SSM - Population Health 18 (2022) 101095

Contents lists available at ScienceDirect

SSM - Population Health

journal homepage: www.elsevier.com/locate/ssmph

A general pattern of health erosion in the United States? An examination of self-reported health status from 1997 – 2018

Alexis R. Santos-Lozada, Ph.D.

Department of Human Development and Family Studies, Pennsylvania State University Park, PA, 16802, USA

ARTICLE INFO

Keywords:
Single item self-rated general health
Self-reported health
Trends
Measurement bias

ABSTRACT

Purpose: Recent research has found a general pattern of health erosion in self-assessed pain and allostatic load among adults in the United States (US). It remains to be determined if self-reported health status, hereafter SRH, also follows this pattern. The aim of this study was to examine whether a general pattern of health erosion is found in SRH among adults in the United States (US).

Methods: Data from the National Health Interview Survey 1997–2018 were used to study sex, educational attainment, and racial/ethnic patterns in SRH by age, period and cohort among adults in the US. The analytic sample consisted of respondents aged 18 years or older at the moment of interview with valid information in the age, sex, education, race/ethnicity and health status question (n = 669,501). Estimates for the percent population reporting poor/fair health were produced by age, period and cohort to study trends in health status by sex, educational attainment and race/ethnicity. All estimates were weighted to account for complex survey design.

Results: No discernible pattern of health erosion, or improvement, is observed in the age, period or cohort analyses of the percent of the population reporting poor/fair SRH by sex, educational attainment or race/ethnicity.

Conclusions: The analysis indicates that self-reported health does not follows the general pattern of health erosion found in self-assessed pain and allostatic load in the US. The percent of the population reporting poor/fair health status has remained relatively stable between 1997 and 2018. Further research is required to determine whether self-reported health is an appropriate metric to track population health in the US.

1. Introduction

Single item self-reported health (SRH) is a widely collected and extensively used measure, which has been employed in epidemiological research since the 1950s (Garbarski, 2016; Joelson et al., 2021). The validity of SRH has long been an issue of discussion with many studies indicating that this subjective health assessment is a valid health status indicator that can be used in cohort studies and for population health monitoring (Miilunpalo et al., 1997). Early analyses of SRH found a strong association between this measure and subsequent mortality regardless of sex or race/ethnicity, even when adjustments for socioeconomic status and comorbidities were incorporated in the models (McGee et al., 1999) adding to the body of scholarship that validated this measure (Jylha, 2009). A subsequent study assessed whether SRH was a valid indicator of health for Latinos/as concluded that using SRH for cross-ethnic comparisons of physical health was a problematic endeavor and recommended at least adjusting for acculturation when doing so (Finch et al., 2002).

Despite how popular of a health metric SRH has become, concerns arose that it may not correspond to objective markers of health for different population subgroups (Dowd & Zajacova, 2010). Over the last decade or so, numerous studies have explored the issue of how valid SRH is as a health metric, and have concluded the validity of this indicator is more complex that previously considered. A pioneer study on this matter assessed whether the predictive power of SRH for subsequent mortality varied by socioeconomic status, and found stronger association between SRH and mortality for adults with higher education and/or higher income (Dowd & Zajacova, 2007). The reason for this may lie in a subsequent study conducted by Dowd and Zajacova (2010) that found that the relation between SRH and objective health differs by socioeconomic status (Dowd & Zajacova, 2010). If SRH corresponds less to what is happening to the bodies of some subpopulations, then it logical that is it is less predictive of subsequent mortality.

A study conducted in 2011 tested reliability of SRH by comparing responses collected on 2 occasions about 1 month apart. The authors concluded that there is substantial variation in SRH and that this is more

Abbreviations: SRH, Self-Reported Health or Self-Rated Health; US, United States.

E-mail address: ars39@psu.edu.

https://doi.org/10.1016/j.ssmph.2022.101095
Received 19 January 2022; Received in revised form 11 March 2022; Accepted 6 April 2022
Available online 9 April 2022

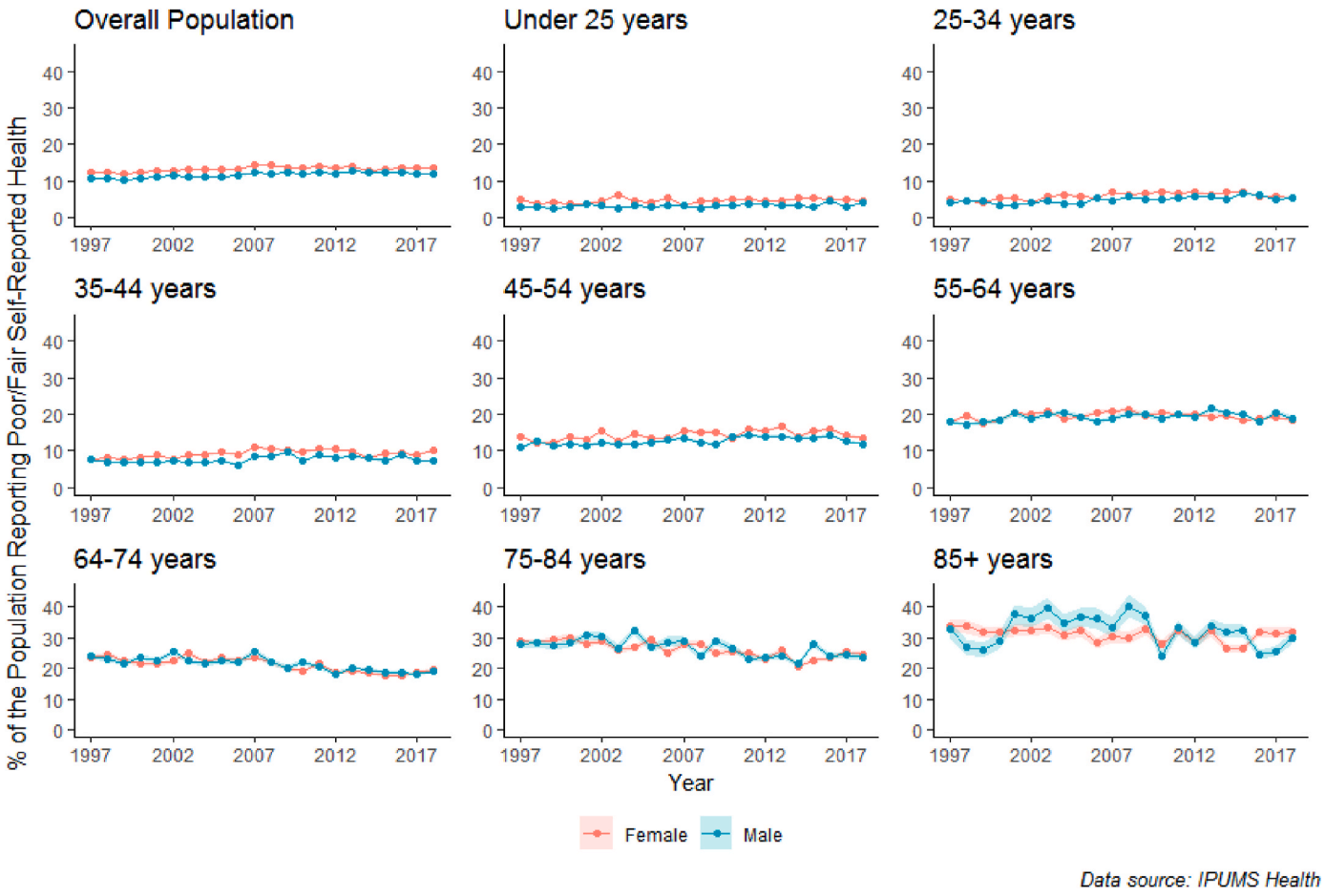

Fig. 1. Percent of the population reporting poor/fair self-reported health by sex for the overall population and by age group between 1997 and 2018 with 95% confidence intervals.

pronounced among racially and ethnically minoritized populations and respondents with lower educational attainment (Zajacova & Dowd, 2011). A more recent study conducted by Woo and Zajacova (2016) found that SRH predicts mortality risk less well for non-Hispanic Blacks and Hispanics than for non-Hispanic whites (Woo & Zajacova, 2016). The authors postulate that individuals from different racial/ethnic groups may evaluate their health differently. The reason for this finding may lie in a study conducted by Santos and Howard (2018) which found that objective health was less predictive of SRH for racially and ethnically minoritized populations (Santos-Lozada & Howard, 2018). The lower correspondence between SRH and objective health (measured through biomarkers) may explain why this metric is less predictive of mortality risk for racially and ethnically minoritized populations. One question that remains unanswered is whether it is appropriate to use SRH for population health monitoring. A potential way to assess this is by exploring whether trends in SRH match secular trends in population health indicators such as self-assessed pain prevalence or objective markers of health.

Recent research has found that pain prevalence follows a general pattern of health erosion of working-class life for those born after 1950s (Case et al., 2020). Detailed analyses of pain prevalence by age and sex has found an extensive escalation of pain prevalence among US adults across the life span (Zajacova et al., 2021). A separate line of scholarship has started to leverage objective markers of health by studying trends and patterns of allostatic load (AL) to track population health. AL, a measure of cumulative wear and tear due to chronic stress produced using biomarkers, is a score that indicates how many biomarkers exceed an acceptable threshold (Doung et al., 2017). Studies in this line of inquiry consistently find that AL has increased since the early 1990s. The first study concluded that from 1988 to 1991 to 2015–2018 the prevalence of high AL increased by more than 45% (Moore et al., 2021). The study found that the average AL score increased from 1.94 to 2.63, hinting at consistent pattern of health deterioration. A second study focused on racial/ethnic and nativity differences in AL found an increase in AL from 2005 to 2006 to 2017–2018, a trend in line with those of cardiovascular and metabolic health observed in the US (Langellier et al., 2021). If such a manifestation of health deterioration is found among the US population, we should observe valid metrics of health to mirror or move in parallel to these patterns. A movement in line with this pattern, or health deterioration, would mean that SRH is accurately capturing the state of the health of the US population.

Is self-reported health moving along with other health metrics? The purpose of this study is to explore whether SRH shows an ongoing pattern of erosion of the health in the US adult population as observed in pain prevalence and measures of cumulative "wear and tear" of the body such as AL. One of the following two competing scenarios is possible: (1) SRH shows a pattern consistent with the ongoing health erosion found in pain prevalence and allostatic load, or (2) SRH does not follows the pattern of population-level health deterioration. If SRH is a valid and reliable measure of population health, it will follow the first scenario. The emergence of the second scenario would indicate that SRH does not move along with other population health metrics. The results will have direct relevance to the issue of validity of SRH as a measure that can be utilized to measure and track population health.

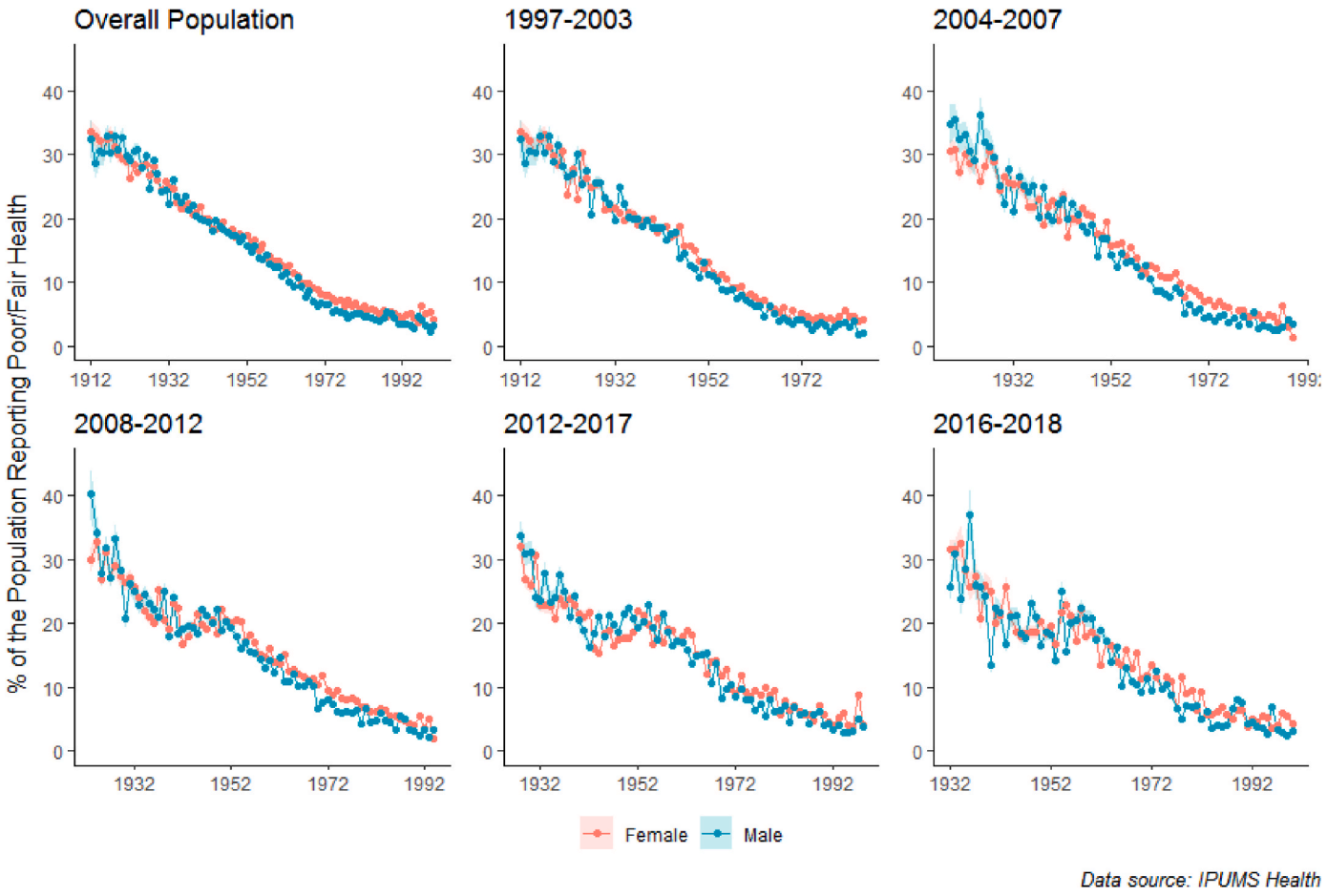

Fig. 2. Percent of the population reporting poor/fair self-reported health by sex and year of birth for the overall population and by period of interview with 95% confidence intervals.

2. Materials and methods

2.1. Analytic sample

Data for this study come from the National Health Interview Survey (NHIS) collected between 1997 and 2018, which were extracted from the IPUMS Health Platform (Blewett et al., 2019). The NHIS is a cross-sectional survey collected every year from a nationally representative sample of the US population. The initial adult sample consisted of 671,696 observations. The analytic sample reduced by 2,195 observations because respondents had missing values in health status items. The final analytical sample consisted of 669,501 observations with valid information for the variables used in the analysis. Instances where small sample sizes cause unreliable estimates will be addressed in the *Discussion* section. A basic description of the analytic sample and variable distribution is included within the *Measurements* section.

3. Measurements

3.1. Self-Reported Health

From 1997 to 2018 the NHIS assessed health status questions through the General Health - Person Module from every sample adult respondent aged 18 years and older. Self-Reported Health (SRH) was collected using a five-point Likert scale where respondents rate their health as: Excellent, Very Good, Good, Fair, or Poor. This variable was operationalized as a dichotomous variable indicating whether respondents classified their health as fair or poor following standard approaches to the analysis of this variable (Manor et al., 2000; Thompson, 2017).

3.2. Sex and education

Sex and education are collected within the Person Core Questionnaire of the NHIS. Sex indicates whether respondents reported their sex was male or female (n = 293,272 and 371,353, respectively). The educational attainment question reports the highest level of schooling an individual had completed. In order to be consistent with the scholarship that guides this research (Case et al., 2020), education was recoded as a dichotomous variable indicating whether the highest level of education was higher than a Bachelor's degree or lower (n = 171,859 and 492,766, respectively). Assessments of these patterns using detailed educational attainment categories are discussed in the sensibility analyses.

3.3. Race/ethnicity

The NHIS collects two variables in the Person Core Questionnaire from which a race/ethnicity variable can be constructed. In the first variable respondents are asked about the main racial background. The second variable corresponds to ethnicity, which indicates whether or not the respondent considers him/herself or themselves to be of (1) Hispanic, (2) Spanish or (3) Latino origin or ancestry. Following standard approaches to the operationalization of race/ethnicity, respondents were first classified as Hispanics if they considered to be of Hispanic/Spanish/Latino origin (n = 110,287). Those who did not consider themselves of Hispanic origin or ancestry were classified into four mutually exclusive racial groups: white (n = 428,621), Black or African

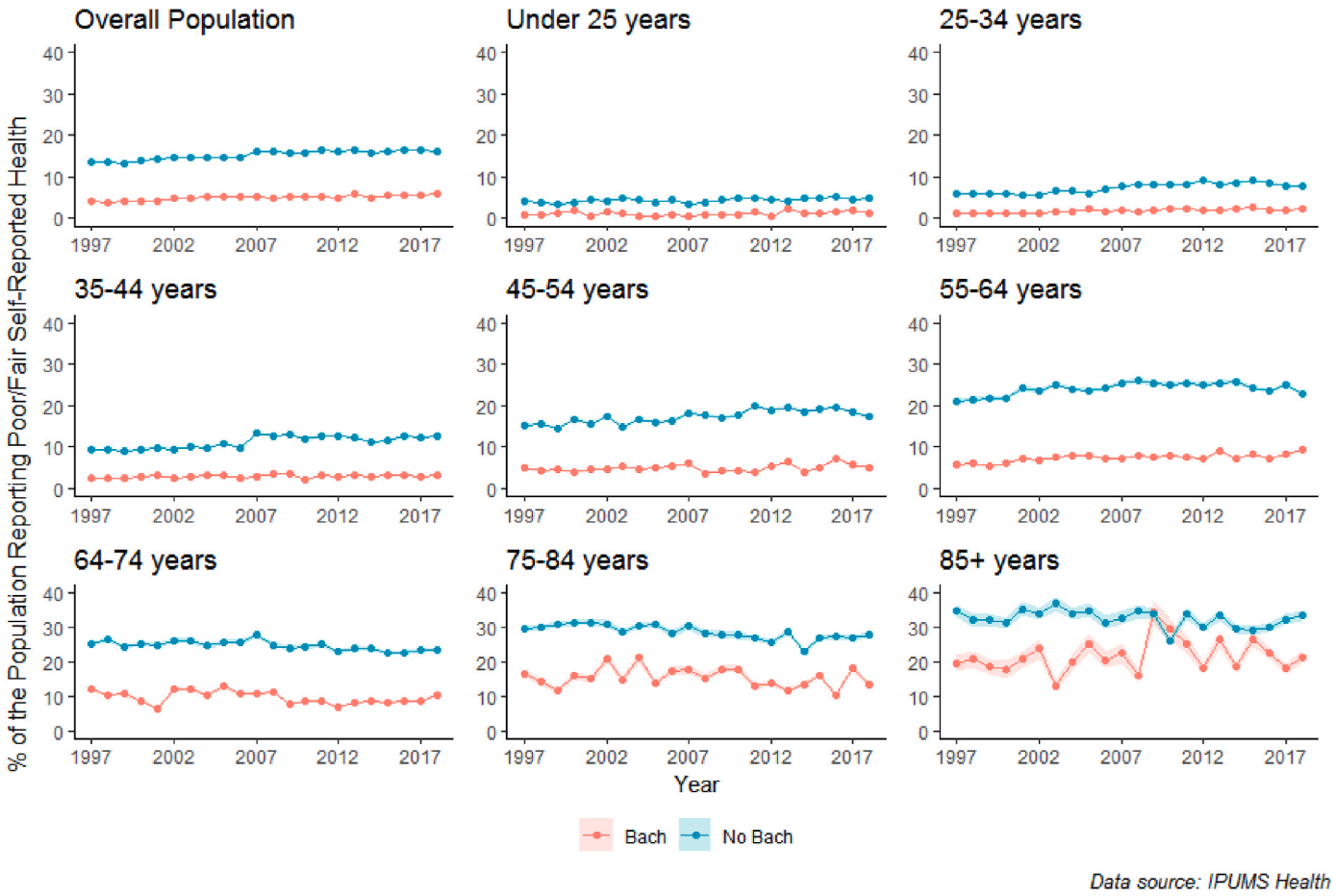

Fig. 3. Percent of the population reporting poor/fair self-reported health by education, and by age group between 1997 and 2018 with 95% confidence intervals.

American (n = 93,965), Asian (n = 29,443), or Other (n = 7,185).

3.4. Age, period and cohort

Age is collected as a continuous variable indicating the respondent's age since their last birthday (Mean = 46.01, SE = 0.06). We recode age into the following categories: Under 25 years (n = 66,099), 25–34 years (n = 121,280), 35–44 years (n = 123,398), 45–54 years (n = 115,127), 55–64 years (n = 98,302), 65–74 years (n = 75,974), 75–84 years (n = 47,573), 85 + years (n = 16,872). The NHIS also reports the calendar year in which the survey was conducted. This variable is used to capture period effects and on average each year contributed 30,000 observations, with a minimum of 21,496 in 2008 and a maximum of 36,464 in 2014. These two variables were used to produce a cohort measure, which is measured as year of birth. Respondent's age is subtracted from the year in which the interview was conducted to approximate a year of birth measure. Cohort was incorporated in the analysis as continuous variable in the visualization of trends (Mean = 1962 and Median = 1961). Within the cohort analyses, period was operationalized as: 1997–2003 (n = 223,779), 2004–2007 (n = 85,714), 2008–2011 (n = 131,755), 2012–2016 (n = 171,472), and 2017–2018 (n = 51,905).

3.5. Analytical approach and sensitivity analysis

The analysis consisted of six stages and a set of sensitivity analyses. The first stage consisted of producing sex-specific estimates by period and age for the analytic sample to ascertain whether the percent of the population reporting poor/fair SRH had increased over the period of analysis by sex and age (Fig. 1). The second stage consisted of ascertaining sex-cohort-period differences in poor/fair SRH to determine whether subsequent cohorts are reporting worse health at different periods (Fig. 2). The third stage consisted of producing period- and age-specific estimates of poor/fair SRH by educational attainment to ascertain whether a pattern of health deterioration is observed for these groups (Fig. 3). The fourth stage of the analysis consisted of producing estimates for poor/fair SRH by educational attainment and year of birth (Fig. 4). The fifth stage of the analyses consisted of producing period- and age-specific estimates of poor/fair SRH by race/ethnicity (Fig. 5). The final stage of the analysis consisted of producing estimates for poor/fair SRH by race/ethnicity and year of birth (Fig. 6). All analyses were conducted in RStudio with adjustments for complex survey design through the '*srvyr*' package, and visualizations were produced using ggplot2 (Freedman et al., 2021; RStudio Team, 2015; Wickman, 2009).

Sensitivity analyses were conducted with (1) alternative groupings for the age- and period-specific analyses and (2) analyzing SRH as a continuous variable following previous assessments of SRH (Thompson, 2017). Further, the analysis was replicated using a single item general health transition question where the population reported whether their health status was better, about the same or worse in comparison to a year ago also collected in the NHIS. This variable was recoded into a dichotomous variable indicating whether respondents reported their health was worse than a year ago or not. Finally, the analysis was also conducted with using detailed educational attainment categories. The detailed educational attainment categories include: No High School, High School Diploma, Some College, Associate Degree and College or more. The visualizations of trends for these sensitivity analyses are included in Supplemental Figs. 1–8. These sensitivity analyses yielded results that were consistent with those presented in the main analysis.

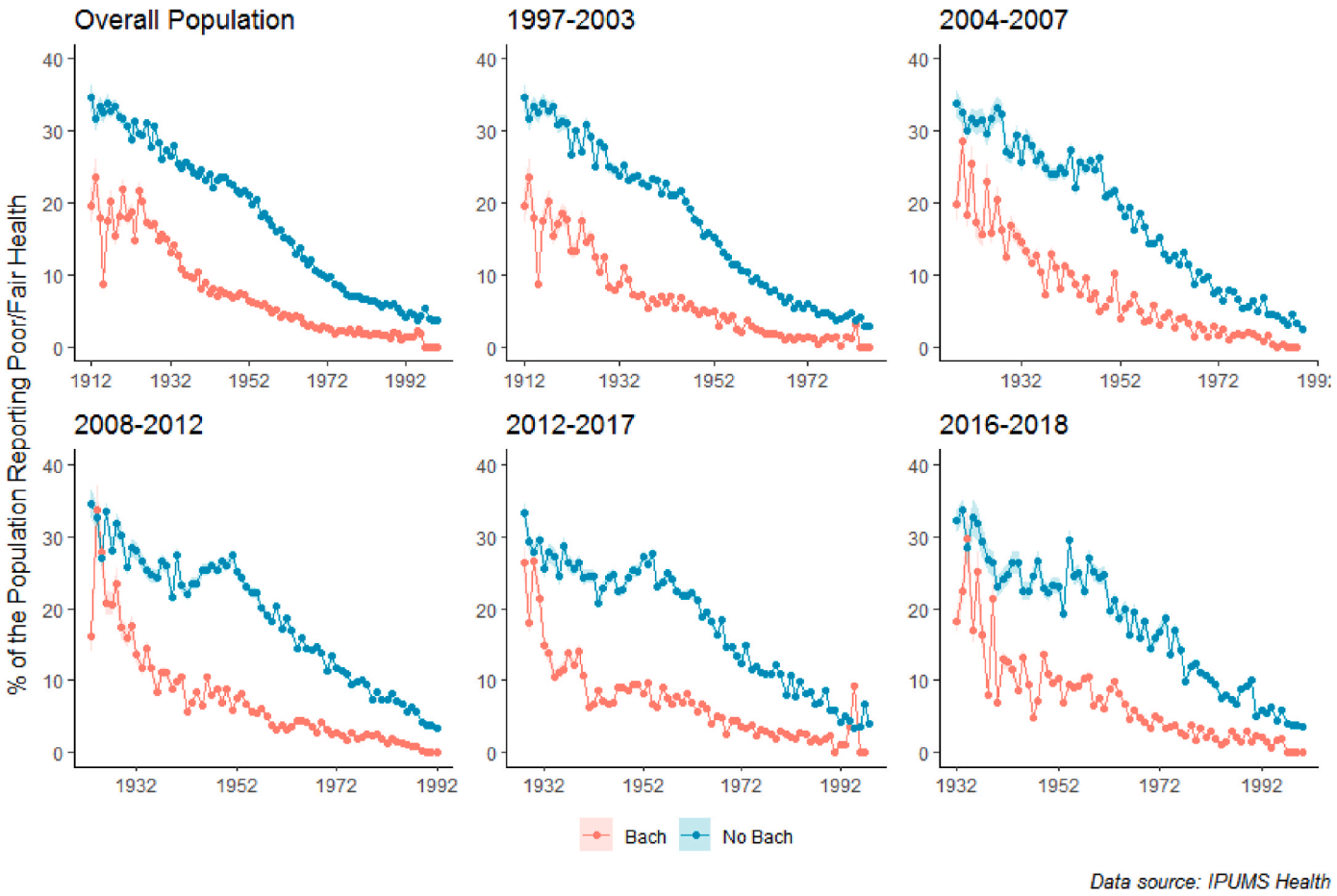

Fig. 4. Percent of the population reporting poor/fair self-reported health by educational attainment and year of birth for the overall population and by period of interview with 95% confidence intervals.

4. Results

Fig. 1, presents the percent of the population reporting poor/fair SRH by sex for the overall population and by age for 1997 and 2018. The percent of the population reporting poor/fair SRH has remained stable for males and females between 1997 and 2018. The analysis by age presents results consistent to those observed in the overall population. The analysis indicates that older age groups report poor/fair SRH at higher rates than younger ones, but there is no trend in this indicator observed for men or women. Fig. 2 presents trends in poor/fair SRH by cohort and period. Within the overall analytic sample, 30% of older cohorts report poor/fair SRH and this percentage decreases steadily with approximately 5% of the youngest cohort reporting the outcome The five period-specific analyses showed consistent curves in the percent of the population reporting poor/fair SRH, indicating stable patterns regardless of period in which the data was collected and cohorts being analyzed.

Figs. 3 and 4 concentrate on trends in poor/fair SRH by educational attainment. Fig. 3 shows trends in poor/fair SRH by educational attainment. Within the overall sample, the percent of the population reporting poor/fair SRH remains relatively stable regardless of educational attainment. Every year, those with a Bachelors' degree reported better health than those without a college degree. The size of this gap is smaller at younger ages and increases with age reaching its widest point between ages 55–74. There is a slight reduction in this gap at older ages, but this is due to older adults with a Bachelor's degree reporting poor/fair SRH at older ages. Within the oldest age groups, the percent of the population reporting poor/fair SRH is approximately 30% for those without a Bachelor's degree with increases observed for those with a bachelor's degree, which until ages 64–74 remained relatively stable around 10%. Fig. 4 concentrates on analyses by cohort and period. Fig. 4 shows that approximately 35% of oldest respondents without a bachelor's degree report poor/fair SRH in comparison to 20% of persons from the same birth cohort with a degree. There is a closing gap by health status that is reduced at the youngest birth cohorts. The period-specific analyses show patterns consistent to those found within the overall population regardless of the cohorts; respondents with a bachelor's degree have better health than their peers without a college degree.

Figs. 5 and 6 concentrate on trends in poor/fair SRH by race/ethnicity. Fig. 5 shows trends in poor/fair SRH by race/ethnicity by period for the overall sample and by age. Within the overall sample, the percent of the population reporting poor/fair SRH remains relatively stable regardless of race/ethnicity. Consistently, Black/African American adults reported poor/fair SRH at higher rates than the other racial/ethnic groups. In the majority of the years, the ranking for racial/ethnic groups reporting poor/fair SRH is: Hispanics, whites, and Asian. The pattern of relative stability in the percent of the population reporting poor/fair SRH, and Blacks/African Americans and Hispanics reporting worse health than white and Asian adults is found for every age group regardless of period of interview. A pattern of increased rates for Black/African American and Hispanic adults is observed starting in with respondents aged 45–54 years, regardless of period of data collection. Fig. 6 shows relative consistent patterns in the percent of the population reporting poor/fair SRH by race/ethnicity and year of birth. Older respondents report higher rates with a stable reduction as age decreases. The pattern seems to be consistent across different period of data collection.

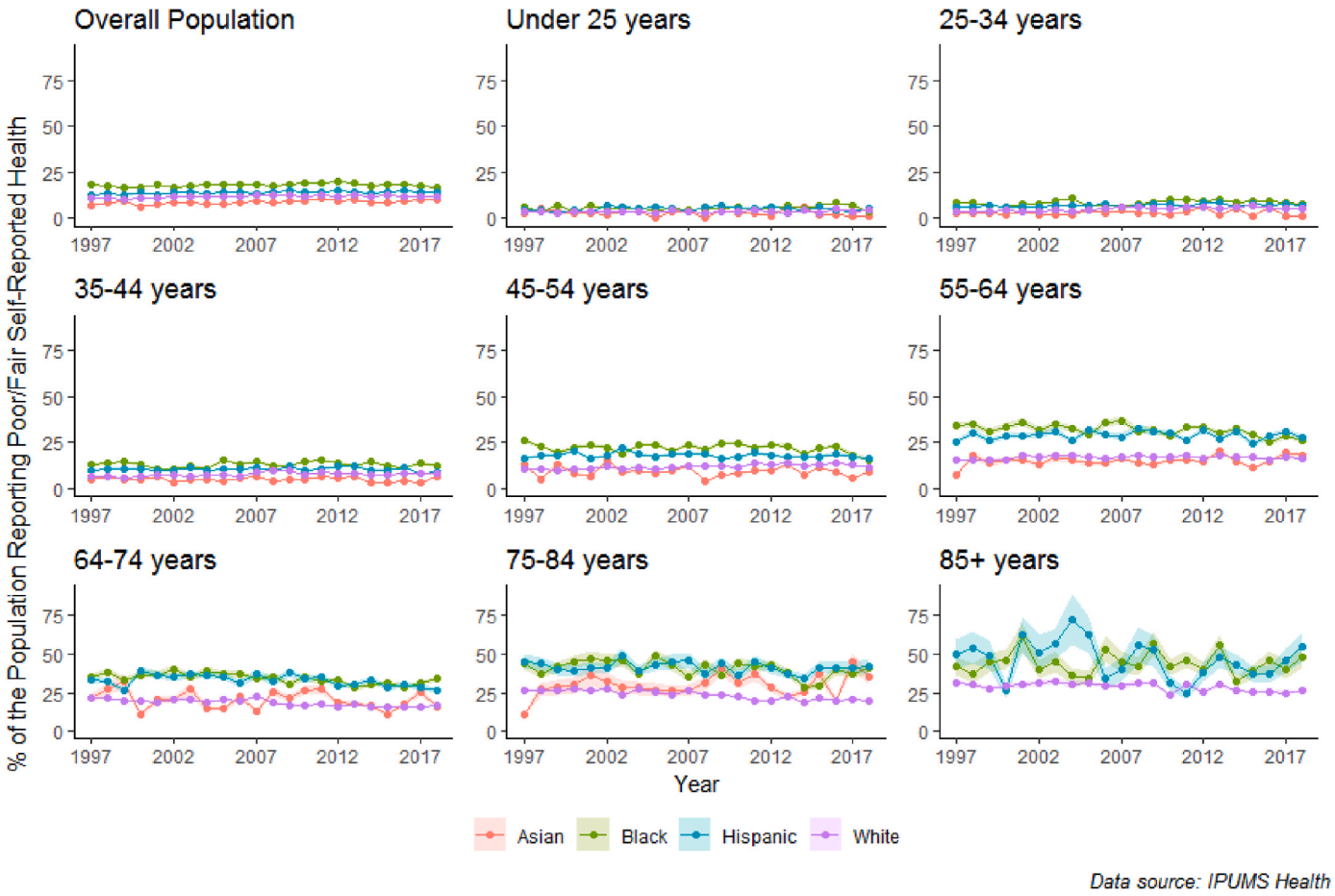

Fig. 5. Percent of the population reporting poor/fair self-reported health by race/ethnicity, and by age group between 1997 and 2018 with 95% confidence intervals. Estimates Asian older adults 85 years and older were suppressed due to small sample sizes which produced unreliable estimates and/or confidence intervals.

5. Discussion

The present study evaluated whether single item self-reported general health follows the ongoing pattern of health deterioration found in pain prevalence or measures of cumulative wear and tear. The detailed analyses found that SRH has remained relatively stable over the last 22 years. Case, Deaton and Stone (Case et al., 2020) and Zajacova and colleagues (Zajacova et al., 2021; Zimmer & Zajacova, 2020) have found that pain prevalence has increased for younger and older persons, males and females, across race/ethnicity, wealth and education, and regardless of chronic conditions; spelling a problematical future for the US population. These results are consistent with recent analyses of allostatic load, an indicator of cumulative wear and tear or physiological dysregulation. Moore and colleagues (Moore et al., 2021) and Langellier and colleagues (Langellier et al., 2021) have found that allostatic load is increasing among adults in the US. Both indicators show, in some way, a pattern of health erosion within the US population. The single item self-rated health, and the health transition analysis conducted in the sensitivity analysis, do not follow this pattern. This finding is not unique as improvement or relative stable trends have been observed in functional limitations and disability and metabolic syndrome (Palmer & Toth, 2019; Zimmer et al., 2020). While the prevalence of metabolic syndrome has remained stable, this is not true for individual components of this health metric and the role of medications has yet to be determined (Beltr á n-S á nchez et al., 2013). Findings are consistent with past work that suggest that SRH may not be a suitable indicator for purposes of tracking population health over time (Salomon et al., 2009).

The trend analyses show relatively stable patterns in self-reported health by sex, educational attainment and race/ethnicity among US adults. How does this compare to existing analyses of trends in self-reported health? The answer to this question is complicated. A study by Owen Thompson found that there is stability in self-reported health for white and Black/African American adults since 2000 (Thompson, 2017). This pattern of stability is consistent with the results presented in this analysis, particularly those presented in Fig. 6. A more recent study by Schellekens and Ziv (2021) found improvements in self-reported health attributable to advances in educational attainment, between 1972 and 2018 (Schellekens & Ziv, 2020). Those results deviate from the ones discussed in this study. On the other hand, research has also found increasing health deterioration driven by worse health among adults with a high school diploma or some college (Lamidi, 2020). The cohort and period analyses (Figs. 3 and 4) show consistent prevalence of self-reported health by educational attainment regardless of cohort analyzed and period of data collection. These results are also supported by the analysis of detailed educational attainment categories presented in the sensitivity analyses (Supplemental Figs. 3 and 4). Despite some differences in the main results, no study reveals a pattern of health erosion when analyzing self-reported health. Thus, the patterns uncovered indicate that self-reported health status does not shifts parallel to physical manifestations of health deterioration such as pain prevalence and biological risk profiles; the findings are consistent with the second scenario hypothesized in the study design.

Studies have postulated that the ongoing increases in pain may reflect a shift in how pain is interpreted, understood, diagnosed and treated (Zimmer et al., 2020; Zimmer & Zajacova, 2020). If this is the case, then this shift is not extensible to self-reported health. On the other hand, it is possible that medicalization of pain is influencing the levels of pain reported by the population. Previous research have shown

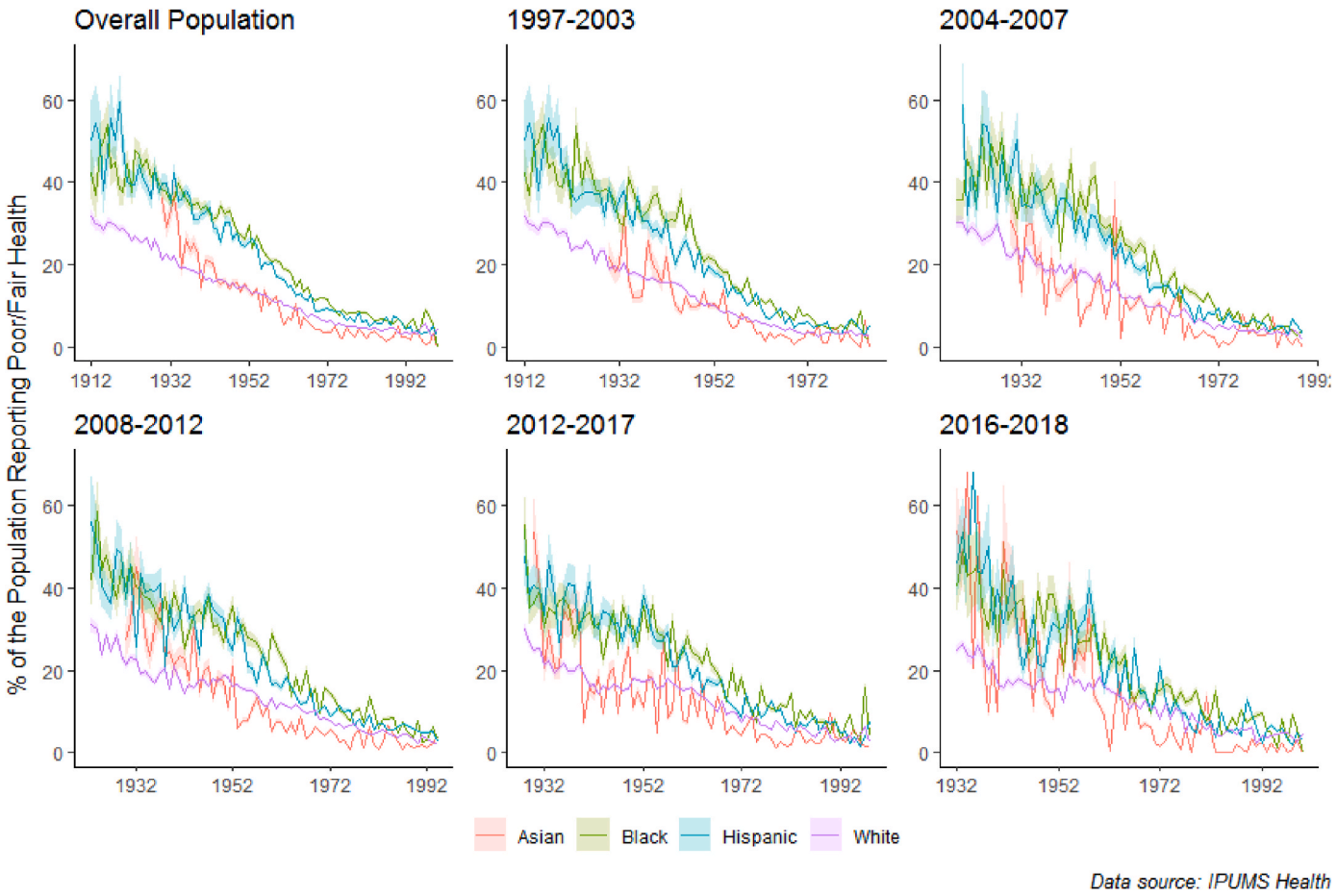

Fig. 6. Percent of the population reporting poor/fair self-reported health by race/ethnicity and year of birth for the overall population and by period of interview with 95% confidence intervals. Estimates for the Asian population born before 1932 were suppressed due to small sample sizes, which resulted in unreliable point estimates and/or confidence intervals.

widespread self-reported prescription pain reliever misuse (Verdery et al., 2020), which may result in an underestimation of pain prevalence in the US. Nevertheless, a pattern of health deterioration is also observed in allostatic load, which is indicative that there is indeed a pattern of health deterioration in the health of adults in the US. The fact that a health deterioration effect is observed in both pain prevalence and biological risk profiles, but not in self-reported health status may indicate that this measure does not align closely to what is happening in the bodies of adults in the US. This study underscores the importance of differentiating between subjective (i.e. self-reports, self-assessments) and objective measures (i.e. symptoms, biomarkers or cognitive measures) in the study of population health (Nesson & Robinson, 2019; Ramírez et al., 2005).

This study should be interpreted in light of its strengths and limitations. The main strength consists of the NHIS being a nationally representative survey, which means the results are generalizable to the US adult population for the period of analysis. In addition, the use of numerous years allows for sample sizes large enough to produce reliable estimates by age, period and cohort. Nevertheless, the sample sizes at both ends of the age or cohort distributions have to be analyzed with caution as they may not contain enough observations to conduct more detailed analyses than those presented in this study (Thompson, 2017). While the NHIS collected information in 2019, there were substantial methodological changes implemented in this year. Similarly, the NHIS was collected in 2020. However, the data collection was interrupted due to the COVID-19 pandemic. Because of this, these years were excluded from the analyses. A limitation of this study is that the NHIS is a cross-sectional dataset which means there is no previous health status question to use as a baseline; thus, there is no way of assessing health decline other than with the measure used in the sensitivity analyses. The results presented in the Supplemental Materials are consistent with those presented in the main text.

In the analysis by race/ethnicity, the analytic sample was restricted in two ways. The first restriction was how to deal with respondents whose racial/ethnic background fell under the *"Other"* classification. The small sample sizes based on age or year of birth resulted in unreliable estimates. Thus, these observations were excluded from this section of the analysis. Further, the analysis contained few observations of Asian adults who were born before 1932, also resulting in unreliable estimates for the cohort and cohort/period analyses. Thus, the estimates for the Asian population aged 85 + (Fig. 5) and for respondents born before 1932 (Fig. 6) were excluded from the visualizations. Finally, because of the cross-sectional design of the NHIS causality cannot be inferred. Yet, the study design is consistent with other studies that found the pattern of health erosion; thus, the comparisons discussed herein are appropriate. Also relevant to the issue of race/ethnicity is the possibility differences in how self-reported items are interpreted across language, particularly among Hispanics (Bzostek et al., 2007; Santos-Lozada & Martinez, 2017; Viruell-Fuentes et al., 2011). In fact, the article by Santos and Howard (2018) finds that AL corresponds less to SRH for Hispanics than for white and African American/Black adults. Because this paper employs stratified analyses, the biases would only affect estimates produced for the Hispanic population; such estimates are significantly higher than those for Asian and white adults.

Future research on adult health in the US should continue to explore the reasons behind the lack of correspondence between trends in self-

reported health and more objective measures of health, and whether this holds for population subgroups such as minoritized populations. Future research should also explore whether the pattern of health deterioration is found when detailed measures of social class or working-class status are operationalized. Further, future analyses may employ regression-based age-period-cohort methods to decompose these effects and assess significance.

6. Conclusions

While recent research of prevalence of pain and allostatic load has found an ongoing pattern of health erosion among adults in US adult by age, sex, and education, this is not observed in the analysis of self-reported health reported in this study. These results indicate that this measure is not capturing ongoing changes in population health as other measures do. Self-reported health is a widely collected and used measure and it may not be providing an accurate overview of the health of the US population. In light of the disconnection between the overall pattern of relative stability of self-reported health status and health deterioration found in pain prevalence and allostatic load, caution should be exercised when self-reported health measures are used to track and understand changes in population health in the US.

Ethics approval

Because these data are deidentified and publicly available, this study is considered to be research not involving human subjects as defined by US regulation (45 CFR 46.102[d]).

Author statement

Alexis R. Santos-Lozada confirms sole responsibility for the following: Conceptualization, Methodology, Formal Analysis, Investigation, Data Curation, Writing - Original Draft, Writing - Review, Revisions & Editing, Visualization.

Conflict of interest

The author does not have any material, immaterial, financial or potential conflict of interests to disclose. Publication of this article was supported by the Social Science Research Institute (SSRI) and the Population Research Institute (PRI) at the Pennsylvania State University. PRI is supported by an infrastructure grant by the Eunice Kennedy Shriver National Institute of Child Health and Human Development (P2CHD041025). The content is solely the responsibility of the author and does not represent the official position of the National Institutes of Health.

Financial disclosures

No disclosures were reported by the author of this paper.

Declaration of competing interest

The author has no relevant financial or non-financial interests to disclose.

Acknowledgments:

This study was supported by the Social Science Research Institute (SSRI) and the Population Research Institute (PRI) at the Pennsylvania State University. PRI is supported by a grant from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (P2CHD041025) and by the Pennsylvania State University and its Social Science Research Institute. The author is supported by a Diversity Supplement granted through the Interdisciplinary Network on Rural Population Health and Aging by the National Institute on Aging (R24AG065159).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2022.101095.

References

Beltrán-Sánchez, H., Harhay, M. O., Harhay, M. M., & McElligott, S. (2013). Prevalence and trends of metabolic syndrome in the adult U.S. Population, 1999-2010. *Journal of the American College of Cardiology, 62*(8), 697–703. https://doi.org/10.1016/j.jacc.2013.05.064

Blewett, L. A., Rivera Drew, J. A., King, M. L., & Williams, K. C. W. (2019). *IPUMS health surveys: National health interview survey*. https://doi.org/10.18128/D070.V6.4. Minneapolis, MN Version 6.4. .

Bzostek, S., Goldman, N., & Pebley, A. (2007). Why do Hispanics in the USA report poor health? *Social Science & Medicine, 65*(5), 990–1003. https://doi.org/10.1016/j.socscimed.2007.04.028

Case, A., Deaton, A., & Stone, A. A. (2020). Decoding the mystery of American pain reveals a warning for the future. *Proceedings of the National Academy of Sciences of the United States of America, 117*(40), 24785–24789. https://doi.org/10.1073/pnas.2012350117

Doung, M. T., Bingham, B. A., Aldana, P. C., Chung, S. T., & Summer, A. E. (2017). Variation in the calculation of allostatic load score: 21 examples from NHANES. *Journal Racial Ethnic Health Disparities, 4*, 455–461. https://doi.org/10.1007/s40615-016-0246-8

Dowd, J. B., & Zajacova, A. (2007). Does the predictive power of self-rated health for subsequent mortality risk vary by socioeconomic status in the US? *International Journal of Epidemiology, 36*(6), 1214–1221. https://doi.org/10.1093/ije/dym214

Dowd, J. B., & Zajacova, A. (2010). Does self-rated health mean the same thing across socioeconomic groups? Evidence from biomarker data. *Annals of Epidemiology, 20*(10), 743–749. https://doi.org/10.1016/j.annepidem.2010.06.007

Finch, B. K., Hummer, R. a, Reindl, M., & Vega, W.a. (2002). Validity of self-rated health among Latino(a)s. *American Journal of Epidemiology, 155*(8), 755–759. https://doi.org/10.1093/aje/155.8.755

Freedman, G., Lumley, T., Zółtak, T., Schneider, B., & Krivitsky, P. N. (2021). *Package "survyr*. Retrieved from http://gdfe.co/srvyr/.

Garbarski, D. (2016). Research synthesis research in and prospects for the measurement of health using self-rated health. *Public Opinion Quarterly, 80*(4), 977–997. https://doi.org/10.1093/poq/nfw033

Joelson, A., Strömqvist, F., Sigmundsson, F. G., & Karlsson, J. (2021). *Single item self-rated general health: SF-36 based observations from 16,910 spine surgery procedures*. Quality of Life Research, Article 0123456789. https://doi.org/10.1007/s11136-021-03048-0

Jylha, M. (2009). What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Social Science & Medicine, 69*, 307–316. https://doi.org/10.1016/jsocscimed.2009.05.013

Lamidi, E. O. (2020). Trends in self-rated health by union status and education, 2000–2018. *SSM - Population Health, 11*, 100616. https://doi.org/10.1016/j.ssmph.2020.100616

Langellier, B. A., Fleming, P. J., Kemmick Pintor, J. B., & Stimpson, J. P. (2021). Allostatic load among U.S.- and foreign-born whites, Blacks, and Latinx. *American Journal of Preventive Medicine, 60*(2), 159–168. https://doi.org/10.1016/j.amepre.2020.08.022

Manor, O., Matthews, S., & Power, C. (2000). Dichotomous or categorical response? Analyzing self-rated health and lifetime social class. *International Journal of Epidemiology, 29*(1), 149–157. https://doi.org/10.1093/ije/29.1.149

McGee, D. L., Liao, Y., Cao, G., & Cooper, R. S. (1999). Self-reported health status and mortality in a multiethnic US cohort. *American Journal of Epidemiology, 149*(1), 41–46. https://doi.org/10.1093/oxfordjournals.aje.a009725

Miilunpalo, S., Vuori, I., Oja, P., Pasanen, M., & Urponen, H. (1997). Self-rated health status as a health measure: The predictive value of self-reported health status on the use of physician services and on mortality in the working-age population. *Journal of Clinical Epidemiology, 50*(5), 517–528. https://doi.org/10.1016/S0895-4356(97)00045-0

Moore, J. X., Bevel, M. S., Aslibekyan, S., & Akinyemiju, T. (2021). Temporal changes in allostatic load patterns by age, race/ethnicity, and gender among the US adult population; 1988–2018. *Preventive Medicine, 147*(February), Article 106483. https://doi.org/10.1016/j.ypmed.2021.106483

Nesson, E. T., & Robinson, J. J. (2019). On the measurement of health and its effect on the measurement of health inequality. *Economics and Human Biology, 35*, 207–221. https://doi.org/10.1016/j.ehb.2019.07.003

Palmer, M. K., & Toth, P. P. (2019). Trends in lipids, obesity, metabolic syndrome, and diabetes mellitus in the United States: An NHANES analysis (2003-2004 to 2013-2014). *Obesity, 27*(2), 309–314. https://doi.org/10.1002/oby.22370

Ramírez, M., Ford, M. E., Stewart, A. L., & Teresi, J. A. (2005). Measurement issues in health disparities research. *Health Services Research, 40*(5 II), 1640–1657. https://doi.org/10.1111/j.1475-6773.2005.00450.x

RStudio Team. (2015). *RStudio*. Boston, MA: Integrated Development for R. RStudio. *RStudio, Inc.*.

Salomon, J. A., Nordhagen, S., Oza, S., & Murray, C. J. L. (2009). Are Americans feeling less healthy? The puzzle of trends in self-rated health. *American Journal of Epidemiology, 170*(3), 343–351. https://doi.org/10.1093/aje/kwp144

Santos-Lozada, A. R., & Howard, J. T. (2018). Using allostatic load to validate self-rated health for racial/ethnic groups in the United States. *Biodemography and Social Biology, 64*(1), 1–14. https://doi.org/10.1080/19485565.2018.1429891

Santos-Lozada, A. R., & Martinez, M. J. (2017). How have you been? or ¿Como estás?: Does language of interview influences self-rated health among hispanic subgroups? *Journal of Immigrant and Minority Health*. https://doi.org/10.1007/s10903-017-0606-4

Schellekens, J., & Ziv, A. (2020). The role of education in explaining trends in selfrated health in the United States, 1972–2018. *Demographic Research, 42*(June), 383–398. https://doi.org/10.4054/DemRes.2020.42.12

Thompson, O. (2017). Black–white differences in self-rated health, 1972–2015. *Economics Letters, 154*, 69–73. https://doi.org/10.1016/j.econlet.2017.02.026

Verdery, A. M., England, K., Chapman, A., Luo, L., McLean, K., & Monnat, S. (2020). Visualizing age, period, and cohort patterns of substance use in the U.S. Opioid crisis. *Socius: Sociological Research for a Dynamic World, 6*, Article 237802312090694. https://doi.org/10.1177/2378023120906944

Viruell-Fuentes, E. a, Morenoff, J. D., Williams, D. R., & House, J. S. (2011). Language of interview, self-rated health, and the other Latino health puzzle. *American Journal of Public Health, 101*(7), 1306–1313. https://doi.org/10.2105/AJPH.2009.175455

Wickman, H. (2009). *ggplot2: Elegant graphics for data analysis. Statistics*. New York: Springer.

Woo, H., & Zajacova, A. (2016). Predictive strength of self-rated health for mortality risk among older adults in the United States: Does it differ by race and ethnicity? *Research on Aging.* , Article 0164027516. https://doi.org/10.1177/0164027516637410

Zajacova, A., & Dowd, J. B. (2011). Reliability of self-rated health in US Adults. *American Journal of Epidemiology, 174*(8), 977–983. https://doi.org/10.1093/aje/kwr204

Zajacova, A., Grol-Prokopczyk, H., & Zimmer, Z. (2021). Pain trends among American adults, 2002–2018: Patterns, disparities, and correlates. *Demography, 58*(2), 711–738. https://doi.org/10.1215/00703370-8977691

Zimmer, Z., & Zajacova, A. (2020). Persistent, consistent, and extensive: The trend of increasing pain prevalence in older Americans. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 75*(2), 436–447. https://doi.org/10.1093/geronb/gbx162

Zimmer, Z., Zajacova, A., & Grol-Prokopczyk, H. (2020). Trends in pain prevalence among adults aged 50 and older across Europe, 2004 to 2015. *Journal of Aging and Health, 32*(10), 1419–1432. https://doi.org/10.1177/0898264320931665