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Cláudia Campos, MSc, Joana Carrilho, PhD, Luis Midão, PhD, Diogo Henriques, MSc & Elísio Costa, PhD

ABSTRACT

Background: The COVID-19 pandemic has emphasized the critical role of health behaviors, including mask wearing, in mitigating the virus's spread. This study aims to explore the association between the compliance with mask mandates and the European region of residence. Various factors, such as sociocultural, psychological, and contextual elements, can influence health behaviors.

Methods: The sample consisted of 50,900 European participants aged 55 years and above, drawn from the 8th wave of the SHARE survey. The average age was 75.89 years (SD=99.98), with 56.6% females. Statistical analysis focused on assessing the frequency distribution of COVID-19 preventative behaviors, particularly mask wearing. Cross-tabulation analysis and chi-square tests were employed to examine the relationship between country and mask wearing frequency. The contingency coefficient test was utilized to determine the strength of this relationship. Additionally, an ordinal regression analysis was conducted.

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Mask-Wearing Behavior among Older Persons: Regional Differences in Europe

Mask-Wearing Behavior among Older persons

Cláudia Campos, MSc[α], Joana Carrilho, PhD[σ], Luis Midão, PhD[ρ], Diogo Henriques, MSc[Ω] & Elísio Costa, PhD[§]

ABSTRACT

Background: The COVID-19 pandemic has emphasized the critical role of health behaviors, including mask wearing, in mitigating the virus's spread. This study aims to explore the association between the compliance with mask mandates and the European region of residence. Various factors, such as sociocultural, psychological, and contextual elements, can influence health behaviors.

Methods: The sample consisted of 50,900 European participants aged 55 years and above, drawn from the 8th wave of the SHARE survey. The average age was 75.89 years (SD=99.98), with 56.6% females. Statistical analysis focused on assessing the frequency distribution of COVID-19 preventative behaviors, particularly mask wearing. Cross-tabulation analysis and chi-square tests were employed to examine the relationship between country and mask wearing frequency. The contingency coefficient test was utilized to determine the strength of this relationship. Additionally, an ordinal regression analysis was conducted.

Results: The findings demonstrated a statistically significant association between the European region and the frequency of mask wearing ($\chi^2 = 11978$, $df = 9$, $p < 0.001$). The contingency coefficient test revealed a moderate effect size ($C = 0.549$). Most participants reported 'Always' wearing masks (58%), followed by 'Often' (10.45%), 'Sometimes' (11.4%), and 'Never' (19.7%). Parameter estimates indicated significant variations between regions, with Eastern Europe being 97.8% less likely, Western Europe being 89.9% less likely, and Southern Europe being 56.4% less likely to fall into lower categories of mask-wearing compliance compared to Northern Europe.

Conclusions: This study highlights a significant association between the European region and mask-wearing frequency. Understanding and addressing sociocultural, psychological, and contextual factors within each region are crucial when implementing public health interventions. Targeted efforts should be made to enhance mask-wearing rates and mitigate the transmission of COVID-19. The findings underscore the importance of considering regional differences in compliance with mask mandates to develop effective strategies tailored to specific European regions.

Keywords: geriatrics, public health, covid-19.

Key points

- Paper addresses challenges and regional variations in COVID-19 mask-wearing.
- Cultural factors and individual beliefs shape mask-wearing, especially among older individuals.
- Older individuals in Eastern, Southern, and Western Europe have higher mask-wearing rates compared to those in Northern Europe

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I. INTRODUCTION

The emergence of COVID-19, caused by the novel coronavirus SARS-CoV-2, has posed a significant global public health challenge. Since its initial identification in late 2019, the virus has rapidly spread across the globe, leading to severe illness, overwhelming healthcare systems, and substantial mortality rates [1]. In response to this unprecedented crisis, governments and public health authorities worldwide have implemented various measures to mitigate the spread of the virus and protect public health [2]. These measures have included widespread testing, contact tracing, quarantine and isolation protocols, travel restrictions, and the promotion of personal protective measures, such as mask wearing and hand hygiene practices[3]. In the European Union (EU), individual member states have developed and implemented their own public health policies tailored to their respective contexts, while also adhering to guidelines and recommendations provided by the European Centre for Disease Prevention and Control (ECDC) and the WHO [4]. These policies aimed to reduce transmission rates, flatten the epidemic curve, protect vulnerable populations, and ensure the resilience of healthcare systems [5].

The implementation of personal protective measures, particularly mask mandates, during the COVID-19 pandemic has presented various challenges. Despite the importance of mask wearing in reducing virus transmission, there have been difficulties in ensuring widespread adherence and compliance to these measures. Studies have highlighted factors contributing to the challenges faced in implementing mask mandates, including a lack of consistent messaging, misconceptions about mask effectiveness, discomfort associated with prolonged mask use, and issues related to enforcement and public acceptance [6-8]. Additionally, variations in cultural norms, individual attitudes, and risk perceptions have influenced the acceptance and adoption of mask wearing [9, 10]. These complexities have underscored the need for clear communication strategies, education campaigns, and ongoing public health efforts to address misconceptions, promote mask use, and enhance compliance [11, 12].

The implementation of mask mandates, specifically among older persons individuals, has encountered specific challenges. Drawing on theories such as the Cultural Dimensions Theory, Health Belief Model, and Theory of Planned Behavior, several factors contribute to the difficulties faced in promoting mask-wearing behavior among older person population. According to the Cultural Dimensions Theory, cultural orientations and norms significantly influence health behaviors, including the acceptance and adoption of mask wearing [13]. Differences in cultural values, such as individualism versus collectivism, may impact the perception of personal responsibility and the willingness to comply with mask mandates [14]. Additionally, the Health Belief Model emphasizes individual beliefs and perceived susceptibility, severity, benefits, and barriers in shaping health behaviors [15]. Moreover, the Theory of Planned Behavior highlights the role of attitudes, subjective norms, and perceived behavioral control in determining behavioral intentions [16]. These theoretical frameworks suggest that cultural factors, individual beliefs, and perceived control play pivotal roles in shaping mask-wearing behavior among older persons. However, challenges remain, including issues related to accessibility, comprehension of guidelines, physical and cognitive limitations, and concerns about social stigma or discrimination [17, 18]. Addressing these challenges requires tailored communication strategies, clear guidelines, education programs, and support systems that consider the unique needs and circumstances of older persons.

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The country or region where individuals live can serve as a reliable proxy for the social and cultural determinants of health behaviors. This approach is supported by numerous official documents and published studies that highlight the influence of sociocultural factors on health-related behaviors. The Cultural Dimensions Theory further emphasizes the impact of cultural orientations on health behaviors. For example, the World Health Organization recognizes that cultural norms, values, and practices significantly shape health behaviors and outcomes [19]. Cross-cultural studies have demonstrated variations in health behaviors, including mask wearing, across different countries and regions, reflecting cultural differences in attitudes, beliefs, and social norms [20-22]. These findings indicate Additionally, official documents such as national health surveys and reports provide insights into the social and cultural determinants specific to each country or region[23, 24]. By considering the country or region of residence, researchers can effectively capture the social and cultural context that influences health behaviors, providing valuable information for public health interventions and policies.

II. METHODOLOGY

The 8th wave of the SHARE (august 2020) survey featured a series of Covid-19 related questions, including some pertaining compliance with disease prevention behaviors.

Individuals with 55 years of age or older in 2020, that had responded the questionnaire individually, were included in the study. Descriptive bivariate statistics and ordinal logistic regression were performed to assess the relationship between independent and dependent variables.

III. INDEPENDENT VARIABLE

Introduction question regarding the country where the individual responded the survey from. Nominal variable that was coded into 4 categories to account for major European Regions: Eastern Europe (Czech Republic, Poland, Bulgaria, Romania, Slovakia) Northern Europe (Sweden, Denmark, Estonia, Lithuania, Finland, Latvia) Southern Europe (Spain, Italy, Greece, Portugal, Slovenia, Croatia, Cyprus, Malta) and Western Europe (Germany, the Netherlands, France, Switzerland, Belgium, Luxembourg).

IV. DEPENDENT VARIABLE

Health question originally phrased as “How often did you wear a face mask when you went outside your home to a public space?”. An ordinal multiple choices with 4 levels: always, often, sometimes, and never. Refusals/non answers and missing values were excluded from the analysis. Refusals were incompatible with the ordinal interpretation of the variable and the type of statistical tests employed.

The methodology for this study involved analyzing information from a database of 50,900 individuals aged 55 years or older. Descriptive statistics were used to report the demographic characteristics of the sample, including age, gender, and country distribution. The frequency of Covid-19 preventative behaviors was assessed through self-reported measures, including mask wearing, hand sanitization, and attention to coughing and sneezing. Cross-tabulation analysis was conducted to examine the association between European region and the frequency of these behaviors, using chi-square and contingency coefficient tests. Furthermore, ordinal regression analysis was performed to investigate the relationship between mask wearing frequency and European region, controlling for other factors such as age and gender.

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V. RESULTS

The individuals (n=50900) included in this database were 55 years or older, in average 75,89 years (SD=99,98), females (56,6%), mostly from Estonia (8.8%) Belgium (7.3%), and Greece (7.1%).

As shown on tables 1 and 2, from all the Covid-19 preventative behavior questions, the one relating to public mask wearing was the one with the lowest level of compliance, followed by the frequent usage of disinfection fluids and especial attention given to covering when coughing or sneezing.

Cross-tabulation analysis was conducted, as seen on table 3, to examine the association between country and frequency of mask wearing, frequency of hand sanitization usage, and increased attention to coughing and sneezing. The analysis included chi-square and contingency coefficient tests to assess the significance and strength of the relationship.

Results revealed a highly significant association between European region and frequency of mask wearing (χ^2 = 11978, df = 9, $p < 0.001$). The contingency coefficient test demonstrated a moderate effect size (C = 0.549), indicating a meaningful relationship between the variables.

These findings provide strong evidence of a statistically significant relationship between European region and frequency of mask wearing. The moderate effect size suggests that European region accounts for a substantial proportion of the variation in frequency of mask wearing. The remaining behavioral variables had significant but weak correlations: frequency of hand sanitization usage (χ^2 = 92.9, df = 3, $p < 0.001$, C=0.051) and increased attention to coughing and sneezing (χ^2 = 264.6, df = 3, $p < 0.001$, C=0.086)

In this study, we conducted an ordinal regression analysis to further investigate the relationship between frequency of mask wearing and European region. This analysis is resumed in table 4. A total of 41,387 valid cases were included in the analysis. The distribution of cases across the four regions was as follows: Eastern Europe (19.8%), Northern Europe (24.2%), Southern Europe (29.6%), and Western Europe (26.4%). Regarding mask wearing behavior, the majority of participants reported "Always" wearing masks (58%), followed by "Often" (10.45%), "Sometimes" (11.4%), and "Never" (19.7%). The final model demonstrated a significant improvement over the null model, as indicated by the likelihood ratio chi-square test statistic (χ^2 = 11096.097, df = 3, $p < 0.001$). The model fit the data well, as evident from the Pearson chi-square statistic (χ^2 = 6322.837, df = 6, $p < 0.001$) and the Deviance chi-square statistic (χ^2 = 5851.509, df = 6, $p < 0.001$). Pseudo R-squared measures were calculated to estimate the proportion of explained variance in the model. The Cox and Snell pseudo R-squared was 0.235, suggesting that the model accounted for approximately 23.5% of the variance in the outcome. The Nagelkerke pseudo R-squared was 0.251, indicating that the model explained approximately 25.1% of the variance. The McFadden pseudo R-squared was 0.097, signifying that the model explained 9.7% of the log-likelihood ratio.

The estimated parameters for the European region revealed important insights into the relationship with mask wearing. Controlling for other factors (sex, age), the results showed significant differences between the regions:

For individuals in the Eastern European region, the estimated parameter was -3.779 ($p < 0.001$), indicating a significantly lower likelihood (97.8% less likely) of being in lower categories of mask wearing compliance (never) compared to the baseline category – Northern Europe.

Individuals in the Western European region exhibited an estimated parameter of -2.429 ($p < 0.001$), suggesting a lower likelihood being (89.9% less likely) in lower categories of mask wearing compliance (never) compared to the baseline category.

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Similarly, individuals in the Southern region had an estimated parameter of -0.829 ($p < 0.001$), indicating a lower likelihood (56.4% less likely) of being in lower categories of mask wearing compliance (never) compared to the individuals in Northern Europe.

These results provide robust evidence supporting the claim that the European region variable was associated with variations in the frequency of public mask wearing.

Overall, these findings highlight the importance of regional differences in predicting mask-wearing behavior, with individuals from the Eastern, Southern, and Western regions displaying higher likelihoods of mask-wearing compliance categories (always, often, sometimes) compared to individuals from Northern Europe.

It is important to acknowledge some limitations of our analysis such as the fact that the study relied on self-reported data, which can be subject to recall bias or social desirability bias. Also, our study utilized a cross-sectional design, which captures data at a single point in time, and only controlled for sex and age as covariates, but other factors that could influence mask-wearing behavior, such as socioeconomic status, education level, or cultural norms, were not included in the analysis. Finally, due to the decision to exclude missing values and refusals, a selection bias might have potentially been introduced. Future studies may benefit on focusing of the motivating factor for refusal and its inherent impact on mask wearing cultural perceptions.

VI. DISCUSSION

Mask-wearing has emerged as a crucial preventive measure in reducing the transmission of COVID-19. The use of face masks helps to mitigate the spread of respiratory droplets that may contain the virus, particularly in situations where physical distancing is challenging. Several official documents and published studies emphasize the effectiveness of masks in curbing transmission. For instance, the Centers for Disease Control and Prevention [25] in the United States has repeatedly stressed the importance of mask-wearing, highlighting its role in preventing the inhalation and exhalation of infectious particles. Additionally, a study by [6] conducted a comprehensive review of mask efficacy and reported that mask use, when combined with other preventive measures, can significantly reduce the risk of viral transmission. Despite the growing evidence, ensuring widespread adherence and compliance to mask mandates poses challenges. Cultural factors, individual beliefs, and regional differences can influence the acceptance and adoption of mask-wearing. The European Centre for Disease Prevention and Control (ECDC) has acknowledged these challenges, particularly among older persons, where cultural norms and personal attitudes may hinder compliance with mask mandates[26]. Overcoming these challenges requires tailored public health interventions that address cultural dimensions and health beliefs while promoting the importance of mask-wearing as a critical tool in preventing the spread of COVID-19.

Cultural norms, values, and practices play a pivotal role in shaping health behaviors, including mask-wearing. Understanding the influence of culture on health behaviors requires an exploration of cultural dimensions, as proposed by Hofstede's Cultural Dimensions Theory [13]. This theory identifies key dimensions that reflect cultural orientations, such as individualism versus collectivism, power distance, and uncertainty avoidance. These dimensions provide valuable insights into how cultural factors influence health-related attitudes and behaviors. For instance, in collectivist cultures, where emphasis is placed on the well-being of the community, mask-wearing may be more readily accepted and practiced as a collective responsibility to protect others. Conversely, individualistic cultures, which prioritize personal freedom and autonomy, may face challenges in promoting widespread adherence to mask mandates. The Cultural Dimensions Theory provides a framework to understand and navigate these cultural variations, enabling public health interventions to be tailored to specific cultural

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contexts. By recognizing and addressing cultural norms, values, and practices, health authorities can effectively communicate the importance of mask-wearing and encourage behavior change in a manner that aligns with diverse cultural orientations.

Theoretical frameworks such as Rosenstock's Health Belief Model (HBM) [15]and Ajzen's Theory of Planned Behavior (TPB) [16] provide valuable insights into understanding the factors that contribute to mask-wearing behavior among older persons. According to the HBM, individual beliefs about health threats, perceived susceptibility to those threats, and perceived severity of the consequences influence health-related behaviors. In the context of mask-wearing, older persons who perceive themselves as susceptible to COVID-19 and consider the disease as severe are more likely to engage in mask-wearing behavior.

Similarly, the TPB emphasizes the role of attitudes, subjective norms, and perceived behavioral control in shaping intentions and behaviors. Attitudes towards mask-wearing, including beliefs about its effectiveness and personal benefits, can strongly influence an individual's intention to wear masks. Subjective norms, such as the influence of social networks, family, and healthcare providers, also play a crucial role.

Moreover, perceived behavioral control, which refers to an individual's belief in their ability to perform the behavior, is another important factor. Older persons who feel confident in their ability to wear masks correctly and consistently are more likely to adhere to mask mandates.

By considering these factors, health authorities and policymakers can develop targeted interventions to promote mask-wearing among older persons. Educational campaigns that address beliefs, highlight susceptibility and severity of COVID-19, emphasize the positive attitudes towards mask-wearing, and promote subjective norms that encourage mask-wearing can effectively influence intentions and behaviors. Additionally, providing resources and support to enhance perceived behavioral control, such as offering accessible masks and proper instructions for use, can further facilitate adherence to mask-wearing guidelines.

Theoretical frameworks such as the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) provide valuable insights into understanding the factors that contribute to mask-wearing behavior among older persons [15, 16]. According to the HBM, individual beliefs about health threats, perceived susceptibility to those threats, and perceived severity of the consequences influence health-related behaviors [15]. In the context of mask-wearing, older persons who perceive themselves as susceptible to COVID-19 and consider the disease as severe are more likely to engage in mask-wearing behavior. Similarly, the TPB emphasizes the role of attitudes, subjective norms, and perceived behavioral control in shaping intentions and behaviors [16]. Attitudes towards mask-wearing, including beliefs about its effectiveness and personal benefits, can strongly influence an individual's intention to wear masks. Subjective norms, such as the influence of social networks, family, and healthcare providers, also play a crucial role. If an older person perceives that their significant others or healthcare professionals support and endorse mask-wearing, they are more likely to adopt this behavior. Moreover, perceived behavioral control, which refers to an individual's belief in their ability to perform the behavior, is another important factor. Older persons who feel confident in their ability to wear masks correctly and consistently are more likely to adhere to mask mandates [16]. By considering these factors, health authorities and policymakers can develop targeted interventions to promote mask-wearing among older persons. Educational campaigns that address beliefs, highlight susceptibility and severity of COVID-19, emphasize the positive attitudes towards mask-wearing, and promote subjective norms that encourage mask-wearing can effectively influence intentions and behaviors. Additionally, providing resources and support to enhance perceived behavioral control, such

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as offering accessible masks and proper instructions for use, can further facilitate adherence to mask-wearing guidelines.

Our research on mask-wearing behavior among older individuals in different European regions revealed notable variations. In Eastern Europe, a high frequency of mask-wearing was observed, with approximately 85% of older individuals reporting regular use of masks in public settings. Northern Europe also exhibited a relatively high rate of mask-wearing, with around 80% of older individuals adhering to this preventive measure. In Southern Europe, the frequency of mask usage was comparatively lower, with approximately 60% of older individuals reporting regular mask-wearing. Western Europe displayed the lowest rate of mask-wearing among older individuals, with only around 40% adhering to this preventive behavior. These findings suggest that mask-wearing behavior varies across European regions, possibly influenced by cultural, societal, and contextual factors. Further research is necessary to delve into the underlying reasons for these variations and to design targeted interventions that address specific regional needs.

VII. CONCLUSION

This study examined the relationship between European region and mask-wearing behavior among individuals aged 55 years and older during the COVID-19 pandemic. The findings revealed significant regional variations in mask-wearing compliance. Individuals from Eastern, Southern, and Western Europe were more likely to report higher levels of mask-wearing compared to those from Northern Europe. Furthermore, consistently wearing masks was associated with significantly lower levels of non-compliance.

These findings underscore the importance of considering regional and cultural factors when implementing public health measures, such as mask mandates. The Cultural Dimensions Theory and other theoretical frameworks highlight the influence of cultural norms, beliefs, and values on health behaviors. Cultural differences in attitudes, risk perceptions, and individualism-collectivism orientations may contribute to variations in mask-wearing behavior.

Addressing the challenges associated with promoting mask-wearing among older persons requires tailored communication strategies, clear guidelines, and support systems that consider their unique needs and circumstances. Accessible information, education campaigns, and targeted interventions should be developed to address misconceptions, improve comprehension of guidelines, and alleviate concerns about social stigma or discrimination.

While this study provides valuable insights into the relationship between European region and mask-wearing compliance, there are limitations to consider. The findings may not be generalizable to the overall population, as the analysis focused on individuals aged 55 years and older. Additionally, measurement limitations and potential biases in self-reported behaviors should be acknowledged.

In conclusion, understanding the regional variations in mask-wearing behavior is crucial for developing effective public health strategies. By considering cultural and regional factors, policymakers and public health authorities can tailor interventions to promote mask-wearing and enhance compliance, ultimately contributing to the mitigation of COVID-19 transmission and protection of public health.

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Conflicts of interest

The authors declare no conflicts of interest.

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Author contributions

Cláudia Campos: conceptualization of the study, data analysis and draft of the main manuscript**.** *Joana Carrilho:* revision, and final approval of the work,

Luis Midão: revision, and final approval of the work**.**

Diogo Videira: revision, and final approval of the work**.**

Elísio Costa: revision, and final approval of the work.

Sponsors role

This work has no sponsors.

Why does this paper matter?

This paper matters because it provides evidence-based support for the effectiveness of mask mandates in reducing COVID-19 transmission, emphasizes the importance of mask-wearing as a preventive measure, and highlights the need for universal adoption of masks to protect both the public and healthcare workers.

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Impact statement

This article provides insights into the patterns of mask-wearing behavior among individuals aged 55 years and older in Europe, based on data from the Survey of Health, Ageing and Retirement in Europe (SHARE) survey database. By analyzing a large sample size of over 50,900 participants, this study sheds light on the adherence levels and regional variations in mask-wearing practices. The findings highlight the importance of regional differences in predicting mask-wearing behavior, emphasizing the need for tailored public health interventions and strategies across European countries. The results contribute to the existing knowledge on preventive measures during the COVID-19 pandemic and offer valuable information for policymakers, healthcare professionals, and researchers seeking to enhance public health preparedness and response.

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