no such contact in the two weeks prior to their own symptom onset were 77% less likely to be infected with influenza compared to those who did have contact. This significant association is confirmed by the adjusted odds ratio of 0.077 (95% CI: 0.011-0.553) and a p-value of 0.011, implying a statistical significance.

Interestingly, this finding aligns with previous research. One study reported that being surrounded by confirmed or suspected influenza cases significantly reduced the risk of infection (OR = 0.1, 95% CI: 0.05–0.30, $p = 0.001$). This further strengthens the conclusion that limiting close contact with individuals exhibiting respiratory symptoms plays a crucial role in preventing influenza transmission.

Another relevant finding from a similar study highlights the potential role of other exposure routes. While only 1.8% of participants reported contact with dead poultry at home, the majority (74.3%) had contact with potential ILI cases. This suggests that transmission pathways beyond direct contact with symptomatic individuals deserve further investigation for a comprehensive understanding of influenza spread.

Overall, this study underscores the importance of minimizing contact with individuals displaying respiratory symptoms as a key preventive measure against influenza. Additionally, it prompts further exploration of other potential transmission routes to develop more effective public health interventions and protect communities from influenza outbreaks. (53)

6.1. Limitations of the study

The findings of this study must be viewed with an understanding of some limitations. The respiratory pathogens identified in this study are limited to influenza, SARS-COV-2, and RSV. Hence, the real disease burden associated with the other potential respiratory pathogens was not assessed in the current study. Secondly, the knowledge of the community about influenza and respiratory viruses was not well analyzed other than through mere descriptive statistical figures. Thirdly, the fact that the study was conducted at the only sentinel surveillance sites in Addis Ababa couldn't represent the burden of

respiratory viruses in the country.

7. Conclusion

In conclusion, our study shows that the magnitude of influenza among the ILI sentinels surveillance sites in Addis Ababa was found to be high, and influenza was prevalent in the age group of less than fifteen years and the female sex. Both influenza type A and B variants circulate among the participants in this study. We also observed a high proportion of influenza subtype AH1NI dominating in the city during the study period. The most frequently mentioned clinical symptoms were a runny nose, headache, and sore throat. More than half of the study participants don't feel they are well informed about influenza and viral respiratory diseases. And the other one-third don't believe influenza-like illness cases can cause complications. Despite some gaps in knowledge, particularly regarding complications and personal awareness, the study participants demonstrate a general understanding of ILI transmission and risk factors.

The independent variables, Sex, marital status, comorbidity category, Exposure to influenza or antiviral drugs during the last 14 days, Close contact with people with SARI or COVID-19 symptoms was

significantly related to influenza-like illness cases of adults over the age of eighteen. The variables under the study were not significantly related to influenza-like illness of children under eighteen years of age among the sentinel surveillance sites in Addis Ababa. Further to this, pregnancy did not emerge as a risk factor for ILI in this study.

8. Recommendations

Building upon the valuable insights from this study, we propose several key recommendations to bolster Ethiopia's preparedness and response to respiratory virus threats:

1. Expanding the Scope of Surveillance:

Beyond the Big Three: While focusing on influenza, COVID-19, and RSV has provided valuable information, the Ethiopian Ministry of Health and Public Health Institute should undertake broader respiratory virus surveillance. Identifying the full spectrum of circulating pathogens can inform more comprehensive control strategies and resource allocation.

2. Prioritizing Influenza Vaccination:

Targeted High-Risk Groups: Despite occurring outside the peak influenza season, this study revealed a significant influenza burden. This underscores the need for proactive vaccination

initiatives, particularly for high-risk groups including children over six months, adults over sixty-five, and individuals with underlying medical conditions.

3. Exploring Antiviral Strategies:

Proactive Protection in Vaccine Gaps: When effective vaccines against circulating strains are unavailable, or individuals remain susceptible despite vaccination, antiviral drugs can provide crucial protection. Investigating the potential value of prophylactic antiviral use warrants further exploration, especially in high-risk populations.

4. Empowering Communities through Education:

Tailored Health Initiatives: Strengthen health education and community engagement campaigns, particularly at sentinel surveillance sites and high-burden facilities. Educational interventions could focus on under-recognized complications, self-awareness of symptoms, and appropriate hygiene practices.

5. Unraveling the Marital Status Puzzle:

Beyond the Correlation: The observed association between marital status and influenza requires further investigation. Studies exploring potential mediating factors, such as social networks, healthcare access, or lifestyle habits, can provide a deeper understanding of this complex relationship.

6. Deepening Our Knowledge:

Continued Research: Ongoing research efforts remain crucial to improve our understanding of influenza in Ethiopia. Investigations into disease severity, seasonality, and additional risk factors will inform targeted interventions and guide effective prevention strategies.

By implementing these recommendations, Ethiopia can move towards a more comprehensive and informed approach to combatting respiratory viruses, protecting vulnerable populations, and safeguarding public health in the face of evolving threats.

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10. Annexes

10.1. English Consent sheet

Hello. My name is _____ I am collecting data for research titled "Magnitude and associated factors of influenza like illness cases among influenza like illness sentinel sites in Addis Ababa, Ethiopia, 2023." We received permission from Saint Paul's Hospital and Millennium Medical College to conduct this study. You have been selected to participate in this study because you attend one of the selected health institutions.

The aim of the study is to assess the magnitude and factors associated with influenza-like illness cases among influenza sentinel sites in Addis Ababa. If you agree to participate, I will ask you some questions about your socio-demographics, health status, and contact and travel history. The interview will last no more than 15 minutes. Your participation in the study is voluntary. You may ask any questions during the interview, skip any question you think is inappropriate, and stop it at any moment you want with no further negative consequences.

The information collected from you will be kept confidential. It will be stored in a file using codes without your name. And it will be exposed to no one except the investigator. In addition, it will be used only for this particular research and for no other purposes. Your participation in the study poses no risk to you.

I comprehend and understand the condition stated above, therefore, I am willing to confirm my participation by signing the consent.

Agreed to participate in the study: Yes ☐

No ☐

Participants signature _____

Date _____

Principal Investigators address

Name: Adane woldeab

Phone +251910007233

10.2. Amharic consent form

ለመረጃ ሰብሳቢዎች፡-

እባካችሁ ለጥናቱ ተሳታፊዎች የጥናቱን አላማና ጭብጥ ከታች በተገለፀው መልኩ አስረዷቸው።

በመረጃ ላይ የተደገፈ የስምምነት ወረቀት

ውድ ተሳታፊ ሥሜ ይባላል። እኔ በኢንፍሉዌንዛ አማካኝነት የሚከሰት የመተንፈሻ አካላት በሽታ ስርጭትና ተያያዥ ችግሮችን በተመለከተ ለሚሰራ ጥናትና ምርምር መረጃ ሰብሳቢ ነኝ።

የዚህ ጥናት ዋና አላማ በኢንፍሉዌንዛ አማካኝነት የሚከሰት የመተንፈሻ አካላት በሽታዎች ስርጭትና ተያያዥ ችግሮችን ለመመልከትና ለሚመለከታቸው የመንግስት አካላትና ለህብረተሰቡ ክፍሎች ግንዛቤ መፍጠር ነው፤ የእርሶ ትክክለኛ ምላሽ ከችግሩ ጋር የትያያዙ ምክንያቶችን በደንብ አንድንገነዘብ እና የመፍትሄ ምክረ ሃሳቦችን ለሚመልከታቸው አካላት እንድናቀርብ ያግዛል። የመተንፈሻ አካላት በሽታ መከላከልና መቆጣጠር ላይ ለሚሰሩ አካላትና ጤና ተቋማትን ጨምሮ ማሻሻያዎችን እንዲያደርጉ ያግዛል። ከተሳታፊዎች የሚገኙት ሁሉም ማስረጃዎች በኮድ እንዲቀመጡ ይደረጋል። ይህም የተሳታፊዎችን ስም ላለመጠቀም ይረዳል። በዉይይትም ሆነ በሪፖርት ወቅት የተሳታፊ ስም አይገልጽም።

በመረጃ ሰብሳቢው የሰበሰበውን ሁሉንም መረጃ በጥናቱ ዋና መሪ ጋር በጥንቃቄ ይቀመጣል። መረጃዎቹ አንድ ጊዜ ተመርምረው/ተጠንተው ከተጠናቀቁ በኋላ በጥንቃቄ ይወገዳሉ። እኔ የምሰበስበው መረጃ ሁሉ ለጥናታዊ ምርምር ብቻ የሚውል እና በሚስጥር የሚጠበቅነው።

አጠቃላይ ጥያቄው ከ15 ደቂቃ በላይ አይወስድም ለዚህ ቃለ መጠይቅ በመሳተፍህ/ሽ ክፍያ የለውም። በፈለገህ/ሽ ጊዜ ማቆረጥ ወይም ሙሉ ለሙሉ አላማሳትፍ መብቱ ያንተ/ኛ ነው። ግልፅ ነው?

(ግልፅ ካልሆነ በመረጃ ላይ የተደገፈ ስምምነቱን ድገም/ሚ) ለመሳተፍ ተስማምተህል/ሻል?

1. አዎ[] 2. አልተስማማሁም[]

የተሳታፊው/ዋ መልስ አልተስማማሁም ከሆነ ውሳኔውን/ዋን አክብረህ/ሽ አመስግነህ/ሽ ሸኝ/ኚ። ምላሹ/ሷ አዎ ከሆነ ቃለ መጠይቁን ቀጥል/ይ።

10.3. English version Data collection tool

Code _____

Date form completed _____

Name of the sentinel site _____

MRN _____

CASE DEFINITION: Acute Respiratory Infection with history of fever or Measured fever of $\geq 38^{\circ}$ C, cough and Onset within the last 10 days.

S.N	Question	Response	Skip
1. DEMOGRAPHIC AND SOCIOECONOMIC FACTORS			
101	Sex	1. Male 2. 2. Female	
102.	How old are you? (Age in years)	_____	
103.	Address	Subcity_____Woreda_____ Don't know_____	
104.	What is your religion?	1. Orthodox 2. Protestant 3. Muslim 4. Catholic 5. Others specify_____	
105.	Have you ever attended school?	1. Yes 2. No	If yes,
106.	What is the highest [GRADE/YEARS] you completed? IF COMPLETED LESS THAN ONE YEAR, RECORD '00'.	[GRADE/YEARS] _____	
107.	Are you employed	1. Employed 2. Unemployed,	If 2, skip to 109 Employment status was asked

			for adults over 18 years.
108.	What is your occupation	1. office work 2. Daily laborer 3. Farmer 4. animal raring (production) 5. house wife 6. Factoryworker 7. Not applicable	
109.	Marital status	1. Not Married 2. Married or living together	The marital status of respondents was asked if they are ≥ 18 years or if they are caregivers of the children under 18 years.
110	How large is your family size?	_____	
111	Your estimated monthly income of any source	_____	
112	Presence of pregnancy	1. Yes 2. No	If No, skip to 201
113	If yes to pregnancy, at which trimester are you now?	1. First trimester 2. Second trimester 3. Third Trimester 4. Unknown	

2, KNOWLEDGE OF INFLUENZA /ACUTE RESPIRATORY TRACT INFECTION

201	Is ARI transmitted from person to person?	1. Yes 2. No	
202	Does influenza like illness infection arise complications, such as pneumonia or cardiovascular diseases?	1. Yes 2. No	
203	Is ARI transmitted from animals?	1. Yes 2. No	
204	Do you feel well informed about influenza	1. Yes 2. No	
What are the signs/ symptoms of ARI			
205	Fever	1. Yes 2. No	
206	Cough	1. Yes 2. No	
207	Runny Nose	1. Yes 2. No	
208	Vomiting	1. Yes 2. No	
209	Difficulty of Breathing	1. Yes 2. No	
210	Headache	1. Yes 2. No	
211	If Others, specify_____	1. Yes 2. No	
212	Do you think there is a risk factor for ARI?	1. Yes 2. No	IF No, skip to 211
213	What do you think are the risk factors for ARI?	_____	
214	Do you think ARI can be prevented?	1. Yes 2. No	

3, CLINICAL PRESENTATION (SYMPTOMS)			
301	Within the past 7-10 days including today, did you have any of the following Symptoms (Circle all that applies)	1. Headache 2. Arthritis (Joint Pain) 3. Sore-throat 4. Runny Nose 5. Vomiting 6. Difficulty of Breathing 7. Hemoptysis (coughing out blood) 8. Skin Rash 9. Unusual Bleeding 10. Other specify_____	
4, PRE-EXISTING MEDICAL CONDITION			
401	Which of the following pre-existing medical conditions do you have? (Circle all that apply)	1. HD: Heart Disease 2. AM: Asthma 3. CLD: Chronic Lung Disease 4. LD: Liver Disease 5. DB: Diabetes 6. CHD: Chronic Hematologic Disorder 7. CND: Chronic Neurological Disease 8. CRD: Chronic Renal Disease 9. NMD: Neuromuscular Dysfunction 10. IC: Immune Compromised 11. Other, specify_____ 12. No known condition	
5, VACCINE AND ANTIVIRAL			

501	Have you Exposed to influenza or other antiviral drugs during the last 14 days?	1. Yes 2. No	
502	Do you have Vaccination for Influenza?	1. Yes 2. No	
503	Do you have SARS-COV-2 Vaccination in current season?	1. Yes 2. No	
6, TRAVEL AND EXPOSURE/CONTACT HISTORY			
601	Have you had close contact with person with SARI or COVID-19 symptoms?	1. Yes 2. No	
602	Have you had close contact with or handled sick or dead poultry?	1. Yes 2. No	
603	Do you have travel history in past two weeks around any epidemic suspected area	1. Yes 2. No	
7, TEST RESULT			
701. Type of specimen collected: ☐ Nasal swab ☐ Throat swab ☐ nasopharyngeal swab ☐ other Lab Confirmation method ☐ PCR/RT ☐ Others _____			
702	Positive for		
	☐ Inf (A / B) ☐ RSV ☐ COVID-19 ☐ Others_____		
703	Negative for		
	☐ Influenza ☐ RSV ☐ COVID-19 ☐ Others		

10.4. Amharic version data collection tool

ከድ _____ መርጃው የተሰበሰበበት ቀን _____

የጤና ተቋሙ ስም _____ የካርድ ቁጥር _____

የልዩታ መስፈርት፡ አጣዳፊ የመተንፈሻ አካል ህመም ሲሆን ባለፉት 10 ቀናት ውስጥ ምልክቶቹም ትኩሳትና ሳል ያሳየ ሰው.

ተቁ	ጥያቄ	መልስ	ይለፍ
1. የ ጥናቱ ተሳታፊዎች አካባቢያዊና ባህላዊ ባህሪያት			
101.	ጾታ	☐ ሴት.....1 ☐ ወንድ.....2	
102.	እድሜ በተጠናቀቀው አመት	_____	
103.	አድራሻ	ክፍለ ከተማ _____ ወረዳ _____ አላውቅም _____	
104.	የምን ሀይማኖት ተከታይ ነህ/ሽ	☐ ኦርቶዶክስ..... 1 ☐ ካቶሊክ..... 2 ☐ ፕሮቴስታንት..... 3 ☐ ሙስሊም..... 4 ☐ ሌላ _____ (ይገለጹ)	
105.	ትምህርት ተመረሀል/ሻል?	☐ አዎ.....1 ☐ የለም.....2	መልሱ የለም ከሆነ ወደ ጥያቄ 107 እለፍ/ፊ
106.	ትምህርት ከተማርህ/ሽ እስከ ስንትኛ	[ክፍል/አመት] _____	
107.	የስራ ሁኔታ	3. ተቀጣሪ 4. ተቀጣሪ የሆነ/ች	መልሱ የለም ከሆነ ወደ ጥያቄ 109 እለፍ/ፊ
108.	ስራህ/ሽ ምንድነው?	☐ የመንግስት/ግል ተቀጣሪ.....1 ☐ ተማሪ.....2	

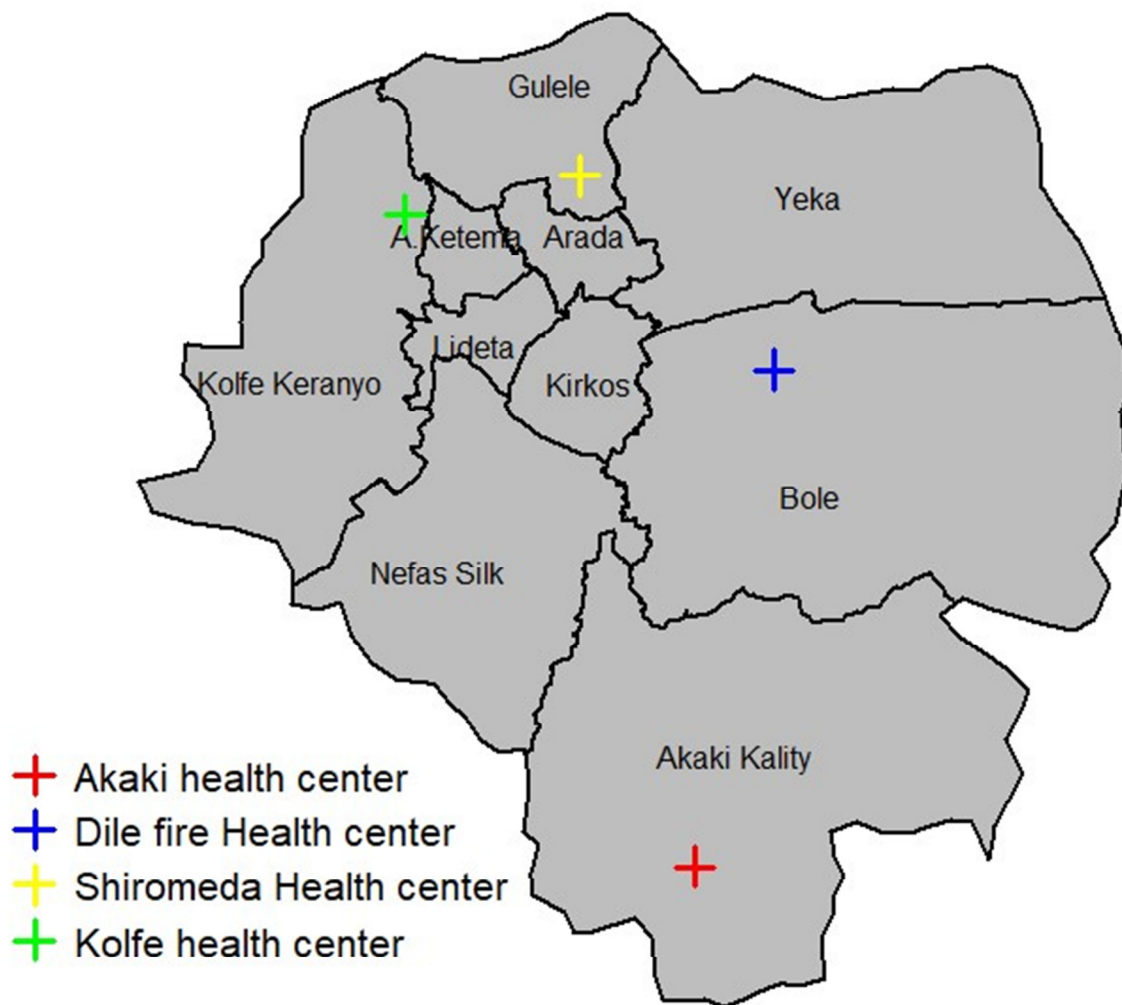
		☐ የቀን ሰራተኛ.....3 ☐ ነጋዴ.....4 ☐ የቤት እመቤት.....5 ☐ የእንስሳት ንግድ.....6 ☐ ሌላ.....ይግለጹ	
109.	የጋብቻ ሁኔታህ/ሽ ምን ይመስላል?	☐ አላገባሁም.....1 ☐ አግብቻለሁ /አብረን እየኖርን ነው.....2	ይህ ጥያቄ የሚመለከተው እድሜያቸው ከ18 አመት በላይ ወይም በበሽታው የተጠረጠረ ህጻን ወላጅ/ተንከባካቢ ሲሆኑ ነው
110	በዚህ ቤተሰብ ውስጥ ምን ያህል ሰው ይኖራል? መግለጫ : በቤተሰቡ ውስጥ ለግማሽ ሰዎች ያክል ምግብ እና መሰል ነገሮችን በጋራ እየተጠቀመ የቆየ ሁሉ እንደ ቤተሰቡ አባል ይቆጠራል።?	____ሰዎች	
111	ማካይ ወርሀዊ ገቢህ/ሽ በኢትዮጵያ ብር ስንት ነው?		
112	በአሁኑ ሰዓት ነፍሰ ጡር ነሽ?	☐ አዎ.....1 ☐ የለም.....2	መልሱ 2/3 ከሆነ ወደ ጥያቄ 201 እለፍ/ፊ
113	አሁን ንፍሰ ጡር ከሆንሽ ስንት ወርሽ ነው?	☐ ከ 1-3 ወር.....1 ☐ 4-6 ወር.....2 ☐ 7-9 ወር.....3 ☐ አላውቀውም.....4+	

2, ስለ አጣዳፊ የመተንፈሻ አካላት በሽታ ግንዛቤ			
201	የመተንፈሻ አካላት በሽታ ከሰው ወደ ሰው ይተላለፋል?	☐ አዎ.....1 ☐ የለም.....2	
202	የመተንፈሻ አካላት በሽታ ወደ ከፋ የህመም ደረጃ ሊደርስንና ሞት ሊያስከትል ይችላል?	☐ አዎ.....1 ☐ የለም.....2	
203	የመተንፈሻ አካላት በሽታ ከእንስሳ ወደ ሰው ይተላለፋል ?	☐ አዎ.....1 ☐ የለም.....2	
204	ብቂ መረጃ አልኝ ብልህ/ሽ ታስባለህ/ሽ	☐ አዎ.....1 ☐ የለም.....2	
የአጣዳፊ የመተንፈሻ አካላት በሽታ ምልክቶች ምን ምን ናቸው?			
205	ትኩሳት	☐ አዎ.....1 ☐ የለም.....2	
206	ሳል	☐ አዎ.....1 ☐ የለም.....2	
207	የአፍንጫ ፍሳሽ	☐ አዎ.....1 ☐ የለም.....2	
208	ትውከት	☐ አዎ.....1 ☐ የለም.....2	
209	መተንፍስ መሳን/አልመቻል	☐ አዎ.....1 ☐ የለም.....2	
210	ራስ ምታት	☐ አዎ.....1 ☐ የለም.....2	
211	ሌላ ካለ _____	☐ አዎ.....1 ☐ የለም.....2	
212	ለመተንፈሻ አካላት በሽታዎች ሊያጋልጡ የሚችሉ ሁኔታዎች አሉ ብልህ/ሽ ታስባለህ/ሽ?	☐ አዎ.....1 ☐ የለም.....2	መልሱ 2/3 ከሆን ወደ ጥያቄ 211 እለፍ/ፈ
213	የሚያጋልጡ ሁኔታዎችን ጥቀስ/ሺ	_____	
214	የመተንፈሻ አካላት በሽታዎች መከላከል ይቻላል?	☐ አዎ.....1 ☐ የለም.....2	

3, የአጠዳፊ መተንፈሻ አካላት በሽታዎች ምልክት			
301	ዛሬን ጨምሮ ባለፉት 10 ቀናት ውስጥ የትኞቹ ምልክቶችን በራስህ/ሽ ላይ አይተህል/ሻል	☐ ራስ ምታት ☐ ቁርጥማት ☐ በጉንፋን የተዘጋ ጉሮሮ ☐ የአፍንጫ ፈሳሽ ☐ ትውከት ☐ መተንፍስ መሳን/አልመቻል ☐ ደም የተቀላቀለበት ሳል ☐ የቆዳ ሽፍታ ☐ ሌላ ካለ ግልጽ/ጺ_____	
4, የቆዩ የጤና ችግሮችን በተመለከት			
401	የትኞቹ የቆዩ የጤና ችግሮችን አጋጥሞህል/ሻል?	☐ የልብ በሽታ ☐ አስም ☐ የቆዩ የሳንባ በሽታ ☐ የጉብት በሽታ ☐ የስኳር በሽታ ☐ የደም ዝውውር ችግሮች ☐ የነርቭ ህመም ☐ የኩላሊት በሽታ ☐ የነርቭና ጡንቻ ህመም ☐ ዝቅተኛ በሽታን አቅም ☐ ሌላ_____	
5,	ክትባትና ጸረ ተህዋሲያን		
501	ባለፉት 14 ቀናት የኢንፍሉዌንዛ ወይም ሌላ ጸረ ተህዋሲያን መድሃኒት ወስደዋል?	☐ አዎ.....1 ☐ የለም.....2	

502	በቅርቡ የኢንፍሉዌንዛ ክትባት ወስደው ያውቃሉ?	☐ አዎ.....1 ☐ የለም.....2	
503	በዚህ ዐመት ውስጥ የኮቪድ 19 ክትባት ወስደዋል?	☐ አዎ.....1 ☐ የለም.....2	
6, የጉዞ ታሪክና የቅርብ ንክኪን በተመለከት			
601	የኮቪድ 19 በሽታ ወይም የመተንፈሻ አካላት በሽታ ምልክት ከሚያሳይ ሰው ጋር የቅርብ ንክኪ ነበረህ/ሽ	☐ አዎ.....1 ☐ የለም.....2	
602	የመተንፈሻ አካላት በሽታ ምልክት ከሚያሳይ ሰው ወይም ከሞተ የዶሮ ዝርያ ጋር ንክኪ ነበረህ/ሽ?	☐ አዎ.....1 ☐ የለም.....2	
603	ባልፉት 14 ቀናት ውስጥ የመተንፈሻ አካላት በሽታ ወረርሽኝ ያለበት አካባቢ የጉዞ ታሪክ አለህ/ሽ?	☐ አዎ.....1 ☐ የለም.....2	
7,	የላቦራቶሪ ውጤት		
701	የተሰበሰበው የናሙና አይነት ☐ ናሳል ስዋብ ☐ ትሮት ስዋብ ☐ ናሶፍሪንጃል ስዋብ ☐ ሌላ የላቦራቶሪ ማረጋገጫ መንገድ €ፒሲአር/አር ቲ €ሌላም _____		
702	ፖዘቲቭ/አለ		
	☐ ኢንፍሉዌንዛ (ኤ / ቢ) ☐ አር ኤስ ሺ ☐ ኮቪድ 19 €ሌላ _____		
703	ነጌቲቭ/የለም		
	☐ ኢንፍሉዌንዛ (ኤ / ቢ) ☐ አር ኤስ ሺ ☐ ኮቪድ 19 €ሌላ _____		

10.5. Map of study area/settings



10.6. Laboratory test procedure

Specimen collection, transportation, extraction and detection

1. Specimen collection and transportation

The samples will be collected from ILI surveillance sentinel site health centers by well-trained sample collectors based on case definition. The collectors have a protocol customized from WHO respiratory sample collection guideline to collect throat or nasopharyngeal swab specimens. The collected samples will be placed in viral transport media (VTM) and stored at 4 °C until transported to the National Influenza Central (NIC) at Ethiopian Public Health Institute. Collected specimens in viral transport media will be transported to the NIC within 2-3 hours of collection using a cold chain system by triple packaging material.

2. RNA Extraction

Viral RNA will be extracted from throat/ nasopharyngeal swab samples within 1–2 hours by using MagaBio plus Virus RNA Purification Kit II by MGISP-NE32 automated extractor which enables extracting 32 samples at a time with in less than 10 minutes.

3. Molecular Detection

Molecular detection of viral respiratory viruses will be done by the real-time reverse transcriptase polymerase chain reaction (RT_PCR) by using multiplex TaqMan SARS-CoV-2, Flu A/B, RSV RT-PCR Assay kit for qualitative detection and differentiation of influenza viruses, SARS-CoV-2 and Respiratory Syncytial Virus. The first step of the assay detects virus types as influenza A/B, RSV and SARS-CoV2 from the same reaction at the same time and the second to differentiate between influenza A and Influenza B viruses and for subtyping for influenza A viruses will be used another a single plex assay kit. And then we will differentiate influenza A from influenza B. We will test influenza A positive for sub type like as A/H1, A/H3 and (H1N1) pdm09. The assay has positive control and primers and probes against the target genes for SARS-CoV-2, Flu A/B, RSV and each influenza subtyping. ABI 7500 Fast PCR machine will be used for detection.

Ref. No. PM23/660
Date: 22/3/2023

Institutional Review Board (IRB) of St. Paul's Hospital Millennium Medical College (SPHMMC)
Ethical Clearance

Research Title: Magnitude and associated factors of influenza like illness cases among influenza like illness sentinel sites in Addis Ababa

Principal Investigator: Adane Woldeab

The IRB of SPHMMC has reviewed the above mentioned research proposal and made the following decision:

- Approved:- X
- Approved with recommendation:- _____
- Approved on condition :- _____
- Disapproved:- _____

The decision is valid for 12 months and the research should be conducted in compliance with the protocol/proposal approved by the IRB of SPHMMC. Any subsequent revision/amendment of the protocol/proposal needs approval before conduct of the research. The researcher should also submit written summaries of the research status to the IRB every 03 months. Upon the conclusion of the study, manuscripts and thesis work to the final/completed research project needs to be submitted to the IRB.

IRB Chair:
Signature: _____
Date: April 20, 2023
Cc:

- Vice Provost for Academic and Research
- IRB
- Adane Woldeab

SPHMMC

Mahteme Bekele
Professor of Surgery
Research Director

10.8. Permission letter from Addis Ababa city Health bureau

 **በአዲስ አበባ ከተማ አስተዳደር ጤና ቢሮ**
CITY GOVERNMENT OF ADDIS ABABA

ቁጥር 46/ሀ/ሀ/13526/100
Ref. No.
ቀን 11/09/2015
Date

To
Akaki Health Centre
ShiroMeda Health Centre
Kolfe Health Centre
Dijfne Health Centre
Addis Ababa

Subject: Request to access Facilities to conduct approved resear

The letter is to support Adane Woldeab of "Mognitude and Associated Factors Of Influenza Like Illness Cases Among Influenza Like illness Sentinel Sites in Addis Ababa". The study proposal was duly reviewed and approved by Addis Ababa health bureau IRB, and the principal investigator is informed with a copy of this letter to report any changes in the study procedures and submit an activity progress report to the Ethical committee as required .Therefore, we request the facility and staffs provide support to the principal investigator.

CC
Adane Woldeab
Addis Ababa

 **With Regard**
Daniel Damtew Woldemariam
Public Health Research and
Emergency Management
Directorate Director

ፍትሃዊ ንግሥት የጠበቀ የጤና አገልግሎት ለሁሉም
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ማልስ ሲጽፉልን የእኛ ቁጥር ይጠቀስ In replaying please quote our Ref.No.

Declaration: signed by both student and primary advisor

Declaration

I, the undersigned declare that this thesis is my original work in partial fulfillment of the requirement for the degree of Master of Public Health. I also declare that it has never been presented in this or any other university and that all resources and materials used in the thesis have been duly acknowledged.

Student Name: _____

Signature: _____

Place of submission: _____

Date of submission: _____

This thesis has been submitted with my approval as a college/university advisor.

Primary Advisor Name: _____

Signature: _____

Date of submission: _____

Co-Advisor Name: _____

Signature: _____

Date of submission: _____