Self-rated health (SRH), or a person’s perception of their overall health status, is a commonly-used measure in health surveys. It has been said that “self-ratings provide a simple, direct, and global way of capturing perceptions of health using criteria that are as broad and inclusive as the responding individual chooses to make them.”2 Single-item measures of SRH have predictive validity and test-retest reliability of overall health among respondents of different ages, genders, and ethnicity groups.3-4 Importantly, SRH is predictive of many clinical outcomes; for example, people with poor SRH have a significantly higher risk of mortality than people with better SRH.1,4 Most studies have focused on physical SRH, but mental SRH is a distinct and important aspect of well-being.5 Importantly, provision of high-quality primary care is associated with better SRH.4 Thus, primary care clinicians and scientists can conceive of SRH as an outcome of clinical care (and other factors) and a predictor of clinical outcomes.

A number of individual and community characteristics impact SRH. On an individual level, older age, pain, and depression correlate with SRH. For example, older adults who are experiencing pain are more than twice as likely to report poor SRH as other older adults, even after controlling for clinical health indicators, sociodemographics, and access to medical care.7 Depressive symptoms prospectively predict greater decline in SRH in older adults in the United States.8 In contrast, individual-level sex is inconsistently associated with SRH.9,10 In general, women report poorer SRH than men, but they have longer life expectancies; as a

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result, SRH has a weaker correlation with mortality for women than for men.9

On a community level, segregation, income inequality, and social capital all correlate with SRH. Racial residential segregation of blacks and whites is most strongly associated with poorer SRH for blacks living in high-poverty neighborhoods.10 Additionally, greater income inequality has been linked to poorer SRH status.11 In contrast, higher social capital is associated with better SRH.12

Given the importance of SRH for predicting health outcomes, we need to better understand how multilevel characteristics work together in their associations with SRH. In this study, we conducted a multilevel analysis of individual- and zip code-level variables and SRH. We examined differences in these associations for physical versus mental SRH. These findings identify community characteristics that may put patients at risk for poorer SRH, highlighting where we can locate future supportive interventions to address community factors and individual health.

**Methods**

We collected cross-sectional survey data from patients visiting 7 primary care clinics14 in July 2019. Patients (≥18 years) self-administered an anonymous paper questionnaire. Of 1769 adult patients, 464 completed a survey (response rate = 26.2%), and 455 provided valid zip codes.

**Measures**

**Outcome variables.** Participants reported physical and mental SRH in response to the question “In general, would you say that your [physical/mental] health is...” Responses options were excellent, very good, good, fair, or poor. We dichotomized responses into excellent or very good versus good, fair, or poor.15

**Predictor characteristics.** Participants reported age, race/ethnicity, sex, marital status, and residential stability (Table 1). Community characteristics were primarily drawn from 2013 to 2017 American Community Survey five-year estimates and linked to participants’ zip code.16 These characteristics were median household income; population density; number of retail establishments per 1000 population; average life expectancy (from 2010 to 2015 U.S. Small-Area Life Expectancy Estimates Project); percent of population (≥25 years) with at least a high school degree; percent of households whose language is only English; percent of students eligible for free and reduced lunch (from 2018 to 2019 [redacted] Department of Education report); and percent of residents who are black, Hispanic, without healthcare insurance, and live in the same house as the previous year.

**Statistical Analysis**

We built multilevel models for physical and mental SRH, accounting for clustering of participants by zip code. For each outcome, we ran empty logistic regression models (Model 0). We calculated intraclass correlation (ICC) using the formula19:

\[
 ICC = \frac{\tau_{00}}{\tau_{00} + 3.29} 
\]

Where \( \tau_{00} \) is the Model 0 intercept and 3.29 is the level-1 error variance.19 ICC summarizes the variation in the outcome attributable to level-2 (ie, zip code) membership.19

Then, we calculated bivariate associations between individual- and zip code-level characteristics and each outcome, accounting for clustering. Finally, we constructed multivariable models simultaneously assessing the associations between individual-level characteristics (Model 1); between zip code-level characteristics (Model 2); and between individual- and zip code-level characteristics (Model 3) with each outcome.

The [redacted] determined this study was exempt from review. Analyses were conducted using SAS version 9.4 (Cary, NC), with a two-sided \( P \)-value of 0.05.

**Results**

Participants lived in 75 zip codes (mean = 6.1 participants/zip code). On average, participants were 50.9 years old (standard error [SE] = 0.9) and predominantly female (72.2%) (Table 1). About half had lived in their current residence for <10 years (51.7%). On average, participants lived in zip codes with a median household income of $61,662 (SE=$ 752.6), with 10.4% black residents (SE=0.6%) and 12.4% Hispanic residents (SE=0.9%).

**Physical SRH**

Overall, 198 (43.9%) participants reported excellent or very good physical health. The ICC for physical SRH was 8.05% (\( t = -2.05, P = .04 \)), indicating that zip code membership had a small-to-medium effect on variation in this outcome.20

In the final, multilevel, multivariable model (Model 3), physical SRH was inversely associated with age (odds ratio [OR] = 0.82, 95% confidence interval [CI] = 0.72-0.93), density of retail establishments (OR = 0.94, 95% CI = 0.90-0.99), and percent of residents who were uninsured (OR = 0.07, 95% CI = 0.02-0.35) (Table 2). Physical SRH was positively associated with zip code-level average life expectancy (OR = 1.47, 95% CI = 1.07-2.01) and percent of students eligible for free and reduced lunch (OR = 1.60, 95% CI = 1.08-2.38).
Mental SRH

Overall, 233 (55.2%) participants reported excellent or very good mental health. The ICC for mental SRH was 5.98% (t=2.01, P < .05), indicating that zip code membership had a small-to-medium effect on variation in this outcome.20

In the final, multilevel multivariable model (Model 3), mental SRH was not associated with any of the individual- or zip code-level characteristics (Table 2).

Discussion

This paper investigated the simultaneous associations of individual- and zip code-level characteristics with self-rated physical and mental health. The study was conducted with adult patients at primary care clinics in central Pennsylvania, many of whom came from relatively affluent zip codes. About half of participants reported excellent or very good physical and mental SRH. Better physical SRH was associated with individual-level characteristics (younger age) as
Table 2. Bivariate and Multivariable Associations of Individual- and Zip Code-Level Characteristics with Physical Self-Rated Health (Top Panel) and Mental Self-Rated Health (Bottom Panel) Among Patients Attending Primary Care Clinics in Pennsylvania (n=455), 2019.

|                              | Bivariate | Model 1 | Model 2 | Model 3 |
|------------------------------|-----------|---------|---------|---------|
|                              | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) |
| **Physical SRH**             |           |         |         |         |
| Individual-level characteristics |           |         |         |         |
| Age, by 10 years             | 0.86 (0.76-0.97) | 0.83 (0.72-0.95) | 0.82 (0.72-0.93) |         |
| Race/ethnicity (ref: NH White) |           |         |         |         |
| Non-Hispanic Black           | 0.9 (0.49-1.64) | 0.8 (0.40-1.59) | 1.04 (0.50-2.14) |         |
| Hispanic                     | 0.58 (0.32-1.05) | 0.5 (0.28-0.90) | 0.74 (0.29-1.91) |         |
| Other                        | 1.73 (0.70-4.32) | 1.34 (0.51-3.50) | 1.2 (0.45-3.25) |         |
| Sex (ref: Male)              |           |         |         |         |
| Female                       | 0.93 (0.64-1.36) | 0.83 (0.55-1.24) | 0.79 (0.49-1.28) |         |
| Marital status (ref: Other)  |           |         |         |         |
| Married/living with partner  | 1.25 (0.86-1.80) | 1.32 (0.94-1.85) | 1.38 (0.88-2.16) |         |
| Residential stability (ref: <10 years) |     |         |         |         |
| Lived in residence for 10+ years | 0.83 (0.61-1.13) | 0.89 (0.63-1.25) | 0.84 (0.53-1.33) |         |
| Zip code-level characteristics |           |         |         |         |
| Median household income, by $1000 | 1.02 (1.00-1.03) |         |         |         |
| Population density, by 100   | 1 (0.99-1.00) | 1.02 (1.01-1.04) | 1.02 (1.00-1.04) |         |
| Retail establishments, per 1000 | 1.01 (0.99-1.03) | 0.95 (0.93-0.98) | 0.94 (0.90-0.99) |         |
| Average life expectancy, by 1 year | 1.15 (1.05-1.26) | 1.42 (1.10-1.83) | 1.47 (1.07-2.01) |         |
| High school completion, by 10% | 0.69 (0.45-1.06) | 0.59 (0.28-1.28) | 0.53 (0.19-1.49) |         |
| Black, by 10%                 | 0.93 (0.74-1.17) | 0.79 (0.55-1.13) | 0.65 (0.42-1.02) |         |
| Hispanic, by 10%              | 0.89 (0.80-0.98) | 0.78 (0.42-1.43) | 0.55 (0.19-1.62) |         |
| Uninsured, by 10%             | 0.51 (0.29-0.89) | 0.14 (0.05-0.37) | 0.07 (0.02-0.35) |         |
| English-speaking households, by 10% | 1.13 (1.00-1.29) | 1.22 (0.58-2.57) | 0.85 (0.25-2.91) |         |
| Living in same house 1 year ago, by 10% | 0.99 (0.66-1.49) | 0.47 (0.26-0.83) | 0.42 (0.17-1.06) |         |
| Students eligible free and reduced lunch, by 10% | 0.91 (0.84-0.99) | 1.42 (1.02-1.99) | 1.6 (1.08-2.38) |         |
| **Mental SRH**                |           |         |         |         |
| Individual-level characteristics |           |         |         |         |
| Age, by 10 years             | 1.17 (1.05-1.32) | 1.14 (1.00-1.30) | 1.13 (1.00-1.29) |         |
| Race/ethnicity (ref: NH White) |           |         |         |         |
| Non-Hispanic Black           | 0.7 (0.42-1.16) | 0.91 (0.53-1.59) | 0.79 (0.37-1.71) |         |
| Hispanic                     | 0.57 (0.28-1.16) | 0.75 (0.33-1.70) | 1 (0.38-2.69) |         |
| Other                        | 1.64 (0.73-3.66) | 1.96 (0.91-4.24) | 1.59 (0.51-5.04) |         |
| Sex (ref: Male)              |           |         |         |         |
| Female                       | 0.94 (0.66-1.32) | 1.01 (0.69-1.49) | 1.03 (0.63-1.66) |         |
| Marital status (ref: Other)  |           |         |         |         |
| Married/living with partner  | 1.38 (0.99-1.91) | 1.33 (0.94-1.88) | 1.4 (0.88-2.21) |         |
| Residential stability (ref: <10 years) |     |         |         |         |
| Lived in residence for 10+ years | 1.28 (0.94-1.72) | 0.97 (0.70-1.36) | 0.98 (0.62-1.56) |         |
| Zip code-level characteristics |           |         |         |         |
| Median household income, by $1000 | 1.01 (1.00-1.02) |         |         |         |
| Population density, by 100   | 0.99 (0.99-1.00) | 0.99 (0.98-1.01) | 1 (0.98-1.02) |         |
| Retail establishments, per 1000 | 1.02 (1.00-1.03) | 0.98 (0.95-1.02) | 0.98 (0.95-1.02) |         |
| Average life expectancy, by 1 year | 1.09 (1.01-1.19) | 1.08 (0.84-1.39) | 1.12 (0.84-1.48) |         |
| High school completion, by 10% | 0.7 (0.46-1.06) | 0.4 (0.16-1.02) | 0.44 (0.18-1.09) |         |

(continued)
Table 2. (continued)

|                                | Bivariate | Model 1 | Model 2 | Model 3 |
|--------------------------------|-----------|---------|---------|---------|
|                                | OR (95% CI)| OR (95% CI) | OR (95% CI) | OR (95% CI) |
| Black, by 10%                  | 0.97 (0.84-1.12) | 0.84 (0.58-1.21) | 0.94 (0.60-1.46) |
| Hispanic, by 10%               | 0.91 (0.86-0.96) | 1.08 (0.47-2.47) | 1.06 (0.38-2.96) |
| Uninsured, by 10%              | 0.64 (0.41-1.01) | 0.48 (0.15-1.61) | 0.44 (0.11-1.76) |
| English-speaking households, by 10% | 1.1 (1.01-1.20) | 1.37 (0.55-3.42) | 1.33 (0.42-4.19) |
| Living in same house 1 year ago, by 10% | 0.85 (0.60-1.20) | 0.57 (0.26-1.23) | 0.52 (0.23-1.19) |
| Students eligible free and reduced lunch, by 10% | 0.94 (0.88-0.99) | 1.22 (0.88-1.70) | 1.22 (0.83-1.79) |

Abbreviations: CI = confidence interval; OR = odds ratio. The intraclass correlation (ICC) for physical self-rated health was 8.05% ($t = -2.05, P = 0.04$; Model 0). The ICC for mental self-rated health was 5.98% ($t = 2.01, P < .05$; Model 0). Each row in the “Bivariate Models” column indicates the results of a separate bivariate logistic regression. Models adjusted for clustering by zip code.

Well as zip code-level characteristics (lower density of retail establishments, higher average life expectancy, lower prevalence of uninsured population, and higher percent of students eligible for free and reduced lunch). In contrast, mental SRH was not associated with any of the individual- or zip code-level characteristics we measured in the full multivariable, multilevel model.

Physical SRH was inversely associated with individual-level age, which was expected based on previous studies. Older individuals tend to have poorer SRH than younger individuals, perhaps due to increasing prevalence of chronic and other health conditions with age. Interestingly, however, the link between clinical health and physical SRH weakens as people age, perhaps because social factors become increasingly influential for health among older adults.

Physical SRH was also found to be associated with several community characteristics: density of retail establishments, percent uninsured, and percent of students eligible for free and reduced lunch. In terms of density of retail establishments, individuals living in more commercialized communities had poorer physical SRH. Future studies should investigate how the type and mixture of retail establishments moderate this relationship; for example, living near establishments that primarily sell alcohol, tobacco, and/or unhealthy foods could hinder physical health. In terms of percent uninsured, lack of health insurance can hinder access to preventive healthcare services, resulting in poorer long-term health outcomes. Uninsured individuals are also more likely to have low-wage jobs, which can negatively impact physical health through higher consumption of unhealthy foods. Finally, in terms of percent of students eligible for free and reduced lunch, we observed an inverse association with physical SRH in bivariate models, but a positive association in multivariable models. The reasons for these associations deserve more exploration, but 1 hypothesis is that communities where students are eligible for free and reduced lunch could foster an environment that can reduce food insecurity and obesity rates, resulting in better physical SRH. In summary, physical SRH is responsive to both individual- and community-level characteristics.

In contrast, mental SRH was not associated with any individual- or zip code-level characteristic in the final models. Although the ICC indicated that zip code membership helped to explain 6% of differences in mental SRH, these differences were not significantly related to the multilevel characteristics we examined. This may indicate that characteristics associated with mental SRH are subtler or more nuanced than our models accounted for (eg, there may be non-linear associations), and/or we did not account for them in our survey. One such individual-level variable is physical activity, as physical activity can increase positive affect. Two related excluded zip code-level variables are walkability and green space, both of which are associated with physical activity and SRH. Crime rate is another excluded zip code-level variable, although previous studies have shown that more neighborhood crime is associated with greater psychological distress, and greater fear of crime is associated with poorer mental health. In addition, individual- and area-level degree of religiosity interact in their associations with SRH, so future studies could incorporate both of these variables into analyses of mental SRH. Finally, the demographic makeup of our sample could also impact observed levels and correlates of mental SRH, as our respondents include a majority of non-Hispanic white women. Sex and racial/ethnic differences in mental SRH have been demonstrated in previous studies.

Importantly, while various associations were found between the individual- and zip code-level characteristics and SRH, we found no statistical evidence for a number of associations that may have been expected, including with race/ethnicity, sex, and high school completion rate.
Previous studies have shown that, compared to NH whites, NH blacks have poorer SRH and Hispanics have better SRH. In the present study, our sample had low variability in racial/ethnic composition, with 72.5% of participants reporting NH white race/ethnicity, which is somewhat higher than the percent of NH whites in Dauphin County, Pennsylvania (64.9%); better representation of different races/ethnicities may have shown a relationship with SRH. Additionally, the racial/ethnic compositions are aggregated data at the zip level; regression with aggregated data is vulnerable to ecological fallacy, which may lead to the discrepancies between results at the individual level and zip code-level. As described above, the relationship between SRH and sex is unclear, with some previous studies reporting that women report poorer SRH than men and others reporting no difference. The present study did not show an association between gender and SRH, which again could be explained by the demographics of our sample (ie, 72.2% female). More representation from males could have provided additional power to detect a sex difference in SRH. Studies have shown that individual-level education levels have been positively associated with SRH; however, our study did not show an association between zip code-level high school completion rate and SRH. Had we asked participants to report their own education, we may have found an association at the individual level. These findings have implications for public health, clinical practice, and future research. In terms of public health, our findings indicate that we can use zip codes to identify subpopulations that are at-risk for poor physical SRH, including more commercialized areas, with high percentages of uninsured and low percentages of students eligible for free and reduced lunch. Interventions to improve physical SRH, perhaps by increasing physical activity and reducing food insecurity, could be located in these zip codes to reach the most at-risk populations. Similarly, clinical practice could use patient zip code (or zip code-level characteristics) as an indicator that a person may live in a community that is at higher risk for poorer physical SRH; as more attention is paid to social determinants of health in the clinical setting, the environment in which patients live, and how that environment may impact health, will become more important to primary care. Future research should continue to examine in greater depth the multilevel factors that are associated with SRH and other health outcomes, with larger and more diverse samples. In particular, future studies could incorporate additional contextual, zip code-level characteristics such as walkability, green space, and crime, as well as interpersonal factors such as social cohesion and capital to create nuanced, multilevel models that are ecologically valid. Importantly, identifying the individual- and zip code-level characteristics that are associated with mental SRH will have important implications for promoting whole-person health in primary care. However, in all of these instances, it is important to remember that SRH reflects a person’s actual health status as well as their idiosyncratic reporting tendencies and as such is an imperfect reflection of health, well-being, and function. This construct can serve dynamically as a patient’s retrospective interpretation of clinical and non-clinical health issues and/or a prospective marker of future outcomes. As a result, stakeholders from public health, clinical medicine, and research need to be explicit about their hypothesized relationships between SRH and outcomes of interest. Strengths of our study include our respectable response rate for a survey-based study, moderate variability in zip-code level characteristics (k = 75), and successful geocoding of 98% of participants (455/464). However, our study does have several limitations including the majority of the respondents identifying as female and white, and geographic location limited to central Pennsylvania, making generalizability of our findings somewhat limited. Ecological fallacy is also important to consider as a limitation; inferences made about groups based on aggregate data cannot be extended to individuals.

Conclusions
In this cross-sectional survey of adult primary care patients, we found that physical SRH was associated with individual-level age and with zip code-level density of retail establishments, percent uninsured, and percent of students eligible for free and reduced lunch. Public health and clinical practice can use these results to identify and intervene with patients living in communities considered at-risk for poorer physical SRH. Additional research is needed to explore other zip code-level characteristics, particularly as they relate to mental SRH. This area of research can support efforts to improve social determinants of health and whole-person primary healthcare.

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References

1. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. J Health Soc Behav. 1997;38(1):21-37.
2. Lundberg O, Manderbacka K. Assessing reliability of a measure of self-rated health. Scand J Soc Med. 1996;24(3):218-224.
3. Pérez-Zepeda MU, Belanger E, Zunzunegui M-V, Phillips S, Ylli A, Guralnik J. Assessing the validity of self-rated health with the short physical performance battery: a cross-sectional analysis of the international mobility in aging study. PLoS One. 2016;11(4):e0153855.
4. Chandola T, Jenkinson C. Validating self-rated health in different ethnic groups. Ethn Health. 2000;5(2):151-159.
5. Levinson D, Kaplan G. What does self-rated mental health represent. J Public Health Res. 2014;3(3):287.
6. Shi L, Starfield B, Politzer R, Regan J. Primary care, self-rated health, and reductions in social disparities in health. Health Serv Res. 2002;37(3):529-550.
7. Reyes-Gibby CC, Aday L, Cleeland C. Impact of pain on self-rated health in the community-dwelling older adults. Pain. 2002;95(1-2):75-82.
8. Han B. Depressive symptoms and self-rated health in community-dwelling older adults: a longitudinal study. J Am Geriatr Soc. 2002;50(9):1549-1556.
9. Idler EL. Discussion: gender differences in self-rated health, in mortality, and in the relationship between the two. Gerontologist. 2003;43(3):372-375.
10. Subramanian SV, Kim D, Kawachi I. Covariation in the socioeconomic determinants of self-rated health and happiness: a multivariate multilevel analysis of individuals and communities in the USA. J Epidemiol Community Health. 2005;59(8):664-669.
11. Do DP, Frank R, Iceland J. Black-white metropolitan segregation and self-rated health: investigating the role of neighborhood poverty. Soc Sci Med. 2017;187:85-92.
12. Hildebrand V, Van Kerm P. Income inequality and self-rated health status: evidence from the European Community Household Panel. Demography. 2009;46(4):805-825.
13. Kawachi I, Kennedy BP, Glass R. Social capital and self-rated health in the community-dwelling older adults. Am J Public Health. 1999;89(8):1187-1193.
14. Westfall JM, Zittleman L, Staton EW, et al. Card studies for observational research in practice. Ann Fam Med. 2011;9(1):63-68.
15. Manor O, Matthews S, Power C. Dichotomous or categorical response? Analysing self-rated health and lifetime social class. Int J Epidemiol. 2000;29(1):149-157.
16. U. S. Census Bureau. American Community Survey (ACS). Published 2018. Accessed 2018. https://www.census.gov/programs-surveys/acs/.
17. Centers for Disease Control and Prevention. U.S. Small-area life expectancy estimates project – USALEEP. Published 2020. Accessed 2020. https://www.cdc.gov/nchs/ncss/nvss/usaleep/usaleep.html#life-expectancy.
18. Pennsylvania Department of Education. National school lunch program reports. Published 2020. Accessed 2020. https://www.education.pa.gov/Teachers%20-%20Administrators/Food-Nutrition/reports/Pages/National-School-Lunch-Program-Reports.aspx.
19. Ene M, Leighton EA, Blue GL, Bell BA. Multilevel Models for Categorical Data Using SAS® PROC GLIMMIX: The Basics. 2015. Accessed 2020. https://support.sas.com/resources/papers/proceedings15/3430-2015.pdf.
20. LeBreton JM, Senter JL. Answers to 20 questions about interrater reliability and interrater agreement. Organ Res Methods. 2008;11(4):815-852.
21. Idler E, Cartwright K. What do we rate when we rate our health? Decomposing age-related contributions to self-rated health. J Health Soc Behav. 2018;59(1):74-93.
22. Larson NI, Story MT, Nelson MC. Neighborhood environments: disparities in access to healthy foods in the U.S. Am J Prev Med. 2009;36(1):74-81.
23. DeVoe JE, Fryer GE, Phillips R, Green L. Receipt of preventive care among adults: insurance status and usual source of care. Am J Public Health. 2003;93(5):786-791.
24. Collins SR, Schoen C, Colasanto D, Downey DA. On the edge: low-wage workers and their health insurance coverage. Findings from the Commonwealth Fund 2001 Health Insurance Survey. Issue Brief (Commonw Fund). 2003:626-1-8.
25. Li Y, Mutchler JE. Do consequences of hardship narrow in later life? The impact of hardship on self-rated health among older adults. Ann Epidemiol. 2019;37:4-9.
26. Gundersen C, Kreider B, Pepper J. The impact of the National School Lunch Program on child health: a nonparametric bounds analysis. J Econom. 2012;166(1):79-91.
27. Wichers M, Peeters F, Rutten BPF, et al. A time-lagged momentary assessment study on daily life physical activity and affect. Health Psychol. 2012;31(2):135-144.
28. Sallis JF, Saelens BE, Frank LD, et al. Neighborhood built environment and income: examining multiple health outcomes. Soc Sci Med. 2009;68(7):1285-1293.
29. Pietilä M, Neuvonen M, Borodulin K, Korpela K, Sievänen T, Tyrväinen L. Relationships between exposure to urban green spaces, physical activity and self-rated health. J Outdoor Recreat Tour. 2015;10:68-73.
30. Mitchell RJ, Richardson EA, Shortt NK, Pearce JR. Neighborhood environments and socioeconomic inequalities in mental well-being. Am J Prev Med. 2015;49(1):80-84.
31. Astell-Burt T, Feng X, Kolt GS, Jalaludin B. Does rising religiosity delay death depends on the cultural context. Am J Public Health. 2015;105(1):207-2081.
32. Stavrova O. Religion, self-rated health, and mortality: whether religiosity delays death depends on the cultural context. Soc Psychol Personal Sci. 2015;6(8):911-922.
33. Krause N. Assessing the relationships among religion, humility, forgiveness, and self-rated health. Res Hum Dev. 2018;15(1):33-49.
34. Poortinga W, Dunstan FD, Fone DL. Perceptions of the neighborhood environment and self rated health: a multilevel analysis of the Caerphilly Health and Social Needs Study. BMC Public Health. 2007;7:285-285.
36. Kim G, DeCoster J, Chiriboga DA, Jang Y, Allen RS, Parmelee P. Associations between self-rated mental health and psychiatric disorders among older adults: do racial/ethnic differences exist? *Am J Geriatr Psychiatry*. 2011;19(5):416-422.

37. Franks P, Gold MR, Fiscella K. Sociodemographics, self-rated health, and mortality in the US. *Soc Sci Med*. 2003;56(12):2505-2514.

38. Ryoo I, Cho Y, Yoon H-J, Park M. Gender differences in the effect of self-rated health (SRH) on all-cause mortality and specific causes of mortality among individuals aged 50 years and older. *PLoS One*. 2019;14(12):e0225732.

39. Liu H, Hummer RA. Are educational differences in U.S. self-rated health increasing?: an examination by gender and race. *Soc Sci Med*. 2008;67(11):1898-1906.

40. DeVoe JE, Bazemore AW, Cottrell EK, et al. Perspectives in primary care: a conceptual framework and path for integrating social determinants of health into primary care practice. *Ann Fam Med*. 2016;14(2):104-108.

41. deGruy FV, Etz RS. Attending to the whole person in the patient-centered medical home: the case for incorporating mental healthcare, substance abuse care, and health behavior change. *Fam Syst Health*. 2010;28(4):298-307.

42. Krause NM, Jay GM. What do global self-rated health items measure? *Med Care*. 1994;32(9):930-942.

43. Layes A, Asada Y, Kepart G. Whiners and deniers – what does self-rated health measure? *Soc Sci Med*. 2012;75(1):1-9.

44. Shooshtari S, Menec V, Tate R. Comparing predictors of positive and negative self-rated health between younger (25-54) and older (55+) Canadian adults: a longitudinal study of well-being. *Res Aging*. 2007;29(6):512-554.

45. Goldman N, Glei DA, Chang MC. The role of clinical risk factors in understanding self-rated health. *Ann Epidemiol*. 2004;14(1):49-57.

46. Vingilis ER, Wade TJ, Seeley JS. Predictors of adolescent self-rated health. Analysis of the National Population Health Survey. *Can J Public Health*. 2002;93(3):193-197.

47. Ryff CD, Radler BT, Friedman EM. Persistent psychological well-being predicts improved self-rated health over 9-10 years: longitudinal evidence from MIDUS. *Health Psychol Open*. 2015;2(2):1-11.

48. McCallum J, Shadbolt B, Wang D. Self-rated health and survival: a 7-year follow-up study of Australian elderly. *Am J Public Health*. 1994;84(7):1100-1105.

49. Stenholm S, Pentti J, Kawachi I, Westerlund H, Kivimäki M, Vahtera J. Self-rated health in the last 12 years of life compared to matched surviving controls: the Health and Retirement Study. *PLoS One*. 2014;9(9):e107879.