HEALTH PSYCHOLOGY BULLETIN

EDITORIAL HISTORY

Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home During COVID-19

Katie Burford, Erin Dooley, Kevin Lanza and Gregory Knell

This document contains the editorial history, organized into three sections. This first section, section 0, provides background information about the paper and the review procedure. Section 1 is organized chronologically and contains the editorial communication and peer review history. Section 2 contains the successive preprints and is organized anti-chronologically.

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Senior editor:	Robbert Sanderman
Peer reviewer A:	Astin Sokang
Peer reviewer B:	Lucy Porter

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Burford, K., Dooley, E., Lanza, K., & Knell, G. (authors); Sokang, A. & Porter, L. (reviewers); Crutzen, R., & Sanderman, R. (editors) (2020) Editorial history for 'Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home During COVID-19'. *Health Psychology Bulletin*, 4(1). DOI: <https://doi.org/10.5334/hpb.24.pr3>

Paper abstract

Background: Few data exist on the characteristics of U.S. adults' compliance with movement restrictions (i.e., "stay-at-home" orders) and protective health behaviors during the COVID-19 pandemic.

Purpose: To evaluate the associations of individual- and area-level characteristics (urbanicity) with reasons for leaving home and subsequent protective health behaviors during the COVID-19 pandemic.

Methods: A convenience sample of U.S. adults ($N = 2,441$) completed a 15-minute self-report online questionnaire. Exclusion criteria included: 1) missing ZIP; 2) currently sick with COVID-19; 3) difficulty with errands; and 4) "essential service" employment. Multivariable logistic regression models estimated the odds of citing reasons for leaving home and protective health behaviors by levels of urbanicity and sociodemographic factors. Data collection and analyses were conducted between April and June 2020.

Results: The analytic sample ($n = 1,374$) was primarily Non-Hispanic white (79%), female (72%), urban residents (43%), and college degree or higher (85%). Rural residents (versus urban residents) had lower odds of wearing a mask ($OR = 0.60$, 95%CI:0.43–0.83). Women (versus men) had lower odds of leaving the home for shopping (grocery: $OR = 0.51$, 95%CI:0.31–0.80; essential: $OR = 0.68$, 95%CI:0.52–0.88), and higher odds of social distancing ($OR = 2.34$, 95%CI:1.12–4.85) and wearing a mask ($OR = 1.58$, 95%CI:1.20–2.08). Older adults [≥ 50 years) versus younger adults (18–34 years)], had higher odds of leaving home for grocery shopping ($OR = 2.07$, 95%CI:1.25–3.48) and higher odds of wearing a mask ($OR = 2.02$, 95%CI:1.42–2.91).

Conclusions: The differences for leaving home and protective health behaviors by age, sex, and urbanicity can be useful for future health promotion strategies to encourage best practices that limit the spread of COVID-19.

Background

This peer review history is published under Health Psychology Bulletin's peer review policy. Peer review at Health Psychology Bulletin (HPB) is blind, but upon acceptance of an article, the entire peer review history is made public. This policy has two aims. First, it makes the reviews citable, rewarding reviewers for their reviews, incentivizing thorough, thoughtful reviews, and stimulating constructive, considerate reviews and responses. Second, to yield the best of both worlds in terms of design of the review procedure. The common procedure of shielding authors' and peer reviewers' identities aims to prevent undue harshness or leniency. However, this anonymity also protects reviewers who make unreasonable requests or statements that are inconsistent with the literature, and authors who refuse to respond adequately to reviewers' requests. These risks are ameliorated by unblinding and publishing the peer review procedure upon paper acceptance.

Health Psychology Bulletin

Health Psychology Bulletin (HPB) is an official journal of the European Health Psychology Society (EHPS). It implements a number of innovative practices such as this peer review procedure, a strong full disclosure policy, a two-tiered review procedure, and explicitly welcoming null findings, replications, and reports of lessons learned such as failed manipulations or measurement instruments, as well as regular articles.

Section 1: editorial correspondence

This section is comprised of the editor-author correspondence followed by the review reports in chronological order.

August 14, 2020

Dr. Diana Tăut, Dr. Gjalte-Jorn Peters & Dr. Rik Crutzen
Editors-in-Chief
Healthy Psychology Bulletin

Dear Dr. Tăut, Dr. Peters, & Dr. Crutzen,

Please find enclosed our submission to Health Psychology Bulletin entitled “Associations of Urbanicity and Sociodemographic Characteristics with Reasons for Leaving the Home and Protective Health Behaviors during COVID-19”.

This work was collected as part of a larger health behaviors survey through the University of Texas Health Science Center at Houston (UTHealth) School of Public Health. The purpose of this paper was to evaluate the associations of individual- and area-level characteristics with reasons for leaving the home and subsequent protective health behaviors during COVID-19 movement restrictions.

After COVID-19 was declared a national emergency, 42 states issued movement restriction policies (i.e. “Stay-at-Home” and “Shelter-in-Place” orders) and the CDC released recommended protective health behaviors that included maintaining physical or social distance, wearing a face mask, washing hands frequently, and cleaning and disinfecting frequently touched surfaces. To date, these are the only existing strategies to reduce the spread of the virus until vaccines become available. However, there is limited evidence for understanding the public’s compliance with these behavioral interventions during the early months of COVID-19. We collected data between April 15th–May 5th, 2020 to build the evidence base for factors associated with these protective health behaviors. Our study broke new ground by finding that the reasons individuals left their homes and protective health behaviors varied by urbanicity levels and sociodemographic characteristics. Specifically, males, younger adults, those without comorbidities, and rural residents left the home more and used fewer protective health behaviors (i.e. masks and social/physical distancing) during this time period. Given these results, and the evidence that men have a higher risk of severity and death from the virus and that younger individuals are making up a growing number of recent cases, increased public health and policy efforts targeting these vulnerable populations are needed.

Given that Healthy Psychology Bulletin seeks to publish studies related to determinants of behaviors related to COVID-19, this paper provides empirical evidence for these determinants of behaviors following the initial movement restriction ordinances. We hope you find this study question of value to COVID-19 research and your journal.

The authors formally acknowledge that this submission comprises original, unpublished material and is not under consideration for publication elsewhere nor available for pre-print. All authors contributed to the manuscript and have approved the paper for submission. The authors would like the editors to know that Ms. Katie Burford and Dr. Erin Dooley share first authorship on this work and would like this denoted on the final publication. As the corresponding author, I have full access to all aspects of the research and writing process, and thus take responsibility for the paper.

Approval to conduct the study was obtained from the University of Texas Health Science Center, Committee for Protection of Human Subjects.

Thank you for your consideration.

Regards,

Gregory Knell, PhD

Editor
2020-09-26 10:55 AM

Subject: [HPB] Editor Decision - "Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19"

Dear Katie Burford,

After review, we have reached a decision regarding your submission to Health Psychology Bulletin, "Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19". Our decision is to request revisions of the manuscript prior to acceptance for publication.

The full review information should be included at the bottom of this email. There may also be a copy of the manuscript file with reviewer comments available once you have accessed the submission account. A summary of the requested edits from the editorial team can be found below. Please consider these points and revise the file accordingly:

Editorial Revision Requests:

1. One of the reviewers noticed that it was difficult to access the replication/analysis packages hosted at Harvard's Dataverse (i.e., because the reviewer's institute did not have a subscription). Please add a direct link to the replication/analysis packages in the manuscript.
2. In the abstract, sometimes OR+95%CI are reported, sometimes just p-values. Please always add effect sizes with confidence intervals (this applies to the whole manuscript).
3. As this is an observational study, please make sure that the manuscript adheres to (and explicitly refers to) the STROBE guidelines for reporting observational studies:
<https://www.equator-network.org/reporting-guidelines/strobe/>
4. Please note that Reviewer C has also made additional comments in the document besides the review comments presented below (those can be accessed in the submission account).

To access your submission account, follow the below instructions:

- 1) login to the journal webpage with username and password
- 2) click on the submission title
- 3) click 'Review' menu option
- 4) download Reviewed file and make revisions based on review feedback
- 5) upload the edited file
- 6) Click the 'notify editor' icon and email the confirmation of re-submission and any relevant comments to the journal.

Please ensure that your revised files adhere to our author guidelines, and that the files are fully copyedited/proofed prior to upload. Please also ensure that all copyright permissions have been attained. This is the last opportunity for major editing, therefore please fully check your file prior to re-submission.

If you have any questions or difficulties during this process, please do contact us.

Please could you have the revisions submitted by October, 9. If you cannot make this deadline, please let us know as early as possible.

Kind regards,

Rik Crutzen
Maastricht University
rik.crutzen@maastrichtuniversity.nl

Reviewer A:

Section 1a, Full Disclosure: Replication Package: Note that for any of these elements, an explanation by the authors as to why this element is omitted, also serves, that is, if the explanation is acceptable. After all, one of HPB's goals is to help emptying the file drawers, and older studies may no longer have all these resources available.:

Includes protocols for recruitment of participants and guiding participants through the study

Includes operationalisations of measurements (e.g. questionnaires, source code)

Includes operationalisations of manipulations (e.g. intervention manuals, stimuli, etc)

Includes analysis plan

Includes confirmation of ethics approval/Institutional Review Board (IRB) approval

If applicable, please indicate here to the authors what exactly was omitted, or which resources were not provided in an open format.:

Section 1b, Full Disclosure: Analysis Package: Note that for any of these elements, an explanation by the authors as to why this element is omitted, also serves, that is, if the explanation is acceptable. After all, one of HPB's goals is to help emptying the file drawers, and older studies may no longer have all these resources available.:

Includes cleaned data

Includes textual output

Includes graphical output

If applicable, please indicate here to the authors what exactly was omitted, or which resources were not provided in an open format.:

Section 2a, Reviewer comments: Here, please type or paste your review. Please make sure to adhere to the editorial policy for reviewers.:

Manuscript ID: 24-434-1-RV

Title: Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19

This article seeks to better understand the associations between respondents' characteristics and area of residence and reasons for leaving the house, and protective health behavior during the Covid-19 pandemic. Overall, this is an interesting paper. The author(s) provide clear

and detailed information regarding the arguments, data collection procedures, including ethical approval and the data presentation (tables). I only have minor suggestions to improve the quality of the manuscript below.

1. Page 7; Statistical analysis section: 'Analyses were performed using RStudio version 1.2.5033 (RStudio, PBC., Boston, MA).'

Please also state the R version (and packages) that were used for statistical analysis.

2. Page 7; Result section: 'Out of the five reasons for leaving the home that were measured, 2.4 ± 1.0 reasons were reported by participants.'

and Page 8; Result section: 'Out of the seven protective health behaviors that were measured, participants reported 4.8 ± 1.3 behaviors.'

The meanings of these numbers are not immediately clear. Please clarify what they mean.

3. Page 9; Discussion section:

'The finding that rural residents were more likely to leave the home for work compared to urban residents may relate to differences in political beliefs and employment type.'

Since the author(s) did not measure political beliefs and employment type, this statement appears to be rather speculative. The author(s) should consider withdrawing such conclusion or provide additional data.

4. The author(s) may consider discussing the findings in light of the characteristics of urban areas (e.g., less dense population; larger distances between individuals) and compare the sample characteristics in Painter & Qiu's study with that of the author(s).

5. Page 11; Discussion section:

Please adjust the citation format to Health Psychology Bulletin preferred style.

6. Page 13; Conclusion section.

The study provided meaningful findings, yet, the practical suggestions are somewhat missing. Considering the mission of Health Psychology Bulletin, the conclusion can be improved by providing more practical feedbacks and suggestions for policy makers. For example: provide more information on the importance of wearing a mask for male and young US citizens.

Reviewer C:

Section 1a, Full Disclosure: Replication Package: Note that for any of these elements, an explanation by the authors as to why this element is omitted, also serves, that is, if the explanation is acceptable. After all, one of HPB's goals is to help emptying the file drawers, and older studies may no longer have all these resources available.:

If applicable, please indicate here to the authors what exactly was omitted, or which resources were not provided in an open format.:

The authors have provided a link to the replication materials but unfortunately they are not

available to my institution. I have tried to create an account on the Dataverse site but unfortunately it shows a warning message to say that I don't have access.

Section 1b, Full Disclosure: Analysis Package: Note that for any of these elements, an explanation by the authors as to why this element is omitted, also serves, that is, if the explanation is acceptable. After all, one of HPB's goals is to help emptying the file drawers, and older studies may no longer have all these resources available.:

If applicable, please indicate here to the authors what exactly was omitted, or which resources were not provided in an open format.:

The authors have provided a link to the analysis materials but unfortunately they are not available to my institution. I have tried to create an account on the Dataverse site but unfortunately it shows a warning message to say that I don't have access.

Section 2a, Reviewer comments: Here, please type or paste your review. Please make sure to adhere to the editorial policy for reviewers.:

Thank you for giving me the opportunity to review this paper. It was well-written and deals with a useful research question.

I have added anonymised comments to the manuscript directly to help locate the sections of text I am discussing in my review, and hopefully aid the authors when revising their manuscript [note: these are included in the original submission at the end of this peer review history document]. However, I will summarise my main recommendations here:

1. Please add the replication and analysis materials to an openly available repository such as Open Science Framework.
2. Please add a greater reflection of the potential determinants that could be impacting the behaviours measured here. Little reference is made to health psychology theory. In addition, you could also add information as to why, for example, political attitudes, perceived risk, perceived norms etc. were not measured.
3. More reflection on health inequalities between groups (both in terms of behaviours and health outcomes) could be included in the introduction and discussion. Some consideration is given to the urban/rural divide, however it would be useful if more reflection on the reasons for such differences in behaviours/health outcomes could be given (e.g., psychological, geopolitical etc.). Further discussion of the observed inequalities in COVID-19 impacts could also be considered, particularly with regards to differences between ethnic groups. The authors could add additional reflection on how representative their survey sample is, and consider whether additional attention needs to be devoted to respondent ethnicity. The paper by Roberts et al., (2020) (available at <https://journals.sagepub.com/doi/full/10.1177/1745691620927709>) provides a series of recommendations for improving research reporting in this respect, including detailing and justifying the racial demographic of study samples, and including statements on generalisability of findings.
4. Please consider adding additional information about the study design and methods. In

alignment with HPB standards, the introduction should include a consideration of why the specified method was chosen (and see point above about decisions regarding not recording psychological determinants of behaviour). In addition, please add more detail on how variables were measured and subsequently processed - for example, were respondents allowed to enter any value for age, or could they only select from a number of options? Descriptions of data processing are not always complete (e.g., when grouping respondents into the "one hour or less outside the home" category, does this include those who did not leave their home at all? This could be clearer.) The analysis section could also benefit from greater clarity e.g., which predictors were included in crude versus adjusted models? How many models were conducted (for how many outcomes)? Were any corrections made for multiple tests?

5. More detail and clarity could be given in the results - for example, making it clearer that means and standard deviations are being presented for descriptive statistics, or describing the magnitude of differences in likelihood (consider adding some of these statistics into the text, although I appreciate they will also be presented in the tables).

I hope that the further detailed comments on the manuscript will help to identify the specific areas towards which these recommendations are targeted.

Many thanks again for the opportunity to review.

Author
2020-10-08 11:01 PM

Subject: Associations of Urbanicity and Sociodemographic Characteristics with
Protective Health Behaviors and Reasons for Leaving the Home during COVID-19

Dr. Rik Crutzen

We have uploaded the revised manuscript and reviews for the reviewers in supplementary material. Thank you for this opportunity.

Katie Burford & Erin Dooley

We thank the reviewers for their time and appreciate their thoughtful and helpful suggestions to improve our work. In response to their comments we have made substantive changes to improve the manuscript. Our point-by-point responses to the reviewer's comments are provided below, with the changes highlighted for your ease of reading.

Editorial Revision Requests:

1. One of the reviewers noticed that it was difficult to access the replication/analysis packages hosted at Harvard's Dataverse (i.e., because the reviewer's institute did not have a subscription). Please add a direct link to the replication/analysis packages in the manuscript.

Response:

We are sorry the reviewer had trouble accessing our replication package. We originally used the Harvard Dataverse because it is one of the Health Psychology Bulletin journal's dataverse suggestions. However, because there were data access issues, we are happy to try the Open Science Framework. Additionally, we have now included the notation (statistical analysis, page 9): "Research materials, data, and syntax files are available on Open Science Framework at the following link:

https://osf.io/3vxpy/?view_only=3f6aef5c86184b42910fcd41a0af0faf

2. In the abstract, sometimes OR+95%CI are reported, sometimes just p-values. Please always add effect sizes with confidence intervals (this applies to the whole manuscript).

Response:

Thank you for your request. We have added the corresponding estimates to the abstract (page 1-2) as well as within the results section (page 10-12).

Abstract:

"Rural residents (versus urban residents) had lower odds of wearing a mask (OR=0.60, 95%CI:0.43-0.83). Women (versus men) had lower odds of leaving the home for shopping (grocery: OR=0.51, 95%CI:0.31-0.80; essential: OR=0.68, 95%CI:0.52-0.88), and higher odds of social distancing (OR=2.34, 95%CI:1.12-4.85) and wearing a mask (OR=1.58, 95%CI:1.20-2.08). Older adults [≥ 50 years) versus younger adults (18-34 years)],

had higher odds to leave home for grocery shopping (OR=2.07, 95%CI:1.25-3.48) and higher odds of wearing a mask (OR=2.02, 95%CI:1.42-2.91)."

Results:

"Rural residents had higher odds of leaving home for work compared with urban residents (OR=1.64, 95%CI:1.03, 2.61). Women reported significantly lower odds of leaving home for work (OR=0.56, 95%CI:0.38, 0.85), grocery (OR=0.51, 95%CI:0.31, 0.81) and other essential shopping (OR=0.68, 95%CI:0.52, 0.88) than men. The oldest age group had significantly higher odds for grocery shopping (OR=2.07, 95%CI:1.25, 3.48) and the middle age group had higher odds for leaving home for work (OR=1.90, 95%CI:1.14, 3.20) compared to the youngest age group. Compared to college graduates, those without a college degree had significantly lower odds of leaving home for grocery shopping (OR=0.53, 95%CI:0.33, 0.87) and exercise (OR=0.69, 95%CI:0.49, 0.98). The highest income bracket had significantly higher odds for leaving home to exercise (OR=1.69, 95%CI:1.06, 2.67) and for walking the dog (OR=2.33, 95%CI:1.46, 3.80), however, lower odds to leave for grocery shopping (OR=0.38, 95%CI:0.16, 0.79), compared to the lowest income bracket. Those living with one or more comorbidities had significantly lower odds of leaving home for grocery shopping (OR=0.64, 95%CI:0.45, 0.96) and exercise (OR=0.61, 95%CI:0.47, 0.79).

Suburban residents had significantly greater odds (OR=1.45, 95%CI:1.08, 1.94) of spending at least 23 hours inside the home compared to urban residents. Rural residents had significantly lower odds of wearing a protective mask (OR=0.60, 95%CI:0.43, 0.83) and gloves (OR=0.60, 95%CI:0.41, 0.88), compared to urban residents. Compared to men, women had significantly higher odds of physical/social distancing (OR=2.34, 95%CI:0.1.12, 4.85), washing hands frequently (OR=1.72, 95%CI:1.11, 2.66), wearing a protective mask (OR=1.58, 95%CI:1.20, 2.08), using hand sanitizer (OR=1.48, 95%CI:1.09, 2.00), and disinfectant wipes (OR=1.82, 95%CI:1.40, 2.36). Those in the oldest age bracket had significantly higher odds of using protective masks (OR=2.02, 95%CI:1.42, 2.91), disinfectant wipes (OR=1.46, 95%CI:1.06, 2.02), and wearing gloves (OR=2.63, 95%CI:1.81, 3.85); however, they had significantly lower odds of using hand sanitizer (OR=0.65, 95%CI:0.45, 0.95) and spending less than one hour outside the home (OR=0.70, 95%CI:0.50, 0.98), compared to the youngest age bracket. Those without a college degree had significantly lower odds of physical/social distancing (OR=0.41, 95%CI:0.18, 0.98) than those with a college degree or more. Those with children had significantly higher odds of using disinfectant wipes (OR=1.43, 95%CI:1.09, 1.88). Participants with moderate to severe depressive symptom severity had significantly lower odds of physical/social distancing (OR=0.37, 95%CI:0.17, 0.84) compared to those with none or mild symptom severity. Finally, compared to those without a comorbidity, those with one or more had significantly higher odds of using hand sanitizer (OR=1.39, 95%CI:1.03, 1.88)."

3. As this is an observational study, please make sure that the manuscript adheres to (and explicitly refers to) the STROBE guidelines for reporting observational studies: https://urldefense.proofpoint.com/v2/url?u=https-3A__www.equator-2Dnetwork.org_reporting-2Dguidelines_strobe_&d=DwIFaQ&c=bKRySV-ouEg_AT-w2QWsTdd9X_KYh9Eq2fdmQDVZgw&r=gh_HDI1uDkWoBdEYkxWLLm0vb5te3Cf9CYjfhlyOCgk&m=0HRGutwcu7yGM4um77zBYFZRdW95fi8DeJxuTrSFzG8&s=I3dn7sB9AJbxNI_n9KQNmhPK9ZCJC5Mxcok_KNyB8U&e=

Response:

Thank you for bringing this to our attention. In addition to referring to STROBE guidelines in the manuscript (methods, page 6), we have uploaded the completed checklist as supplementary material.

“Additionally, this study was reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement guidelines (von Elm et al., n.d.).”

4. Please note that Reviewer C has also made additional comments in the document besides the review comments presented below (those can be accessed in the submission account).

Response:

Thank you for bringing this to our attention. In addition to responding to the comments below, we have addressed the additional comments in the revised manuscript.

Reviewer A:

This article seeks to better understand the associations between respondents' characteristics and area of residence and reasons for leaving the house, and protective health behavior during the Covid-19 pandemic. Overall, this is an interesting paper. The author(s) provide clear and detailed information regarding the arguments, data collection procedures, including ethical approval and the data presentation (tables). I only have minor suggestions to improve the quality of the manuscript below.

1. Page 7; Statistical analysis section: ‘Analyses were performed using RStudio version 1.2.5033 (RStudio, PBC., Boston, MA).’

Please also state the R version (and packages) that were used for statistical analysis.

Response:

Thank you for your comments and concerns. To address this suggestion, we have added the missing information on R version and packages to the manuscript (statistical analysis section, now page 9).

“Analyses were performed using the odds ratio (v1.0.2; Schratz, 2017) and car (Fox & Weisberg, 2019) packages in RStudio version 1.2.5033 (RStudio, PBC., Boston, MA) and R version 3.6.2 (R Core Team, 2019).”

2. Page 7; Result section: ‘Out of the five reasons for leaving the home that were measured, 2.4 ± 1.0 reasons were reported by participants.’ and Page 8; Result section: ‘Out of the seven protective health behaviors that were measured, participants reported 4.8 ± 1.3 behaviors. The meanings of these numbers are not immediately clear. Please clarify what they mean.

Response:

To clarify the meaning of these statements, we have updated these two lines (Results section, now pages 10-11) by adding participants reported “on average ($M \pm SD$)”.

“Out of the five possible reasons for leaving the home that were measured, participants reported, on average ($M \pm SD$), leaving their home during stay-at-home orders for 2.4 ± 1.0 reasons total.”

“Out of the seven possible protective health behaviors that were measured, participants reported, on average ($M \pm SD$), engaging in 4.8 ± 1.3 behaviors total.”

3. Page 9; Discussion section:

‘The finding that rural residents were more likely to leave the home for work compared to urban residents may relate to differences in political beliefs and employment type.’

Since the author(s) did not measure political beliefs and employment type, this statement appears to be rather speculative. The author(s) should consider withdrawing such conclusion or provide additional data.

Response:

After reviewing your concern, the authors agree with the reviewer in that this statement is more speculative in nature and we have chosen to withdraw these conclusions. Instead, we have included political beliefs as an area for future research for differences in protective health behaviors as supported by recent literature (discussion, now page 14).

“Future research could also consider examining political beliefs in the context of urbanicity differences as geographical areas may have variations in majority party affiliations (Parker et al., 2018). Painter & Qiu found that residents living in Republican counties were less likely to fully comply with movement restriction orders relative to those living in Democratic counties (Painter & Qiu, 2020). Further, political conservatism has been found to mediate trust in science and compliance with COVID-19 preventive behaviors, such that those with higher political conservatism trust science to a lesser degree, and therefore have lower levels of compliance with the preventive behaviors (Plohl & Musli, 2020).”

4. The author(s) may consider discussing the findings in light of the characteristics of urban areas (e.g., less dense population; larger distances between individuals) and compare the sample characteristics in Painter & Qiu’s study with that of the author(s).

Response:

We have added to our discussion section involving determinants of the urban-rural differences to reflect the reviewers concerns by incorporating discussion of new literature around this topic (discussion, page 13-15). Further, while we appreciate the attention to Painter & Qiu’s study, we are unable to compare the present study’s characteristics as Painter & Qiu’s conclusions are based upon geolocation (cell phone) data at the county-level rather than individual-level data.

“The finding that suburban residents were more likely to spend at least 23 hours inside the home compared to urban residents may be because there is typically more space available within suburban private homes than in urban areas. Generally, suburban communities are characterized by large lots with single-family detached homes and private yards (Ewing, 2008). Urban areas single-family detached homes constitute only 57.5% of all housing units with multifamily housing accounting for a large percentage of housing (32.0%) (U.S. Census Bureau, 2018b). However, in rural areas, 77.1% of housing units are single-family detached homes (U.S. Census Bureau, 2018b). These differences in housing spaces and the lower population density may explain why rural residents were less likely to wear protective masks and gloves compared to urban residents as they may perceive their risk for COVID-19 infection as lower than those living in urban areas. As found by Chen &

Chen (2020), rural residents may evaluate the relevance of the protective health information as less salient to them than urban residents and therefore are less likely to engage in protective behaviors.

Additionally, the known health disparities across rural environments such as healthcare access and critical care resources have hindered the infectious disease response in rural communities and may result in greater mortality in these areas due to COVID-19 (Santibanez et al., 2019; Prusaczyk, 2020)."

5. Page 11; Discussion section:

Please adjust the citation format to Health Psychology Bulletin preferred style.

Response:

The authors appreciate the reviewer's attention to this error and have updated the in-text citations throughout the manuscript.

6. Page 13; Conclusion section.

The study provided meaningful findings, yet, the practical suggestions are somewhat missing. Considering the mission of Health Psychology Bulletin, the conclusion can be improved by providing more practical feedbacks and suggestions for policy makers. For example: provide more information on the importance of wearing a mask for male and young US citizens.

Response:

Thank you for this suggestion. We have updated the discussion (now page 15) and conclusion paragraph (now page 17) to reflect upon the practical application of our findings.

"Thus, national, state, and local health leaders should target their messaging around adherence to protective health behaviors towards men, younger individuals, and rural communities as this may be critical for preventing the spread and consequences of COVID-19.

Clarity in health messages and developing intervention efforts involving these groups could be one strategy to mitigate the spread of the virus. Alongside determining the mechanisms behind reasons for leaving the home and protective health behaviors during COVID-19, national surveillance is desperately needed to uncover additional sociodemographic disparities in leaving the home and protective health behaviors."

Reviewer C:

The authors have provided a link to the analysis materials but unfortunately they are not available to my institution. I have tried to create an account on the Dataverse site but unfortunately it shows a warning message to say that I don't have access.

General Comment:

Thank you for giving me the opportunity to review this paper. It was well-written and deals with a useful research question.

Major Revision:

I have added anonymised comments to the manuscript directly to help locate the sections of text I am discussing in my review, and hopefully aid the authors when revising their manuscript. However, I will summarise my main recommendations here:

1. Please add the replication and analysis materials to an openly available repository such as Open Science Framework.

Response:

We are sorry you had an issue with our data package. Thank you for bringing this issue with data access to our attention, we have since published the data package in Open Science Framework and hope this now allows for easy access.

Additionally, we have now included the notation and website link (statistical analysis, page 9): “Research materials, data, and syntax files are available on Open Science Framework at the following link:

https://osf.io/3vxpy/?view_only=3f6aef5c86184b42910fcd41a0af0faf”

2. Please add a greater reflection of the potential determinants that could be impacting the behaviours measured here. Little reference is made to health psychology theory. In addition, you could also add information as to why, for example, political attitudes, perceived risk, perceived norms etc. were not measured.

Response:

Thank you for this suggestion. We believe our study provides a critical first step in the surveillance of populations that may be at an increased risk for COVID-19 because of their (or lack of) protective health behaviors. Thus while we agree that measuring the behavioral determinants would have been beneficial to further understanding these behaviors, it was out of the scope of this study but mentioned as a limitation. However, we now recognize the lack of discussion made about health psychology theory, and thus have included literature on this topic in the 2nd paragraph of the introduction (page 3-4) and discussion sections (page 13-14).

Introduction

“The objectives of these strategies are to reduce transmission rates of COVID-19 until wide-scale vaccines and effective antiviral drugs are available (Andersen et al., 2006). However, the uptake of these mitigation strategies may be reliant on psychological factors, such as perceived risk and susceptibility. The Health Belief Model suggests perceived barriers, benefits, and threats are predictive of behavior change (Rosenstock, 1974). Perceived susceptibility has been found to be associated with preventive behaviors, such as hand washing and mask wearing, and avoidant behaviors, such as avoiding large gatherings, during a pandemic (Bish & Michie, 2010). Additionally, COVID-19 risk perception has been shown to be associated with COVID-19 prevention guidelines compliance (Abdelrahman, 2020; Harper, Satchell, Fido & Latzman, 2020; Plohl & Musil, 2020).

Discussion

“Evidence suggests that certain chronic conditions may be associated with a higher risk of COVID-19 severity and death (CDC, 2020b; Yang et al., 2020). Therefore, those with chronic conditions may have higher perceived risk of disease and subsequently stay at home more. Future studies should include measures of perceived risk when studying leaving home and protective health behaviors during pandemics to examine this association.

These differences in housing spaces and the lower population density may explain why rural residents were less likely to wear protective masks and gloves compared to urban residents as they may perceive their risk for COVID-19 infection as lower than those living in urban areas. As found by Chen & Chen (2020), rural residents may evaluate the relevance of the protective health information as less salient to them than urban residents and therefore are less likely to engage in protective behaviors.

Further, political conservatism has been found to mediate trust in science and compliance with COVID-19 preventive behaviors, such that those with higher political conservatism, trust science to a lesser degree, and therefore have lower levels of compliance with the preventive behaviors (Plohl & Musli, 2020).

Also, as perceived risk is associated with behavior changes (Abdelrahman, 2020; Bish & Michie, 2010; Harper, Satchell, Fido & Latzman, 2020), women in this sample may have perceived themselves as more susceptible to COVID-19 than men and therefore engaged in protective behaviors to a greater degree.”

3. More reflection on health inequalities between groups (both in terms of behaviours and health outcomes) could be included in the introduction and discussion. Some consideration is given to the urban/rural divide, however it would be useful if more reflection on the reasons for such differences in behaviours/health outcomes could be given (e.g., psychological, geopolitical etc.). Further discussion of the observed inequalities in COVID-19 impacts could also be considered, particularly with regards to differences between ethnic groups. The authors could add additional reflection on how representative their survey sample is, and consider whether additional attention needs to be devoted to respondent ethnicity. The paper by Roberts et al., (2020) (available at https://urldefense.proofpoint.com/v2/url?u=https-3A__journals.sagepub.com_doi_full_10.1177_1745691620927709&d=DwIFaQ&c=bKRySV-ouEg_AT-w2QWsTdd9X_KYh9Eq2fdmQDVZgw&r=gh_HDI1uDkWoBdEYkxWLlm0vb5te3Cf9CYjfhlyOCgk&m=0HRGutwcu7yGM4um77zBYFZRdW95fi8DeJxuTrSFzG8&s=DcWA9k63bxET3bEqsTicFucFNsOnROioUd-UGkCYuAg&e=) provides a series of recommendations for improving research reporting in this respect, including detailing and justifying the racial demographic of study samples, and including statements on generalisability of findings.

Response:

We agree of the importance of considering racial/ethnic disparities within the context of our research, unfortunately due to the rapidly evolving COVID-19 landscape, we were limited to an online-only survey that utilized social media platforms for recruitment which limited our findings to a convenience sample that was primarily represented by women, non-Hispanic white, and highly educated individuals, as addressed in our limitation section (page 15-16). We have added to the limitations to reflect these concerns.

“The findings of this study were from a convenience sample that was overrepresented by women, higher income, college educated, non-essential workers, and non-Hispanic white individuals. Further, individuals without online access would have been unable to participate in this web-based survey. Although most of the sample resided in Texas, participants across 39 states (+ District of Columbia) were surveyed. Because these results may not be generalizable, future studies should strive to capture these behaviors in other populations.

Despite this, the convenience sampling methodology allowed for an important first step in the surveillance of human behavior during a critical time period of COVID-19.

Additionally, we sought to increase our discussion of the potential determinants of the urban/rural disparities in our introduction and results (introduction, page 4; discussion, page 14). Also we added discussion of the implication of COVID-19 in rural contexts given the existing health-related disparities in these communities and concerns in the existing literature around infectious disease response in these areas (discussion, page 15)

“These behavioral disparities in rural health have been correlated with limited health care resources and lower socioeconomic status, and may persist in COVID-19 behaviors. Preliminary evidence exploring urban-rural differences in COVID-19 preventive behaviors among a convenience sample of Chinese residents found that rural residents were less likely to engage in preventive behaviors compared to urban residents, however this has yet to be explored in other samples.

Generally, suburban communities are characterized by large lots with single-family detached homes and private yards (Ewing, 2008). In urban areas single-family detached homes constitute only 57.5% of all housing units with multifamily housing accounting for a large percentage of housing (32.0%) (U.S. Census Bureau, 2018b). However, in rural areas, 77.1% of housing units are single-family detached homes (U.S. Census Bureau, 2018b). These differences in housing spaces and the lower population density may explain why rural residents were less likely to wear protective masks and gloves compared to urban residents as they may perceive their risk for COVID-19 infection as lower than those living in urban areas. Additionally, as found by Chen & Chen (2020), rural residents may evaluate the relevance of the protective health information as less salient to them than urban residents and therefore are less likely to engage in protective behaviors.

Additionally, the known health disparities across rural environments such as healthcare access and critical care resources have hindered the infectious disease response in rural communities and may result in greater mortality in these areas due to COVID-19.”

4. Please consider adding additional information about the study design and methods. In alignment with HPB standards, the introduction should include a consideration of why the specified method was chosen (and see point above about decisions regarding not recording psychological determinants of behaviour). In addition, please add more detail on how variables were measured and subsequently processed - for example, were respondents allowed to enter any value for age, or could they only select from a number of options? Descriptions of data processing are not always complete (e.g., when grouping respondents into the "one hour or less outside the home" category, does this include those who did not leave their home at all? This could be clearer.) The analysis section could also benefit from greater clarity e.g., which predictors were included in crude versus adjusted models? How many models were conducted (for how many outcomes)? Were any corrections made for multiple tests?

Response:

Thank you for bringing to our attention the need for clarifying our study design and methods. We have provided more detailed information regarding how the variables were measured and processed on page 8-9. We also refer readers to the Questionnaire which will be included in our Replication Package. Additionally, the

statistical analyses section has been updated on page 9 to address questions of the fully adjusted models and number of outcomes. Changes to these sections are highlighted below.

“Sex was reported as sex at birth (male/female). Race/ethnicity was coded, based on response size, as “Non-Hispanic white” or “Non-white.” Non-white included Hispanic, Black or African American, Asian, American Indian/Alaska Native, Native Hawaiian or Other Pacific Islander, and More than One Race. Participants selected their current age from a continuous list (18-85 years), which was recoded into (18-24 years; 35-39 years; 50 years and older) based on response size. Household income was measured from ‘Less than \$9,999’ to ‘Over \$150,000’ in \$10,000 category increments and subsequently categorized as <\$50,000; \$50,000-\$100,000; \$100,000-\$150,000; and Over \$150,000. Education was measured as ‘Never attended school’; ‘Grades 1-8’; ‘Some high school’; ‘High school graduate/ GED’; ‘Some college/technical school’; and ‘College graduate or more.’ Those selecting anything other than ‘College graduate’ were recoded into ‘Not a college graduate.’ Presence of children less than 18 years of age living in the home was measured as free response (maximum response allowed = 75 children) and categorized as ‘No’ if participants responded with 0 and ‘Yes’ if participants responded with 1+ children. Measures of health were depressive symptom severity (categorized into ‘none or mild’ and ‘moderate to severe’), measured by the Patient Health Questionnaire (PHQ-9) (Kroenke, Spitzer & Williams, 2001), and number of comorbidities selected, including asthma, obesity, cancer, etc. (categorized into ‘none’ and ‘one or more’) (see Questionnaire in Replication Package for a full list of measured comorbidities).

“Descriptive analyses, including frequencies, percentages, means, and standard deviations, were calculated for participant characteristics, reasons for leaving home, and protective health behaviors. Logistic regression models were used to estimate the odds [odds ratios (OR) and 95% confidence intervals (CI)] of 1) leaving home (reasons) and 2) protective health behaviors by levels of urbanicity and participant characteristics. Each outcome (5 reasons for leaving home and 7 protective health behaviors) was modeled separately. The models were mutually adjusted for the other factors of interest (urbanicity, sex, age, education, income, children in the home, depression symptom severity, comorbidity).

5. More detail and clarity could be given in the results - for example, making it clearer that means and standard deviations are being presented for descriptive statistics, or describing the magnitude of differences in likelihood (consider adding some of these statistics into the text, although I appreciate they will also be presented in the tables).

Response:

To address this concern, we have added the corresponding estimates to the abstract (pages 1-2) as well as within the results section (page 10-12). Please see specific edits highlighted above in the Editorial Revision Requests #2.

Additionally, we have updated two lines (results, page 10-11) by adding participants reported “on average ($M \pm SD$)”.

“Out of the five possible reasons for leaving the home that were measured, participants reported, on average ($M \pm SD$), leaving their home during stay-at-home orders for 2.4 ± 1.0 reasons total.

Out of the seven possible protective health behaviors that were measured, participants reported, on average ($M \pm SD$), engaging in 4.8 ± 1.3 behaviors total.”

I hope that the further detailed comments on the manuscript will help to identify the specific areas towards which these recommendations are targeted.

Many thanks again for the opportunity to review.

Response:

We want to thank the reviewer for providing us with specific comments to our manuscript in a separate document. We have incorporated these edits throughout our manuscript. For example, we have reformatted the Methods section to include a “Procedures, Recruitment, and Data Collection” section (page 5) and now explicitly detail our measures (starting on page 6) to address the reviewer’s specific comments related to measurement and recruitment procedures. We also removed mentioning “22 or more hours per day” as this may have added confusion to readers. We now include how many states (39) were represented in this research. Additionally, we appreciate your advice on how to increase the clarity of our findings and have incorporated the phrase “spending at least 23 hours inside the home” throughout the manuscript. Finally we added discussion of the determinants of urban/rural health disparities that may help to explain our findings and highlight the significance of this topic.

Editor
2020-10-24 12:04 PM

Subject: [HPB] Editor Decision - "Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19"

Dear Katie Burford,

After review, we have reached a decision regarding your submission to Health Psychology Bulletin, "Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19". Our decision is to request revisions of the manuscript prior to acceptance for publication.

The full review information should be included at the bottom of this email. Reviewer A is pleased with the revision; Reviewer B has some additional suggestions.

To access your submission account, follow the below instructions:

- 1) login to the journal webpage with username and password
- 2) click on the submission title
- 3) click 'Review' menu option
- 4) download Reviewed file and make revisions based on review feedback
- 5) upload the edited file
- 6) Click the 'notify editor' icon and email the confirmation of re-submission and any relevant comments to the journal.

Please ensure that your revised files adhere to our author guidelines, and that the files are fully copyedited/proofed prior to upload. Please also ensure that all copyright permissions have been attained. This is the last opportunity for major editing, therefore please fully check your file prior to re-submission.

If you have any questions or difficulties during this process, please do contact us.

Please could you have the revisions submitted by November 7. If you cannot make this deadline, please let us know as early as possible.

Kind regards,

Rik Crutzen
Maastricht University
rik.crutzen@maastrichtuniversity.nl

Reviewer A:

The author made revisions in accordance to the comments and suggestions; The revisions were clear and the quality of the manuscript is improved.
I am satisfied with the revised manuscript.

Reviewer B:

Thank you for responding to my comments. The manuscript has greatly improved, and I suggest some additional amendments here.

1. You have added a consideration of health psychology theory to the introduction and discussion. This works well in the discussion section, however it seems odd to mention theory in the introduction when it is not examined in the study method and results. Also;

Several of these differences may be explained by the evidence that men and younger populations have been found to engage in risky health behaviors more than their counterparts (Duell et al., 2018; Pawlowski et al., 2008). Also, as perceived risk is associated with behavior change (Abdelrahman, 2020; Bish & Michie, 2010; Harper et al., 2020), women in this sample may have perceived themselves as more susceptible to COVID-19 than men and therefore engaged in protective behaviors to a greater degree.

The earlier literature about likelihood of engaging in risk behaviours cannot “explain” the current results (i.e., because there is no suggested mechanism here), but they certainly dovetail – perhaps phrasing could be reconsidered. In addition, I wonder why perceived risk is chosen as a potential explanation for gender differences? The perceived risk account makes sense when discussing rural vs. urban residents, and those with vs. without comorbidities, but it's unclear why perceived risk would differ between genders. There are many other factors that influence behaviour change so the fact that “perceived risk is associated with behaviour change” seems an unconvincing argument for focusing on it here. Is there any literature that explains the aforementioned gender gap in risk taking for health behaviour that can be drawn upon here?

2. Thank you for providing additional information on the methodology, this is a great addition. It is not entirely clear what is meant by “based on response size” for ethnicity and age. I think I get what is meant – that based on number and distribution of responses, decisions were made to split the sample into those specific bands in order to retain adequate group sizes – but it could be made a little more explicit. It is also not clear if participants could enter free text to describe their ethnicity or if they were selecting from existing categories.

3. Thank you very much for making the replication packages available on OSF. On revising these materials, I see that there are some questions in codebook that don't appear in study e.g., questions about tobacco use, physical activity and domestic abuse, is there a reason for this? They should be indicated in the text to ensure that the full experimental procedure is clearly signposted.

4. A few points in the Discussion could be refined slightly. Firstly, the Discussion reports that younger respondents had higher odds of leaving the home but the Results section does not

support this. In fact it supports the opposite, with older respondents being more likely to report some reasons for leaving the home than younger respondents, and older respondents being less likely to spend at least 23 hours in the home. Also;

Individuals reporting household incomes of \$150,000 or more and those without a college education were less likely to report leaving home to grocery shop. These findings may be due to the availability of online shopping and delivery services for those with the financial ability to do so. The use of meal delivery services increased by an estimated 70% at the end of March 2020 from the previous year (Hobbs, 2020; Savitz, 2020).

This explains why those on higher incomes would be less likely to report leaving for groceries, but does not explain why those without a college education would

Many thanks again for your response.

Author
2020-11-02 10:10 PM

Subject: Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19

Dear Dr. Crutzen,

Thank you again for the opportunity to re-revise our manuscript, "Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19." We addressed the requested additional reviews, which we believe strengthened the quality of our manuscript.

Following this letter are the reviewer and editor comments with our responses, including where and how text was modified, highlighted in yellow. The revision has been developed in consultation with all coauthors, and they approve the final form of this revision.

Thank you for your consideration.

Sincerely,

Katie Burford, MS & Erin Dooley, PhD

We thank the reviewers again for their time to review our manuscript. In response to their comments we have made additional changes to improve the clarity of the manuscript. Our point-by-point responses to the reviewer's comments are provided below, with the changes highlighted for your ease of reading.

Editorial Revision Requests:

Reviewer A:

The author made revisions in accordance to the comments and suggestions; The revisions were clear and the quality of the manuscript is improved.

I am satisfied with the revised manuscript.

Response:

Thank you for your time and effort reviewing our manuscript.

Reviewer B:

Thank you for responding to my comments. The manuscript has greatly improved, and I suggest some additional amendments here.

1. You have added a consideration of health psychology theory to the introduction and discussion. This works well in the discussion section, however it seems odd to mention theory in the introduction when it is not examined in the study method and results. Also;

Several of these differences may be explained by the evidence that men and younger populations have been found to engage in risky health behaviors more than their counterparts (Duell et al., 2018; Pawlowski et al., 2008). Also, as perceived risk is associated with behavior change (Abdelrahman, 2020; Bish & Michie, 2010; Harper et al., 2020), women in this sample may have perceived themselves as more susceptible to COVID-19 than men and therefore engaged in protective behaviors to a greater degree.

The earlier literature about likelihood of engaging in risk behaviours cannot “explain” the current results (i.e., because there is no suggested mechanism here), but they certainly dovetail – perhaps phrasing could be reconsidered. In addition, I wonder why perceived risk is chosen as a potential explanation for gender differences? The perceived risk account makes sense when discussing rural vs. urban residents, and those with vs. without comorbidities, but it’s unclear why perceived risk would differ between genders. There are many other factors that influence behaviour change so the fact that “perceived risk is associated with behaviour change” seems an unconvincing argument for focusing on it here. Is there any literature that explains the aforementioned gender gap in risk taking for health behaviour that can be drawn upon here?

Response:

We thank the reviewer for this suggestion. We have removed health psychology theory from the introduction as we did not explicitly measure behavioral determinants. We subsequently moved the theoretical pieces in the introduction to the discussion to help ameliorate the reviewers concerns for the choice of perceived risk as a determinant of protective health behaviors (discussion, page 13). We have also sought to address the concern for word choice of “explaining” by rephrasing this sentence (discussion, page 14). Additionally, we have decided to remove the discussion of gender and age differences by psychological determinants and discuss our findings more broadly with the existing literature.

“In addition to perceived risk, the Health Belief Model suggests perceived barriers, benefits, and susceptibility are predictive of behavior change (Rosenstock, 1974). Future studies should consider including these constructs, such as perceived risk, when studying leaving home and protective health behaviors during pandemics to examine this association.

Several of these differences could be further expanded upon by tying them to psychological factors such as risk perception and perceived susceptibility across demographic groups. Perceived susceptibility has been found to be associated with preventive behaviors, such as hand washing and mask wearing, and avoidant behaviors, such as avoiding large gatherings, during a pandemic (Bish & Michie, 2010). Additionally, COVID-19 risk perception has been shown to be associated with COVID-19 prevention guidelines compliance (Abdelrahman, 2020; Harper et al., 2020; Plohl & Musil, 2020). Men and younger individuals have been found to engage in risky health behaviors more than their counterparts (Duell et al., 2018; Pawlowski et al., 2008). While additional research is warranted to discern the mechanisms of COVID-19 health behaviors, it may be that individuals who were more likely to use protective health behaviors in this sample perceived themselves as more susceptible to COVID-19 and therefore engaged in protective behaviors to a greater degree.”

2. Thank you for providing additional information on the methodology, this is a great addition. It is not entirely clear what is meant by “based on response size” for ethnicity and age. I think I get what is meant – that based on number and distribution of responses, decisions were made to split the sample into those specific bands in order to retain adequate group sizes – but it could be made a little more explicit. It is also not clear if participants could enter free text to describe their ethnicity or if they were selecting from existing categories.

Response:

We thank the reviewer for bringing this to our attention. To increase clarity, we have updated the lines related to ethnicity and age (methods, page 8).

“Ethnicity was based on selecting Hispanic or Latino (Yes/No). Race options included: white, Black or African American, Asian, American Indian/Alaska Native, Native Hawaiian or Other Pacific Islander, and More than One Race. For these analyses, based on distribution of responses size, a single race/ethnicity category was coded, as “Non-Hispanic white” or “Non-white.” Non-white included Hispanic, Black or African American, Asian, American Indian/Alaska Native, Native Hawaiian or Other Pacific Islander, and More than One Race. Participants selected their current age from a continuous list (18-85 years), which was recoded into (18-24 years; 35-39 years; 50 years and older) based on distribution of responses in order to obtain adequate group sizes.”

3. Thank you very much for making the replication packages available on OSF. On revising these materials, I see that there are some questions in codebook that don't appear in study e.g., questions about tobacco use, physical activity and domestic abuse, is there a reason for this? They should be indicated in the text to ensure that the full experimental procedure is clearly signposted.

Response:

These findings were collected as part of a larger survey exploring health and related behaviors during COVID-19. We are sorry this might not be clear from the original wording in the manuscript. We have added terminology to address the reviewers concerns (methods, page 5).

“Between April 15-May 5, 2020, adults residing in the U.S. were asked to respond to an anonymous 15-minute online survey on their health and related behaviors during the COVID-19 pandemic. The survey included questions related to the variables of interest in the present study (reasons for leaving home and protective health behaviors) as well as a range of other self-reported behaviors, for example sleep quality, tobacco use, alcohol consumption, drug use, physical activity, and work productivity (Knell et al., 2020).”

4. A few points in the Discussion could be refined slightly. Firstly, the Discussion reports that younger respondents had higher odds of leaving the home but the Results section does not support this. In fact it supports the opposite, with older respondents being more likely to report some reasons for leaving the home than younger respondents, and older respondents being less likely to spend at least 23 hours in the home. Also;

Individuals reporting household incomes of \$150,000 or more and those without a college education were less likely to report leaving home to grocery shop. These findings may be due to the availability of online shopping and delivery services for those with the financial ability to do so. The use of meal delivery services increased by an estimated 70% at the end of March 2020 from the previous year (Hobbs, 2020; Savitz, 2020).

This explains why those on higher incomes would be less likely to report leaving for groceries, but does not explain why those without a college education would

Response:

We thank you for these reviews. To improve the clarity of our findings for younger and older respondents, we have edited the first paragraph of the discussion on page 12 and added a line within the discussion (page 15). Additionally, we believe we have resolved the confusion about the discussion of findings for household incomes and college education as shown below (discussion, page 13):

“The major findings of this study were that in this sample of U.S. adults, those who were male, **younger-older**, living without comorbidities, and residing in rural areas had higher odds of leaving the home. **Additionally, those who were male, younger, and residing in rural areas had** lower odds of enacting various protective health behaviors.

Men, younger adults, those without children, and those living without comorbidities were less likely to report protective health behaviors, **although younger adults were more likely to spend at least 23 hours at home than older adults.** Several of these differences may be explained by the evidence that men and younger populations have been found to engage in risky health behaviors more than their counterparts (Duell et al., 2018; Pawlowski et al., 2008).

Individuals reporting household incomes of \$150,000 or more and those without a college education were less likely to report leaving home to grocery shop. **The differences between household income** may be due to the availability of online shopping and delivery services for those with the financial ability to do so. The differences between household income may be due to the availability of online shopping and delivery services for those with the financial ability to do so. The use of meal delivery services increased by an estimated 70% at the end of March 2020 from the previous year (Hobbs, 2020; Savitz, 2020). **For lower income and those without a college degree, lower odds of leaving to grocery shop may be due to possible use of food banks and food pantries (Feeding America, 2020). Higher levels of education have been found to be protective against food insecurity during COVID-19 (Kent et al., 2020).”**

Many thanks again for your response.

Response:

Thank you for your time and helping us clarify our intent and approach to our readers.

Editor
2020-11-05 02:17 PM

Subject: [HPB] Editor Decision - "Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19"

Dear Katie Burford,

After review, we have reached a decision regarding your submission to Health Psychology Bulletin, "Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19", and are happy to accept your submission for publication, pending the completion of copyediting and formatting processes.

As there are no further reviewer revisions to make, you do not have to complete any tasks at this point. The accepted submission will now undergo final copyediting. You will be contacted once this is complete to answer any queries that may have arisen during copyediting and to allow a final chance to edit the files prior to typesetting. If you wish to view your submission during this time, you can log in via the journal website.

The review information should be included in this email.

Kind regards,

Rik Crutzen
Maastricht University
rik.crutzen@maastrichtuniversity.nl

Section 2: manuscript iterations

NOTE: the original manuscript (the last file) contains comments that were added by Reviewer B.

This section is comprised of the manuscript preprints in anti-chronological order (i.e. the originally submitted manuscript is placed last, preceded by the revisions, with the penultimate version directly following this title page).

Title Page

Title: Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19

Abstract

Background

Few data exist on the characteristics of U.S. adults' compliance with movement restrictions (i.e., "stay-at-home" orders) and protective health behaviors during the COVID-19 pandemic.

Purpose

To evaluate the associations of individual- and area-level characteristics (urbanicity) with reasons for leaving home and subsequent protective health behaviors during the COVID-19 pandemic.

Methods

A convenience sample of U.S. adults (N=2,441) completed a 15-minute self-report online questionnaire. Exclusion criteria included: 1) missing ZIP; 2) currently sick with COVID-19; 3) difficulty with errands; and 4) "essential service" employment. Multivariable logistic regression models estimated the odds of citing reasons for leaving home and protective health behaviors by levels of urbanicity and sociodemographic factors. Data collection and analyses were conducted between April and June 2020.

Results

The analytic sample ($n=1,374$) was primarily Non-Hispanic white (79%), female (72%), urban residents (43%), and college degree or higher (85%). Rural residents (versus urban residents) had lower odds of wearing a mask (OR=0.60, 95%CI:0.43-0.83). Women (versus men) had lower

odds of leaving the home for shopping (grocery: OR=0.51, 95%CI:0.31-0.80; essential: OR=0.68, 95%CI:0.52-0.88), and higher odds of social distancing (OR=2.34, 95%CI:1.12-4.85) and wearing a mask (OR=1.58, 95%CI:1.20-2.08). Older adults [≥ 50 years) versus younger adults (18-34 years)], had higher odds of leaving home for grocery shopping (OR=2.07, 95%CI:1.25-3.48) and higher odds of wearing a mask (OR=2.02, 95%CI:1.42-2.91).

Conclusions

The differences for leaving home and protective health behaviors by age, sex, and urbanicity can be useful for future health promotion strategies to encourage best practices that limit the spread of COVID-19.

Keywords: COVID-19; Mitigation Strategies; Protective Health Behaviors; Urbanicity

Introduction

On March 13, 2020, the novel Coronavirus Disease 2019 (COVID-19) was declared a national emergency in the U.S. following the World Health Organization (WHO) characterization of the virus as a pandemic (Trump, 2020). After the national declaration, movement restrictions (i.e., “stay-at-home” or “shelter-in-place” orders) were implemented between March 19-April 7, 2020 (Silverstein, 2020). Although policies varied by state, county, and municipality, generally residents were required to stay at home, unless one’s occupation was considered essential or to carry out essential services. Proximal to these state-wide orders, the Centers for Disease Control and Prevention (CDC) released recommended community mitigation strategies to reduce the risk of infection, which included maintaining physical or social distance, wearing a face mask, washing hands frequently, and cleaning and disinfecting frequently touched surfaces (Allegrante, Auld & Natarajan, 2020; CDC, 2020a). With no pharmaceutical treatments or vaccines currently available for the virus, the combination of these protective health behaviors is the only existing population-level health intervention.

The objectives of these strategies are to reduce transmission rates of COVID-19 until wide-scale vaccines and effective antiviral drugs are available (Andersen et al., 2006). However, the uptake of these mitigation strategies may be reliant on psychological factors, such as perceived risk and susceptibility. The Health Belief Model suggests perceived barriers, benefits, and threats are predictive of behavior change (Rosenstock, 1974). Perceived susceptibility has been found to be associated with preventive behaviors, such as hand washing and mask wearing, and avoidant behaviors, such as avoiding large gatherings, during a pandemic (Bish & Michie, 2010). Additionally, COVID-19 risk perception has been shown to be associated with COVID-

19 prevention guidelines compliance (Abdelrahman, 2020; Harper et al., 2020; Plohl & Musil, 2020).

Given the reliance on human behavior to reduce community transmission of COVID-19, there remains a limited understanding of the U.S. public's compliance with these protective health recommendations during state-wide orders. In one report, April 7, 2020, was identified as the peak of adherence to restrictive movement orders in the U.S., with Americans staying at home for 93% of the day (i.e., 22.3 hours) (Schaul, Mayes & Berkowitz, 2020). Based on cell phone data, the researchers found Americans were primarily visiting parks and grocery stores when they did leave the home, and individuals exhibited different propensities for leaving the home based on levels of urbanicity—those living in rural areas tended to leave the home more than those living in suburban and urban areas (Schaul, Mayes & Berkowitz, 2020). Geographic differences in health behaviors have also been observed across a variety of other health behaviors. For example, residents in rural areas have been found to generally smoke more, eat less nutritious foods, and engage in less leisure time physical activity compared to urban and suburban residents (Eberhardt & Pamuk, 2004; Hartley, 2004). These behavioral disparities in rural health have been correlated with limited health care resources and lower socioeconomic status and may persist in COVID-19 behaviors (Hartley, 2004; Thomas, DiClemente, & Snell, 2014). Preliminary evidence exploring urban-rural differences in COVID-19 preventive behaviors among a convenience sample of Chinese residents found that rural residents were less likely to engage in preventive behaviors compared to urban residents (Chen & Chen, 2020), however this has yet to be explored in other samples. Additionally, there is limited understanding for the differences in protective health behaviors across sociodemographic characteristics, which is needed for determining at-risk populations and developing targeted public health interventions.

Ultimately, the behavioral decisions individuals make during the pandemic are central to preventing community transmission. Despite the significance of these protective health behaviors, researchers have yet to explore how urbanicity and sociodemographic characteristics are associated with Americans' reasons for leaving the home and protective health behaviors during COVID-19 state-wide orders. Understanding these associations may help to develop policies and public health communication efforts across a variety of communities, particularly among those who are least compliant in following protective health behaviors and/or most vulnerable to the virus. Therefore, the purpose of this study was to evaluate the associations of urbanicity and sociodemographic characteristics with 1) reasons for leaving home and 2) protective health behaviors during the COVID-19 movement restriction orders among a sample of U.S. adults.

Methods

Procedures, Recruitment, and Data Collection

Between April 15-May 5, 2020, adults residing in the U.S. were asked to respond to an anonymous 15-minute online survey on their health and related behaviors during the COVID-19 pandemic. Potential participants were recruited through the investigators' social media platforms (i.e., Twitter, Facebook, Instagram). Participants were provided a brief overview of the study, informed their participation was anonymous, that they could terminate the survey at any time, and asked for informed consent prior to completing the survey. Study data were collected and managed using REDCap electronic data capture tools hosted at the XXXXX (Harris et al., 2009). This study was approved by the Committee for the Protection of Human Subjects review board at XXXXXX (IRB number: HSC-SPH-20-0346). All procedures performed were in accordance with the ethical standards of the institutional research committee and with the Declaration of

Helsinki. Additionally, this study was reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement guidelines (von Elm et al., n.d.).

Study sample

Approximately 47,796 social media users viewed or interacted with the social media postings during the recruitment period, of which a total of 2766 (5.8%) agreed to participate and met the eligibility criteria (aged over 18 years and currently residing in the U.S.). After consenting, the survey was submitted by 2,441 participants. For the current study, participants were included in the analyses if they reported a stay-at-home/shelter-in-place order at the time of survey completion ($n=1,859$ [76.2%]). Participants were excluded from analyses if they 1) had no ZIP code ($n=26$ [1.4%]); 2) were currently sick with COVID-19 ($n=27$ [1.5%]); 3) had a physical, mental, or emotional condition causing them serious difficulty with doing errands ($n=39$ [2.1%]); or 4) self-reported their employment as an “essential service” ($n=393$ [21.1%]). Essential service workers were excluded from these analyses due to the potential need to leave their residence for work and differences in necessity of protective health behaviors.

Measures

Reasons for Leaving Home

To assess reasons for leaving the home during COVID-19, participants were asked to *check all that apply* to the question, “*For what reasons have you left your home during the “stay in place” order?*” Responses included: 1) work, 2) grocery shopping, 3) other essential shopping, 4) exercise, and 5) walking dog. Individual responses were then coded as yes/no based upon selection.

Protective Health Behaviors

Protective health behaviors were assessed with two questions. First, participants were asked to *check all that apply* to the question, “*If you leave your home for any reason, what do you do to protect yourself when out in public?*” Responses included: 1) physical/social distancing, 2) protective mask, 3) wearing gloves, 4) using hand sanitizer, 5) using disinfectant wipes, and 6) washing hands frequently. Individual responses were then coded as yes/no based upon selection. Second, participants were asked, “*On average, how many hours per day (out of 24-hours) have you remained at home during the coronavirus outbreak?*” Those reporting more than 24 hours at home ($n=2$) were recoded as missing. Histograms and frequencies were examined for hours spent at home. The median was determined as 23 hours and given this, a dichotomous variable (yes/no) was created based on those that reported spending at least 23 hours inside the home (i.e., reported 23 or 24 hours at home). Further, the 23-hour cutoff value used in this study is similar to stay-at-home orders in countries such as France, which allowed citizens only one hour of leave per day (DW Made for Minds, n.d.).

Urbanicity

Levels of urbanicity (urban, suburban, and rural) were based on the Department of Health and Human Services definition where urban was defined as ZIP codes where population density was over 3,000 persons per square mile; suburban was defined as ZIP codes where population density was between 1,000 and 3,000 persons per square mile; and rural was defined as ZIP codes where population density was less than 1,000 persons per square mile (Cyril, Oldroyd & Renzaho, 2013; Department of Health and Human Services, 2003). Population density was calculated within a geographic information system (*ArcGIS 10.6.1, ESRI, Redlands, CA*) from 2014–2018 American Community Survey 5-year estimates for total population per ZIP Code

Tabulation Area (ZCTA), and a Shapefile of ZCTAs (U.S. Census Bureau, 2018a; U.S. Census Bureau, 2019).

Sociodemographic and health-related characteristics

COVID-19 sickness was self-reported based on, “*Do you think you have been sick from coronavirus/COVID-19?*” and for those selecting “Yes” or “Maybe”, a follow-up question asking the outcome of the sickness – I have recovered, I am still sick, or I was never sick. Those selecting “I am still sick” were removed. Due to the study aims, participants who selected “Yes” to the question, “*Because of a physical, mental, or emotional condition, do you have difficulty doing errands alone such as visiting a doctor’s office or shopping?*” were also removed prior to analyses. Additionally, participants who selected “Yes” to the question, “*Is your work considered ‘essential services’?*” were also removed prior to analyses.

Sex was reported as sex at birth (male/female). Race/ethnicity was coded, based on response size, as “Non-Hispanic white” or “Non-white.” Non-white included Hispanic, Black or African American, Asian, American Indian/Alaska Native, Native Hawaiian or Other Pacific Islander, and More than One Race. Participants selected their current age from a continuous list (18-85 years), which was recoded into (18-24 years; 35-39 years; 50 years and older) based on response size. Household income was measured from ‘Less than \$9,999’ to ‘Over \$150,000’ in \$10,000 category increments and subsequently categorized as <\$50,000; \$50,000-\$100,000; \$100,000-\$150,000; and Over \$150,000. Education was measured as ‘Never attended school’; ‘Grades 1-8’; ‘Some high school’; ‘High school graduate/ GED’; ‘Some college/technical school’; and ‘College graduate or more.’ Those selecting anything other than ‘College graduate’ were recoded into ‘Not a college graduate.’ Presence of children less than 18 years of age living in the home was measured as free response (maximum response allowed = 75 children) and

categorized as ‘No’ if participants responded with 0 and ‘Yes’ if participants responded with 1+ children. Measures of health were depressive symptom severity (categorized into ‘none or mild’ and ‘moderate to severe’), measured by the Patient Health Questionnaire (PHQ-9) (Kroenke, Spitzer & Williams, 2001), and number of comorbidities selected, including asthma, obesity, cancer, etc. (categorized into ‘none’ and ‘one or more’) (see Questionnaire in Replication Package for a full list of measured comorbidities).

Statistical analysis

Descriptive analyses, including frequencies, percentages, means, and standard deviations, were calculated for participant characteristics, reasons for leaving home, and protective health behaviors. Logistic regression models were used to estimate the odds [odds ratios (OR) and 95% confidence intervals (CI)] of 1) leaving home (reasons) and 2) protective health behaviors by levels of urbanicity and participant characteristics. Each outcome (5 reasons for leaving home and 7 protective health behaviors) was modeled separately. The models were mutually adjusted for the other factors of interest (urbanicity, sex, age, education, income, children in the home, depression symptom severity, comorbidity). Variance inflation factors (VIF) (<5) were used to determine the presence of multicollinearity in the fully adjusted models. Analyses were performed using the odds ratio (*v1.0.2*; Schratz, 2017) and car (*Fox & Weisberg, 2019*) packages in RStudio version 1.2.5033 (*RStudio, PBC., Boston, MA*) and R version 3.6.2 (*R Core Team, 2019*). Research materials, data, and syntax files are available on Open Science Framework at the following link: https://osf.io/3vxpy/?view_only=3f6aef5c86184b42910fcd41a0af0faf

Results

The final analytical sample included 1,374 adults (71.7% female, 78.8% non-Hispanic white) primarily living in Texas (64.0%) (Table 1). Participants had a mean ($\pm$ standard

deviation) age of 42.7 ± 14.0 years, and the majority were college graduates (84.6%) with 63.1% reporting a household income of \$100,000 or more. About 40% of participants were living with one or more comorbidities, such as asthma ($n=196$; 34.5%) and/or obesity ($n=130$; 23.0%), and 20% were categorized as living with moderate to severe depressive symptom severity.

Of the five possible reasons for leaving the home that were measured, participants reported, on average ($M \pm SD$), leaving their home during stay-at-home orders for 2.4 ± 1.0 reasons total. The most commonly reported reasons for leaving home by respondents were grocery shopping (88.4%) and exercise (67.5%) (Figure 1). The models, where estimates were mutually adjusted for all factors of interest, are presented in Table 2. Rural residents had higher odds of leaving home for work compared with urban residents ($OR=1.64$, 95% CI :1.03, 2.61). Women reported significantly lower odds of leaving home for work ($OR=0.56$, 95% CI :0.38, 0.85), grocery ($OR=0.51$, 95% CI :0.31, 0.80) and other essential shopping ($OR=0.68$, 95% CI :0.52, 0.88) than men. The oldest age bracket had significantly higher odds for grocery shopping ($OR=2.07$, 95% CI :1.25, 3.48) and the middle age bracket had higher odds for leaving home for work ($OR=1.90$, 95% CI :1.14, 3.20) compared to the youngest age bracket. Compared to college graduates, those without a college degree had significantly lower odds of leaving home for grocery shopping ($OR=0.53$, 95% CI :0.33, 0.87) and exercise ($OR=0.69$, 95% CI :0.49, 0.98). Compared to the lowest income bracket, the highest income bracket had significantly higher odds for leaving home to exercise ($OR=1.69$, 95% CI :1.06, 2.67) and for walking the dog ($OR=2.33$, 95% CI :1.46, 3.80), and lower odds to leave for grocery shopping ($OR=0.38$, 95% CI :0.16, 0.79). Those with a household income between \$100,000-\$150,000 had significantly higher odds for leaving home for walking the dog ($OR=2.40$, 95% CI :1.49, 3.94). There were no significant differences between those reporting a household income between

\$50,000-\$100,000 and the lowest income bracket. Those living with one or more comorbidities had significantly lower odds of leaving home for grocery shopping ($OR=0.64$, $95\%CI:0.45$, 0.96) and exercise ($OR=0.61$, $95\%CI:0.47$, 0.79).

Of the seven possible protective health behaviors that were measured, participants reported, on average ($M\pm SD$), engaging in 4.8 ± 1.3 behaviors total. Physical/social distancing (97.2%) and frequent hand washing (91.8%) were the most commonly reported behaviors by participants (Figure 2). The models, where estimates were mutually adjusted for all factors of interest, are presented in Table 3. Suburban residents had significantly greater odds ($OR=1.45$, $95\%CI:1.08$, 1.94) of spending at least 23 hours inside the home compared to urban residents. Rural residents had significantly lower odds of wearing a protective mask ($OR=0.60$, $95\%CI:0.43$, 0.83) and gloves ($OR=0.60$, $95\%CI:0.41$, 0.88), compared to urban residents. Compared to men, women had significantly higher odds of physical/social distancing ($OR=2.34$, $95\%CI:1.12$, 4.85); washing hands frequently ($OR=1.72$, $95\%CI:1.11$, 2.66); wearing a protective mask ($OR=1.58$, $95\%CI:1.20$, 2.08); using hand sanitizer ($OR=1.48$, $95\%CI:1.09$, 2.00); and disinfectant wipes ($OR=1.82$, $95\%CI:1.40$, 2.36). Those in the oldest age bracket had significantly higher odds of using protective masks ($OR=2.02$, $95\%CI:1.42$, 2.91); disinfectant wipes ($OR=1.46$, $95\%CI:1.06$, 2.02); and wearing gloves ($OR=2.63$, $95\%CI:1.81$, 3.85); however, they had significantly lower odds of using hand sanitizer ($OR=0.65$, $95\%CI:0.45$, 0.95) and spending at least 23 hours inside the home ($OR=0.70$, $95\%CI:0.50$, 0.98), compared to the youngest age bracket. There were no significant differences between the middle age bracket and the youngest age bracket. Those without a college degree had significantly lower odds of physical/social distancing ($OR=0.41$, $95\%CI:0.18$, 0.98) than those with a college degree or more. Those with children had significantly higher odds of using disinfectant wipes ($OR=1.43$,

95%CI:1.09, 1.88). Participants with moderate to severe depressive symptom severity had significantly lower odds of physical/social distancing ($OR=0.37$, 95%CI:0.17, 0.84) compared to those with none or mild symptom severity. Finally, compared to those without a comorbidity, those with one or more had significantly higher odds of using hand sanitizer ($OR=1.39$, 95%CI:1.03, 1.88). No significant differences by household income for any of the measured protective health behaviors were found, when controlling for the other participants characteristics.

Discussion

During the COVID-19 movement restriction orders, the reasons for a convenience sample of U.S. adults leaving their homes and their protective health behaviors were explored. The major findings of this study were that in this sample of U.S. adults, those who were male, younger, living without comorbidities, and residing in rural areas had higher odds of leaving the home and lower odds of enacting various protective health behaviors. These findings suggest that encouraging protective health behaviors is needed among specific sociodemographic populations including males, younger individuals, and rural communities, especially as cases rise across the U.S (CDC, 2020c).

State-wide orders were established by government officials to help mitigate the risk of COVID-19 hospitalizations by mandating individuals stay home as much as possible (Sen et al., 2020). Approximately 80% of CDC survey respondents approved of state-wide movement restriction orders (Czeisler et al., 2020). This study supports this finding as almost 70% of participants reported staying at home 23 hours or more hours per day.

Reasons for leaving the home differed by sociodemographic characteristics. Leaving home to grocery shop was reported by almost 90% of the sample, and the greatest number of

differences across populations was seen for this activity. Individuals reporting household incomes of \$150,000 or more and those without a college education were less likely to report leaving home to grocery shop. These findings may be due to the availability of online shopping and delivery services for those with the financial ability to do so. The use of meal delivery services increased by an estimated 70% at the end of March 2020 from the previous year (Hobbs, 2020; Savitz, 2020).

Income and education categories were also associated with individuals leaving the home to exercise and/or walk their dogs. Those in the highest income and education categories, and those without a comorbidity were more likely to leave the home to exercise and/or walk their dogs. Evidence suggests that certain chronic conditions may be associated with a higher risk of COVID-19 severity and death (CDC, 2020b; Yang et al., 2020). Therefore, those with chronic conditions may have higher perceived risk of disease and subsequently stay at home more. Future studies should include measures of perceived risk when studying leaving home and protective health behaviors during pandemics to examine this association. Additionally, while this study only captured two types of physical activity behaviors, researchers have found the greatest reductions in walking during the early COVID-19 time period occur among those in lower income households (Dunton et al., 2020).

Individuals' protective health behaviors also varied by levels of urbanicity, sex, age, education, income, and comorbidity status. The finding that suburban residents were more likely to spend at least 23 hours inside the home compared to urban residents may be because there is typically more space available within suburban private homes than in urban areas. Generally, suburban communities are characterized by large lots with single-family detached homes and private yards (Ewing, 2008). In urban areas single-family detached homes constitute only 57.5%

of all housing units with multifamily housing accounting for a large percentage of housing (32.0%) (U.S. Census Bureau, 2018b). However, in rural areas, 77.1% of housing units are single-family detached homes (U.S. Census Bureau, 2018b). These differences in housing spaces and the lower population density may explain why rural residents were less likely to wear protective masks and gloves compared to urban residents as they may perceive their risk for COVID-19 infection as lower than those living in urban areas. As found by Chen & Chen (2020), rural residents may evaluate the relevance of the protective health information as less salient to them than urban residents and therefore are less likely to engage in protective behaviors. Future research could also consider examining political beliefs in the context of urbanicity differences as geographical areas may have variations in majority party affiliations (Parker et al., 2018). Painter & Qiu (2020) found that residents living in Republican counties were less likely to fully comply with movement restriction orders relative to those living in Democratic counties. Further, political conservatism has been found to mediate trust in science and compliance with COVID-19 preventive behaviors, such that those with higher political conservatism trust science to a lesser degree, and therefore have lower levels of compliance with preventive behaviors (Plohl & Musli, 2020).

Men, younger adults, those without children, and those living without comorbidities were less likely to report protective health behaviors. Several of these differences may be explained by the evidence that men and younger populations have been found to engage in risky health behaviors more than their counterparts (Duell et al., 2018; Pawlowski et al., 2008). Also, as perceived risk is associated with behavior change (Abdelrahman, 2020; Bish & Michie, 2010; Harper et al., 2020), women in this sample may have perceived themselves as more susceptible to COVID-19 than men and therefore engaged in protective behaviors to a greater degree.

Moreover, the present results are in line with a study in Hubei Province, China, which found that women and older adults in higher socioeconomic status households were most likely to wear face masks and were most knowledgeable about the importance of wearing masks (Zhong et al., 2020).

An urgent public health response is needed to increase adherence to mask wearing and maintaining physical/social distance among men, younger individuals, and in rural contexts. Evidence suggests that men have a higher risk of COVID-19 severity and death, and in states where cases are surging, younger individuals are making up a growing number of cases (Chu et al., 2020; Fox, 2020; Zheng et al., 2020). In Texas (as of late June 2020), residents under the age of 30 contributed to the majority of positive cases (Champagne & Oxner, 2020). Additionally, the known health disparities across rural environments such as healthcare access and critical care resources have hindered the infectious disease response in rural communities and may result in greater mortality in these areas due to COVID-19 (Santibanez et al., 2019; Prusaczyk, 2020). Thus, national, state, and local health leaders should target their messaging around adherence to protective health behaviors towards men, younger individuals, and rural communities as this may be critical for preventing the spread and consequences of COVID-19.

Limitations

The findings of this study were from a convenience sample that was overrepresented by women, higher income, college educated, non-essential workers, and non-Hispanic white individuals. Further, individuals without online access would have been unable to participate in this web-based survey. Although most of the sample resided in Texas, participants across 39 states (+ District of Columbia) were surveyed. Because these results may not be generalizable, future studies should strive to capture these behaviors in other populations. Despite this, the

convenience sampling methodology allowed for an important first step in the surveillance of human behavior during a critical time period of COVID-19. The reliance of self-report for this survey might have been subject to social desirability bias; making the survey anonymous attempted to mitigate bias. In addition, there may be other sociodemographic exposures that influence protective health behaviors and reasons for leaving home (Plohl & Musil, 2020). Additionally, including psychological exposures and measures associated with behavior change such as perceived risk, knowledge, beliefs, social context, and policy efforts in the context of COVID-19 is needed to strengthen future efforts to encourage protective health behaviors and inform public health strategies and communication efforts. Finally, the U.S. stay-at-home/shelter-in-place orders had no specific requirements for the number of hours spent at home, unlike in other countries. Therefore, using a different cutoff value may lead to different associations. However, the 23-hour cutoff value used in this study is similar to stay-at-home orders in other countries, such as France, which allowed citizens only one hour of leave per day (DW Made for Minds, n.d.).

Conclusions

As COVID-19 continues to spread across the U.S. with over 7.4 million cases and over 200,000 deaths to date, reducing the burden of disease is paramount (CDC, n.d.). We know that human behaviors enforced by mitigation policies, such as stay-at-home orders and CDC recommendations, can significantly limit the growth and impact of COVID-19 (Hsiang et al., 2020). As one of the first national surveys conducted on COVID-19 and individuals' behavior, these findings underlay the need for federal-, state-, and community-level leadership to continue encouraging protective behaviors as people travel to essential services. In addition, sustained public health response efforts should promote use and provide access to protective masks, hand

sanitizer, and disinfectant wipes for individuals that are least likely to engage in protective health behaviors such as males, younger individuals, and those in rural areas. Clarity in health messages and developing intervention efforts involving these groups could be one strategy to mitigate the spread of the virus. Alongside determining the mechanisms behind reasons for leaving the home and protective health behaviors during COVID-19, national surveillance is desperately needed to uncover additional sociodemographic disparities in leaving the home and protective health behaviors.

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Figure Caption List

Figure 1. Prevalence of reported reasons for leaving home during COVID-19 pandemic among a convenience sample of U.S. adults, 2020.

Figure 2. Prevalence of reported protective health behaviors during COVID-19 pandemic among a convenience sample of U.S. adults, 2020.

Table 1. Participant characteristics of the sample (N = 1374)

Characteristic	Total % (n)
Urbanicity	
Urban	43.2 (593)
Suburban	33.3 (458)
Rural	22.0 (302)
Missing	1.5 (21)
Sex	
Male	28.0 (385)
Female	71.7 (985)
Missing	0.3 (4)
Race	
Non-Hispanic white	78.8 (1083)
Non-white	18.6 (256)
Missing	2.5 (35)
Age	
18-34	30.1 (414)
35-49	39.2 (539)
50 and older	29.9 (411)
Missing	0.7 (10)
Education	
Not a college graduate	15.3 (210)
College graduate or more	84.6 (1162)
Missing	0.1 (2)
Income	
<\$50,000	10.1 (139)
\$50,000-\$100,000	24.5 (336)
\$100,000-\$150,000	24.7 (339)
Over \$150,000	38.4 (537)
Missing	2.4 (33)
Children	
No	56.3 (774)
Yes	42.3 (581)
Missing	1.4 (19)
Depressive Symptom Severity	
None/Mild	73.1 (1004)
Moderate to Severe	20.1 (285)
Missing	6.2 (85)
Comorbidity	
None	58.7 (807)
1 or more	41.3 (567)
Missing	—

Table 2. Adjusted odds for reasons for leaving home during COVID-19 pandemic movement restriction orders

	Reasons for Leaving Home				
	Grocery Shopping	Exercise	Walking Dog	Other Essential Shopping	Work
N = 1374	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
<i>Urbanicity (Referent = Urban)</i>					
Suburban	0.99 (0.65, 1.53)	1.06 (0.79, 1.43)	0.89 (0.68, 1.17)	0.76 (0.57, 1.00)	0.70 (0.42, 1.15)
Rural	0.89 (0.56, 1.46)	0.77 (0.56, 1.07)	0.78 (0.57, 1.06)	0.95 (0.70, 1.30)	1.64 (1.03, 2.61)
<i>Sex (Referent = Male)</i>					
Female	0.51 (0.31, 0.80)	0.85 (0.64, 1.13)	1.14 (0.88, 1.48)	0.68 (0.52, 0.88)	0.56 (0.38, 0.85)
<i>Age (Referent = 18-34 years)</i>					
35-49 years	1.52 (0.96, 2.40)	0.79 (0.56, 1.09)	1.12 (0.83, 1.53)	1.04 (0.76, 1.42)	1.90 (1.14, 3.20)
50 years and older	2.07 (1.25, 3.48)	0.77 (0.54, 1.09)	1.08 (0.78, 1.49)	1.31 (0.94, 1.81)	1.14 (0.64, 2.03)
<i>Education (Referent = College graduate or more)</i>					
Not a college graduate	0.53 (0.33, 0.87)	0.69 (0.49, 0.98)	0.80 (0.56, 1.13)	1.17 (0.83, 1.63)	0.84 (0.46, 1.46)
<i>Household Income (Referent = <\$50,000)</i>					
\$50,000-\$100,000	0.54 (0.23, 1.13)	1.48 (0.94, 2.33)	1.44 (0.90, 2.35)	0.94 (0.60, 1.49)	1.25 (0.61, 2.71)
\$100,000-\$150,000	0.50 (0.21, 1.06)	1.30 (0.81, 2.06)	2.40 (1.49, 3.94)	1.01 (0.64, 1.61)	0.97 (0.46, 2.18)
Over \$150,000	0.38 (0.16, 0.79)	1.69 (1.06, 2.67)	2.33 (1.46, 3.80)	0.98 (0.62, 1.55)	0.79 (0.38, 1.79)
<i>Children (Referent = No)</i>					
Yes	1.05 (0.69, 1.62)	1.25 (0.93, 1.67)	0.94 (0.71, 1.23)	1.16 (0.88, 1.53)	0.86 (0.55, 1.35)
<i>Depressive Symptom Severity (Referent = None/Mild)</i>					
Moderate to Severe	1.30 (0.83, 2.09)	0.77 (0.57, 1.04)	0.97 (0.72, 1.31)	0.95 (0.70, 1.28)	1.08 (0.53, 1.21)
<i>Comorbidity (Referent = None)</i>					
1 or More	0.65 (0.45, 0.96)	0.61 (0.47, 0.79)	1.13 (0.89, 1.45)	1.18 (0.92, 1.52)	0.80 (0.56, 1.14)

CI confidence interval; OR odds ratio

^aAdjusted models are mutually adjusted for all other variables

^bBoldface indicates statistical significance ($p < 0.05$)

Table 3. Adjusted odds for protective health behaviors during COVID-19 pandemic movement restriction orders

	Protective Health Behaviors						
	Physical/ social distancing	Washing hands frequently	Using hand sanitizer	Protective mask	Spending at least 23 hours inside the home	Using disinfectant wipes	Wearing gloves
N = 1374	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Urbanicity (<i>Referent = Urban</i>)							
Suburban	0.71 (0.32, 1.60)	0.99 (0.61, 1.62)	1.12 (0.81, 1.56)	0.91 (0.67, 1.23)	1.45 (1.08, 1.94)	1.28 (0.97, 1.69)	0.82 (0.60, 1.12)
Rural	1.11 (0.43, 3.24)	1.05 (0.61, 1.86)	1.20 (0.83, 1.75)	0.60 (0.43, 0.83)	1.32 (0.96, 1.82)	0.95 (0.70, 1.29)	0.60 (0.41, 0.88)
Sex (<i>Referent = Male</i>)							
Female	2.34 (1.12, 4.85)	1.72 (1.11, 2.66)	1.48 (1.09, 2.00)	1.58 (1.20, 2.08)	1.17 (0.89, 1.54)	1.82 (1.40, 2.36)	1.18 (0.87, 1.61)
Age (<i>Referent = 18-34 years</i>)							
35-49 years	0.76 (0.30, 1.97)	0.67 (0.38, 1.17)	0.97 (0.67, 1.41)	1.25 (0.91, 1.72)	0.90 (0.65, 1.24)	1.03 (0.76, 1.40)	1.33 (0.92, 1.94)
50 years and older	0.99 (0.35, 2.82)	0.81 (0.45, 1.46)	0.65 (0.45, 0.95)	2.02 (1.42, 2.91)	0.70 (0.50, 0.98)	1.46 (1.06, 2.02)	2.63 (1.81, 3.85)
Education (<i>Referent = College graduate or more</i>)							
Not a college graduate	0.41 (0.18, 0.98)	1.11 (0.62, 2.13)	1.16 (0.78, 1.76)	0.88 (0.61, 1.27)	0.94 (0.66, 1.34)	1.24 (0.88, 1.74)	1.23 (0.83, 1.79)
Household Income (<i>Referent = <\$50,000</i>)							
\$50,000-\$100,000	0.81 (0.17, 2.99)	1.22 (0.60, 2.69)	1.29 (0.77, 2.13)	1.19 (0.74, 1.89)	1.27 (0.81, 1.99)	1.01 (0.65, 1.57)	1.67 (0.96, 3.02)
\$100,000-\$150,000	0.83 (0.16, 3.32)	1.45 (0.55, 2.58)	1.04 (0.62, 1.73)	1.22 (0.75, 1.98)	1.24 (0.77, 1.97)	1.09 (0.69, 1.71)	1.70 (0.96, 3.12)
Over \$150,000	0.57 (0.12, 2.07)	1.45 (0.66, 3.06)	1.56 (0.92, 2.60)	0.98 (0.60, 1.56)	1.51 (0.95, 2.39)	1.32 (0.84, 2.06)	1.51 (0.86, 2.75)
Children (<i>Referent = No</i>)							

Yes	1.32 (0.59, 3.02)	1.50 (0.92, 2.48)	1.33 (0.96, 1.86)	0.84 (0.63, 1.13)	1.08 (0.81, 1.44)	1.43 (1.09, 1.88)	1.03 (0.75, 1.42)
Depressive Symptom Severity (<i>Referent = None/Mild</i>)							
Moderate to Severe	0.37 (0.17, 0.84)	0.82 (0.50, 1.38)	0.76 (0.54, 1.08)	1.08 (0.79, 1.49)	1.24 (0.91, 1.71)	0.88 (0.65, 1.18)	1.12 (0.79, 1.58)
Comorbidity (<i>Referent = None</i>)							
1 or More	1.87 (0.87, 4.31)	0.94 (0.61, 1.46)	1.39 (1.03, 1.88)	1.19 (0.91, 1.55)	1.16 (0.99, 1.50)	1.04 (0.81, 1.32)	1.01 (0.77, 1.35)

CI confidence interval; *OR* odds ratio

^aAdjusted models are mutually adjusted for all other variables

^bBoldface indicates statistical significance ($p < 0.05$)

Title Page

Title: Associations of Urbanicity and Sociodemographic Characteristics with Protective Health Behaviors and Reasons for Leaving the Home during COVID-19

Abstract

Background

There are few data on the characteristics of US adults' compliance with movement restrictions (i.e. "stay-at-home" orders) and protective health behaviors during the COVID-19 pandemic.

Purpose

To evaluate the associations of individual- and area-level characteristics (urbanicity) with reasons for leaving the home and subsequent protective health behaviors during the COVID-19 pandemic.

Methods

A convenience sample of U.S. adults (N=2,441) completed an online survey on their reasons for leaving home and subsequent protective health behaviors. Multivariable logistic regression models estimated the odds of citing a reason for leaving home and protective health behaviors by levels of urbanicity and sociodemographic factors. Data collection and analyses were conducted between April and June 2020.

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Results

The analytic sample (n=1,374) was primarily Non-Hispanic white (79%), female (72%), urban residents (43%), and college degree or higher (85%). Rural residents (versus urban residents) had lower odds of wearing a mask (OR=0.60, 95%CI:0.43-0.83) and gloves (OR=0.60, 95%CI:0.41-0.88). Women (versus men) had lower odds of leaving the home for shopping (grocery:

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OR=0.51, 95%CI:0.31-0.80; other essential: OR=0.68, 95%CI:0.52-0.88), and higher odds ($p<0.05$) to use most of the protective health behaviors. Older adults (≥ 50 years) versus younger adults (18-34 years)], had higher odds to leave home for grocery shopping (OR=2.07, 95%CI:1.25-3.48), and higher odds ($p<0.05$) to wear masks, wear gloves, and use disinfectant wipes.

Conclusions

The differences for leaving the home and protective health behaviors by age, sex, and urbanicity can be useful for future health promotion strategies to encourage best practices that limit the spread of COVID-19.

Keywords: COVID-19; COVID-19 Behaviors; Mitigation Strategies; Protective Health Behaviors; Urbanicity

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Introduction

On March 13, 2020, the novel Coronavirus Disease 2019 (COVID-19) was declared a national emergency in the U.S. following the World Health Organization (WHO) characterization of the virus as a pandemic (Trump, 2020). After the national declaration, movement restrictions (i.e., “stay-at-home” or “shelter-in-place” orders) were implemented between March 19-April 7, 2020 (Silverstein, 2020). Although policies varied by state, county, and municipality generally residents were required to stay at home, unless one’s occupation was considered essential or to carry out essential services. Proximal to these state-wide orders, the Centers for Disease Control and Prevention (CDC) released recommended community mitigation strategies to reduce the risk of infection, which included maintaining physical or social distance, wearing a face mask, washing hands frequently, and cleaning and disinfecting frequently touched surfaces (Allegrante et al., 2020; Centers for Disease Control and Prevention, 2020a). With no pharmaceutical treatments or vaccines currently available for the virus, the combination of these protective health behaviors is the only existing population-level health intervention. The objectives of these strategies are to reduce transmission rates of COVID-19 until wide-scale vaccines and effective antiviral drugs are available (Andersen et al., 2006).

Given the reliance on human behavior to reduce community transmission of COVID-19, there remains a limited understanding of the public’s compliance with these protective health recommendations during the state-wide orders. In one report, April 7, 2020 was identified as the peak of adherence to restrictive movement orders in the U.S., with Americans staying at home for 93% of the day (i.e., 22.3 hours) (Schaul et al., 2020). Although these data were anecdotal, the researchers found Americans were primarily visiting parks and grocery stores when they did leave the home, and individuals exhibited different propensities for leaving the home based on

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levels of urbanicity – those living in rural areas tended to leave the home more than those living in suburban and urban areas (Schaul et al., 2020). Geographic differences in health behaviors have also been seen across a variety of other health behaviors. Residents in rural areas have been found to generally smoke more, eat less nutritious foods, and engage in less leisure time physical activity compared to urban and suburban residents (Eberhardt & Pamuk, 2004; Hartley, 2004).

Given this, one may hypothesize that rural residents may be less likely to engage in protective behaviors during COVID-19; however, this is yet to be fully understood. Additionally, there is limited understanding for the differences in protective health behaviors across sociodemographic characteristics, which is needed for determining at-risk populations and developing targeted public health interventions.

Ultimately as movement restriction orders are lifted, the behavioral decisions individuals make during the pandemic are central to preventing community transmission. Despite the significance of these protective health behaviors, researchers have yet to explore how urbanicity and sociodemographic characteristics are associated with Americans' reasons for leaving the home and protective health behaviors during COVID-19 state-wide orders. Understanding these associations may help to develop policies and public health communication efforts across a variety of communities, particularly among those who are the least compliant in following protective health behaviors and/or the most vulnerable to the virus. Therefore, the purpose of this study was to evaluate the associations of urbanicity and sociodemographic characteristics with 1) reasons for leaving home and 2) protective health behaviors, during the COVID-19 movement restriction orders among a sample of U.S. adults.

Methods

Study sample

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Between April 15-May 5, 2020, after movement restriction orders were implemented in a majority of states, a convenience sample of adults residing in the U.S. was recruited through various media outlets (i.e., Twitter, Facebook, Instagram) and were asked to respond to a 15-minute online survey on current health behaviors. Study data were collected and managed using REDCap electronic data capture tools hosted at the XXXXX (Harris et al., 2009). Participants were provided a brief overview of the study; informed their participation was anonymous; and asked for informed consent prior to completing the survey. Participants could have terminated the survey at any time. This study was approved by the Committee for the Protection of Human Subjects review board at XXXXXX (IRB number: HSC-SPH-20-0346). All procedures performed were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

The survey was submitted by 2,441 participants. For the current study, participants were included in the analyses if they reported a stay-at-home/shelter-in-place order at the time of survey completion ($n=1,859$ [76.2%]). Participants were excluded from analyses if they 1) had no ZIP code ($n=26$ [1.4%]); 2) were currently sick with COVID-19 ($n=27$ [1.5%]); 3) had a physical, mental, or emotional condition causing them serious difficulty with doing errands ($n=39$ [2.1%]); or 4) self-reported their employment as an “essential service” ($n=393$ [21.1%]). Essential service workers were excluded from these analyses due to the potential need to leave their residence for work and differences in necessity of protective health behaviors.

Measures

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To assess reasons for leaving the home during COVID-19, participants were asked, “*For what reasons have you left your home during the “stay in place” order?*” Responses included: 1) work; 2) grocery shopping; 3) other essential shopping; 4) exercise; and 5) walking dog. Responses were dichotomized into yes/no.

Protective health behaviors were assessed with two questions. First, participants were asked, “*If you leave your home for any reason, what do you do to protect yourself when out in public?*” Responses included: 1) physical/social distancing; 2) protective mask; 3) wearing gloves; 4) using hand sanitizer; 5) using disinfectant wipes; and 6) washing hands frequently. Responses were dichotomized into yes/no. Second, participants were asked, “*On average, how many hours per day (out of 24-hours) have you remained at home during the coronavirus outbreak?*” Those reporting more than 24 hours at home ($n=1$) were recoded as missing. Histograms and frequencies were examined for hours spent at home. The median was determined as 23 hours and given this, a dichotomous variable (yes/no) was created based on those that reported an hour or less spent outside the home.

Levels of urbanicity (i.e., urban, suburban, and rural) were based on the Department of Health and Human Services definition where urban was defined as ZIP codes where population density was over 3,000 persons per square mile; suburban was defined as ZIP codes where population density was between 1,000 and 3,000 persons per square mile; and rural was defined as ZIP codes where population density was less than 1,000 persons per square mile (Cyril et al., 2013; Department of Health and Human Services, 2003). Population density was calculated within a geographic information system (*ArcGIS 10.6.1, ESRI, Redlands, CA*) from 2014–2018 American Community Survey 5-year estimates for total population per ZIP Code Tabulation Area (ZCTA), and a Shapefile of ZCTAs (United States Census Bureau, n.d., 2019).

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Sociodemographic characteristics of interest were sex, age, household income, education level, and presence of children in the home. Characteristics were computed into categorical variables prior to analysis (Table 1). Measures of health were depressive symptom severity (none or mild/moderate to severe), measured by the Patient Health Questionnaire (PHQ-9), and comorbidities (none/one or more) (Kroenke et al., 2001).

Statistical analysis

Descriptive analyses, including frequencies and percentages, were calculated. Logistic regression models (crude and adjusted) were used to estimate the odds [odds ratios (OR) and 95% confidence intervals (CI)] of 1) leaving the home (reasons) and 2) protective health behaviors by levels of urbanicity and sociodemographic characteristics. Variance inflation factors (VIF) (<5) were used to determine the presence of multicollinearity in the fully adjusted models. Analyses were performed using RStudio version 1.2.5033 (RStudio, PBC., Boston, MA).

Results

The final analytical sample included 1,374 adults (71.7% female, 78.8% non-Hispanic White) who primarily lived in Texas (64.0%) (Table 1). Participants had a mean ($\pm$ standard deviation) age of 42.7 ± 14.0 years, and the majority were college graduates (84.6%) with 63.1% reporting a household income of \$100,000 or more. About 40% of participants were living with one or more comorbidities, such as asthma ($n=196$; 34.5%) and/or obesity ($n=130$; 23.0%), and 20% were categorized as living with moderate to severe depressive symptom severity.

Out of the five reasons for leaving the home that were measured, 2.4 ± 1.0 reasons were reported by participants. The most commonly reported reasons for leaving the home were grocery shopping (88.4%) and exercise (67.5%) (Figure 1). In the fully adjusted model (Table 2), where estimates were mutually adjusted for all factors of interest, rural residents had higher odds

Commented [A12]: How were these reported by participants? Could they enter any value for income, for example, or were they selecting from options? Please make more explicit – e.g., the bands that age was split into

Commented [A13]: Can you give examples of comorbidities for illustrative purposes? Are these comorbidities of depression, or general health conditions (i.e., someone could have a standalone health condition such as asthma and no other conditions/depression symptoms – in which cases the term “comorbidities” isn’t appropriate)

Commented [A14]: For which variables? More information would be useful here as there are mean and standard deviations reported below too.

Commented [A15]: Which outcomes were models conducted for? Were they conducted separately for each outcome? Were any corrections for multiple tests carried out?

Commented [A16]: Which predictors were included in the crude and unadjusted models?

Commented [A17]: Would be useful to know how representative of the population the current sample is.

Commented [A18]: Please make it clearer that this is a mean average. You could consider reporting means and standard deviations as ($M = 2.4$, $SD = 1.0$)

Commented [A19]: Make clearer that this is 88.4% of respondents

Commented [A20]: Any mention of the crude models? Not clear what these were investigating.

Commented [A21]: These factors should be explained clearly in the analysis section

of leaving home for work compared with urban residents. Women reported significantly lower odds of leaving home for work, grocery and other essential shopping than men. The oldest age group had significantly higher odds for grocery shopping and the middle age group had higher odds for leaving home for work compared to the youngest age group. Compared to college graduates, those without a college degree had significantly lower odds of leaving home for grocery shopping and exercise. The highest income bracket had significantly higher odds for leaving home to exercise and for walking the dog, however, lower odds to leave for grocery shopping, compared to the lowest income bracket. Those living with one or more comorbidities had significantly lower odds of leaving home for grocery shopping and exercise.

Out of the seven protective health behaviors that were measured, participants reported 4.8 ± 1.3 behaviors. Physical/social distancing (97.2%) and frequent hand washing (91.8%) were the most commonly reported behaviors (Figure 2). In the fully adjusted model (Table 3), where estimates were mutually adjusted for all factors of interest, suburban residents had significantly greater odds of spending an hour or less outside the home compared to urban residents. Rural residents had significantly lower odds of wearing a protective mask and gloves, compared to urban residents. Compared to men, women had significantly higher odds of physical/social distancing, washing hands frequently, wearing a protective mask, and using hand sanitizer or disinfectant wipes. Those in the oldest age bracket had significantly higher odds of using protective masks, disinfectant wipes, and wearing gloves; however, they had significantly lower odds of using hand sanitizer and spending less than one hour outside the home, compared to the youngest age bracket. Those without a college degree had significantly lower odds of physical/social distancing than those with a college degree or more. Those with children had significantly higher odds of using disinfectant wipes. Participants with moderate to severe

Commented [A22]: It would be useful to have some information in-text about the magnitude of the increase in odds (although I understand that specific statistics will be available in the tables)

Commented [A23]: It could be useful to highlight in the text where there were (or were not) differences between the middle income bracket versus the lowest income bracket.

Commented [A24]: Could be explicit about the baseline – “compared to those with no comorbidities”.

Commented [A25]: Similar comment about stating this is M and SD, and about explicitly reporting that the % reflect the percentage of respondents reporting them

Commented [A26]: This would be easier to understand if it was phrased “spending at least 23 hours inside the home” to show that this group is mainly staying in (rather than focusing on time spent out – it makes it sound like they’re going out more)

depressive symptom severity had significantly lower odds of physical/social distancing compared to those with none or mild symptom severity. Finally, compared to those without a comorbidity, those with one or more had significantly higher odds of using hand sanitizer.

Discussion

During the COVID-19 movement restriction orders, the reasons for a convenience sample of U.S. adults leaving their homes and their protective health behaviors were explored. The major findings of this study were that in this sample of U.S. adults, those who were male, younger, living without comorbidities, and residing in rural areas had higher odds of leaving the home and lower odds of using various protective health behaviors. These findings suggest that encouraging protective health behaviors is needed among specific sociodemographic populations including males and younger individuals, especially as cases rise across the U.S (Centers for Disease Control and Prevention, 2020c)

State-wide orders were established by government officials to help mitigate the risk of COVID-19 hospitalizations by mandating that individuals stay home as much as possible (Sen et al., 2020). Approximately 80% of CDC survey respondents approved of their state-wide movement restriction order (Czeisler et al., 2020). This study supports this finding as almost 70% of participants reported staying at home 23 hours or more hours per day and 88% stayed at home an average of 22 or more hours per day.

The finding that rural residents were more likely to leave the home for work compared to urban residents may relate to differences in political beliefs and employment type. Geographical areas may consist of variations in majority party affiliations, for example urban areas in the U.S. are generally characterized by majority Democrats (Parker et al., 2018). In a recent study, individuals living in Republican counties were less likely to fully comply with movement

Commented [A27]: Enacting or carrying out?

Commented [A28]: Earlier it states that the sample was divided based on whether they spent at least 23 hours per day at home. There is no discussion of the 22 hour cut-off in methods or results.

restriction orders relative to individuals living in Democratic counties (Painter & Qiu, 2020). In addition, rural residents may have professions that offer less flexibility to work remotely than those of urban residents. Furthermore, rural residents oftentimes have less access to paid sick days and lower access to internet services than non-rural residents, which may put pressure on rural workers to continue to leave the home for work (Smith & Schaefer, 2011).

In addition to urbanicity findings, several sociodemographic differences across reasons for leaving the home were found. Leaving home to grocery shop was reported by almost 90% of the sample, and the greatest number of differences across populations was seen for this activity. Individuals reporting household incomes of \$150,000 or more and those without a college education were less likely to report leaving home to go grocery shopping. These findings may be due to the availability of online shopping and delivery services for those with the financial ability to do so. The use of meal delivery services increased by an estimated 70% at the end of March 2020 from the previous year (Hobbs, 2020; Savitz, 2020).

Income and education categories were also associated with individuals leaving the home to exercise and/or walk their dogs. Those in the highest income and education categories, and those without a comorbidity were more likely to leave the home to exercise and/or walk their dogs. Early evidence suggests that certain chronic conditions may be health conditions associated with a higher risk of COVID-19 severity and death (Centers for Disease Control and Prevention, 2020b; Yang et al., 2020). As widely known, physical activity is associated with reduction in risk of these chronic conditions (Booth et al., 2012). However, the present study showed that individuals with comorbidities left home less frequently to exercise compared to those without an underlying condition during this time period. The study's findings align with the existing direct association between physical activity and socioeconomic status among adults,

Commented [A29]: There are a number of interesting reasons for the observed differences here – why were none of these recorded in the survey? Some reflection on the limitations of the study (i.e., for not exploring the impact of various psychological factors on behaviour) could be added.

Commented [A30]: However these groups were more likely to report going outside for other reasons, which is interesting. This could be highlighted here and discussed with regards to potential reasons.

such that those of higher income tend to engage in more physical activity (Trost et al., 2002). Similar to the present study, researchers found the greatest reductions in walking among those in lower income households during the early COVID-19 time period (Dunton et al., 2020).

Individual's protective health behaviors also varied by levels of urbanicity, sex, age, education, income, and comorbidity status. The finding that suburban residents were more likely to spend an hour or less outside the home compared to urban residents may be a product of more space available in suburban areas than in urban areas. Conventional suburban communities are typically characterized by large lots with single-family detached homes and private yards.²⁸ Rural residents were less likely to wear protective masks and gloves compared to urban residents, which could also be related to increased space, lower population density, fewer destinations to travel, and political party affiliation (Painter & Qiu, 2020; Plohl & Musil, 2020; Schaul et al., 2020).

Men, younger adults, those without children, and those living without comorbidities were less likely to report protective health behaviors. Several of these differences are not surprising as men and younger populations have been found to engage in risky health behaviors more than their counterparts (Duell et al., 2018; Pawlowski et al., 2008). Moreover, the present results are in line with a recent study in Hubei Province, China, which found that women and older adults in higher SES households were most likely to use a mask and were also most knowledgeable about the importance of the behavior (Zhong et al., 2020). Given the effectiveness of using face masks and physical/social distancing of at least six feet in reducing the spread of infection against coronaviruses (i.e., SARS, MERS, COVID-19), the differences observed in the current study are notable. Furthermore, evidence suggests that men have a higher risk of COVID-19 severity and death, and in states where cases are surging, younger individuals are making up a growing

Commented [A31]: This conclusion isn't fully supported by the data – total PA was not measured, only leaving the home for PA. Perhaps PA was occurring in the home as well.

Commented [A32]: This could be made clearer – again, by emphasizing that suburban residents are spending 23 or more hours at home (emphasis on the staying at home, not the going out), and also by making it clear that there is more space “within private homes” in suburban areas – at first I read this to mean that there was more space in the suburban neighbourhoods (e.g., public parks) which would have been a reason for people to leave home, not stay in

Commented [A33]: Can you describe the typical urban living arrangement as a comparison?

Commented [A34]: Can you describe why these factors may impact these behaviours in this way? For example why would increased space lead to less use of PPE? What are the theorized psychological underpinnings? Decreased perception of risk?

number of cases (Chu et al., 2020; Fox, 2020; Zheng et al., 2020). In Texas (as of late June 2020), residents under the age of 30 were **attributing** to the majority of positive cases (Champagne & Oxner, 2020). It is clear that ensuring adherence to these protective health behaviors among these groups is critical for virus prevention and spread.

Limitations

The findings of this study were from a convenience sample that was overrepresented by women, high socioeconomic status (SES), college educated or more, non-essential workers, and non-Hispanic white individuals. Thus, these results may not be generalizable, however future studies should strive to capture these behaviors in populations at most risk to **COVID-19**.

Further, as this survey was administered online, individuals without online access may have been unable to participate in this study. The reliance of self-report for this survey might have been subject to social desirability bias; however, making the survey anonymous attempted to mitigate these issues. In addition, there may be other sociodemographic exposures that might influence protective health behaviors and reasons for leaving the home (Plohl & Musil, 2020). A follow-up study could strengthen these analyses by including additional exposures and measures associated with behavior change such as perceived risk, knowledge, beliefs, social context, and policy **efforts**. Finally, the U.S. stay-at-home/shelter-in-place orders had no specific requirements for

the number of hours spent at home, unlike in other countries. Therefore, using a cutoff value of 23 or more hours spent at home as a protective behavior may have influenced the results of this **study**. However, results examining a cutoff value of 22 or more hours (data not presented) in which 88% complied, showed similar findings. **The** 23-hour cutoff value used in this study is similar to stay-at-home orders in other countries, such as France, which allowed citizens only

Commented [A35]: Should this be contributing?

Commented [A36]: Could you expand on which populations are most at risk? There is a lot more potential to discuss health inequalities in the paper. For example, the low representation of non-white respondents (it is also difficult to assess the true representativeness of the sample as respondents are only categorized as white and non-white – whose voices are captured here and whose are not?). Who is most affected by COVID-19 and why might this be? More reflection and expansion on these points in the discussion would be welcome. You may want to refer to the work of Roberts et al., (2020)
<https://journals.sagepub.com/doi/full/10.1177/1745691620927709>

Commented [A37]: A greater reflection on the psychological determinants of behaviours would be useful – what are the theorized effects? What have other studies found?

Commented [A38]: How might this have influenced the results?

Commented [A39]: This justification should be mentioned in the methods too

one hour of leave per day (*Coronavirus: What Are the Lockdown Measures across Europe?*, n.d.).

Conclusions

As COVID-19 continues to spread across the U.S. with over 5.2 million cases and over 166,000 deaths to date, reducing the burden of disease is paramount (Centers for Disease Control and Prevention, n.d.). We now know that human behaviors enforced by mitigation policies, like the stay-at-home orders and CDC recommendations, significantly limit the growth and impact of COVID-19 (Hsiang et al., 2020). As one of the first **national** surveys conducted on COVID-19 and individuals' behavior, these findings underlay the need for federal, state, and community level leadership to continue encouraging safe protective behaviors as people continue to travel to essential services. In addition, sustained public health response efforts should promote use and provide access to protective masks, hand sanitizer, and disinfectant wipes for individuals that are least likely to engage in protective health behaviors such as males and younger **individuals**. For public health leaders, the time is now to ensure compliance with these behavioral interventions as cases are rising across the U.S (Centers for Disease Control and Prevention, 2020c). Thus, it is necessary to continue surveillance for adherence with these behaviors, and act upon factors associated with behavior change among these populations.

Commented [A40]: Another limitation is that the majority of the sample was from a single state. How many other states were represented in this research?

Commented [A41]: Something to consider throughout the paper – how can these findings be used to develop these response efforts? What steps need to be taken next? There is a need to understand what is driving these differences in behaviour.

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Figure Caption List

Figure 1. Prevalence of reported reasons for leaving home during COVID-19 pandemic among a convenience sample of U.S. adults, 2020.

Figure 2. Prevalence of reported protective health behaviors during COVID-19 pandemic among a convenience sample of U.S. adults, 2020.

Table 1. Participant characteristics of the sample (N = 1374)

Characteristic	Total % (n)
Overall	100 (1374)
Urbanicity	
Urban	43.2 (593)
Suburban	33.3 (458)
Rural	22.0 (302)
Missing	1.5 (21)
Sex	
Male	28.0 (385)
Female	71.7 (985)
Missing	0.3 (4)
Race	
Non-Hispanic white	78.8 (1083)
Non-white	18.6 (256)
Missing	2.5 (35)
Age	
18-34	30.1 (414)
35-49	39.2 (539)
50 and older	29.9 (411)
Missing	0.7 (10)
Education	
Not a college graduate	15.3 (210)
College graduate or more	84.6 (1162)
Missing	0.1 (2)
Income	
<\$50,000	10.1 (139)
\$50,000-\$100,000	24.5 (336)
\$100,000-\$150,000	24.7 (339)
Over \$150,000	38.4 (537)
Missing	2.4 (33)
Children	
No	56.3 (774)
Yes	42.3 (581)
Missing	1.4 (19)
Depressive Symptom Severity	
None/Mild	73.1 (1004)
Moderate to Severe	20.1 (285)
Missing	6.2 (85)
Comorbidity	
None	58.7 (807)
1 or more	41.3 (567)
Missing	—

Commented [A42]: You can remove this as the *n* is already reported

Table 2. Adjusted odds for reasons for leaving home during COVID-19 pandemic movement restriction orders

	Reasons for Leaving Home				
	Grocery Shopping	Exercise	Walking Dog	Other Essential Shopping	Work
N = 1374	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
<i>Urbanicity (Referent = Urban)</i>					
Suburban	0.99 (0.65, 1.53)	1.06 (0.79, 1.43)	0.89 (0.68, 1.17)	0.76 (0.57, 1.00)	0.70 (0.42, 1.15)
Rural	0.89 (0.56, 1.46)	0.77 (0.56, 1.07)	0.78 (0.57, 1.06)	0.95 (0.70, 1.30)	1.64 (1.03, 2.61)
<i>Sex (Referent = Male)</i>					
Female	0.51 (0.31, 0.80)	0.85 (0.64, 1.13)	1.14 (0.88, 1.48)	0.68 (0.52, 0.88)	0.56 (0.38, 0.85)
<i>Age (Referent = 18-34 years)</i>					
35-49 years	1.52 (0.96, 2.40)	0.79 (0.56, 1.09)	1.12 (0.83, 1.53)	1.04 (0.76, 1.42)	1.90 (1.14, 3.20)
50 years and older	2.07 (1.25, 3.48)	0.77 (0.54, 1.09)	1.08 (0.78, 1.49)	1.31 (0.94, 1.81)	1.14 (0.64, 2.03)
<i>Education (Referent = College graduate or more)</i>					
Not a college graduate	0.53 (0.33, 0.87)	0.69 (0.49, 0.98)	0.80 (0.56, 1.13)	1.17 (0.83, 1.63)	0.84 (0.46, 1.46)
<i>Household Income (Referent = <\$50,000)</i>					
\$50,000-\$100,000	0.54 (0.23, 1.13)	1.48 (0.94, 2.33)	1.44 (0.90, 2.35)	0.94 (0.60, 1.49)	1.25 (0.61, 2.71)
\$100,000-\$150,000	0.50 (0.21, 1.06)	1.30 (0.81, 2.06)	2.40 (1.49, 3.94)	1.01 (0.64, 1.61)	0.97 (0.46, 2.18)
Over \$150,000	0.38 (0.16, 0.79)	1.69 (1.06, 2.67)	2.33 (1.46, 3.80)	0.98 (0.62, 1.55)	0.79 (0.38, 1.79)
<i>Children (Referent = No)</i>					
Yes	1.05 (0.69, 1.62)	1.25 (0.93, 1.67)	0.94 (0.71, 1.23)	1.16 (0.88, 1.53)	0.86 (0.55, 1.35)
<i>Depressive Symptom Severity (Referent = None/Mild)</i>					
Moderate to Severe	1.30 (0.83, 2.09)	0.77 (0.57, 1.04)	0.97 (0.72, 1.31)	0.95 (0.70, 1.28)	1.08 (0.53, 1.21)
<i>Comorbidity (Referent = None)</i>					
1 or More	0.65 (0.45, 0.96)	0.61 (0.47, 0.79)	1.13 (0.89, 1.45)	1.18 (0.92, 1.52)	0.80 (0.56, 1.14)

CI confidence interval; OR odds ratio

^aAdjusted models are mutually adjusted for all other variables

^bBoldface indicates statistical significance ($p < 0.05$)

Table 3. Adjusted odds for protective health behaviors during COVID-19 pandemic movement restriction orders

	Protective Health Behaviors						
	Physical/ social distancing	Washing hands frequently	Using hand sanitizer	Protective Mask	Spending ≤1 hour outside the home	Using disinfectant wipes	Wearing gloves
N = 1374	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
<i>Urbanicity (Referent = Urban)</i>							
Suburban	0.71 (0.32, 1.60)	0.99 (0.61, 1.62)	1.12 (0.81, 1.56)	0.91 (0.67, 1.23)	1.45 (1.08, 1.94)	1.28 (0.97, 1.69)	0.82 (0.60, 1.12)
Rural	1.11 (0.43, 3.24)	1.05 (0.61, 1.86)	1.20 (0.83, 1.75)	0.60 (0.43, 0.83)	1.32 (0.96, 1.82)	0.95 (0.70, 1.29)	0.60 (0.41, 0.88)
<i>Sex (Referent = Male)</i>							
Female	2.34 (1.12, 4.85)	1.72 (1.11, 2.66)	1.48 (1.09, 2.00)	1.58 (1.20, 2.08)	1.17 (0.89, 1.54)	1.82 (1.40, 2.36)	1.18 (0.87, 1.61)
<i>Age (Referent = 18-34 years)</i>							
35-49 years	0.76 (0.30, 1.97)	0.67 (0.38, 1.17)	0.97 (0.67, 1.41)	1.25 (0.91, 1.72)	0.90 (0.65, 1.24)	1.03 (0.76, 1.40)	1.33 (0.92, 1.94)
50 years and older	0.99 (0.35, 2.82)	0.81 (0.45, 1.46)	0.65 (0.45, 0.95)	2.02 (1.42, 2.91)	0.70 (0.50, 0.98)	1.46 (1.06, 2.02)	2.63 (1.81, 3.85)
<i>Education (Referent = College graduate or more)</i>							
Not a college graduate	0.41 (0.18, 0.98)	1.11 (0.62, 2.13)	1.16 (0.78, 1.76)	0.88 (0.61, 1.27)	0.94 (0.66, 1.34)	1.24 (0.88, 1.74)	1.23 (0.83, 1.79)
<i>Household Income (Referent = <\$50,000)</i>							
\$50,000-\$100,000	0.81 (0.17, 2.99)	1.22 (0.60, 2.69)	1.29 (0.77, 2.13)	1.19 (0.74, 1.89)	1.27 (0.81, 1.99)	1.01 (0.65, 1.57)	1.67 (0.96, 3.02)
\$100,000-\$150,000	0.83 (0.16, 3.32)	1.45 (0.55, 2.58)	1.04 (0.62, 1.73)	1.22 (0.75, 1.98)	1.24 (0.77, 1.97)	1.09 (0.69, 1.71)	1.70 (0.96, 3.12)
Over \$150,000	0.57 (0.12, 2.07)	1.45 (0.66, 3.06)	1.56 (0.92, 2.60)	0.98 (0.60, 1.56)	1.51 (0.95, 2.39)	1.32 (0.84, 2.06)	1.51 (0.86, 2.75)
<i>Children (Referent = No)</i>							

Yes	1.32 (0.59, 3.02)	1.50 (0.92, 2.48)	1.33 (0.96, 1.86)	0.84 (0.63, 1.13)	1.08 (0.81, 1.44)	1.43 (1.09, 1.88)	1.03 (0.75, 1.42)
Depressive Symptom Severity (<i>Referent = None/Mild</i>)							
Moderate to Severe	0.37 (0.17, 0.84)	0.82 (0.50, 1.38)	0.76 (0.54, 1.08)	1.08 (0.79, 1.49)	1.24 (0.91, 1.71)	0.88 (0.65, 1.18)	1.12 (0.79, 1.58)
Comorbidity (<i>Referent = None</i>)							
1 or More	1.87 (0.87, 4.31)	0.94 (0.61, 1.46)	1.39 (1.03, 1.88)	1.19 (0.91, 1.55)	1.16 (0.99, 1.50)	1.04 (0.81, 1.32)	1.01 (0.77, 1.35)

CI confidence interval; *OR* odds ratio

^aAdjusted models are mutually adjusted for all other variables

^bBoldface indicates statistical significance ($p < 0.05$)