

A Comparison of the Public's use of PPE and Strategies to avoid Contagion during *COVID-19* Pandemic in Australia and Germany

Abstract

The *SARS-CoV-2* pandemic has raised public awareness around disease protection. The aims in this study were to recruit participants from Australia and Germany to determine their use of personal protective equipment and *COVID-19* avoidance strategies using scales designed for this study. Principal Components Analyses with the Australian data revealed two Protection from Infection factors: Self-Care and Protective Behaviours and one Infection Avoidance factor, each demonstrated strong internal reliability. Data from German participants were used to confirm the scales' structure using confirmatory factor analysis. A comparison of the two data sets data revealed that Australian participants scored higher overall on protection and avoidance strategies but at the item level there were several commonalities. Commonalities evident at the micro level included self-care behaviours people adopted to avoid contracting *COVID-19*. With no foreseeable end to this pandemic, it is important follow-up studies ascertain whether the public continues to adopt high levels of PPE and follows government advice or if pandemic fatigue sets in.

Keywords *SARS-CoV-2*; *COVID-19*; Public; PPE; pandemic; avoidance.

Key points

- Two scales were validated: 1) Protection from Infection Scale and 2) Infection Avoidance Scale in relation to COVID-19
- People from two different continents reflected high levels of adherence to adoption of Infection protection and avoidance strategies
- Monitoring public adherence to these strategies over time is important in light of potential “pandemic fatigue”

A Comparison of the Public's use of PPE and Strategies to avoid Contagion during *COVID-19* Pandemic in Australia and Germany

The severe acute respiratory syndrome coronavirus 2 (*SARS-CoV-2*) or *COVID-19* pandemic, to which some 150 million cases and over 3 million deaths were attributed at the end of April 2021 (Dong, Du, & Gardner, 2021) is challenging health care systems worldwide. Health care workers dealing with patients with *COVID-19* are protected from infection to some extent by their use personal protective equipment (PPE) as outlined in transmission based precautions, used in addition to the Standard Precautions Guidelines (SP) (Siegel, Rhinehart, Jackson, & Chiarello, 2007). Although past adherence rates have often been described as suboptimal for SP (Oh & Choi, 2019), the virulence and spread of the *COVID-19* pandemic has resulted in significant consciousness raising around the need for PPE use. National and international guidelines have also emphasised the essential need for health care workers to universally adopt PPE (Centers for Disease Control and prevention, 2020) as they 'may be in contact with patients and colleagues who have atypical, few, or no symptoms of *SAR-CoV-2* while still being highly contagious' (Bielicki et al., 2020) (p. 2). But what of the general public and the strategies they adopt to avoid infection or community transmissions of the disease which can also reduce the burden on health services?

Governments across the world have introduced community management strategies with the broad aim to slow or stop the community spread of the disease and prevent health services being overwhelmed by cases of *COVID-19*. The range of strategies implemented is multipronged and governments have relied on voluntary strategies as well as legally enforceable ones. These strategies include personal measures such as the requirement that people wear some personal protection, such as face masks when in public places, they voluntarily self-isolate if feeling sick or awaiting *COVID-19* test results, use cough etiquette,

and increased hand hygiene using soap and water or alcohol hand rubs (Department of Health and Human Services, 2020). In addition, community strategies include social distancing, such as mandating the physical distance between people, restricting the number of people allowed per square metre in public places such as shops and public transport, and cancelling large gatherings (Seale et al., 2020). Often these measures are supplemented by increased environmental disinfection. In many countries, these measures have also been accompanied by government enforced lockdowns, where citizens' individual freedom of movement was curtailed to prevent the spread of *COVID-19* (Bo et al., 2021).

For the general public, the use of PPE is largely a new concept and there have been conflicting messages across the course of the pandemic about their use. While hand washing or sanitising, social distancing, and social isolation are among the government mandated criteria to be followed by the public, the WHO originally did not recommend the use of face masks for community, based on what they argued was a lack of evidence that face masks prevent the transmission of respiratory viruses (Cheng, Lam, & Leung, 2020; Stone, Kunaviktikul, Omura, & Petrini, 2020). This failure to recommend the public's use of masks was despite the inclusion of cough etiquette in Standard Precautions since the 2002-2003 *SARS-CoV-1* epidemic (World Health Organization, 2006). At that time, it was clearly recognised that there are benefits to covering the mouth to prevent droplet transmission: one of the main routes of transmission of *COVID-19* (Rabi, Al Zoubi, Kasasbeh, Salameh, & Al-Nasser, 2020). This recommendation has since been amended to include the use of masks (World Health Organization, 2020).

Alongside physical measures to avoid infection, healthy diet and regular exercise, are advocated to boost immune function, for example, by lowering chronic low-grade inflammation (Gleeson et al., 2011; Nieman & Wentz, 2019). These measures are regularly promoted in popular media and websites to the general public as having a protective effect against infections (Paul & Dredze, 2014). Many of the public have also adopted the use of

gloves as a self-protection tool (European Centre for Disease Prevention and Control, 2020), although Yadav, Shah, Shah, and Yadav (2020) reported that glove use increases the risk of cross-transmission if proper technique and precautions are not followed. Faced with such conflicting information on how best to be protected and avoid contracting *COVID-19*, and in view of the fact that the general public might not be fully educated on PPE use, it is important to ascertain what actions people are taking to avoid exposure to *COVID-19*.

In order to explore the strategies adopted by the public, we established a collaboration to consider samples from two countries, Australia and Germany. Although the profile of the pandemic in Australia and Germany has been slightly different, there are some commonalities demonstrated in their approach to guidelines provided to the public and other initiatives. The first cases of *COVID-19* were reported late January in both Germany (27th) and Australia (25th). Both countries quickly introduced public health messages around the need for social distancing, limited public gatherings and work from home while emphasising the necessity for hand hygiene. Germany quickly required travellers originating from high risk areas (i.e., China and Italy) to provide information about possible exposure and on March 18th Germany acted to prevent non-EU citizens from entering Germany and implemented a 14-day quarantine for anybody entering the country from April 10th regardless of country of origin (German Federal Ministry of Health, 2020). Conversely, Australia blocked arrivals from China as early as 2nd February and required mandatory hotel quarantine for all international arrivals from the 28th March (Karp & Murphy, 2020). Both countries also implemented contact tracing and testing strategies early in the outbreak.

The aims in this study were to investigate the strategies people in Australia and Germany use to protect themselves from contracting *COVID-19* as well as situations they avoid to reduce their risk of contagion. These data will provide insight into the current strategies adopted by the public and provide a basis for informing future advice and determining whether pandemic fatigue occurs over time in the adoption of these strategies

(MacIntyre et al., 2021). In order to determine these strategies, we wrote items targeted at avoidance and protective strategies most likely to be employed by people at this time.

Data collected during late April, early May 2020 in Germany and in Australia, when the populations of both countries were in social lockdown, will be collated and compared to determine the strategies used by people in these two countries.

Method

Design

This was a cross-sectional online study of convenience samples to assess the strategies used by the public to protect themselves from, and avoid exposure to, *COVID-19*.

Participants

Data were obtained as part of a larger study from participants in Australia and in Germany. Australian data were collected from 213 respondents (147 females) whose mean age was $M = 37.82$ years ($SD = 13.24$). The German sample comprised 424 respondents (320 females) whose mean age was 37.25 years ($SD = 10.88$).

Scale Development

A review of the literature identified common behaviours around infection prevention which were used as a basis to generate questions for this study. These questions focus on strategies people use to actively protect themselves and situations they avoid, in order to reduce the possibility of contracting *COVID-19*. Initially written in English, the questions were then submitted to a forward/backward translation following the recommendations of Beaton, et al. (2000). The first step was the translation of the English version of the scales into German by an academic fluent in both languages. A second academic fluent in both German and English subsequently back translated the scales. The two professionals then discussed and evaluated any discrepancies and produced the final version of the scales in German.

Procedure

Ethical approval was granted by Federation University Australia's Human Ethics Committee (#B20-23), following this the study was uploaded in English to Qualtrics.com and in German to Soscisurvey.de. after an extensive process of translation and back translation by two academics fluent in both German and English. Advertisements were posted on social media in English and German respectively, inviting residents to participant in an online study on the factors influencing behaviour around *COVID-19*. The Plain Language Statement on the opening page of each survey advised readers that participation was voluntary, their data anonymous, and submission of the completed questionnaire would be deemed to be their informed consent. No incentives were offered for participation.

Materials

The Protection from Infection Scale (PIS) has nine items (e.g., To protect myself from coronavirus I ... wash my hands, eat a balanced diet; use hand sanitiser). Items are rated on a 5-pt Likert scale from 1 = *Not at all* to 5 = *Always*.

The Infection Avoidance Scale (IAS) has 10 items (e.g., To avoid getting coronavirus, I have not or avoid ... travel to infected areas; large gatherings of people; touching my face). Items are rated on a 5-pt Likert scale from 1 = *Not at all* to 5 = *Always*.

In addition, participants were asked to provide demographic data on their age, gender, marital and educational status.

Analyses

An Exploratory Factor Analysis of the scales developed for this study will be conducted on the Australian data, and a Confirmatory Factor Analyses conducted on the German data. Cronbach's Alpha will be used to determine scale reliabilities and Independent t-tests, with a Bonferroni Correction Factor, to compare scale scores by country.

Results

The data were exported to SPSS for analyses. Fifty-six percent of the 213 people in the Australian sample were married/cohabitating, 34% were single, and 10% reported they were

separated or divorced. The majority of respondents were University educated (87%) or had completed high school or an apprenticeship (13%). Of the 424 German respondents, the majority were married or cohabitating with a partner (70.3%), 25.6% were single, 10% reported they were widowed, and 4% of participants failed to answer this question. The majority of German respondents (65.4%) had completed or were undertaking a University degree, 7.2% reported they held a post graduate degree, 8.4% reported they had completed Middle School, and 19% had completed or were undertaking an apprenticeship. **In order to confirm the adequacy of the samples, an a priori test with power of .8 and alpha $p < .05$, with $N1/N2 = 1$ yielded a recommended sample size of 64 in each group ((G*Power) V 3.1.9.7). Our actual samples sizes exceeded this recommendation at 213 and 424, respectively.**

The data were screened for missing data and normality. Eleven Australian and 10 German participants failed to complete the majority of items and were removed from subsequent analyses. Across the other participants there was less than 1% missing data distributed randomly and item-mean substitutions were used by country. Usable data were available from 414 German participants and 202 Australian participants.

Factor analyses

Principal Components Analyses were conducted on the Protection from Infection Scale (PIS) and the Infection Avoidance Scale (IAS) using the Australian data. The Kaiser-Meyer-Olkin statistic and Bartlett's Test of Sphericity both indicated the factorability of the data in each scale.

The Protection from Infection Scale (PIS) revealed two independent factors, labelled Self-Care and Protective Behaviours ($r = .09$), which together explained 42.77% of the variance. Internal reliabilities are strong (Cronbach's $\alpha = .79$ and $.84$, respectively).

Insert Table 1 about here

The Infection Avoidance Scale (IAS) was unifactorial explaining 51.62% of the variance. Internal reliability is strong (Cronbach's $\alpha = .88$).

Insert Table 2 about here

Confirmatory Factor Analyses (CFA)

The German data were used to conduct CFA on the two scales: PIS and IAS. Support for the structure of both scales was confirmed with these data. While the modifications indices suggested intra-correlations between scale items which would improve the fit, these modifications were not adopted in order to maintain the parsimony of the scales. All items on the PIS loaded significantly onto their respective latent factor, and the two factors were again independent ($r = .12$). The fit of the data for the PIS was satisfactory ($\chi^2 (26) = 75.21, p < .001$, $c/min = 2.89$, $CFI = .89$, $RMSEA = .07$, and $p/close p = .047$). Each item on the Infection Avoidance Scale (IAS) loaded significantly onto the latent factor and the fit of the data to the model was satisfactory ($\chi^2 (35) = 250.91, p < .001$, $c/min = 7.11$, $CFI = .90$, $RMSEA = .09$, $p/close = .05$).

Comparisons by Country

Independent t-tests using a Bonferroni Correction Factor ($p = .017$ at 5% level) were used to compare the total scores on the Self-Care and Protective Behaviours factors of the Protection from Infection Scale, and the Infection Avoidance Scale by country (Table 3). The Australian sample scored statistically higher on all three scales than the German sample. The effect sizes for unequal groups using Hedges' g were moderate to large. We then drilled down to explore differences by country on participants' ratings of individual items using a series of independent t-tests.

Insert Table 3 about here

We used Microsoft Excel to graph the item means for each scale by country and have indicated those which were significantly different. On the Protection from Infection Scale (PIS), there was no difference by country on the Self-Care items (i.e., eating well, exercising, and getting adequate sleep) that participants used to protect themselves from *COVID-19*. In terms of the Protective Behaviours factor, the Australian sample reported significantly higher

scores on the use of hand sanitiser, taking vitamins and following government advice around *COVID-19*, while the German participants reported using hand washing more to protect themselves and also reported wearing masks more when outside the home. There was no difference on the wearing of gloves outside the home (Figure 1).

Insert Figure 1 about here

The items on the Infection Avoidance Scale (IAS) revealed no differences by country on participants avoiding using public transport, large groups, and restaurants and cafés. The German sample avoided touching their face, shaking hands and hugging others more than the Australian sample but the Australian sample indicated they avoided travel, leaving the house, people who sneeze or cough, and going out except for work or schooling.

Insert Figure 2 about here

Discussion

The aim in this study was to investigate the protective measures the general public use and the situations they avoid to reduce their risk of contracting *COVID-19* across Australian and German samples. In order to assess these strategies, we developed domain specific measures targeting government recommendations at this time and components of PPE used by health professionals.

Principal components analyses using the Australian data revealed that the Protection from Infection Scale yielded two independent factors: Self-care and Protective Behaviours; while the Infection Avoidance Scale was unifactorial. Internal reliability was strong for all factors. The factor structure of both scales was confirmed in the German data using confirmatory factor analyses.

A comparison of the Australian and German data revealed that globally the Australian participants scored higher overall on strategies to protect themselves from infection, both self-care and protective behaviours, and on infection avoidance initiatives. We drilled down to the individual items, aside from some differences, we found several areas of commonality.

On the Protection from Infection Scale, participants from both countries reported adopting similar levels of self-care that is, exercising regularly, eating a balanced diet, and ensuring they get enough sleep. While these behaviours might form part of people's normal routine, and do not specifically protect people from *COVID-19*, these self-care behaviours do contribute to overall physical well-being which is especially important during this pandemic and period of social isolation (Leigh-Hunt et al., 2017). In contrast, Mutz and Gerke (2021) found that 60% of their German sample were sedentary during *COVID-19*. In terms of the Protective Behaviours factor, there was no difference by country on wearing gloves outside the house although scores on this item were low overall. A low score is not unexpected as, unlike health professionals in their workplace, this was not a government mandated requirement for the general public and it has been shown to increase the risk of cross transmission when used outside of healthcare settings (Yadav et al., 2020). More German participants reported wearing masks outside the home than did Australians although it is also important to note that during data collection, the use of masks became compulsory in Germany on 22nd April (Mitze, Kosfeld, Rode, & Wälde, 2020) when using public transport and while shopping. There was no such requirement in Australia at the time these data were collected. Australians scored higher on taking vitamin supplements and using hand sanitisers while German participants scored higher on hand washing. It is suggested that there is a balance between participants' hand washing and use of hand sanitisers so that both groups are equally conscious of the need for hand cleansing. It is also relevant to note that scores on hand washing were high, demonstrating close to a ceiling effect. The final item relates to following government recommendations and while the Australian sample score higher than the German group, both samples reported high scores. It is important to note that the magnitude of any differences was not large.

The items from the Infection Avoidance Scale revealed that both samples avoided public transport, restaurants and cafés, and large groups, typically areas of possible contagion

as recommended by governments. The German sample reported higher scores on avoiding shaking hands, hugging, and touching their face: the Australian sample scored higher on avoiding travel, avoiding leaving the house either generally or unless for work and school, as well as avoiding people who sneeze or cough. Again, the magnitude of any differences was not large.

Despite the good psychometric properties of the scales developed for this study and the apparently high level of strategies both groups reported in order to protect themselves and avoid possible infection, it must be noted that participants were recruited via social media and completed the survey online. As such there is always the possibility of selection bias. Furthermore, participants in both countries were highly educated and overrepresented by females.

Implications

The ability of health care workers and governments to understand the general public's adoption of masks, PPE more generally and disease avoidance strategies is essential. Monitoring this information will enable policy makers to determine any "pandemic fatigue" (MacIntyre et al., 2021) among the public which might lead to a decline in the use of disease avoidance strategies over time. These data can also enable government and health workers to target advice to the general public to ensure the use of disease avoidance strategies is sustained. Such advice could complement the role-modelling provided by health workers and ensure that the public continue to employ disease avoidance strategies and reduce the spread of *COVID-19*.

Conclusion

In conclusion, the construct validity and internal reliability of the scales we devised for this study were satisfactory. While Australians reported higher protective and avoidance strategies than Germans overall, when examined at the micro level, there were many commonalities including use of self-care behaviours to protect themselves from contracting

COVID-19; wearing gloves although not mandated, and avoiding public places (transport, restaurants and cafés, large groups). While there were differences on several items it is important that the magnitude of these differences was small. It is particularly encouraging that people from two different continents faced with a pandemic common to both were largely adherent to the use of relevant PPE and moreover, followed their respective government's advice around strategies to reduce the transmission of *COVID-19*. As there is currently no foreseeable end to this pandemic, particularly in parts of Europe, the Americas, Asia and Africa, community efforts to reduce the transmission remain imperative. It will be important to ascertain in follow-up studies whether people continue to adopt protection and avoidance strategies and follow government advice.

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