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Disparities in health literacy during the COVID-19 pandemic between the hearing and deaf communities

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disease and the shortage of therapeutic options (Sohrabi et al., 2020), healthcare staff and facilities are confronting unforeseen human costs with more than three million recorded deaths (World Health Organization, 2020), notwithstanding the severe economic impacts (Nicola et al., 2020). Driving this burden is the highly infectious nature of the virus, which can result in a severe respiratory illness amongst other complications (Palacios Cruz et al., 2020). Public health measures, aimed at limiting the spread of the virus have been implemented in countries around the world according to local or national policies. These include temporary lockdowns, testing strategies, contact tracing and travel restrictions; all with a limited, but growing evidence base.

(Ioannidis, 2020). However, behind each of these policies is a universal stake on the population awareness of the disease burden, its symptoms and the individual measures to control its spread. As such, one of the most consistent measures cited as a long-term strategy regardless of economic and political capacity are education campaigns focusing on behavioural modifications such as social distancing, hand hygiene, the use of face-masks and self-isolation (Khadka et al., 2020). Countries are therefore advised to invest into these campaigns to ensure highly inclusive and far-reaching awareness (Lopes & McKay, 2020). Communication of these public health measures has been described as inconsistent and confusing in some cases. Studies from the United States, for example indicated a lack of essential knowledge among older adults and those with co-morbidities, whose behaviour remained resistant despite the apprehension and greater risk in these groups (Wolf et al., 2020; Yang et al., 2020). This is in parallel with the observation that vulnerability is also related to reduced “health literacy”, an umbrella term for the extent of access and comprehension of medical information, and the resultant capacity to make informed individual decisions towards better health (Paasche-Orlows et al., 2005; Wolf et al., 2005). In the context of COVID-19, public health education to ensure global recognition of transmission routes and symptoms is a vital step towards controlling the spread of the disease (Li et al., 2020). Hence, given the importance of health communication particularly during a rapidly developing pandemic (Wolf et al., 2020), insufficient awareness-promoting measures may not only endanger vulnerable people, but also the communities in which they live due to the contagious nature of the disease.

Due to a combination of intrinsic and societal barriers affecting the receipt and quality of healthcare (Barnett et al., 2011; Kuenburg et al., 2016), the Deaf or Hard of Hearing (DHH) are among the minorities potentially at risk from a reduced ability to protect themselves and their communities. Their reliance on a diverse array of visual, aural or gestural communication methods is unmet by the usual means of health information dissemination via mass media (Barnett, 1999; Tamaskar et al., 2000), which is often designed to serve the majority hearing population. Those who primarily use sign language for communication have inaccurate and inconsistent health knowledge (Margelllos-Anast et al., 2006; McKee et al., 2011; Smith et al., 2015; Zazove et al., 2009), and experience worse physical and mental health outcomes compared to hearing individuals (Barnett et al., 2011; Emond et al., 2015). DHH individuals who primarily communicate with spoken language were also observed to have a reduced vocabulary and literacy abilities (Almusawi, 2014, 2019; Zazove et al., 2013) which is thought to be strongly associated with their disadvantaged health outcomes (Margelllos-Anast et al., 2006; McKee et al., 2011). Poor literacy is also a determinant of increased hospital admissions and mortality among hearing people (Baker et al., 1998, 2007; DeWalt et al., 2004). An additional challenge in the context of this study is the diglossia of the Arabic language, where “high” societal functions including official health information are communicated predominantly using the literary form of Arabic, instead of the more familiar yet highly distinct dialects (Alherz et al., 2019).

This study aimed to explore and compare the levels of knowledge and practice among hearing and DHH communities surrounding COVID-19 and associated public health measures in Kuwait and Saudi Arabia. As of July 2021, these countries have been affected by more than 80,000 and 13,000 confirmed COVID-19 cases per million respectively (WHO, 2021). In addition to the primary aim, differences in the reliance on various information sources and awareness of health service availability are also examined.

2. Methods

2.1. Questionnaire

The questionnaire [Supplementary file] was adapted from a published survey (Wang et al., 2020) and included items on knowledge about COVID-19 in accordance with the official public health information available from the ministries of health in both Kuwait and Saudi Arabia. The items were either adopted or developed to accommodate the Arabic context. The first section of the questionnaire addressed the demographics of the participants, including their gender, age, country of residence, educational level, occupation and whether they have any hearing loss in addition to their degree of hearing loss and communication mode. The second section of the questionnaire addressed the participants’ knowledge about COVID-19 and included its main symptoms, incubation period, transmission modes, prevention and treatment strategies, and the factors which may contribute to severe illness. In addition, it addressed the participants’ behavioural measures towards the infection and included knowledge of precautionary practices taken by adults and children to prevent transmission such as the use of masks and social distancing. Extra questions were also added to the questionnaire to address other important aspects of the study such as the participants’ sources of knowledge about COVID-19, whether they believed themselves to be sufficiently informed, whether they felt more advice was needed and their views on the availability of medical services, if required. DHH participants were specifically directed to questions on their awareness of the services available to them in case of medical emergencies such as text enquiries and sign language interpreters, and whether they are able to understand and communicate with all sign language interpreters. There was a total of 35 statements within the three sections. To ensure the face validity and accuracy of adopted statements in the Arabic context, a process of translation and back translation was then revised by bilingual experts in the domain, as well as a crosscheck with the official information on COVID-19 provided by the Kuwaiti and Saudi ministries of health during the conception of the study. To ensure clarity of the questionnaire items, a small scale preliminary study was piloted among 8 hearing and 3 DHH individuals. Comments received from participants were incorporated into the final version. The final questionnaire was available for three months from March to June 2020. The questionnaire was introduced with the aims of the
study, and statements assuring the confidentiality and anonymity of responses. The reliability of the survey was 0.893, as assessed by Cronbach’s alpha. The participants’ knowledge score in the relevant section was calculated by coding one point for correct answers and zero points for incorrect and uncertain answers.

2.2. Participants

In order to maximize DHH responses, a snowball sampling technique was employed. DHH contacts were specifically targeted and encouraged to disseminate the questionnaire among the DHH community, as well as to hearing individuals. The electronic questionnaires were sent in Kuwait and Saudi Arabia via Email, Twitter and WhatsApp. Sign Language interpretation was offered to participants, if needed, but this was not taken up. The majority of participants were female (66.4%) from Kuwait (63.6%) and aged under 30 (55.6%). Further, DHH participants constituted 36.36% of the sample (N = 40). Table 1 shows additional details of the obtained demographic variables.

2.3. Data analysis

Data analysis was performed using Minitab 19 (Minitab LLC, PA USA). Descriptive statistics shown in Table 1 for the 110 respondents employ the frequency and percentage of participants. In addition, a multivariate linear regression analysis was carried out to assess the relationship of age, country, educational attainment, occupation, hearing impairment and mode of communication with the total knowledge score as the dependent variable. The regression assumptions of linearity, homoscedasticity and independence, as well as the presence of outliers were assessed using plots of the residual errors. The Kolmogorov-Smirnov and Shapiro-Wilk tests confirmed normality (P > 0.05). In addition, the assumption of lack of multicollinearity was verified using the Variance Inflation Factor (VIF), which was below 5 for all predictors. The regression model (Table 2) yielded an R² value of 0.2125 and a P-value for the overall regression as 0.0109, hence significantly explaining approximately 21% of the overall variance. Individual P-values for each of the predictors along with the 95% Confidence Intervals (95% CI) are reported in Table 2. A P-value of less than 0.05 was considered to be statistically significant.

3. Results

3.1. Predictors of total knowledge score on COVID-19

Out of the independent variables of age, country, educational attainment, occupation, hearing impairment, and communication mode, only the latter two were significant predictors of the total score (Table 2). Those with a moderate, severe or profound hearing
imPAIRMENT (P = 0.0349), as well as exclusive sign language users (P = 0.0188) were at a disadvantage in the total score. A moderate or worse hearing loss status incurred an average reduction of -4.669 points in the total knowledge score, keeping all other variables constant. Similarly, exclusive sign language users scored -7.570 points lower on average, keeping all else constant.

### 3.2. A comparison of DHH and hearing responses on COVID-19 knowledge

In a more detailed comparison of DHH participants’ performance on COVID-19 awareness in each item, they were shown to score less than their hearing counterparts in 15 out of the 19 items (Table 3). The lowest percentage of correct responses for both groups of participants was concerning the necessity of precautions even in the younger population, where only 4.29 % of the hearing group and 12.5 % of the DHH group answered correctly. In each of the other 18 items, the majority of respondents in both groups answered correctly, except on the routine use of antibiotics to treat COVID-19, where only 30 % of DHH and 42.9 % of hearing participants gave correct answers.

### Table 3
Correct responses on COVID-19 according to hearing status.

| Question                                                      | Deaf (N = 40) | Hearing (N = 70) |
|---------------------------------------------------------------|---------------|------------------|
| Q1 Common symptoms of COVID-19                               | 33            | 59               | 84.29 |
| Q2 Differences from the common cold                          | 15            | 41               | 58.57 |
| Q3 The current lack of curative treatments                   | 30            | 61               | 87.14 |
| Q4 Risk of complications with old age and comorbidities      | 25            | 51               | 72.86 |
| Q5 The potential for asymptomatic transmission               | 30            | 61               | 87.14 |
| Q6 The existence of an incubation period                     | 33            | 63               | 90.00 |
| Q7 Respiratory mode of transmission                          | 36            | 59               | 84.29 |
| Q8 Surface contamination                                     | 23            | 59               | 84.29 |
| Q9 Pneumonia as a complication                               | 34            | 61               | 87.14 |
| Q10 Isolation of cases                                       | 38            | 70               | 100   |
| Q11 Isolation of contacts                                    | 39            | 70               | 100   |
| Q12 Handwashing                                              | 39            | 70               | 100   |
| Q13 Social distancing                                       | 38            | 70               | 100   |
| Q14 Covering mouth while sneezing/cough                      | 37            | 69               | 98.57 |
| Q15 Facemask use                                             | 37            | 57               | 81.43 |
| Q16 Necessity of precautions in younger populations           | 5             | 3                | 4.29  |
| Q17 Avoidance of touching eyes                               | 35            | 60               | 85.71 |
| Q18 Gatherings if attendees have no symptoms of illness       | 33            | 67               | 95.71 |
| Q19 The routine use of antibiotics to treat COVID-19          | 12            | 30               | 42.86 |
3.3. Sources and satisfaction with information and services during the COVID-19 pandemic

A further group of questions were asked in order to gain an understanding of the potential disparities between the DHH and hearing groups regarding health information sources, awareness and satisfaction (Table 4). The mostly frequently cited source of information among the hearing group was official government websites (84%), while social media was the predominant source among the DHH group (65%). Only 25% of DHH participants relied on sign language interpreters on television. Only a minority of 12.9% of hearing and 10% of DHH participants did not think that they received sufficient information on COVID-19. When asked whether they need more infection prevention advice, approximately half of both groups (52.9% of hearing and 47.5% of DHH) felt that they did not. Only 30% of DHH participants were aware of the availability of medical advice services during quarantine periods, compared to 40% of hearing participants. Responses specific to the DHH group indicated that 15% are aware of written inquiry services. Only 45% were able to understand and communicate with all sign language interpreters available to them in their experience, and 37.5% require sign language interpreters in medical emergencies but only 20% have an interpreter available in these scenarios.

4. Discussion

In addition to the general obstacles faced by DHH individuals in everyday life, specific to the pandemic are the issues of attenuated acoustic transmission and the inability to lip read due to the use of face masks by healthcare staff, as reported by deaf patients in Italy (Trecca et al., 2020). The reliance on visual mechanisms for information access (McKee et al., 2015), when obstructed by face masks, results in reduced understanding and discomfort in listening when wearing hearing aids and devices (Brooks, 2020; Trecca et al., 2020). For example, a diagnosis of COVID-19 can be particularly frightening for those with hearing loss who communicate via oral language, due to uncertainties in communication quality and outcome (West et al., 2020). While those with mild hearing loss were not found to be at a disadvantage according to this study, a moderate, severe or profound hearing impairment was associated with reduced knowledge scores, supporting the degree of impairment as a discriminatory factor. In addition, it is reported that sign language users are faced with up to 15 novel signs for the virus, including unscientific variants invoking fears of an animal’s bite for instance (Castro et al., 2020). The results presented here, showing that sign language users had poorer knowledge about COVID-19 and associated public health measures is further indication of the importance of providing information in sign language. The use of written communication in the majority language does not reliably compensate as it is invariably considered the second language of deaf individuals (Castro et al., 2020).

In the diglossic context of this study, official written communication in the “high” form of the language is another key challenge for DHH Arabs who are exposed to a continuum of linguistic varieties characterising Arabic-speaking countries (Al-Qenaie, 2011) including Kuwait and Saudi Arabia. Of note, regression analysis has confirmed that whilst participants were recruited from these two different countries, this did not explain any of the variance ($P = 0.1537$), with all else kept constant The prestigious forms of classical and standard Arabic, as means for religious and formal communication respectively, are both substantially distinct from the “low”
spoken dialects of daily interaction (Holes, 1995). The dialects take distinctive forms according to the diverse geographical regions or the user’s community affiliation, and are sometimes not mutually intelligible (Ferguson, 1959). The linguistic distance or gap between these forms of Arabic is known to disadvantage both hearing or deaf, early or advanced language users in their literacy skills (Almusawi, 2014, 2019). The impact of these barriers may be readily seen through the reduced literacy skills as well as the high drop-out and repetition rates among Arab learners, which are incongruous with the relative wealth of these nations (Ayari, 1996; Maamouri, 1998). By extension, these outcomes may also be associated with reduced health literacy (Margellos-Anast et al., 2006; McKee et al., 2011).

Exposure to these linguistic and cultural complexities may cause difficulties with the expressive and receptive abilities of orally communicating DHH individuals. On the other hand, deaf Arab signers might be entirely inattentive to the spoken dialectic varieties due to their scarce written presence (Abdel-Fattah, 2005). However, with the advent of social media and the use of unstandardised dialectic writing online, the reverse is also currently feasible, which is perhaps reflected by the greater reliance on social media for health information among DHH individuals in this study. Furthermore, Arabic sign languages are as numerous as the spoken dialects, and are also not mutually comprehensible, even within the local communities (Abdel-Fattah, 2005). The lack of a widely used and standardised sign language within the Arab states (Al-Fityani & Padden, 2010) may limit any gains in general knowledge and health literacy to local rather than regional sources of information.

Additional systemic barriers include the insufficient numbers of formally certified and qualified sign language interpreters. According to the Saudi Sign Language Association (2019), there are 103 sign translators, while there are only 7 specialists in the State of Kuwait (Alqabas, 2016). This is inadequate for fulfilling even the regular needs of sign language users, regardless of the urgent needs during pandemics or other disasters. The shortage of sign language interpretation training in Saudi (Alasim, 2020) and Kuwaiti (Almusawi et al., 2019) universities has led to self-directed learning efforts in an attempt to satisfy the societal demands for these vocations.

Beyond these linguistic, cultural and educational barriers that may prevent DHH individuals from accessing health information, their social concerns may also be amplified by aspects of the pandemic. The discriminatory hurdles in carrying out daily activities (Dobie & Hemel, 2004) along with the social and emotional isolation which sometimes co-occur with deafness (Grote & Izagaren, 2020), may be further compounded by lockdown and social distancing measures (Trecca et al., 2020), resulting in greater physical and mental consequences (Hwang et al., 2020). DHH individuals also have limited representation in mass media including television and social media, which is known for its impact on framing public issues and health policies that promote equity (Hawkins & Linvill, 2010).

This study was limited by the relatively small sample size due to the difficulty in reaching a large number of DHH participants. This was partly due to the closure of a number of schools and organisations for the DHH due to the lockdowns. The chosen snowball sampling method of actively recruiting participants and encouraging further dissemination was designed to maximise responses with limited resources, but results in a sampling bias of undetermined significance. This may in future be avoided with a large pool of participants facilitated by a multinational collaborative involving DHH groups in which sampling can be effectively randomized.

5. Conclusions

The data in this study shed light on the gap in the level of essential health knowledge in the COVID-19 pandemic among the DHH minority group who are thereby potentially at a greater risk from the spread of infectious disease. The development of strategies and technologies for healthcare systems with the intention of providing DHH individuals with accurate and accessible information must be established internationally (West et al., 2020), including increasing sign language training and support in the local context of this study. Further research is needed to determine how best to produce and deliver healthcare information that is accessible to DHH individuals. This should specifically take into account regional linguistic varieties, and different modes of disseminating information such as written information and QR codes linking to online videos in sign language. There is also a need for transparent masks to enable access to facial features for lipreading and non-manual features of sign language, as well as normalization of the presence of interpreters at government briefings.

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Hashemiah Almusawi: Conceptualization, Methodology, Investigation, Writing - original draft, Supervision, Validation. Khalid Alasim: Software, Project administration. Sumaya BinAli: Resources, Visualization. Mohammad Alherz: Formal analysis, Data curation, Writing - review & editing.

Declaration of Competing Interest

The authors report no declarations of interest.
