Prevalence and patterns of facemask use in marketplaces in Addis Ababa: Implications for targeted SARS-CoV-2 risk communication

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Abstract: COVID-19 is arguably the most challenging global pandemic ever, but it is considered preventable. A number of prevention strategies have been popularized through risk communication strategies. These have included facemask wearing, which has included a lot of attention that has covered concerns including whether people wear them and how correctly. The study intended to measure the facemask-wearing practices of Addis Ababa residents in street markets as well as the factors predicting facemask use. Based on WHO protocols, the categories of facemask use included full compliance, partial use, and no facemask use across gender and age categories. Visual-epidemiology methods were used in the objective observation of facemask-wearing. Data were collected as video recordings of facemask wearing behaviors among people in street markets in a randomly selected borough of Addis Ababa by a trained cameraman over 3 days and analyzed by two coders. Individuals observed were assessed for full compliance, partial compliance, and no compliance. Coders A and B rated 316 observations individually, respectively. Inter-rater agreement averaged 91%. The observations were further analyzed using multinomial logistic regression methods. The results showed that 400 (63.3%) did not wear a facemask at all, 137 (21.7%) used facemasks correctly, and...
the remaining 95 (15%) used them partially. About 69% of males and 52% of females failed to use any facemask. Failure to use facemasks was highest among teens (93.6%). Further, parameter estimates showed age and gender were significant predictors of facemask use. Study limitations and implications for targeted risk communication are discussed.

Subjects: Persuasion; Risk Communication; Communication Research Methods; Communication Theory; Health Communication

Keywords: COVID-19; facemask; compliance; transmission; protection

1. Introduction

Based on the current state of knowledge regarding the transmission pathways of SARS-CoV-2, the adoption of community mask wearing is considered the best mitigation strategy, especially in epidemiologically high-risk ecologies such as shopping centers as well as open-air markets where crowding presents elevated risks of infection. However, optimum preventative efficacy requires the deployment of additional measures including hand-washing, physical distancing and other strategies in addition to facemasks as Personal Protective Equipment (PPE). The critical importance of facemasks is demonstrated in a study which found that SARS-CoV-2 transmission was more than 7 times higher in countries that failed to adopt a mask mandate (Leffler et al., 2020). Replications of the study in the US and other countries have strengthened the empirical evidence that facemasks constitute an important strategy in the effort to reverse the course of the pandemic (Hatzius et al., 2020). The body of evidence seems to support earlier epidemiological investigations on personal prevention equipment which concluded that “overall masks were the best performing intervention across populations, settings and threats.” (Jefferson et al., 2020). There has been fundamental international consensus on the most common strategy to mitigate the pandemic. However, Sweden represented an anomalous case where facemasks were not recommended, despite findings clearly indicating COVID-19 deaths in the country were much more than in the Nordic region that had embraced COVID prevention strategies. Sweden had drawn international criticism for its COVID-19 strategy until the country’s Royal Swedish Academy of Sciences’ validated WHO recommended containment strategies, including facemask use and eventually the government made the decision to implement WHO guidelines after 18 December 2020 (Claeson & Hanson, 2021).

In line with international protocols, as one of the worst hit countries in Africa, Ethiopia, has introduced a risk communication policy package with a set of measures as recommended by the WHO (Zikargae, 2020). One important measure has been a mandatory wearing of facemasks and coverings in all public places at all times in addition to proxemic care and respirator etiquettes as well as hand washing.

While appropriate use of facemasks is essential, we do not know the degree of public adherence to official guidelines, but we do know that the pandemic is worsening despite earlier optimism that the worst was over (Thornton, 2020). On 24 February 2021, Ethiopia’s Federal Ministry of Health Epidemiological Update showed 154,257 coronavirus (COVID-19) cases and 2,305 deaths were reported in the country which represented a significant upsurge from earlier incidence reports (UNHCR Ethiopia “2021). The surge in cases, making Ethiopia one of the worst hit in Africa based on the same report, seemed to suggest complacency, which may be understood as a lack of adequate vigilance in the face of a clear and present danger (Moray & Inagaki, 2000). Complacency is related to the issue of risk perception as the evaluation of the dangerousness of a risk as an important factor explaining adherence patterns to policy measures. Complacency may suggest that the mitigation messages are either not reaching or not resonating with audiences or specific groups. Since the introduction of vaccines, there may have emerged a sense of unwarranted optimism that the pandemic has finally succumbed to science, while the Center for Diseases Control (CDC) and other bodies continue to recommend the wearing of facemasks even by those fully vaccinated. The CDC has further recommended that the use of two facemasks or double masking offers better
protection (CDC, 2021, 2021). More recently, pathogen surveillance has shown that there are more than eight variants including the Delta virus and Omicron (Khateeb et al., 2021), which have led to more public health communication and more risk communication campaigns becoming necessary (Lopez Bernal et al., 2021) as the likelihood of the emergence of mask fatigue as a reaction to extended use of facemasks is also present.

In Ethiopia, risk communication has been in place since early in the pandemic, advocating the use of facemasks by the general public as a complementary measure. Defined as a set of strategies “to provide the public with meaningful, relevant, accurate and timely information in relation to … health risks to influence choice” (Adum et al., 2016, p. 5), risk communication has a central position in the effort to arrest the spread of pandemics. Its centrality cannot be more pronounced in poor countries characterized by weak health systems and limited capacity to manage epidemiological burdens. In Addis Ababa in particular, in multichannel risk communication campaigns, automated calls and automated text messages to cellphone numbers to communicate risk information about COVID-19 have been sent daily in addition to messages from news media (Zikargae, 2020).

The mass risk communication intervention is motivated by the logic that behavioral modifications are the best and the most affordable mechanisms available for poor countries as global realities are dire and countries in more advanced parts of the world are self-focused and self-absorbed. While pandemics are global, poor countries are much less likely to have universal vaccination programs on account of vaccine affordability. It has been estimated that more than 90% of people in 67 poor countries would have no access to vaccines in 2021, while some rich countries have excess reserves (Dyer, 2020). Based on some scenario predictions, until 2023–4 there may not be any implementation of universal vaccination globally (Launch & Scale Speedometer, 2021). Ethiopia intended to offer vaccination to just 20% of the population in 2021, which was a contextually overoptimistic estimate given its epidemiologically aggravating socio-economic troubles, which of course only serves to strengthen the policy of prevention as a first-line strategy. As the latest figures show, the country managed to vaccinate just 1.4% of the population (Our World in Data, 2022). Even with higher vaccination rates, the limits of vaccines are now well documented in the context of rising variants of concern (VOC; Leung & Wu, 2022) and waning vaccine effectiveness, which has led to booster vaccination becoming necessary. In poor countries, a universal first dose seems highly unlikely, much less booster vaccination. The need for more risk communication is implied in these contexts because of the additional limiting factor of the issue attention cycle, which claims that any vigilance is temporary despite the severity of an issue of concern. Typically, an issue “leaps into prominence, remains there for a short time, and then, though still largely unresolved, gradually fades from the center of public attention” (Downs, 1972). For now, although the pandemic is still an issue, it is not the same weighty issue it once was (Koh et al., 2020. It may continue to be in the center of public and media discourse but in subdued form.

Certainly, discourses of facemask use as a vital self-defense strategy and varied public health messaging strategies continue to characterize mass communication (Nigussie, 2021; Zikargae, 2020). There is constant messaging on the effectiveness of masks as helping to empower the general public as they grapple with a mix of emotions of fear and helplessness partly from a lack of confidence in health information as warnings continue to report new variants and the rise of infections (Cherry et al., 2021; Escandón et al., 2020). However, the risk perception has been inadequate for behavioural modification to occur (Birhanu et al. 2021). There is also the cultural factor of a society with a collectivist orientation, placing more focus on others than oneself and putting premiums on communicative closeness, relational warmth, and proxemic presence (Germani et al., 2020). These characteristics appear to permeate social, cultural, and business life. As a result, the transmission risks may be more pronounced in culturally based commercial settings that necessarily involve face-to-face communication. In such markets, people may be engrossed in the details of transactions that are culturally full of lengthy negotiations as the
norm of fixed prices is limited to more modern markets, often causing agents to drop masks as they may be considered hindrances to effective communication. Based on gaps identified in the risk communication and public health literature, the present observational study aimed to determine the prevalence and patterns of facemask use in selected outdoor markets in Addis Ababa. The aim was also to identify sub/groups that may be implementing mitigation measures the least and to recommend targeted messaging/risk communication to meet their particular intervention needs.

2. Literature review
The SARS-CoV-2 pandemic has led to extensive global research on ways of reversing and containing the spread, which has included the use of risk communication using various channels and modalities. Studies (Abrams & Greenhawt, 2020; Costantino & Fiacchini, 2020; Hu & Qiu, 2020) have explored epidemiological trends and health communication efforts and a substantial body of knowledge has been generated. However, the picture is complicated as preventive intervention has not been conclusively shown to have led to the adoption of recommended strategies (MacIntyre et al., 2021). At the core of mitigation strategies has been the use of facemasks by the general public and in many countries people are daily reminded about the threat and the need to remain vigilant by using their facemasks correctly in all or most enclosed places (Kabakian-Khasholian et al., 2020). A multichannel risk communication environment that includes the use of multiple media and avenues of communication has been in place in many countries across the globe to communicate vital information regarding the threat posed by COVID-19 and recommended prevention strategies as well as in some cases measures against violations of relevant public health regulations. The channel diversity is based on the theory that the use of one medium may lead to the use of another, thus aiding mitigation efforts (Holbert, 2005). Nevertheless, surveys across countries show different levels of adherence explained by a variety of regulatory, cultural, or demographic factors (Adjodah et al., 2021). However, the adoption of masks was generally higher than would be predicted by the theory of diffusion of innovation (Rogers, 1995), with critical mass levels achieved quite early. Thus, in the US and Canada, observance of facemask use rules was 80–85% early in the pandemic, which suggested virtual universal compliance (Pew Research Center, 2020), although it is not clear whether the observance resulted from public health risk communication or a mandatory mask use policy or a combination of both.

In some studies (Davis et al., 2021; Shahnazi et al., 2020; Sarwar et al., 2020) findings were consistent with theory. In particular, the health belief model was found to explain the variability in mask use in the general population. Accordingly, perceived susceptibility, perceived benefits, perceived severity, perceived barriers, and cues to action were related to mask compliance levels (Sim et al., 2014). Further determinants have included age, gender, but the picture is marred by inconsistent findings. For instance, in some studies, gender produced a pattern of mask use, often with women demonstrating greater observance of public health messages for facemask use. There is, however, the possibility of mask refusal by both men and women as studies seem to suggest (Taylor & Asmundson, 2021). Studies seem to suggest that women are more receptive to risk communication, which may explain why fewer women than men are falling ill and dying due to the pandemic (Gerdeman, 2020). While men tend to take more active health risks (Capraro, 2000), it has been shown that there are no gender differences in the arena of passive health risks such as maskwearing (Miroglio & Johns, 2016). There are also international differences in observance degrees, reflecting a variety of cultural and developmental factors, among others (Van Bavel et al., 2020). Scholarship on the subject from African countries has been limited and the few studies reported are prone to measurement errors. They are typically based on self-reports of compliance, which can be impacted by social desirability bias and may therefore be misleading as a consequence (Vesely & Klöckner, 2020). Therefore, studies that overcome the subjective nature of self-reports which may be addressed by actual observance of mask use are needed. There are gaps in facemask use studies, pivotally the
measurement of actual facemask use, especially in the context of developing countries including Ethiopia.

3. Risk communication model

Theories have been developed to explain and predict how people process health risk information and respond to it (Glik, 2007). A host of variables that include cognitive and motivational issues are accounted for by some but not other theories of health risk communication reception in the form of adoption of recommended preventive behaviors. These have included the health belief model and risk communication as “the intentional effort to inform the public about risks and persuade individuals to modify their behavior to reduce risk” (Reynolds et al., 2005, p. 9) materialized through a number of measures including public health messaging. The messages may be received by most targets but used as sources of behavioral modification by fewer recipients of risk communication. For instance, messages regarding facemask use may be available to the public at large but may actually be received and acted upon differently by segments of the audience differently. No single theory or model seems to have the explanatory or predictive potential for all contexts of message reception and action (Backer et al., 1992).

However, a more powerful model than others is Blanchard-Boehm’s (1998) model formulating a series of logical steps explaining the materialization of risk response. Thus, people

(1) receive a warning message; 2) figure out the related content; (3) accept or believe the importance of the message included; 4) establish the truth of their interpretations with other people; and (5) take actions or measures regarding the message

These steps and tenets may be considered applicable to the SARS-COVID epidemiological context where the use of risk communication for facemask use is concerned (Porat et al., 2020). The logic of the model is consistent with subsequent conceptualizations of risk communication in the context of the COVID-19 pandemic (World Health Organization, 2019).

4. Materials and methods

In recent years, visual epidemiology has gained momentum as an important tool of enquiry in health-related investigations including topics of health communication (Harrison, 2002; Pink, 2012; Wall et al., 2012). The method involves the use of videos and photographs in the systematic observation of behavior for analysis and understanding of issues of interest. It can be a highly reliable method generating rich and reliable data on important details and dimensions of a complex subject (Asan & Montague, 2014). Recent studies have used surveillance videos mainly to determine mask use behavior in a variety of settings as direct video observation provides the most valid and accurate data not contaminated by memory or desirability issues (Chen et al., 2020; Chu et al., 2020; Tao et al., 2020). Indeed, in interactive socially dense contexts where health policies require facemasks are used to protect against the COVID-19 virus, visual methods can be ideal. In such environments, which are data rich yet challenging to research conventionally, no other method can be more suited. Overt behavior is best measured using nonobtrusive methods because obtrusive methods can lead to reactive behavior which compromises data quality as subjects may behave differently than they would under normal circumstances, denying the researcher real data necessary for intervention. In fact, data obtained from obtrusive and nonobtrusive observations tend to be far apart (Kazdin, 1979). These methodological merits were behind the choice of the use of visual epidemiology in the present study.

4.1. Subjects

The face-mask wearing behaviours of buyers and vendors in street markets were video-recorded on three consecutive days in Addis Ababa’s Nifas Silk-Lafto Sub City in February 2021. Age categories included children, teens, adults, and seniors. Subjects were both male and female.
4.2. Procedure

Once the focus of observational interest was determined as facemask behavior, next was the scheduling of observations that considered issues of frequency, duration and time of day. Since the purpose of the study was to have a snapshot of adherence, it was felt that three video observations made on consecutive weekdays (16, 17 and 18 February 2021) at three different sites would suffice. The surveillance would take on average 1 hour in midmornings (11am–12am) when the markets would see a peak transactional activity. The observational focus was on the facial region.

In the interest of preventing reactivity, which would potentially distort and undermine empirical data fidelity, the video camera, which was in a parked car, was concealed from view with the positive result that study subjects would not change their mask use behavior. Therefore, there was no effect of video recording on the vendors and shoppers in the outdoor markets. It was thus possible to use the video camera to capture “what is really going on” (Jewitt, 2012, p. 10). This was preceded by an observational preparatory phase that helped to assess the camera layout of sites to obtain the best possible angle for a full view of the participants. The decision to use a mobile camera was based on a preliminary inspection of sites and practices and decision was then made where the most valid shots would be possible in the transactional spaces. The video recording and the analytical gaze was guided by the research questions and the data type required.

In all, the researcher collected 316 observations, which were to be counted twice for reliability by raters. Two persons made a count of persons wearing and not wearing facemasks as well as deciding how a mask was worn, i.e., the level of compliance as either partial or full depending on how the facemasks were used to cover both the mouth and nose or just the mouth. The observation included subjects’ gender and demographic categories as children, adolescents, adult, or seniors. Inter-rater agreement was above 90%.

4.3. Method of analysis

The study employed multinomial logistic regression (MLR) as a method of data analysis. MLR is an extension of the binary logistic regression algorithm used to estimate and predict membership of a nominal multi-category outcome variable (Anderson & Rutkowski, 2008). More pertinently, the method involves prediction of multiclass units such as the facemask use categories employed in the present study. The multinomial logit model is expressed as:

\[
\log \frac{p(y = j | x_i)}{p(y = 1 | x_i)} = \alpha_j + \beta_j x_i \quad \text{and estimated as} \quad \log \frac{p(y = j | x_i)}{p(y = 1 | x_i)} = \sum \beta_j \exp(\log(p(y = j | x_i)) \quad (\text{XLSTAT, 2021}).
\]

Sequentially, identification of the outcome variable, testing of relevant assumptions, estimating and fitting the model, and interpreting the results and validation of the model were conducted (Fernandes et al., 2021; Tolles & Meurer, 2016). SPSS version 25 was used in the management of data. In keeping with protocols, following tests of multicollinearity and linearity as well as inspection of standard error, which was acceptable, a multinomial logistic regression analysis was conducted to determine the relationship between the predictors (gender and age category) and the response variable mask adherence (presented as level of compliance- no mask at all, wearing a mask fully, partially, mask present but unused and no mask at all). The model assumes a response variable with five categories as outlined above.

Before the final model was fitted, the first full model was specified that included all main effects and two-way interactions. It was found that the gender * age group interaction was not significant. This led to the elimination of the two-way interaction term, resulting in a reduced model involving gender and age categories as independent predictors.
4.4. Findings
Findings from the video-recording analysis of the facemask use practices in the Addis Ababa City market places studied are presented. Table 1 presents the descriptive statistics for mask use adherence categories (full, partial, and no mask use), age groups (children, teens, adult, and senior) as well as gender (men and women). As shown in the table, there was a total count of 632 observations of which 430 were males and 202 females, constituting 68% and 32% of the total, respectively. They were adults (448) (70.9%), teens (94) (14.9%), seniors (77) (12. 2%), and children (13) (2.1%). Compliance data showed that 400 (63.3%) did not wear a facemask at all, 137 (21.7%), wore masks fully, and 95 (15.0%) partially.

| Table 1. Data summary | N    | Marginal percentage |
|-----------------------|------|---------------------|
| Compliance            |      |                     |
| full                  | 137  | 21.7%               |
| partial               | 95   | 15.0%               |
| No mask               | 400  | 63.3%               |
| Agegroup              |      |                     |
| child                 | 13   | 2.1%                |
| teen                  | 94   | 14.9%               |
| adult                 | 448  | 70.9%               |
| senior                | 77   | 12.2%               |
| gender                |      |                     |
| male                  | 430  | 68.0%               |
| female                | 202  | 32.0%               |
| Valid                 | 632  | 100.0%              |

Gender-based facemask compliance figures (see, Table 2) showed that 18.5% of males and 26.2% of females complied correctly and 22.3% of females as opposed to 11.6% of males complied partially. Additionally, 68.8% of all males and 52.5% of females failed to wear a mask.

| Table 2. Compliance by gender | Total   | Full   | Partial | No mask |
|-------------------------------|---------|--------|---------|---------|
| gender                        |         |        |         |         |
| male                          |         |        |         |         |
| female                        |         |        |         |         |

| Table 3. Compliance by age group | Total   | Full   | Partial | No mask |
|----------------------------------|---------|--------|---------|---------|
| Age group                        |         |        |         |         |
| child                            |         |        |         |         |
| teen                             |         |        |         |         |
| adult                            |         |        |         |         |
| senior                           |         |        |         |         |

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Table 4. Model fitting information

| Model          | Model fitting criteria | Likelihood ratio tests |
|----------------|------------------------|------------------------|
|                | −2 Log likelihood      | Chi-square | df | Sig. |
| Intercept Only | 155.741                |            |    |     |
| Final          | 56.341                 | 99.401     | 8  | .000 |

The figures for age-based compliance (see, Table 3) showed that children represented the highest figure of full compliance (38.5%), while a further 30.8% of children did not wear a mask at all. Full compliance was next observed most highly in the senior age category (31.2%), although this group also showed a similar level of failure to wear a mask. Most strikingly, in the teen group, full compliance was 1.1% and total failure to wear a mask was 93.6%.

Table 4 presents a summary of the model fitting information. As shown in the table, the final model clearly is far better than the intercept model (baseline model) as the significantly reduced −2 Log Likelihood values indicate. The intercept—only model is a model without predictors of facemask use and the intercept and covariates are elements in the final model that provides a deterministic evidence of model fitness as a more global hypothesis of the roles of gender (membership of male, female categories) and age (with categories of child, teen, adult and senior) as predictors of facemask use.

Furthermore, the deviance (see, Table 5) as a measure of the degree of unexplained variation or error shows that the model has passed the test of goodness as an index of correspondence between data and model predictions. As a rule, Deviance R² is always a value between 0% and 100% (McElreath, 2018). The higher the value of the Deviance, the greater is the data-model correspondence. In this study, the deviance (5.866) indicates that the model predictions that gender and age are associated with facemask use are significantly accurate as the gap between the predicted and observed outcomes is small. The Pearson chi-square as another statistical test provides further evidence of model fitness. As shown in Table 5, the Pearson value is significant (P. > .05), indicating that the model fits the data well.

Table 6 reports the Cox & Snell R Square and Nagelkerke R Square values as methods for determining the explained variability. These pseudo R² values (see, Table 6), are measures of the goodness of the fitted model. In particular, the more useful of the two model fitness tests, the Nagelkerke R² test, explains the proportion of variance successfully explained by the model. Although the value of 0.17 (17%) is not impressive, it does, nevertheless, prove to be statistically significant. In other words, it adequately explains the variation in the dependent variable in the

Table 5. Goodness-of-fit

|              | Chi-square | df | Sig. |
|--------------|------------|----|------|
| Pearson      | 4.906      | 6  | .556 |
| Deviance     | 5.866      | 6  | .438 |

Table 6. Pseudo R-square

|              |           |
|--------------|-----------|
| Cox and Snell| .139      |
| Nagelkerke   | .166      |
| McFadden     | .083      |
context of facemask adherence or in the prediction of who is likely to belong to the different categories of facemask use.

Furthermore, the likelihood ratio test was used to determine the goodness of the competing models. Accordingly, the chi-square values (75, 13) in the likelihood ratio test table (see, Table 7) show that the multinomial logistic regression model with the two predictors is better at predicting compliance in mask use level than the multinomial logistic regression model without the two predictor variables (p ≤ 0.001). The table shows the two predictors, gender and age group, are statistically significant. In other words, both membership of an age category and gender have important associations with facemask wearing to prevent infection with the corona virus.

In terms of measuring facemask adherence, logistic regression was successfully used to predict what compliance behavior subjects would demonstrate. Thus, the classification table (Table 8) indicates that the multinomial logistic regression with the two predictor variables correctly predicts 65% of cases regarding the predicted events of compliance. In particular, the sensitivity of prediction was highest for total compliance failure events (not using a mask at all) standing at a high 90.7%. Particulars of occurrence are also presented as prediction specificity for partial compliance.

Following the classification above, it is necessary to report the coefficients of the parameter estimation output. Accordingly, Table 9 shows the multinomial logistic regression coefficient, Wald test, and odds ratio for each of the two predictors. As shown in the Table, regarding full compliance and partial compliance, the b coefficients for teens =4.160 (Wald = 20.988, df = 1, p < .05) and adults =.624 (Wald = 11.633, df = 1, p < .05) are significant in the reverse direction, pointing to reduced odds of positive facemask compliance events. For males, the b coefficients of =.529 (Wald = 5.6381, df = 1, p < .05) for full compliance and =.810 for partial compliance (Wald = 10.583, df = 1, p < .05) are significant in the reverse direction, suggesting that males are less likely to observe mask rules than females. The Exp (B) column with the value of .589 indicates that women are 59% more likely to use masks correctly. Furthermore, the B value of .53 6 shows that, holding other variables constant, adults are 54% more likely to fully use masks than others. A chi-square test further showed that gender and compliance are significantly related, as are age and compliance.

Overall, the findings show that adherence to facemask use was low, with only 21.7% correct use observed, in spite of a pandemic masscommunication environment characterized by sustained
Table 9. Parameter estimates

| Compliance | B   | Std. error | Wald | df | Sig. | Exp (B) | 95% Confidence interval for Exp (B) |
|------------|-----|------------|------|----|------|---------|--------------------------------------|
|            |     |            |      |    |      |         | Lower bound | Upper bound   |
| full       |     |            |      |    |      |         |            |               |
| Intercept  | .042| .294       | .021 | 1  | .886 |         |            |               |
| [children] | .642| .734       | .765 | 1  | .382 | 1.901   | .451       | 8.015         |
| [teens]    | −4.160| 1.045     | 15.864| 1  | .000 | .016    | .002       | .121          |
| [adults]   | −6.24| .306       | 4.156| 1  | .041 | .536    | .294       | .976          |
| [seniors]  | 0⁰  |            | 0      |    |      |         |            |               |
| [males]    | −.529| .223       | 5.638| 1  | .018 | .589    | .381       | .912          |
| [females]  | 0⁰  |            | 0      |    |      |         |            |               |
| partial    |     |            |      |    |      |         |            |               |
| Intercept  | .138| .296       | .219 | 1  | .640 |         |            |               |
| [children] | .554| .773       | .513 | 1  | .474 | 1.740   | .382       | 7.920         |
| [teens]    | −2.482| .542     | 20.988| 1  | .000 | .084    | .029       | .242          |
| [adults]   | −1.090| .320     | 11.633| 1  | .001 | .336    | .180       | .629          |
| [seniors]  | 0⁰  |            | 0      |    |      |         |            |               |
| [males]    | −.810| .249       | 10.583| 1  | .001 | .445    | .273       | .725          |
| [females]  | 0⁰  |            | 0      |    |      |         |            |               |

conversation on the important public health subject. The data indicate that gender is an important predictor of adherence to facemask recommendations by public health authorities. The relevance of gender is shown by the finding that far more males (69%) failed to use facemasks than females (52%). Besides gender, age was also an important predictor. Thus, failure to use facemasks was highest among teens (93.6%). Males and teens were also more likely to wear masks incorrectly.

5. Discussion

The findings in the present study indicate that 63.3% (400) did not wear a facemask at all, 21.7% (137) wore masks fully, and 15.0% (95) partially. Earlier surveys in Ethiopia reported very low compliance rates with as low as 14% to 29%, saying they used a facemask (Kebede et al., 2020; Kassaw, 2020). The present findings indicate that failure to wear a mask is extremely high, even higher than many international surveys would indicate, suggesting perhaps risk communication efforts were ineffectual. For instance, an overall prevalence of facemask usage of 45.6% was reported in an Asian study (Rahimi et al., 2021), which is far higher than is reported in the present African research. The present Ethiopian study sharply contrasts in degree of compliance with a Malaysian wet market study, which reported mask use of over 95% (Gunasekaran et al., 2020). Within Africa, face-mask wearing differs among countries with Malawi reporting (22% in urban areas; Burn et al., 2020), Sudan (49.4%; Mousa et al., 2020) and Kenya (73%; Austrian et al., 2020). The facemask wearing rates in the present study are much higher than are the figures reported in a Kenyan study which found that only 10 were using facemasks (Jakubowski et al., 2021).

In Japan, facemask use prevalence was 80%, but correct use was as low as 23.1% based on WHO guidelines for correct facemask use (Machida et al., 2020). The problems with correctly using a face mask are also noted in the present study. Thus, partial facemask (with the facemask covering either the mouth or nose only) is also high (15.0%).

The present study found that gender was a statistically significant factor in facemask event occurrence. The data showed 68. 8% of all males and 52.5% of females failed to wear a facemask. Additionally, teens were most likely not to wear a facemask (93.6%), showing there is a pattern
that is demographic. The present findings agree with international mask use reports regarding both dimensions of gender and age (Haischer et al., 2020; Howard, 2021).

The relevant figures in the current study agree with those of an American study which reported high age- and gender-based significant differences in facemask usage (Beckage et al., 2020). The study reported that women and older persons made the highest use of facemask. In the current study, 256 (59.5%) of males and 88 (43.6%) of females wore no facemask at all. The present findings are also consistent with those of a multiracial study which showed women are more likely to wear facemasks than men (Heare & Nino, 2021) and the conclusions of a study of eight countries demonstrating that women are more receptive to COVID-19 messages and more compliant (Galasso et al., 2020). The higher care among women is also consistent with earlier findings (Danielsen & Noll, 2020; Okten et al., 2020) reporting more compliance among women. The present findings seem to support the argument that men take more risks and are less likely to self-protect owing to macho myopia (Tamás et al., 2019), implying public health regulations and messaging should be directed at men. Women tend to be more receptive to health messages and more compliant (Harris & Jenkins, 2006) about which the literature seems to be consistent, although there have been no adequate theoretical explanations (Gustafson, 1998). However, it comes as no surprise that there are fewer fatalities for women attributed to COVID-19 (Danielsen & Noll, 2020).

The medical literature (Asefa et al., 2020; Rosi et al., 2021; Bruine de Bruin, 2020) is generally consistent in reporting that older is better in regard to risk perception (Haischer et al., 2020). Elderly people may be presumed to be more careful because of the observational experience they have accumulated and the perspective taking advantage that results, but it may also be because they are more vulnerable of which they may be aware as a result of exposure to health communication information, which the health belief model calls cues to action, which are stimuli for taking preventive action that come from sources such as the media (Maiman et al., 1977). The enhanced vulnerability due to ageing-related morbidity may be a further incentive for an enhanced level of alertness, which agrees with the significance of perceived vulnerability as a self-protection motivational factor as the health belief model posits. It should come as no surprise that older persons tend to wear facemasks more than younger persons (Bekalu et al., 2021).

On the contrary, teenagers seem to be taking SARS-CoV-2 messages less seriously. This demographic group may have less incentive to engage in self-protection behaviors because of their perception of susceptibility being lower on account of their youth that has been reported by health authorities as being an advantage in a relative sense. In addition to lower perceived susceptibility threat, teens may also sense an advantageous lower perceived severity of a SARS-CoV-2 infection and a higher chance of recovery. They may, therefore, see fewer perceived benefits as opposed to seniors, who appear to be epidemiologically the most vulnerable, which has promoted preferential SARS-CoV-2 vaccination programs in their favor. Previous studies showed only about 6% had the perception that young people were vulnerable and needed to self-protect (Kebede et al. 2020). The particularly low mask adherence among the youth in the present study paints a validating picture of the reported attendant trends. Older persons were most likely to use a facemask as a strategy of self-protection (37.7%) and while children were also facemask protected (30.8%), they were most likely under parental guidance and supervision. Regarding children and facemask use, the WHO and UNICEF seem to agree that children above 2 years of age need to wear masks further with the degree of discretion given to parents (Health Policy Watch, 2020).

The generally low compliance rates in the present study would be further explained by what has been called optimistic bias (Tali, 2011) irrespective of public health information availability. Optimism bias is a tendency to underestimate risks even when they are real and to assess threats more optimistically than would be warranted more realistically (Ginn, 2012). In health contexts, this translates into a perception that one is safe or safer than others in the absence of any evidence, resulting in taking no precautions, despite exposure to health media. In epidemiological frameworks such as SARS-COVID, public health messaging may fail because of resistance due to
optimistic bias, which may lead to risk misperception and unfitting decision-making (Brnstrm & Brandberg, 2010). In the SARS-CoV2 pandemic literature, international surveys showed optimistic bias was an important factor explaining the response to the pandemic (Druică et al., 2020). The issue of optimistic bias may further be linked to facemask complacency, which has been raised as an important concern in the face of the “potential for disaster in Africa” (Lancet, 2020). As an African country, Ethiopia’s vulnerability is also clear, given the state of its economy and the limits of health infrastructure and enabling factors, which points to both optimistic bias and complacency as shown in the low facemask use, being unwarranted in context. Optimistic bias regarding infectability has implications for more focused risk communication interventions in Ethiopia to help raise the alarm. The abundance of myths and misinformation in Ethiopia as a developing country is also probably contributory to risk communication efforts being compromised (Kebede et al. 2020).

In general, the study findings are in agreement with the relevant theoretical and empirical literature in public health and risk communication (Howard, 2021; Kim & Crimmins, 2020; Kowalski & Black, 2021; Tong et al., 2020) and more particularly evidence from Ethiopia about the low level of risk perception and prevention (Kebede et al. 2020; Birhanu et a, 2021) as well as poor health communication (Tola, 2020). The evidence seems to suggest that risk communications were inadequate as they were not targeted to perceptions of risk in relation to age and gender as important factors influencing perception (Le et al., 2020) or that several factors could be at work influencing risk communication and perception (Breakwell, 2000). Studies in Ethiopia have shown that young people seem to underestimate their vulnerability, taking the pandemic as a particular challenge to the elderly (Kebede, et al. 2020). As previous studies of risk communication in different epidemiological scenarios have shown, precautionary messaging focusing on enhanced risks associated with being older could lead to faulty assumptions of invulnerability among younger people (Boehmert et al., 2016). Previous research has shown that risk communication in Ethiopia’s effort to contain the pandemic has been faulty (Birhanu et al., 2021), which may explain the low level of use of facemask across demographics, especially youthful groups. The crux of the evidence in the present study points to the importance of public health messaging that addresses young people’s vulnerability.

6. Conclusions
The purpose of the study was to determine the magnitude and pattern of facemask use as a mitigation strategy against the spread of COVID-19. The facemask adherence study has given us a snapshot of the use of COVID-19 prevention measures in market settings in Addis Ababa where considerable in-person communication occurs socially, presenting real risks of contagion. Unlike the results of a survey which may be biased by social desirability, the present results come from actual observations of obvert behavior and as such provide reliable empirical evidence of mask adherence.

The findings of this study indicate that facemask-wearing rates in market places among sellers and buyers along street paths are low, which is disconcerting in view of the considerable risks with which noncompliant subjects expose themselves as well as their interactional partners. The study shows that risk communication involving diverse media strategies has not led to significant degrees of mask adherence, as the use of facemasks continues to be low even as public health authorities warn about rising infection rates and the emergence of new variants of the virus. While there are gender- and age-based differences with women and older persons implementing public health messages more, the compliance rate is generally low, suggesting considerable risks to further spread of the virus and new variants in an epidemiological context were health services are already overstretched. Rethinking existing risk communication strategies and adopting tailored messaging may help mitigate/contain the spread of the pandemic through shaping correct perception and encouraging adoption of proper preventative strategies by groups that are under-protecting as well as the general population.
6.1. Implications
The Ethiopian study, as the nationally first of its kind, contributes to international facemask use in public settings, and has implications for risk communication and other containment strategies such as policy formulation and enforcement. The present study data show that there are real risks of pandemic worsening as people are not implementing prevention strategies as recommended by public health authorities in a wide variety of communication modalities. The low facemask compliance may suggest limits to communication or inadequate risk communication centering on poor and vulnerable communities in cities (Ataguba & Ataguba, 2020). More theoretically informed two-way communication channels could yield better results (Boersma et al., 2017).

In view of the low adherence to recommended facemask use policies among the study subjects and other studies, risk communication interventions and messages need to be tailored to the characteristics of the demographic group that is least compliant. To enhance the effectuality of interventions targeting mask use among young persons, a focus on perceptual changes through more fashionable face coverings and relaying health messages via popular role models may be an important step. Risk communication will also have to be deployed in a more two-way modality to ensure a more effective risk communication that leads to necessary levels of risk perception leading to the adoption of preventative mask behaviours. Further studies may also be necessary that explicate the dynamic interaction of factors including the different pathways that may impact facemask adherence to enable the choice and development of interventions that the barriers and facilitators to facemask use as a principal mitigation strategy.

As well as a pandemic communication strategy using multiple modalities, communication evaluation as part of general communication and multisectoral interventions should be put in place that monitor the trajectory and impact of the pandemic and introduce the needed changes to the international experience to help address the dynamically changing circumstances of the COVID-19 pandemic. More work and more theoretically informed risk communication interventions are needed as the potential for the emergence of facemask fatigue as a threat to containment efforts is present. The emerging condition, which results from extended use of masks, has many biomedical and psychosocial manifestations that would also require appropriate communication interventions (Kalra et al., 2020). More longitudinal epidemiologically informed studies that address the pitfalls of the present study may be conducted to plot trends and devise attendant public health risk communication strategies by way of containment of the threat posed to communities throughout the country. Further, regulatory policies may have to be in place and persons flouting mask rules should face legal consequences to protect the public as the experience of other countries would show.

6.2. Limitations
The results of the study need to be interpreted in light of limitations in this study. Whilst video can support an exploratory research design, it nonetheless is limited in providing answers to the question of why? Thus, whilst the present study found correlations between mask use, gender and age, causal associations are not established. Causal factors would be identified easily in a questionnaire-based study, but asking observed subjects for mask behavior would raise ethical issues relating to anonymity violations, besides the feasibility problems of filming subjects, identifying them individually and asking them questions relating to why they were or were not wearing masks. However, the exploratory design was intended to provide evidence relating to overt mask use behavior, which is reliably judged since it involves significant agreement between two observers. At the time of the study, social distancing rules further affected the use of interviews to help any gaps in the quality of evidence. Future studies may address limitations inherent to the use of multiple logistic regression (MLR) as a classification algorithm and find ways of triangulating evidence to add value to public health and risk communication scholarship, as well as relevant policy and practice.
At the level of categories of facemask use, the typologies of facemask worn initially were no facemask use, full-facemask use, partial facemask use, facemask present but completely wrongly used which included such malpractices as putting a facemask either around the neck, on the forehead, on the chin, or dangling from the ear or on the arm. The use of this categorization caused a model-fitting issue. For this reason, variable cloning was necessitated in response to SPSS modification recommendations, resulting in unexpected singularities in the Hessian matrix in NOMREG as the SPSS program for multiple logistic regression. Based on conceptual grounds, the indicated dimension of the dependent variable of compliance was reduced to three dimensions, which successfully resolved the singularity computational issue. Future studies with more samples may help mitigate the relevant classificatory challenges.

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