Annals of Epidemiology 27 (2017) 558–562

Contents lists available at ScienceDirect

Annals of Epidemiology

journal homepage: www.annalsofepidemiology.org

Original article

Factors affecting workforce participation and healthy worker biases in U.S. women and men

Candice Y. Johnson PhD [a,*], Carissa M. Rocheleau PhD [a], Christina C. Lawson PhD [a], Barbara Grajewski PhD [a,1], Penelope P. Howards PhD [b]

[a] National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Cincinnati, OH
[b] Department of Epidemiology, Rollins School of Public Health, Emory University, Atlanta, GA

ARTICLE INFO

Article history:
Received 16 June 2017
Accepted 11 August 2017
Available online 25 August 2017

Keywords:
Bias (epidemiology)
Healthy worker effect
Women

ABSTRACT

Purpose: To investigate potential attenuation of healthy worker biases in populations in which healthy women of reproductive age opt out of the workforce to provide childcare.
Methods: We used 2013–2015 data from 120,928 U.S. women and men aged 22–44 years participating in the Gallup-Healthways Well-Being Index. We used logistic regression to estimate adjusted prevalence odds ratios (PORs) and 95% confidence intervals (CIs) for associations between health and workforce nonparticipation.
Results: Women and men reporting poor health were more likely to be out of the workforce than individuals reporting excellent health (POR: 3.7, 95% CI: 3.2–4.2; POR: 6.7, 95% CI: 5.7–7.8, respectively), suggesting potential for healthy worker bias. For women ($P < .001$) but not men ($P = .30$), the strength of this association was modified by number of children in the home: POR: 7.3 (95% CI: 5.8–9.1) for women with no children, decreasing to POR: 0.9 (95% CI: 0.6–1.5) for women with four or more children.
Conclusions: These results are consistent with attenuation of healthy worker biases when healthy women opt out of the workforce to provide childcare. Accordingly, we might expect the magnitude of these biases to vary with the proportion of women with differing numbers of children in the population.
Published by Elsevier Inc.

Introduction

Healthy worker biases encompass a variety of biases that arise in occupational epidemiology studies and result from differential entry into and exit from the workforce by factors related to health or disease risk [1]. Healthy hire bias and healthy worker survivor bias are the two types most often studied.

Healthy hire bias is confounding arising from differential entry into the workforce by healthy versus unhealthy individuals [2,3]. An example of a scenario resulting in healthy hire bias is comparison of risk (or prevalence) of disease in a worker population to risk in the general population: because healthier individuals are more likely to join the workforce than less healthy individuals, the risk of disease is lower in the working population than in the general population, which results in confounding when the two risks are compared [3].

Healthy worker survivor bias involves differential exit from the workforce by healthy versus unhealthy individuals. This bias takes the form of time-varying confounding affected by prior exposure and occurs when exposure causes less healthy individuals to leave the workforce, leaving healthier workers in the workforce [1,4]. Thus, a higher cumulative occupational exposure is accrued by the healthy individuals remaining in the workforce and a lower cumulative occupational exposure is accrued by the less healthy individuals who leave the workforce. The result is often a downward bias in the association between cumulative exposure and disease [1].

Poor physical health and mental health are important reasons why individuals leave or do not join the workforce, and these are the mechanisms through which healthy worker biases are thought to operate [2]. However, in many populations, substantial proportions of healthy women opt out of the workforce for reasons unrelated to health, such as to provide childcare [5]. Investigators have also found evidence suggestive of weaker healthy worker biases caused by healthy women leaving the workforce after marriage among U.S. white women in the 1960s and in a contemporary population of college-educated Japanese women [6,7].

* Corresponding author. National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1090 Tusculum Ave MS R-15, Cincinnati, OH 45226. Tel.: (513) 841-4454; fax: (513) 841-4486.
E-mail address: cyjohnson@cdc.gov (C.Y. Johnson).
[1] Present address: Wisconsin Division of Public Health, 1 W. Wilson St., Madison, WI 53701 USA.

http://dx.doi.org/10.1016/j.annepidem.2017.08.017
1047-2797/Published by Elsevier Inc.

The objective of this study was to explore relationships between health, workforce participation, and childcare in a contemporary U.S. population in which the number of children in the home might be a strong predictor of workforce nonparticipation for women, just as marriage was once a strong predictor of workforce nonparticipation in this population. We hypothesized healthy worker biases would be weaker among U.S. women with children compared with women without children and that a greater attenuation would be seen as the number of children in the home increased. However, we would not expect to see this effect for men, who do not traditionally leave the workforce to provide childcare. We used the magnitude of the association between workforce participation and self-reported health among women and men with differing numbers of children as a proxy for healthy worker bias.

Materials and methods

We included adult women and men participating in the Gallup-Healthways Well-Being Index (WBI) between January 2013 and October 2015 [8,9]. Approximately 175,000 adults (aged 18 years and over) from the 50 U.S. states and the District of Columbia were sampled yearly for the WBI using a cross-sectional telephone survey conducted in English or Spanish.

Participants were identified by dual-frame (landline and cell phone) random digit dialing from lists purchased from Survey Sampling International. The sample was stratified by time zone within U.S. census region and phone type. At least three attempts were made to contact the household. For landlines, the adult household member with the next upcoming birthday was selected to participate. For cell phones, the person answering the phone was selected (if eligible) because the device is treated as a personal device. Since the WBI began in 2008, an average of 74% of eligible respondents reached have completed the interview (the overall contact rate [persons reached out of all active or inactive numbers called] was 9%). Samples were weighted to account for selection probability, nonresponse, and households with both cell phones and landlines being present in both sampling frames. In addition, samples were weighted by demographic variables to match distributions expected based on the most recent Current Population Survey (gender, age, race, ethnicity, education, region, population density, phone status) [9]. Participants provided verbal agreement to participate in the telephone survey.

Our primary association of interest was between self-reported health (exposure) and workforce nonparticipation (outcome), the magnitude of which was used as a proxy for the magnitude of healthy worker bias. For this to be valid, we made the following assumptions. First, we assumed that healthy worker bias had the structure of confounding (either time invariant or time varying affected by prior exposure), in which health affected both an occupational exposure (through workforce participation) and a hypothetical disease outcome (corresponding directed acyclic graphs are provided in eAppendix Fig. A1). Second, we assumed that the association between health and the hypothetical disease outcome was constant, so that the stronger the association between health and workforce participation, the stronger the likely effect of healthy worker bias.

We restricted our analysis to adults aged 22–44 years to focus on the time when reproductive-aged women might be raising young children, to exclude age groups in which substantial proportions of respondents are out of the workforce because they are in school (ages 18–21 years), and to reduce the likelihood that workforce nonparticipation would be driven by retirement or work-related chronic disease, which might be more prevalent in older populations.

We used self-rated health as our measure of general health status based on the question, “Would you say your own health, in general, is excellent, very good, good, fair, or poor?”.

We categorized WBI participants as in the workforce (working for an employer, being self-employed fulltime or part-time, or being unemployed and looking for work) or out of the workforce (unemployed and not looking for work) at the time of the survey. To determine employment status, participants were asked: “Thinking about your work situation over the past 7 days, have you been employed by an employer—even minimally like for an hour or more—from whom you receive money or goods?” and “Again thinking about the last 7 days, were you self-employed, even minimally like for an hour or more? This means working for yourself, freelancing, or doing contract work or working for your own or you family’s business?”. To determine if participants who did not report a job were actively looking for work, they were asked: “In the past four weeks, have you actively been looking for employment? ‘Actively looking’ means applying for jobs, searching for jobs, and the like”.

Additional variables of interest related to self-reported health and workforce nonparticipation included age (22–29, 30–34, 35–39, 40–44 years), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other), educational attainment (less than high school, high school or equivalent, some college or vocational training, college graduate, graduate work or degree), and number of children aged less than 18 years in the home (0, 1, 2, 3, $\geq$4).

We first investigated which of our variables of interest were associated with the outcome (workforce nonparticipation) by using multivariable models to examine associations between these variables (including self-reported health, the exposure) and workforce nonparticipation. Covariate choice for multivariable models was guided by directed acyclic graphs (eAppendix Fig. A2) [10]. We adjusted the models for age and race/ethnicity when education was the variable of interest and adjusted for age, race/ethnicity, and education in models for self-rated health and number of children. Models in which age or race/ethnicity was the variable of interest remained unadjusted.

A second set of models was created to see how presence of children in the home affected the strength of the main association of interest between self-reported health and workforce nonparticipation. First, we included interaction terms between number of children in the home and self-reported health to assess departure from multiplicative interaction. Then, we used stratified analyses to see how the magnitude of the association varied.

We used survey procedures for logistic regression to estimate prevalence odds ratios (PORs) and 95% confidence intervals (CIs) for associations between variables in SAS version 9.4 (Cary, NC), accounting for the sampling weights. Linear tests for trend were used to identify potential dose-response relationships, using the variable itself for continuous variables and ordinal scores for categorical variables. Results for this test were presented as both *P*-values and POR and 95% CI.

We excluded individuals with missing data for any variables of interest from all analyses. Of 55,262 participating women and 70,215 men aged 22–44 years, we excluded the following number of participants for missing data on the following variables: workforce participation (1 woman), self-reported health (30 women, 82 men), race/ethnicity (1273 women, 2088 men), educational attainment (338 women, 397 men), and number of children in the home (99 women, 241 men). Overall, 1741 (3%) women and 2808 (4%) men were excluded from the analysis.

Results

Among the 53,521 women and 67,407 men in the analysis, 24% of women and 10% of men (weighted prevalence) were not participating in the workforce.

Characteristics of women and men in and out of the workforce are shown in Table 1. Women aged 30 years and above were slightly