**Adherence of Covid-19 mitigation measures and its associated factors among health care workers at Referral Hospitals in Amhara Regional state of Ethiopia.**

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**Abstract:**

Introduction: With fragile health care systems, sub-Saharan Africa countries like Ethiopia are facing a complex epidemic, and become difficult to control the noble coronavirus. The use of COVID-19 preventive measures is strongly recommended. This study aimed to assess the adherence of COVID-19 mitigation measures and associated factors among health care workers. Methods and materials: A facility-based cross-sectional study was conducted from May 15 to June 10; 2021. It was a web-based study using an online questionnaire. It was conducted at referral hospitals in the Amhara regional state of Ethiopia among health care workers. STATA 14.2 was used for data analysis. Variables with a p-value < 0.05 at 95% confidence level in multivariable analysis were declared as statistically significant using binary logistic regression. Result: Adherence to COVID-19 mitigation measures was 50.24% in the current study. The odd of adherence of participants with a monthly income of ≥12801birr was 15% whereas the odds of adherence of participants who hesitate to take the COVID 19 vaccine was 10% as compared to those who don't hesitate. Participants who had undergone COVID-19 tests adhered 6.64 times more than their counterparts. Those who believe adequate measurements are taken by the government adhered 4.6 times more than those who believe not adequate. Participants who believe as no risk of severe disease adhered 16% compared to those with fear of severe disease. Presence of households aged >60years adhered about 7.9 times more than with no households aged>60. Participants suspected of COVID-19 diagnosis adhered 5.7 times more than those not suspected. Conclusion: This study found lower adherence to COVID-19 mitigation measures. It is better to boost the practice of health care workers on the prevention methods of the COVID-19 pandemic in the current study setting. Keywords: Adherence, COVID-19, Mitigation measures, Amhara regional state

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Additional data availability information:
Adherence of Covid-19 mitigation measures and its associated factors among health care workers at Referral Hospitals in Amhara Regional state of Ethiopia.

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Abstract

Introduction: With fragile health care systems, sub-Saharan Africa countries like Ethiopia are facing a complex epidemic, and become difficult to control the noble coronavirus. The use of COVID-19 preventive measures is strongly recommended. This study aimed to assess the adherence of COVID-19 mitigation measures and associated factors among health care workers.

Methods and materials: A facility-based cross-sectional study was conducted from May 15 to June 10; 2021. It was a web-based study using an online questionnaire. It was conducted at referral hospitals in the Amhara regional state of Ethiopia among health care workers. STATA 14.2 was used for data analysis. Variables with a p-value<0.05 at 95% confidence level in multivariable analysis were declared as statistically significant using binary logistic regression.

Result: Adherence to COVID-19 mitigation measures was 50.24% in the current study. The odd of adherence of participants with a monthly income of ≥12801birr was 15% whereas the odds of adherence of participants who hesitate to take the COVID 19 vaccine was 10% as compared to those who don't hesitate. Participants who had undergone COVID-19 tests adhered 6.64 times more than their counterparts. Those who believe adequate measurements are taken by the government adhered 4.6 times more than those who believe not adequate. Participants who believe as no risk of severe disease adhered 16% compared to those with fear of severe disease. Presence of households aged >60years adhered about 7.9 times more than with no households aged>60. Participants suspected of COVID-19 diagnosis adhered 5.7 times more than those not suspected.

Conclusion: This study found lower adherence to COVID-19 mitigation measures. It is better to boost the practice of health care workers on the prevention methods of the COVID-19 pandemic in the current study setting.

Keywords: Adherence, COVID-19, Mitigation measures, Amhara regional state
Introduction

The COVID-19 pandemic entered Africa by the end of February 2020 after it was declared a Public Health Emergency of International Concern by the world health organization[1]. With fragile health care systems, sub-Saharan Africa like Ethiopia is facing a complex COVID-19 epidemic and it becomes a difficult task to control the virus reservoir, from where the virus may be reintroduced to other regions [2].

Globally, COVID-19 affected over 119.7 million confirmed cases and 2.6 million deaths[3] whereas in Africa over 4 million confirmed cases and over 107 thousand deaths have been reported [4]. Considering its pandemic and absence of effective treatment, authorities across the world have designed various mitigation measures to combat the spread of COVID-19 [5, 6]. To control the pandemic transmission, WHO recommends minimizing contact, early detection and isolation of cases, personal and material hygiene measures [6, 7].

As part of these measures, the use of face masks, hand washing, physical distancing, cough etiquette, and avoidance of crowded places are strongly recommended [7]. Even though adherence to preventive measures is the only means to tackle the disease, reluctance to do so has been reported to be a major problem everywhere [8].

Health care professionals are experiencing higher workload, psychological distress, shortage of quality personal protective equipment, social exclusion, lack of incentives, absence of coordination, and proper management during their service[9].

The prevalence of good adherence towards COVID-19 was 51.04% and 8.3% in different Ethiopian studies conducted in the general community [10, 11]. As far our search, there is no
research conducted among health care workers in the current study setting and it is also true in the country as large. Therefore, this study intended to assess the adherence of COVID-19 mitigation measures and their associated factors among health care providers in the Amhara region regional state of Ethiopia.

Methods and Materials

Study design, period and Setting

A facility-based cross-sectional study was conducted from May 15 to June 10; 2021. It was a Web-based anonymous study using an online questionnaire. The study was conducted at referral hospitals in the Amhara regional state. According to the Amhara national regional health bureau annual performance report, the region has 81 hospitals, 858 health centers, and 3560 health posts. Among the hospitals in the region, the University of Gondar, Dessie, Felege-Hiwot, Tibebe-Ghion, Debre-Markos, Waldiya, Debre Tabor, and Debebirhan are referral hospitals. The health care professionals working in these hospitals are estimated to be 4,000 [12, 13].

Study participants

Telegram and email (the most popular social media platforms in Ethiopia) were used to promote and circulate the survey link to the participants. Data collectors in each hospital were asked to distribute the survey link to the randomly selected contacts in each hospital. The participants were informed that their participation was based on voluntariness, and consent was implied through their completion of the questionnaire. The respondents working during the data collection period were included in the current study.

Sample Size Determination
The sample size was determined using the single population proportion formula taking the proportion of compliance to the COVID19 preventive measures 22%[14], 95% confidence interval, and 4% marginal error. After adding a 5% non-response rate, the final sample size was ~433.

**Sampling Procedure**

There are about 4,000 health care workers in Amhara regional state referral hospitals (906 in Gondar hospital, 320 in Debre tabor hospital, 255 in Tibebe Ghione hospital, 917 in Felege Hiot hospital, 430 in Debre Markos Hospital, 604 in Dessie hospital, 300 in Woldiya hospital and 270 in Debre Berhan hospital). The entire sample size was first allocated proportionally to those eight referral hospitals. Then, the link of the questionnaire was given to the data collectors and forwarded to randomly selected health care workers of respected hospitals, using e-mail or telegram. The link was forwarded to each hospital’s data collector to avoid coverage bias and to be representative.

**Operational Definitions**

**Good adherence of COVID-19 mitigation measures:** Adherence in the current study was measured as participants who adhered (responded “yes”) to all of the three basic preventive measures (Wearing a mask, keeping physical distancing of a minimum of 2 meters, and hand washing a minimum of ≥6 times/day) and measured ‘Yes’ or ‘No’ answers to the questions.

**Health Care worker (HCW):** Any member of the health care unit that includes medical doctors, pharmacists, physiotherapists, midwifery, laboratory technologists, nursing professions, or any other person in the course of his or her professional activities who may prescribe, administer, or dispense a medicinal product to an end-user [15].
**Vaccine Hesitancy:** World Health Organization (WHO) declared vaccine hesitancy as "the reluctance or refusal to vaccinate despite the availability of vaccines" [16].

**Perceived susceptibility/risk of getting COVID-infection:** Refers to a participant’s subjective perception of the risk of acquiring COVID-19 and is measured as High, Moderate, Low, No risk, or not sure [17].

**Perceived severity/risk of developing the severe disease:** Refers to a person’s subjective perception of the seriousness of contracting COVID-19 and measured as High, Moderate, Low, No risk, or not sure [17].

**Data Processing and Analysis**

The responses from the participants were downloaded in Excel using Google Forms. The data were checked for completeness and consistency, then compiled and coded. After that, it was exported to STATA version 14.2 statistical software for analysis. Descriptive statistics were used to summarize the results and presented using tables. Binary logistic regression was used to identify factors that affect the outcome variable. Variables with a p-value less than or equal to 0.2 in the bi-variable analysis were candidates for multivariable analysis. The multivariable analysis was used to declare statistical significance at a p-value of <0.05. Lastly, variables with a p-value<0.05 at a 95% confidence level in multivariable analysis were declared as statistically significant.

**Data Quality Assurance**

The web-based self-administered questionnaire was pretested by taking 5% of the sample size before the actual data collection period. Afterward, the pretests, amendments to the tool, like formatting were corrected. The tool was first developed in the English language and was translated into the local language (Amharic) with back translation to English to check its
consistency. Moreover, Cronbach’s alpha value was calculated to check the tools’ reliability and the value of an item score was 0.892.

**Ethics approval and consent to participate**

This study was approved by the institutional review board (IRB) of the University of Gondar. Respondents were informed that their participation was voluntary and their confidentiality was maintained by avoiding registration of personal identifiers like names on the questionnaire and also, no raw data was given to anyone other than the investigator. In addition, the raw data is secured by a strong computer password.

**Results**

**Socio-demographic characteristics of study participants**

From the total 433 samples, 418 participants completed the questionnaire that yielded a 96.5% response rate. The mean age of study participants was 29.95 in the current study. More than half of the participants were under the age category of 26-30 years and nearly two-thirds were males. About 54% were married, 55% BSc and below educational level. The majority of the study participants have a monthly income in the category of 6991-12800 birr. Based on family size, 53.35% have less than or equal to 2 and nearly one thirds (31.58%) have children with school-age (Table 1).

**Table 1: Socio demographic characteristics of study participants (N=418)**

**COVID-19 related characteristics of study participants**

Nearly two-thirds (63.64%) of the participants were socially isolated because of their profession. About 59% underwent the COVID test and 44% were confident in health care services delivered on their institution whereas 45.69% got unclear information by health authorities related to the
COVID-19 pandemic. Only 100 (23.92%) believe measurements taken by the national government related to COVID-19 preventive measures are adequate. More than half (52.39%) of participants reported that they are at higher risk of COVID-19 infection but 53.35% believe they are at low risk to develop the severe disease if infected with the coronavirus. Nearly two-thirds (63.64%) had good compliance on social isolation if suspected to COVID-19 whereas 57.89% were suspected of COVID-19 diagnosis. About 55% perceive that their health status was very good. Only 3.83% have autoimmune diseases taking steroidal drugs. Nearly 54% of the participants were willing to take the COVID-19 vaccine but about 19% are confident in the current vaccine (Table 2).

**Table 2: COVID-19 related characteristics of the study participants (N=418)**

**Adherence towards COVID-19 mitigation measures**

The Adherence towards COVID-19 mitigation measures among health care workers in the current study was 50.24[95%CI (45.44- 55.04)]. Adherence to COVID-19 measures was 71.29%, 73.21%, and 56.94% for wearing a mask, washing hands ≥6 times per day based on WHO handwashing rules, and physical distancing of at least 2 meters respectively (Fig 1).

**Figure 1: Distribution of Adherence of COVID-19 mitigation measures among health care workers in referral hospitals of Amhara regional state of Ethiopia**

**Factors associated with adherence of COVID-19 mitigation measures**

Binary logistic regression was employed to identify independent factors that can affect the outcome variable. In bivariable analysis, monthly income, hesitancy to take COVID-19 vaccine, age, marital status, undergone COVID-19 test, the information given by health authority, measures taken by the national government, the risk to get COVID-19 disease, risk of severe
COVID-19 disease, household age >60 years, suspected to COVID-19 infection, Comorbidity and Confident on the current COVID-19 vaccine were associated with the outcome variable.

But in multivariable analysis, monthly income, hesitancy to take COVID-19 vaccine, age, undergone COVID-19 test, measures taken by the national government, household aged >60 years, and suspected to COVID-19 infection were statistically significant variables that affected adherence of COVID-19 mitigation measures.

Study participants with a monthly income of ≥12801birr adhered to COVID-19 measures 15% taking monthly income of ≤6990 as reference [AOR=0.15, 95%CI (0.02-0.92)]. Participants who hesitate to take COVID 19 vaccine adhered 10% [AOR=0.10, 95%CI (0.04-0.25)] as compared to those who don’t hesitate. Those participants with the age group of 26-30 years adhered to mitigation measures 9% [AOR=0.09, 95%CI (0.02-0.39)] compared to age groups <26 years. Study participants who underwent the COVID-19 test adhered to about 6.6[AOR=6.64, 95%CI (3.10-14.22)] times more than those who didn't undergo the test. Participants who believe adequate measurements are taken by the government adhered to about 4.6 [AOR =4.60, 95%CI (1.66-12.78)] times more than those who believe measurements are not adequate. Participants who believe with no risk of severe COVID-19 disease adhered 16% [AOR=0.16, 95%CI (0.06-.46)] as compared to those with fear of severe COVID-19 disease. Participants who have households aged >60 years adhered about 7.9[AOR =7.94, 95%CI (3.14-20.04)] times more than those with no households aged>60 years and those participants suspected to COVID-19 diagnosis adhered to mitigation measures about 5.7 [AOR=5.74, 95%CI (1.81-18.16)] times more than those who didn't suspect.

Table 3: Factors associated with adherence of COVID-19 mitigation measures among health care workers in referral hospitals of Amhara regional state of Ethiopia (N=418)
Discussion

The current study aimed to determine adherence to COVID-19 mitigation measures and their associated factors among health care workers in the Amhara regional state of Ethiopia. The adherence of COVID-19 mitigation measures among the participants was 50.24%. The highest adherence (73.21%) was reported for handwashing whereas the lowest (56.94%) was reported for physical distancing.

The current finding of adherence was lower than the study conducted in Saudi Arabia (82%), the United Kingdom (80%), and the Kingdom of Saudi Arabia (80.9%) [18-20]. The possible reasons for this difference might be the countries' policy to prevent the pandemic, the monthly income difference of the study participants which might affect buying abilities of face masks, the data collection period differences in which all the studies conducted before the current study when vaccines were not found. But the current finding is more than the studies conducted in Western Ethiopia (22%) and southeast Ethiopia (21.6 %) [14, 21]. The possible justification of the differences of the findings might be differences in COVID-19 prevention policies of the respected health institutions in the specified regions even though they are found in the same country.

Different independent variables in the current study affected the outcome variable. Monthly income, vaccine hesitancy, age, undergone COVID19 test, measurements taken by the national government, perception of the severity of the disease, presence of households with age>60 years and suspected to COVID-19 diagnosis significantly affected the adherence of COVID-19 measures in different directions.

Study participants in the current study with a monthly income of $\geq12801$ birr adhered to COVID-19 measures less than those with a monthly income of $\leq6990$ birrs. This might be participants
with low monthly income could use public transportation which might increase fear to acquire COVID-19 infection and cause them to adhere more[22, 23]. Participants who hesitate to take COVID-19 vaccines adhered lower than those who are volunteers to take the vaccine. The possible reason could be those who hesitate to take the vaccine might be individuals that believe as COVID-19 is not a severe disease and even there is no such disease [24-26].

Study participants with age groups of 26-30 years adhered to mitigation measures lower than those with age groups of <26 years. This would be younger professionals might abide by mitigation measures more than elders due to negligence [27].

The experienced COVID-19 test increased the participants' adherence to the current study. This might be the participants who believe the existence of the pandemic is high and resulted to undergo COVID-19 test and consequently adhered to the mitigation measures than those who didn’t experience the COVID-19 test[1, 28]. Similarly, study participants who think that adequate measurements are taken by the national government adhered to mitigation measures more than those who think not taking adequate measurements. This could be those thinking the national government is taking adequate measurement trusted the national policies related to the pandemic and consequently adhered more [29, 30].

Study participants who perceived the severity of the disease as High adhered more than those who perceived no risk on COVID-19 mitigation measures. Naturally, those who perceive the disease as severe are more committed to preventing it[31]. Participants who have households aged>60 years adhered more than those with no. This might be because individuals with age >60 years are at the risk of getting severe complications of the COVID-19 like death[32]. Therefore,
those participants with households of age >60 years adhered more to prevent such complications of their households.

Another factor that increased the adherence to the COVID-19 mitigation measures was suspected of COVID-19 infection. This might be as those suspected of the disease would not be allowed to enter the working area and consequently adhere to the preventive measures[33].

Conclusion

This study found lower adherence to COVID-19 mitigation measures among health care workers. Greater monthly income, hesitate to take the vaccine and older age decreased the adherence whereas undergone COVID-19 test, adequate measurement by the government, believing severity of the disease, households with age >60 years and suspected to COVID-19 diagnosis increased the adherence of mitigation measures. It is better to boost the practice of health care workers on the prevention methods of the COVID-19 pandemic in the current study setting since the adherence of the mitigation measures is lower than the recommended.

Limitations of the study

Since this study is cross-sectional, it shares the limitations of a cross-sectional study design. Social desirability bias could be introduced through study participants since the data collection technique was self-administered. To avoid the mentioned bias, the authors recommend doing further investigation using observational checklists.

Acknowledgment

The authors would like to acknowledge the healthcare workers for their collaboration during the data collection. Our gratitude also goes to data collectors in each hospital. Last but not least, we would like to pass our thanks to the University of Gondar for providing ethical clearance to conduct this study.
Authors’ Contribution: AA worked on conception, designing the study, supervising the data collectors, interpreting the result, and preparing the manuscript. BF and MW worked on the conception, analysis, and interpretation of the results and wrote the manuscript. All authors reviewed the results and approved the final version of the manuscript.

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This study was approved by the institutional review board (IRB) of the University of Gondar. Respondents were informed that their participation was voluntary and their confidentiality was maintained by avoiding registration of personal identifiers like names on the questionnaire and also, no raw data was given to anyone other than the investigator. In addition, the raw data is secured by a strong computer password.

Consent for publication.

Not applicable

Conflict of interest

None

Availability of data and materials

The datasets used in the current study are available from the corresponding author.

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Table 1: Socio-demographic characteristics of study participants (N=418)

| Variables | Category | Frequency | Percent (%) |
|-----------|----------|-----------|-------------|
| Age       | ≤25      | 49        | 11.72       |
|           | 26-30    | 234       | 55.98       |
|           | ≥31      | 135       | 32.30       |
| Sex       | Female   | 129       | 30.86       |
|           | Male     | 289       | 69.14       |
| Marital status                        | Single   | 194 | 46.41 |
|-------------------------------------|----------|-----|-------|
| Marital status                      | Married  | 224 | 53.59 |
| Educational status                  | BSc and below | 230 | 55.02 |
| Educational status                  | MSc and above | 188 | 44.98 |
| Monthly income                      | <6990    | 27  | 6.46  |
| Monthly income                      | 6991-12800 | 357 | 85.41 |
| Monthly income                      | ≥12801   | 34  | 8.13  |
| Family size                         | ≤2       | 223 | 53.35 |
| Family size                         | 3-4      | 128 | 30.62 |
| Family size                         | ≥5       | 67  | 16.03 |
| School-age children                 | No       | 286 | 68.42 |
| School-age children                 | Yes      | 132 | 31.58 |

Table 2: COVID-19 related characteristics of the study participants (N=418)

| Social isolation                  | No       | 152 | 36.36 |
|-----------------------------------|----------|-----|-------|
| Social isolation                  | Yes      | 266 | 63.64 |
| Undergone COVID test              | No       | 172 | 41.15 |
| Undergone COVID test              | Yes      | 246 | 58.85 |
| Confident in health care services | Not confident | 194 | 46.41 |
| Confident in health care services | Confident | 184 | 44.02 |
| Confident in health care services | Very confident | 40  | 9.57  |
| Information by health authorities | Clear    | 134 | 32.06 |
| Information by health authorities | Inconsistent | 93  | 22.25 |
| Information by health authorities | Unclear  | 191 | 45.69 |
| Measurements by Gov’t             | Not very adequate | 186 | 44.50 |
| Measurements by Gov’t             | Not adequate | 132 | 31.58 |
| Measurements by Gov’t             | Adequate  | 100 | 23.92 |
| Risk to get COVID-19 infection    | Low      | 96  | 22.97 |
| Risk to get COVID-19 infection    | Moderate | 103 | 24.64 |
| Risk to get COVID-19 infection    | High     | 219 | 52.39 |
| Risk to severe COVID-19 disease   | Moderate/high | 115 | 27.51 |
| Risk to severe COVID-19 disease   | Low      | 223 | 53.35 |
| Risk to severe COVID-19 disease   | No/not sure | 80  | 19.14 |
| Households age >60 years           | No       | 355 | 84.93 |
| Households age >60 years           | Yes      | 63  | 15.07 |
| Compliance to social isolation     | No       | 152 | 36.36 |
| Compliance to social isolation     | Yes      | 266 | 63.64 |
| Suspected COVID-19                 | No       | 176 | 42.11 |
Table 3: Factors associated with adherence of COVID-19 mitigation measures among health care workers in referral hospitals of Amhara regional state of Ethiopia (N=418)

| Variables                        | Category                          | COR   | AOR   | P-value | 95% CI                |
|----------------------------------|-----------------------------------|-------|-------|---------|-----------------------|
| Monthly income                   | ≤6990                             | 1     | 1     | 1       |                       |
|                                  | 6991-12800                        | 0.21* | 0.29  | 0.105   | (0.06-1.29)           |
|                                  | ≥12801                            | 0.18* | 0.15  | 0.041   | (0.02-0.92)           |
| Hesitancy to COVID 19 vaccine    | No                                | 1     | 1     | 1       |                       |
|                                  | Yes                               | 0.09* | 0.10  | <0.001  | (0.04-0.25)           |
| Age                              | <26                               | 1     | 1     | 1       |                       |
|                                  | 26-30                             | 0.53* | 0.09  | 0.001   | (0.02-0.39)           |
|                                  | ≥31                               | 0.97  | 0.25  | 0.065   | (0.05-1.08)           |
| Marital status                   | single                            | 1     | 1     | 1       |                       |
|                                  | Married                           | 0.72* | 1.33  | 0.422   | (0.66-2.68)           |
| Undergone COVID-19 test          | Yes                               | 8.28* | 6.64  | <0.001  | (3.10-14.22)          |
|                                  | No                                | 1     | 1     | 1       |                       |
| Information health by authorities| clear                             | 0.89  | 1.79  | 0.250   | (0.66-4.88)           |
|                                  | Inconsistent                      | 0.37* | 0.41  | 0.071   | (0.15-1.07)           |
|                                  | Unclear                           | 1     | 1     | 1       |                       |
| Measures by Gov’t                | Not very adequate                 | 1     | 1     | 1       |                       |
|                                  | Not adequate                      | 0.29* | 0.66  | 0.299   | (0.29-1.45)           |
|                                  | Adequate                          | 1.28  | 4.60  | 0.003   | (1.66-12.78)          |
| Risk to get COVID-19 disease     | low                               | 1     | 1     | 1       |                       |
|                                  | Moderate                          | 0.89  | 2.40  | 0.136   | (0.75-7.61)           |
|                                  | High                              | 3.09* | 2.13  | 0.125   | (0.81-5.60)           |
| Fear to risk of sever COVID-19 disease | No risk                        | 0.13* | 0.16  | 0.001   | (0.06-0.46)           |
|                                  | Low risk                          | 0.57* | 0.45  | 10.07   | (0.18-1.08)           |
|                                | Moderate/high risk | 1     | 1     | 1     |
|--------------------------------|--------------------|-------|-------|-------|
| Household with age >60yrs      | Yes                | 1.80* | 7.94  | **<0.001** | (3.14-20.04) |
|                                | No                 | 1     | 1     | 1     |
| Suspected to COVID-19 infection | Yes                | 12.51*| 5.74  | **0.003** | (1.81-18.16) |
|                                | No                 | 1     | 1     | 1     |
| Comorbidity                    | No                 | 1     | 1     | 1     |
|                                | Yes                | 0.14  | 0.35  | 0.347  | (0.04-3.08)   |
|                                | No                 | 1     | 1     | 1     |
| Confident on COVID-19 vaccine  | Not confident      | 0.50  | 0.78  | 0.618  | (0.29-2.07)   |
|                                | Confident          | 1     | 1     | 1     |

*=variables associated with the outcome variable at p-value<0.2, 1= reference category of the respected variable.
