Original Article

Spatial variation and level of compliance on COVID-19 Prevention strategies in Amhara region, Ethiopia: Observational survey

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Abstract

Background: The novel Coronavirus was first detected in Wuhan, China in December 2019. In Ethiopia, The COVID-19 pandemic was expanding geopgraphically overtime. Understanding the spatial variation of the pandemic and the level of compliances towards COVID-19 prevention strategies is important to guide focused prevention and control efforts.

Aim: This study aimed to explore the level of compliance and spatial variation in COVID-19 prevention strategies in major cities and towns in the Amhara region, Ethiopia.

Methods: A community based observational survey was conducted from June 25 to August 10, 2020, in 16 selected cities and towns of the Amhara region. The level of compliance with hand hygiene, physical distancing and mask utilization as per the WHO recommendations were observed from 6,002 individuals and 346 transport services. Getis-Ord Gi* statistics were used to identify hot spot areas with a low level of compliance with COVID-19 preventive strategies. Spatial interpolation was performed to predict the level of compliance for un-sampled areas in the region.

Results: The practice of hand hygiene, physical distancing and mask utilization were 12.0%, 13% and 26%, respectively. COVID-19 prevention strategies were found to be spacially non-random in Amhara region (Global Moran's I = 0.23, z-score = 9.5, P-value < 0.001). Poor (Hot Spot Areas) COVID-19 Prevention practices were spatially clustered at Northern Amhara (Metema, Gondar, and Woghemira town) and Western Amhara (Moarkos, Enjibara, And Bahir Dar town).Southern (Shewa Robit, and Kemissie Twon) and Eastern (Dessie, Kombolcha, Wolidiya, and Kobo) parts of the Amhara region were spatially clustered as cold spots (better practice) for COVID-19 prevention strategies. With regards to the practice of COVID19 prevention strategies, practices were low in northern and northwestern parts of the region (5%), whereas this was found to be much higher in the southern part of the region (41%).

Conclusion: The level of compliance with regards to hand hygiene, physical distancing and mask utilization exhibit spatial variation across the region. Continuous community-based education using different modalities are necessary to increase the practice of hand hygiene, physical distancing and mask utilization. [*Ethiop. J. Health Dev*. 2021; 35(3):000-000]

Keywords: Hand hygiene, physical distancing, mask utilization, CVOID-19, Amhara, Ethiopia

Background

A novel Coronavirus was first detected in Wuhan, China on 29 December 2019. The World Health Organization (WHO) has declared that the coronavirus disease 2019 (COVID-19) outbreak is a global pandemic on March 11, 2020 [1]. It is one of the greatest challenges that human beings ever faced [2]. Since 4 September 2020, it has affected 213 countries and territories with more than 26,441,490 confirmed cases and 872,164 deaths [3]. Currently, the pandemic rapidly increased to more than 153 million cases and 3 million deaths reported in the world [4]. In Ethiopia, the pandemic affects 258062 cases and 3709 deaths [5]. The main transmission routes of COVID-19 are droplet transmission, contact transmission, and aerosol transmission which makes it difficult to contain the disease transmission globally [6].

Despite it being the lowest at the initial stage, the confirmed cases in sub-Saharan Africa are increasing [7]. The research predicted that COVID-19 is expected to hit drastically the countries of the regions in sub-Saharan Africa [8]. In Ethiopia, COVID-19 has increased since its inception on March 13, 2020 [9].

COVID-19 has neither a proven vaccine to prevent nor a drug known to treat the virus. However, like other infectious diseases, it can be controlled by blocking the transmission routes and protecting the susceptible populations [10]. Avoiding travel to high-risk areas, contact with symptomatic and asymptomatic individuals, and the consumption of meat from regions with a known COVID-19 outbreak, are the major preventative measures to prevent the further spread of COVID-19 [11,12] Similarly, active case finding, tracing close contacts and placing them under quarantine, promoting basic hygiene measures,

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cancelling public gathering, closing schools, delaying the return to work, social distancing, using a mask and city lockdown is the integrated public health interventions implemented to contain the COVID-19 transmission [6,13].

Though the country and the region implemented a range of prevention and control measures, the cases and deaths are increasing which impact the health care system. Implementing COVID-19 preventive behaviors such as hand-washing social distancing and mask utilization are necessary to curb the spread of the coronavirus [14]. Urban areas are at a high risk of transmission of infectious diseases, including COVID-19. Facilities/services in urban areas such as market places, religious places, public transport services, streets, banks, food and drinking establishments are potential areas for transmission of COVID-19. To implement the corrective measures regarding COVID 19 prevention, there is insufficient evidence regarding spatial variation and prevention practices of COVID-19 at major cities/towns in the Amhara regional state.

Understanding the spatial variation and level of compliances on hand hygiene, physical distancing and mask utilization for COVID-19 at major cities/towns in the Amhara region are crucial in responding effectively to COVID-19. This study helps to propose program options for policymakers and program implementers for combating COVID19 in the region. Therefore, this study aimed to explore the spatial variation and level of compliance on hand hygiene, physical distancing and mask utilization for COVID-19 in the major cities/towns in Amhara.

Methods and Materials

Study settings: The study setting was Amhara Region, Ethiopia. It is one of Ethiopia's largest regions with 12 zones, 3-metropolitan cites, and 180 Woredas (139 rural and 41 urban). According to the Ethiopian Central Statistics Agency, the region has a projected population of 22,189,999 million people, about 80 percent of whom are rural farmers. The region has 82 hospitals (2 teaching and specialized, 5 comprehensives specialized, 12 general, and 63 primary), 5 blood banks, 847 health centers, and 3,342 health posts. Different facilities such as Bank, church, hotels, groceries, health facilities, Juice houses, local drinks, open markets, supermarkets, restaurants, streets, transport services, and government workplaces (Ethiopian Electric Power, Kebeles, Mahiberat, Telecommunication, trade and industry) are the common services in urban areas of the region.

Study design and period: A community based cross-sectional study design using an observational survey was employed from June 25 to August 10, 2020.

Study population

People are eligible for trips to worship sites, markets, public transit systems, banks, food and drink outlets, health facilities, and workplaces.

Sampling procedure and sample size

Multistage stratified cluster sampling was used in two stages. Major hot-spot areas for COVID-19 were identified in the region based on past confirmed cases and exposed status. Each city/town was stratified into high, medium and low-risk zones based on the movement of people during the days of the week. This risk stratification was determined based on the movement of people per week and was supported by town administration workers. In the first stage, observation sites where people gather for different reasons in the town were selected using the lottery method as per the risk of sites during the days of the week. In the second stage, individuals who are in the public congregation sites (worship places, market places, transport, banks, supermarkets, and health facilities) were selected based on a person (reference person for physical distancing) who was there in front of the observed individual.

The selected individuals were observing and data was collected using an observation checklist. In each hot-spot area, approximately 20% of the public congregation sites were considered and at least 10 observations were made at each observation place to increase the power of the study and reduce observer bias. The first observee was the person who arrived on the site at the time of arrival and then every other person was observed. A total of 6348 observations (6002 individuals at a different site and 346 from transport services) were made.

Data collection tools and Techniques

The data collection tool was developed based on the national guidelines for clinical and community management of COVID-19 by the authors. The practice domain consisted of three domains; hand hygiene, physical distance, and mask utilization. The checklist was developed and validated by an expert panel consisting of an epidemiologist, public health, behavioral sciences, and biostatistician. Web-based data collection techniques were used using the Epicollect5 mobile application using the English version questionnaire (Supplementary file 1). The data was collected by MSc/MPH degree health professionals. The observations included demographic variables like age, gender, facility name, type of service/facility as well as, vehicle occupant capacity, driver and his/her assistant mask utilization.

Operational definitions for practice measurement

Hand hygiene:

Proper hand hygiene practice: A person washed their hands with an available detergent and water at least for 20 -30 seconds or used sanitizer/hand rub before getting in the facility or taking the services [15]

Improper hand hygiene practice: A person washed their hands only with water or water and detergent for less than 20 seconds before getting into the facility or taking the services [15]

No hand hygiene practice: A person got into the facility or took the services without washing their hands or using sanitizer

Physical distance:

Proper physical distance: A person is kept 2 meters away from another person whilst accessing services or greetings or shopping or having a conversation or praying [16].

Improper physical distance: A person keeping less than 1 meter away from another person whilst accessing services or greetings or shopping or having a conversation or praying

No physical distance: A person has body contact or shakes hands with another person during greetings or shopping or having a conversation or praying

Mask Utilization:

Proper mask utilization: A person covers their mouth and nose with a mask or any type of cloth in any of their activities

Improper mask utilization:

a. If a person covered only the mouth or nose with a mask or cloth or

b. If a person covered both nose and mouth with a mask but touched the mask with their hands or touched the eyes

No mask utilization: A person did not cover the mouth and nose

Classification of cities/towns with risk of transmission

- High-risk area refers to an area in the cities/towns where peoples movement exists 6 to 7 days of a week
- Medium risk area refers to an area in the cities/towns where peoples movement exists in 3 to 5 days of a week
- Low-risk area refers to an area in the cities/towns where people movement exists in 1 to 2 days of a week

Quality Assurance

A standardized and pretested observation checklist was used to collect the data. Two days of training was given to data collectors and supervisors on the observation checklist, on how to select the observes, and methods of observations to minimize observers' error. The tool was pretest and modified based on the feedback to minimize the inter-observer difference. The collected data was checked daily by the supervisor and feedback was given to the observer.

Data Analysis

The mobile-based data was exported to STATA Software for analysis. Categorical variables were presented by frequency and percentage. A Chi-square test was used to assess the association between the practices with the socio-demographic variables.

Spatial Analysis

To explore the spatial analysis of COVID-19 related prevention and control strategies, the services (Bank, Church, Grocery, Health facility, Hotel, Juice, local drink sites, market, and restaurant) location clusters were created. The average latitude and longitude were taken as the centroid locations. Finally, a total of 558 clusters (service location sites) were created using ArcGIS version 10.8 software. Figures were generated by integrated raw data and spatial statistical tools.

Spatial autocorrelation (Global Moran's I) statistic was employed to assess spatial heterogeneity for COVID-19 prevention and control strategies. The global Moran's I values close to −1 indicate poor practice is dispersed, close to +1 indicates clustered, and zero indicates random distribution of COVID 19 prevention strategies [17]. Hot spot analysis (Getis-Ord Gi* statistics) z-scores and significant p-values served to determine either hot spot or cold spot values for the services spatially.

The spatial interpolation technique was used to predict the level of practice of COVID-19 prevention and control strategies for un-sampled areas in the region. Geostatistical Empirical Bayesian Kriging spatial interpolation techniques were used for the prediction of unsampled locations or areas. Empirical Bayesian Kriging relaxes the assumption of the Gaussian distribution of the observed semi-variogram in the input data which rarely holds in practice. Empirical Bayesian Kriging interpolation works by generating a new simulated semi-variogram at each service location from the estimated semi-variogram for the input data. The weight of the new simulated semi-variogram was calculated by Bayes' rule [18].

Ethical approval and consent to participate

Ethical approval was obtained from Amhara Public Health Institute (APHI) review board before the study. The ethical approval letter (Ref. no. RTTD//766, Date 05/05/2020) was attached as a supplementary file (supplementary file 2). A Permission letter was secured from the COVID 19 regional task force to ensure the safety of data collectors and supervisors. The questionnaire was designed to be anonymous and waived consent was used. The data was kept confidential and the results did not identify the respondents personally.

Results

A total of 6,002 participants were observed for COVID19 prevention measures practice. The majority of the observed participants were males (67.9%) and found to be in the age ranges between 18 and 50 years (87.4%). Two-thirds of the participants were observed in the high-risk zone. Eight hundred ninety-one (14.9%) were observed in Dessie Town and the lowest observation was done in Sekota (3.1%). The highest observation was done at health facilities and the lowest was done in local drinker sellers (**Table 1**).

Table 1: **Participants sociodemographic characteristics, place of observation and facilities in Amhara Region, June to August 2020**

Variable	Response	Frequency	Percentage
Sex	Male	4,078	67.9
	Female	1,924	32.1
Age of participants	<18 years	215	3.6
	18-50 Years	5,244	87.4
	> 50 years	543	9.0
Strata with risk	High risk	4,222	70.3
	Medium risk	391	6.5
	Low risk	1,389	23.1
	Addis Kidamie	277	4.6
	Bahir Dar	689	11.5
	Bati	243	4.0
	Metema	296	4.9
	D/Birhan	497	8.3
	D/Markos	478	8.0
	Dessie	891	14.9
City of observation	Gondar	409	6.8
	Injibara	445	7.4
	Kemissie	404	6.7
	Kobo	248	4.1
	Kombolcha	398	6.6
	Sekota	187	3.1
	Showa Robit	205	3.4
	Woldiya	335	5.6
	Bank (Government)	278	4.6
	Bank (private)	377	6.3
	Church	515	8.6
	Grocery	451	7.5
	Health Facility	742	12.4
	Hotel	529	8.8
	Juice	243	4.1
Facilities observed	Local drink sellers	104	1.7
	Market (Open Market)	296	4.9
	Market (Super Market)	242	4.0
	Microfinance	109	1.8
	Restaurant	652	10.9

Practices of COID-19 prevention measures

Only 12.0% (95%CI: 11.1 to 12.9%) of the participants had proper hand hygiene practice. Similarly, 13.4% (95%CI: 12.6 to 14.3%) of the participants kept the recommend physical distance. One-fourth of the participants (25.7% 95%CI: 24.6 to 26.8%) made use of proper mask utilization (**Table 2**).

Table 2: **COID19 prevention measures practices by study participants in Amhara Region, June to August 2020**

Variables	COID19 prevention measures practices		
	Proper (95 % CI)	Improper (95% CI)	No (95 % CI)
Hand hygiene	614 (12%: 11.1-12.9)	816 (15.9:15.0-17.0)	3,688 (72.1%: 70.8-73.2)
Physical distance	807 (13.4%: 12.6-14.3)	3,468 (57.8% :56.5-59.0)	1,726 (28.8%:27.6-29.9)
Mask utilization	1,540 (25.7%:24.6-26.8)	474 (7.9% :7.2 to 8.6)	3,984 (66.4%: 65.2-67.6)

COVID-19 preventive measures by town

Hand Hygiene: Across all the towns where the observation had taken place, most of the study participants did not practice hand hygiene at all. However, proper hand hygiene was the highest in Bati (29.5%) and the lowest in Addis Kidamie (0%). Addis Kiedam, Bahir Dar, Metema, Gondar, Injibara, Kemissie, Kobo, and Sekota did proper hand hygiene below the overall practice (12.0%) whereas the rest of the towns did above the average (Figure 1).

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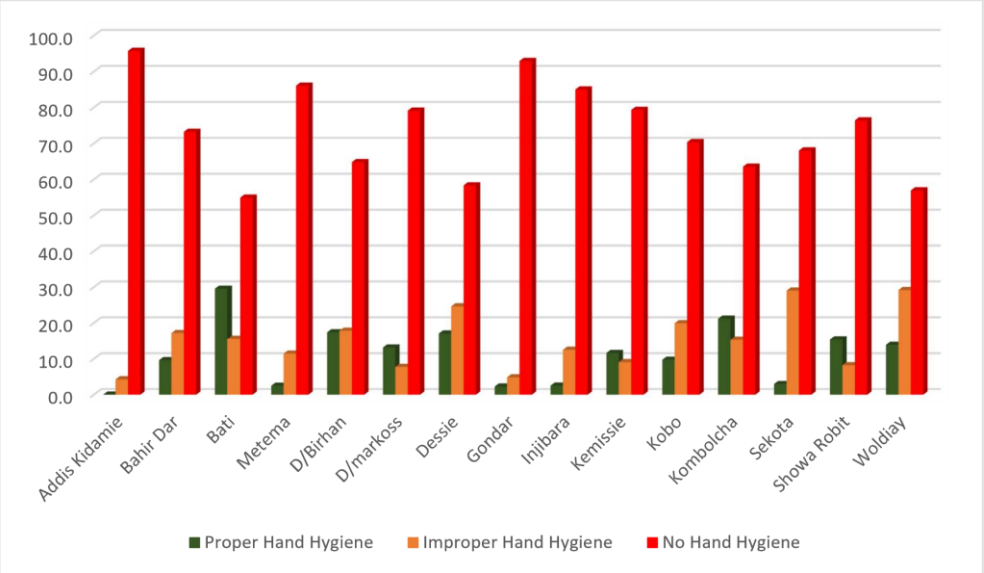

Figure 1: Hand hygiene practices across towns in Amhara Region, June to August, 2020

Physical Distancing

Physical distancing as a prevention measure was better practised; however, the practice was improper across the study sites. Residents of Metema had the highest (80.7%) improper physical distancing as compared to other sites. The proper physical distance was the highest in D/Birhan (20.9%) and the lowest in Metema (5.4%). Addis Kiedam, Bahir Dar, Metema, D/Markos, Injibara, Kemissie, Kobo, and Sekota did proper hand hygiene below the average (13.4.0%) whereas the rest of the towns did above the average **(Figure 2).**

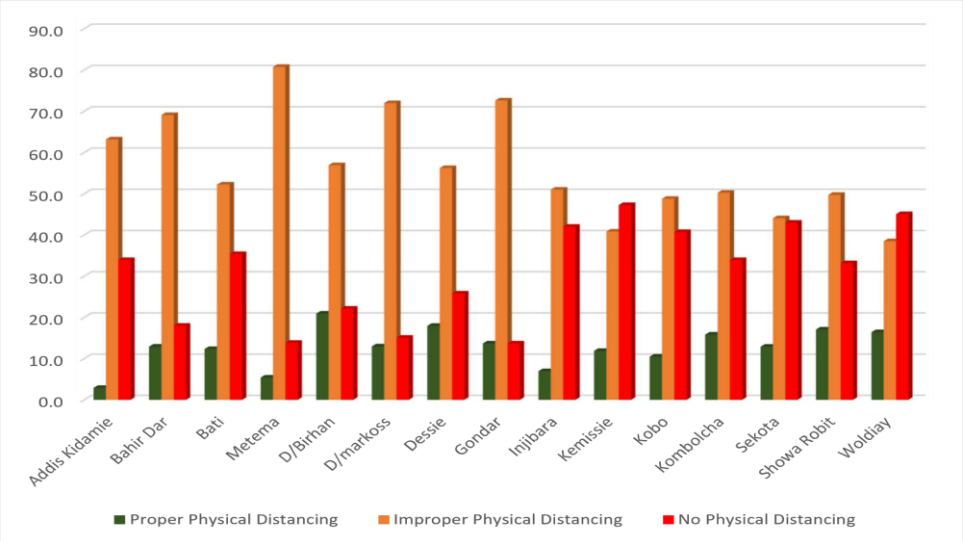

Figure 2: Physical distancing practices in the towns in Amhara Region, June to August 2020

Mask utilization

Similarly, the practice of mask utilization remained low across the towns where the study was conducted. Adis Kidam, Metema and Injibara were the towns where people were not using masks at all. Proper mask utilization was the highest in D/Birhan (51.9%) and the lowest in Addis Kidamie (4.3%). Addis Kiedam, Bati, D/Markos, Metema, Gondar, Injibara, Kemissie, Kobo, Sekota, Showa Robit and Woldiya did proper hand hygiene below the average (25.7%) whereas the rest of the towns did above the average (**Figure 3**).

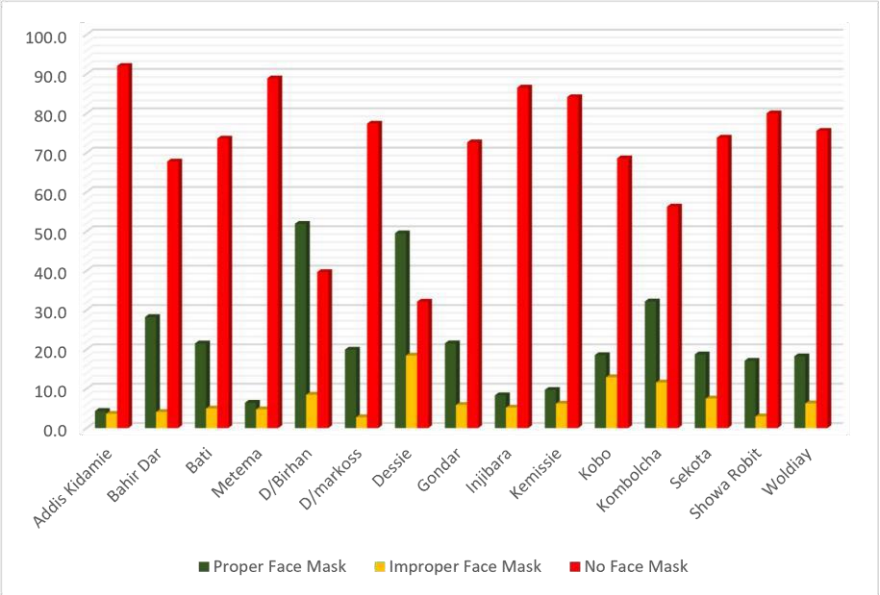

Figure 3: Mask utilization practices in the towns in Amhara Region, June to August 2020

Workplaces of proper COVID-19 preventive measures by facility type

Proper hand hygiene was practised the most at Juice houses (13.1%) and the lowest at the restaurant (1.7%). All facilities did proper hand hygiene below the average (12.0%) except Juice houses **(Figure 4).**

Proper physical distance was the highest practiced at Cafeteria (15.1%) and the lowest at Health Facilities (4.5%). Cafeteria (15.1%), Street (13.4%), Juice houses (12.9%), Banks (government) (12.2%), Hotel (12.1%) and Restaurants (13.5%) did proper physical distance above the average (12.0%) whereas the rest did below the average (12.0%): Banks (private) (11.3%), Church (11.4%), Groceries (10.5%), Health Facilities (4.5%), Local drink sealer (10.2%). Markets (open=7.7% and shop=11.9%), Microfinance (11.0%), and workplace (8.1%). All the facilities did proper mask utilization below the average (25.7% **(Figure 4).**

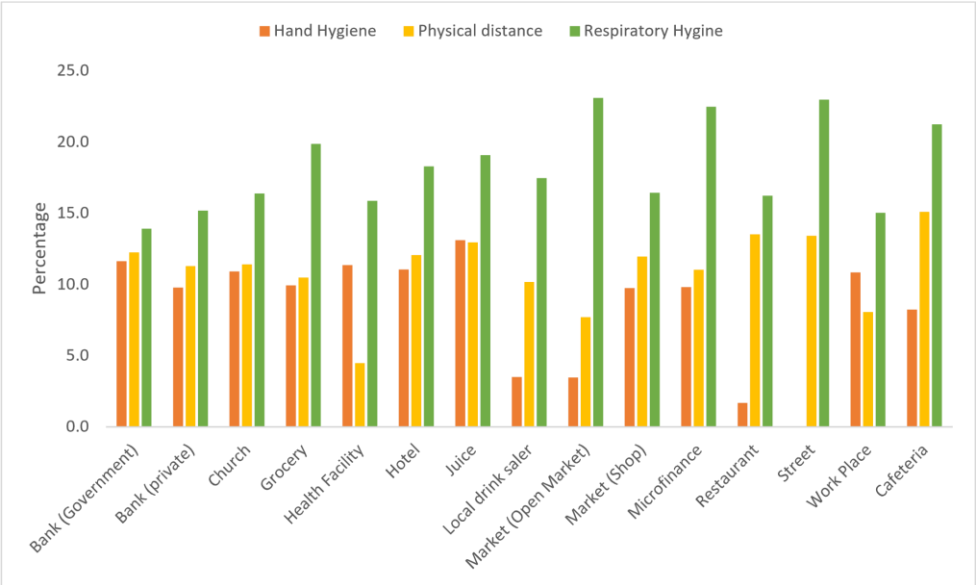

Figure 4: **Proper Hand hygiene, physical distance, and mask utilization practices by facility type in Amhara Region, June to August 2020**

Measures of association

Chi-square statistics showed that there was an association between hand hygiene and sex (chi2=20.0, p<0.001), hand hygiene and age (chi2=17.2, p<0.001), hand hygiene and strata with risk (chi2=47.0, p<0.001). There was also an association between physical distance and age (chi2=22.6, p<0.001), and physical distance and strata with risk (chi2=57.5, p<0.001). There was no association between physical distance and sex. There was also an association between mask utilization and sex (chi2=45.6, p<0.001), mask utilization and age (chi2=58.4, p<0.001), and mask utilization and strata with risk (p<0.001).

COVID-19 preventive strategies in transport services

A total of 346 public transport services (minibus) were observed for COVID19 prevention measures practice. Most of the observed passengers in the cars were males (61.0%) and were found to be between 18 and 50 years old (74.6%). Half of the observed services (51.4%) were observed in high-risk zones. One-fourth of the observed services were observed in Bahir Dar and the lowest observation was done in Kobo (2.9%). Only 18% of the cars obey the maximum occupancy rate (loads of carrying passengers <=50).

Of all passengers, only 9.5% (95%CI: 6.8-13.1%) practiced proper physical distance and 24.1% (19.8%-28.9%) did mask utilization. Only 17.6% (95%CI: 13.9%-22.0%) and 7.2% (95%CI: 4.9%-10.5%) of drivers and assistant drivers, respectively, did proper mask utilization (**Table 3).**

Table 3: COVID-19 prevention measures practices by study participants in Amhara Region, June to August 2020

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Variables	COID19 prevention measures practices		
	Proper (95%CI)	Improper (95%CI)	No (95%CI)
Passengers physical distance	33 (9.5%:6.8-13.1)	283(81.8%:77.3-85.5)	30 (8.7%: 6.1-12.2)
Passengers mask utilization	83 (24.1%:19.8-28.9)	45(13.0%:9.9-17.0)	217 (62.9%:57.6-67.9)
Drivers mask utilization	61 (17.6%: 13.9-22.0)	86 (24.9%: 20.6-29.7)	199 (57.5: 52.2-62.6)
Assistant drive mask utilization	25(7.2%:4.9-10.5)	62(17.9%:14.2-22.3	259 (74.9%: 70.0-79.2)

The spatial distribution of COVID-19 Prevention Measures

Spatial Autocorrelation: Spatially, the COVID-19 prevention strategies were non-random in Amhara Region, Ethiopia (Global Moran's I = 0.23, z-score = 9.5, P-value < 0.001From the incremental spatial autocorrelation, the maximum spatial clustering was identified at 175 kilometers distance. Using a maximum distance spaal clustering (Figure 5). of 175 km a spatial hot spot and the cold spot of COVID-19 prevention strategies were identified. Statistically, a significant z-score indicates at 175 km distance thresholds spatial clstering of poor COVID-19 prevention strategies was most pronounced. Given thez-score of 5.6, there wasless than 1% likelihood that this high-clustered patter n of poor mask utilization could be the result of random chance across the Region

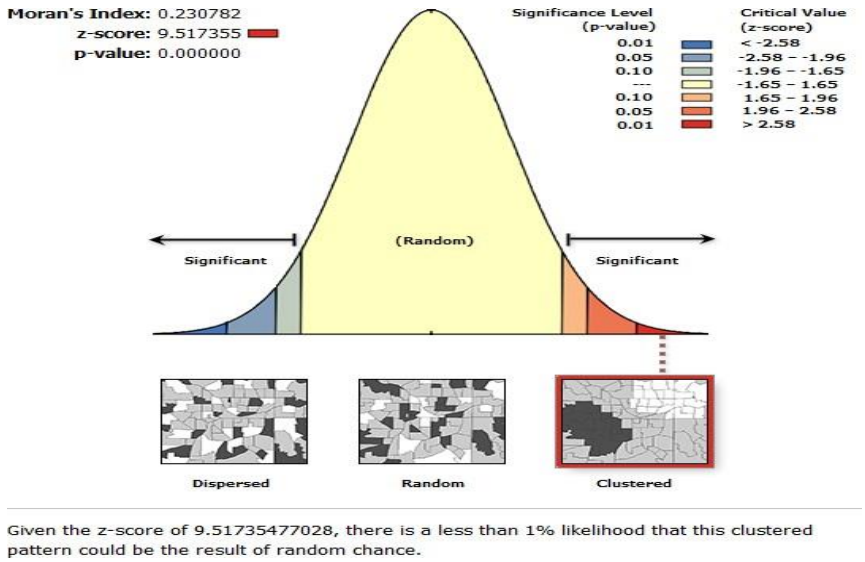

Figure 5: **Spatial autocorrelation of COVID-19 prevention strategies in Amhara region Ethiopia, June to August 2020.**

Hot Spot Analysis (Getis-Ord Gi*) of the poor practice of COVID-19 prevention strategies

In the spatial hot spot analysis, Northern Amhara (Methema Yohanes, Genda Wuha, Sekota, and Gondar), Western Amhara (Addis Kidam, Injibara, and Markos), and Bahir Dar city were spatially clustered (Hot spot) in poor practice COVID-19 prevention strategies. Whereas, Southern (Debre Birhan and Shewa Robit) and Eastern (Kobo, Wolidiya, Dessie, Kombolicha, Bati, and Kemissie) part of Amhara region was spatially clustered (cold spot) as good practice of COVID-19 prevention strategies **(Figure 6).**

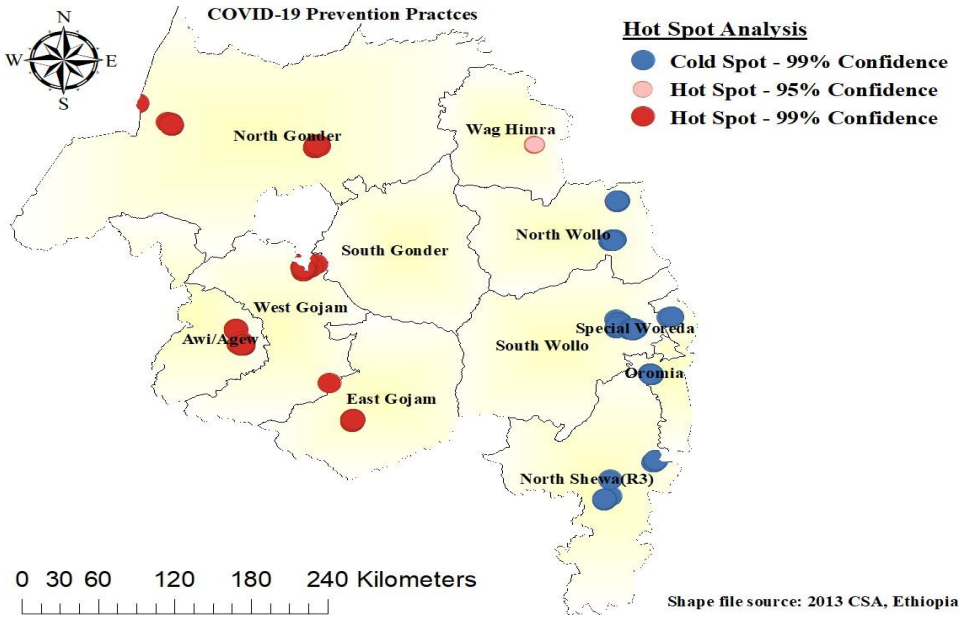

Figure 6: **Hot spot analysis of the poor practice of COVID-19 prevention strategies in the Amhara region, Ethiopia, June to August 2020.**

Empirical Bayesian Kriging interpolation of the poor practice of COVID-19 prevention strategies.

The empirical Bayesian Kriging interpolation result revealed that most parts of the Amhara did not keep up with the COVID-19 prevention strategies as per the WHO recommendation. The northern and northwestern parts of the Amhara region practice on 5% as per the WHO recommendation of COVID-19 prevention strategies. The Central part of the Amhara region practiced up to 16% as per the recommendation. Relatively, the Southern part (Debre Birhan, and Chacha) of the Amhara region had good (41%) practice of COVID-19 prevention strategies **(Figure 7).**

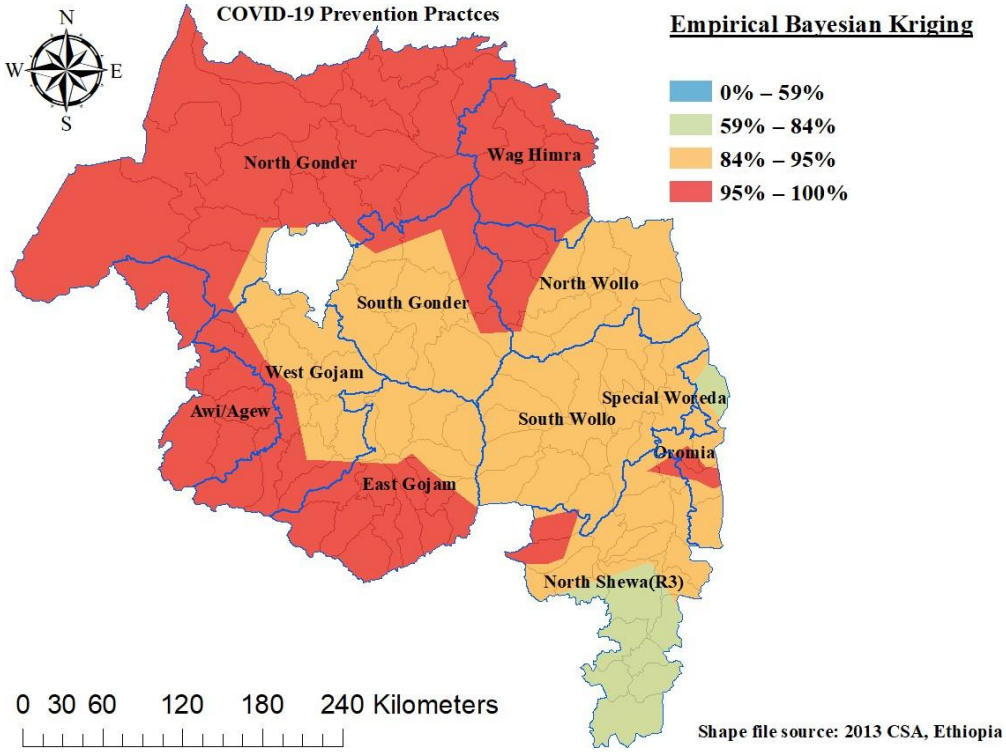

Figure 7: **Empirical Bayesian Kriging interpolation of the poor practice of COVID-19 prevention strategies in the Amhara region, Ethiopia, June to August 2020**

Discussions

COVID-19 is affecting 213 countries and territories around the world [19] and has become one of the largest pandemics in recent times with several devastating and significant public health challenges. Studies showed that non-pharmaceutical public health interventions such as individual practices on hand and mask utilization, and physical distancing are effective strategies to mitigate and delay the epidemic of COVID-19 [20–22]. The government of Ethiopia has also adopted preventive measures of COVID-19 and taken enforcement actions such as lockdowns and public behavioral promotion using media to delay the epidemic of COVID-19 since March 13, 2020, when the first case was detected [19,23]. In Ethiopia, the cases and deaths of COVID-19 are rising to 55,213 and 856 as of September 8, 2020 [7]. Amhara Region has also shown an increasing trend with the numbers of COVID -19 cases. However, the current study conducted in 3 metropolitan cities and 13 towns showed that the practice of hand and mask utilization, and physical distancing were low (below 25%) which could be the possible reason for the rising of cases from time to time in the region. Studies in China showed that combined interventions of hand and mask utilization and physical distancing substantially reduced the transmission of COVID-19 [24,25]

In this study, the practice of proper hand hygiene was 12% (95%CI: 11.1 to 12.9%) which is lower than the study done in Jimma Ethiopia (77%) [26], Nigeria (96%) [27], Vietnam (26%) [28], Malaysia (88%) [29] and China (67%) [30]. The variation could be due to the difference in measurement of hand hygiene, the availability of handwashing facility and water, study period and population. For example, in this study hand hygiene was measured using observation, whereas, in the above studies, hand hygiene was measured as reported by study participants which could have a social desirability bias. Furthermore, the levels of access to water with its continuity and availability of handwashing facilities with soap in Ethiopia are also suboptimal in order to adopt the hand-washing recommendations [31].

Physical distancing is one of the non-pharmaceutical public health interventions to slow down the transmission of COVID-19 outbreaks [25]. However, physical distancing was low in cities and towns of the Amhara Region (13.4%). The findings are lower than the study done in Nigeria (82%) [27] and Malaysia 83%) [29]. The difference could be due to the presence of government policy and strict measures and perceptions of the community towards COVID-19. Qualitative findings also support the above possible reasons which found out that the government's inability to sustain the physical distancing policy and ban on large gatherings, including government meetings, religious and cultural activities, funerals,

weddings and sports are evident in the study area [32]. Also, the spread of misinformation and tales regarding COVID-19 within the community further threatened the implementation of physical distancing in the region, and this was documented by qualitative findings [32].

In the current study, the practice of mask utilization was 25.7% which is lower than the study done in Nigeria (82%) [27] and Malaysia (51%) [29]. The possible reasons for not practicing in the study area could be due to the presence or absence of enforcement measurement by the government and specific facilities or institutions, as well as misinformation of the community regarding COVID 19. Misinformation towards COVID 19 was also documented by a qualitative study [32].

This study revealed that the prevention strategies of hand hygiene practice were non-random in Amhara Region, Ethiopia. The poor practice of COVID-19 prevention strategies was clustered between Debre Markos, Bahir Dar, Gondar, and Metema town the Amhara regional state. Whereas the good practice of COVID-19 strategies was clustered between Kobo, Wolidiya, Dessie, Kombolicha, Kemissie, and Debre Birhan parts of the Amhara region. The possible spatial variation might be due to the different behaviours of the communities, in accepting the behavior change communication. Another explanation might be, the southern part of the Amhara region near Addis Ababa the capital city of Ethiopia, practiced more of the prevention strategies since more COVID-19 cases were reported from Addis Ababa.

The study has strengths and limitations. This study is the first large population survey using 6,002 observations in 3 cities and 12 towns in the Amhara Region, aimed at assessing the practice of hand hygiene, physical distancing and mask utilization and exploring the challenges of practicing COVID-19 prevention whilst identifying key areas of concern and needs for optimal sub-national and community intervention. This study lacks some important variables in the quantitative study as a result of the nature of the study (observation) which can understand the characteristics of participants with education, occupation status and level of knowledge and attitude towards COVID-19.

Conclusion

The study revealed that the practices of hand hygiene and mask utilization, and physical distancing were low in cities and towns of the Amhara region. There was an association between enforcement and hand hygiene, physical distancing and mask utilization practice. The level of compliance of hand hygiene, physical distancing and mask utilization exhibit spatial variation across the region. The poor practice of COVID-19 prevention strategies was clustered at the Northern and Northwestern parts of Amhara regional state. Therefore, continuous community-based education using different modalities are necessary to increase the practice of hand and mask utilization, and physical distancing to devoid misconceptions regarding COVID-19.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from Amhara Public Health Institute (APHI) review board before the study. A permission letter was secured from the COVID 19 regional task force to ensure the safety of data collectors and supervisors. The government of Ethiopia applied different enforcement measures to prevent community-based transmission. This study was conducted to generate evidence to communicate to stakeholders who were involved in the prevention of COVID-19. Therefore, waived consent was taken from the COVID-19 regional task force to observe the actual practice of the community towards COVID-19 measures. The questionnaire was designed to be anonymous and waived consent was used. The data was kept confidential and the results did not identify the respondents personally.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used for the current study are available from the corresponding author on reasonable request.

Abbreviations

APHI: Amhara Public Health Institute
Chi^2: Chi-square
COVID-19: coronavirus disease 2019
WHO: World Health Organization

Competing interests

The authors declare that they have no competing interests

Funding

This research was funded to cover data collection expenses by Amhara Public Health Institute. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Author contributions

TAA, NF, MH, SAT, TZ, GM, MT, DS, AA, MB, TB and MA conceived and designed this study, assisted with the literature review, and developed the manuscript. TAA, NF, MH, SA, TZ, GM, MT, DS and MA assisted with the supervision of the data collection process. TAA, SA and MS drafted the first manuscript. TAA, NF, MH, SA, TZ, GM, MT, DS, AA, MB, TB and MA assisted with the review of the literature, interpretation, and review of the manuscript. All authors have read and approved the manuscript.

Acknowledgements

The authors would like to thank Amhara Public Health Institute for their financial support to conduct this research project. We would also like to thank Amhara Regional Health Bureau and Zonal health offices for their cooperation and support. Finally, our acknowledgement goes to supervisors, data collectors

and study participants for providing information, their time and commitment during data collection.

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