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ORIGINAL ARTICLE

The healthy worker effect: Do health problems predict participation rates in, and the results of, a follow-up survey?

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Abstract
Purpose To determine the impact of the healthy worker effect (HWE) as a bias for the external and internal validity of the follow-up assessment in prospective survey research. Specifically, the study examined (1) whether the health status of respondents at the baseline measurement influenced response at the follow-up survey (external validity) and (2) whether HWE is a threat to internal validity by differential attrition, i.e., whether associations between work and health at baseline differ between stayers and dropouts.
Methods In a two-wave questionnaire survey with a 2-year time lag comprising 6283 persons, 4392 responded at both time points (response rate 70 %). Mental distress and somatic symptoms served as indicators of health. Role conflict and role clarity were indicators of work factors.
Results There were few differences in response rate at follow-up between persons with and without health complaints at the baseline measurement. As response rate increased incrementally with educational level, there seems to be a socio-educational bias, rather than a HWE bias on survey participation. Baseline relationships between work factors and health indicators were equal in magnitude among stayers and dropouts.
Conclusion The health status of participants at baseline seems to have little impact on the external and internal validity of the follow-up assessment in prospective survey research. Hence, the findings provide little support to the HWE as a potential bias in prospective studies within occupational health research. A limitation of the study is that the findings do not inform about the impact of the HWE on participation in the baseline assessment.

Keywords Participation · Attrition · Non-response bias · Generalizability · Research design

Introduction

The questionnaire survey method is a frequently used approach in research in occupational health. In survey research, sampling is concerned with the selection of a subset of individuals to estimate characteristics representative of the whole population of interest. To achieve a valid and representative selection of individuals, an important assumption is that participation and attrition, i.e., the cumulative gain and loss of respondents, in a study is completely random and not influenced by systematic biases (Rogelberg and Stanton 2007). However, the overall level of non-participation is high in most surveys. A meta-analysis of survey response rates in organizational research, which covered 1607 studies from 17 high impact peer-refereed academic journals, found an average cross-sectional response rate of only 52.7 % (SD 20.4) in studies with data collected from individuals (Baruch and Holtom 2008). In prospective survey designs, i.e., longitudinal survey designs with one or more follow-up assessments, there is usually also an additional attrition of respondents from baseline to follow-up assessments (Powell et al. 1990). Low response rates will result in smaller data samples and may decrease statistical power, increase the size of the confidence intervals around sample statistics, limit the use of statistical techniques, undermine the perceived credibility of the collected data,

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and most importantly undermine the potential for valid internal (accuracy) as well as external validity (generalizability) of the results (Rogelberg and Stanton 2007).

Among many factors which can influence survey participation in health research, the healthy worker effect (HWE) has long been considered as a main source of selection bias (Burns et al. 2011; Dumas et al. 2013; Li and Sung 1999). The HWE suggests that workers usually exhibit better health status and lower overall death rates than the general population because severely ill and disabled people are excluded from employment (McMichael 1976). In prospective survey research, the HWE may have an impact on response rates in two ways. Healthy workers may be more likely than unhealthy workers to have the capacity to participate at the baseline survey. Secondly, healthy workers may be more likely than unhealthy workers to still be employed at follow-up surveys. If the HWE does influence survey response levels, health problems will be significantly higher among non-participants than participants and the prevalence of health problems in a given population will be underestimated. While the HWE probably will have the largest impact on participation in a baseline survey, it is also important to understand the relatively extensive loss of respondents from the first survey to the follow-up. In the current study, we therefore aimed to elucidate the impact of the HWE on participation in the follow-up assessment of a prospective questionnaire survey. To add to the knowledge of how the HWE can influence the external and internal validity of a follow-up assessment, we determined (1) whether somatic health complaints and mental distress predict response at the follow-up assessment of a prospective study (external validity), and (2) whether relationships between important work factors and indicators of health status at the baseline assessment are different between respondents (stayers) and non-respondents (dropouts) at follow-up (internal validity).

Method

Procedure and participants

The present study is based on data from a large sample of Norwegian adults employed in a full- or part-time position. The survey was Web-based although participants with limited access to computers at work were given the option of filling out a paper version of the questionnaire. Subjects were recruited from organizations in Norway that were contacted and offered to participate in the survey. The survey design was full panel prospective with all variables measured at baseline and follow-up about 2 years later. This time frame was employed to test the impact of HWE because 2 years seem to be the most commonly used interval in occupational health research (Ford et al. 2014; Nielsen and Einarsen 2012). This is an ongoing survey where data are gathered continuously. While the organizations have participated at different dates, the time lags between the assessment points were more or less equal for all respondents as the average time period from the end of baseline to the end of follow-up was 23 months.

Employees and management in the companies were informed at the organizational level first. Subsequently, all employees, excluding those on sick leave, were mailed a letter with information about the survey. This letter contained a personalized code for logging into the Web questionnaire and a paper version of the questionnaire with a pre-stamped return envelope, in addition to information about the survey. The written information explained the aims of the study and assured that responses would be treated confidentially, in strict accordance with the general guidelines and specific license from the Norwegian Data Inspectorate. Employees were given the opportunity of filling out the questionnaire at work, but it was also possible to fill it out from home or any other location. Each subject had the opportunity to log into the Web questionnaire an unlimited number of times to change or complete their answers during the survey period.

By the time of data analysis, companies totaling 19,476 employees had been invited to participate at the baseline survey. According to the company register data, the invited respondents comprised 59.3 % women and 40.7 % men with a mean age of 43.58 years (SD = 11.43; range 16–83 years). Totally, 11,429 of the invited persons responded to the baseline survey (58.7 %). Of these baseline respondents, altogether 6283 persons have so far been invited to participate in the follow-up survey, with total of 4392 responding (70 %). Altogether, 5146 persons from the baseline survey have not yet been invited to the follow-up survey as it is less than 2 years since they participated in the baseline assessment. Hence, the attrition from baseline to follow-up is 1891 persons. In order to be included in the analyses of attrition from baseline to follow-up, a respondent had to be invited at both survey time points. Respondents who had left their job between the two assessment points were not invited to participate in the follow-up assessment.

Respondents were recruited from 91 organizations. The participating organizations represented a wide variety of job types, comprising among others municipalities, insurance company, health institutions, and public organizations. About 88 % of the sample responded to the survey using the electronic survey form. In line with the figures from the company registers, mean age in the sample at the time of data analysis was 43.92 (SD 10.89) years with a range from 18 to 76, and the sample consisted of more women (58 %) than men (42 %). Five percent had between 1 and 9 years

of education, 33 % had between 10 and 12 years, 43 % had between 13 and 16 years, and 19 % had 16 years or more. The majority of the sample reported to be in regular full-time employment (93 %). Altogether, 21 % had a leadership position with personnel responsibilities. Following the criteria suggested by Ilies et al. (2003), the sample can be considered as randomly selected at an individual level as all employees in the invited organizations had a possibility to participate in the survey.

Ethics statement

This study has been approved by the Regional Committees for Medical and Health Research Ethics (REK) in Norway, has permission from the Data Inspectorate of Norway, and was conducted in accordance with the World Medical Association Declaration of Helsinki. All study participants provided their informed consent. When accessing the Web-based questionnaire by a personal login code, informed consent had to be confirmed before responding to the questionnaire. This consent procedure was approved by the Data Inspectorate of Norway and REK. Data were analyzed anonymously.

Instruments

Demographical background factors included in this study were age, gender, and educational level. Several indicators of the health status of the respondents were included in the study. Mental health was measured by the ten items version of the Hopkins Symptom Checklist (HSCL-10) (Derogatis et al. 1974). The HSCL-10 consists of ten items on a four-point scale, ranging from "1 = not at all" to "4 = extremely." In line with recommendations, caseness of psychological distress defined as having a mean score of ≥1.85 (Nettelbladt et al. 1993). Cronbach's alpha for the HSCL-10 scale was .86. Somatic health complaints were measured by five single-item questions asking "have you been bothered by… "neck pain," "headache," "back pain," "chest pain," and "stomach pain" during the last 4 weeks" (Steingrimsdottir et al. 2004), with optional answers "not bothered" (1), "a little bothered" (2), "rather intensely bothered" (3), and "very intensely bothered" (4). Due to relatively few responses in each category, the latter to categories were grouped into a single class labeled "Rather or very intensely bothered."

Role conflict (three items, $a = 0.68$) and role clarity (three items, $a = 0.82$) were used as indicators of work strain and were measured with scales from the General Nordic Questionnaire for Psychological and Social Factors at Work (QPSNordic) (Dallner et al. 2000). The scales were constructed on the basis of the following frequency scoring: "1 = very seldom or never," "2 = somewhat seldom," "3 = sometimes," "4 = somewhat often," and "5 = very often or always."

Statistical analyses

Data were analyzed with IBM SPSS Statistics 22.0 and IBM SPSS AMOS 22.0 (IBM Corp. Released 2013). Associations between health indicators at baseline and participation in the follow-up survey were determined by Chi-square tests and logistic regression analyses. The level for significance was set to $p < .05$ (95 % confidence interval). Structural equation modeling with multi-group comparisons was used to indicate whether HWE has an impact on internal validity. Differences in associations between work factors and health indicators at baseline for respondents and non-respondents at follow-up were examined with pairwise tests of path coefficients (i.e., evaluation of critical ratios for differences). The goodness of fit of the structural regression models is usually evaluated using a Chi-square value, with a nonsignificant p value indicating a good fit. However, the Chi-square test is known to be sensitive to sample size. That is, in large samples, even small and substantively unimportant differences between the estimated model and the "true" underlying model will result in rejection of the model that is tested (Bentler and Chou 1987). Therefore, other indices of model fit were also considered in this study. More specifically, we assessed the root-mean-square error of approximation (RMESA) with values of 0.06 or less, and a comparative fit index (CFI) and Tucker–Lewis Index (TLI) with values in the area of 0.90–0.95 as indicative of good fit (Hu and Bentler 1999).

Results

The impact of HWE on external validity of the follow-up assessment

Prevalence rates at baseline for demographic characteristics and health indicators, response rates at the follow-up assessment, as well as significance tests for differences in rates between categories of the demography and health variables, are displayed in Table 1. No differences in response rate were found for categories of gender, mental distress, headache, back pain, and stomach pain. Small, but significant differences between response categories were found for neck pain ($\chi^2 = 9.38$; $df = 2$; $p < .05$) and chest pain ($\chi^2 = 9.01$; $df = 2$; $p < .05$). For neck pain, respondents who were "rather or very intensely bothered" (68.7 %) at baseline exhibited lower response rate at follow-up compared to those were "not bothered" (73.4 %) or "a little bothered" (73.1 %). Among those who reported chest pain at baseline, the lowest response rate at follow-up was

Table 1 Prevalence rates and differences in response rates at the follow-up assessment for indicators of demographic characteristics and health

Baseline predictors	Subcategory	Prevalence at baseline (%)	Response rate at follow-up (%)	Group difference response rate (χ^2)
Gender	Male	40.0	71.2	3.42^{NS}
	Female	60.0	69.0	
Education	<9 years	6.8	59.5	54.66***
	10–12 years	36.3	67.3	
	13–16 years	40.7	72.6	
	16 years<	16.2	79.8	
Mental distress	No	87.9	73.1	2.54^{NS}
	Yes	12.1	70.1	
Headache	Not bothered	51.9	73.6	4.60^{NS}
	A little bothered	31.5	71.5	
	Rather or very intensely bothered	16.6	70.3	
Neck pain	Not bothered	51.1	73.4	9.38*
	A little bothered	29.7	73.1	
	Rather or very intensely bothered	19.2	68.7	
Back pain	Not bothered	56.5	73.5	5.83^{NS}
	A little bothered	28.5	71.7	
	Rather or very intensely bothered	15.0	69.5	
Chest pain	Not bothered	92.1	72.9	9.01*
	A little bothered	6.4	65.6	
	Rather or very intensely bothered	1.5	74.7	
Stomach pain	Not bothered	79.4	73.2	4.62^{NS}
	A little bothered	16.8	70.4	
	Rather or very intensely bothered	3.7	68.8	

* $p < .05$; ** $p < .01$; *** $p < .001$; ^{NS} nonsignificant

found for respondents that were "a little bothered" (65.6). Respondents who were "rather or very intensely bothered" by chest pain exhibited the highest response rate (74.7 %).

Educational level emerged as the strongest predictor of survey response at follow-up ($\chi^2 = 54.66$; $df = 3$; $p < .001$). The findings showed that participation in the follow-up survey increased incrementally with higher levels of education. Whereas a response rate of 59.5 % was found for respondents with less than 10 years of education, respondents with more than 15 years of education exhibited a response rate of 79.8 %. Hence, a difference in survey response of 20.3 % points at the follow-up assessment was found between respondents of the lowest versus the highest educational levels.

Table 2 presents crude and adjusted odds ratio for demographic characteristic and health as predictors of survey response at follow-up. The crude associations repeat the findings from the above Chi-square analyses. The findings from the adjusted analyses confirm that educational level was the most important predictor of survey response. There were no other consistent patterns in response rate for levels of health complaints. As a final test of whether the HWE influences survey response, the somatic health complaints were summarized into a "Do you have pain" scale in order to examine whether the cumulative number of complaints among respondents predicts response rate. The findings showed that this cumulative scale was not associated with survey response (OR 1.04; 95 % CI .99–1.08).

The impact of HWE on threats to internal validity by differential attrition of the follow-up assessment

To determine whether there were differences among stayers and dropouts in associations between work factors and health indicators at baseline, we tested a structural model where paths from the indicators of role expectations to the indicators of health problems were estimated. All variables were modeled as latent factors in SPSS AMOS using their respective observed indicators. The observed indicators of somatic complaints comprised headache, neck pain, back

Table 2 Baseline demographic factors as predictors of survey response at follow-up

Baseline predictors	Crude OR[a]	95 % CI for crude OR	Adjusted OR[b]	95 % CI for adjusted OR
Age	1.01	1.00–1.01	1.01	1.00–1.01
Gender (ref. cat: male)	.90	.81–1.01	.98	.83–1.15
Education				
<9 years (ref. cat.)	–	–	–	–
10–12 years	1.40*	1.08–1.82	1.57**	1.18–2.09
13–16 years	1.80**	1.38–2.34	2.02***	1.52–2.69
16 years<	2.69***	1.99–3.65	2.92***	2.09–4.09
Mental distress (ref. cat. "No")	.86	.72–1.03	.88	.70–1.12
Headache				
Not bothered (ref. cat.)	–	–	–	–
A little bothered	.90	.79–1.03	.94	.79–1.13
Rather or very intensely bothered	.85	.72–1.01	.98	.78–1.24
Neck pain				
Not bothered (ref. cat.)	–	–	–	–
A little bothered	.99	.86–1.13	1.06	.89–1.27
Rather or very intensely bothered	.79*	.68–.93	.93	.74–1.17
Back pain				
Not bothered (ref. cat.)	–	–	–	–
A little bothered	.91	.80–1.05	1.07	.90–1.27
Rather or very intensely bothered	.82*	.69–.97	.98	.78–1.23
Chest pain				
Not bothered (ref. cat.)	–	–	–	–
A little bothered	.71**	.56–.89	.77	.57–1.03
Rather or very intensely bothered	1.10	.67–1.81	1.11	.63–1.96
Stomach pain				
Not bothered (ref. cat.)	–	–	–	–
A little bothered	.87	.75–1.02	.88	.73–1.08
Rather or very intensely bothered	.81	.60–1.09	.83	.57–1.20

* $p < .05$; ** $p < .01$; *** $p < .001$; [NS] nonsignificant

[a] Unadjusted odds ratios, [b] odds ratios adjusted for age, gender, educational level, and other health complaints

Table 3 Pairwise test for differences in baseline associations between role expectations and health indicators for stayers and dropouts

Association	Dropouts	Stayers	Pairwise test for differences (z-score)
Role conflict—mental distress	.23***	.28***	$-.52^{NS}$
Role clarity—mental distress	−.18***	−.17***	$-.25^{NS}$
Role conflict—somatic complaints	.30***	.39***	$.68^{NS}$
Role clarity—somatic complaints	$-.02^{NS}$	$.04^{NS}$	-1.22^{NS}

*** $p < .001$; [NS] nonsignificant

pain, chest pain, and stomach pain. Using multi-group analyzes, the model was analyzed separately for stayers and dropouts. The overall model had acceptable fit to data ($\chi^2 = 3278.33$; $df = 366$; CFI = .92; TLI = .89; RMSEA = .036; 95 % CI RMSEA = .034–.037). The findings on associations between role expectations and health indicators for stayers and dropouts are presented in Table 3. Both role conflict ($b = .23$; $p < .001$) and role clarity ($b = -.18$; $p < .001$) were significantly associated with mental distress among stayers. Role conflict ($b = .28$; $p < .001$) and role clarity ($b = -.17$; $p < .001$) were also associated with mental distress among dropouts ($b = -.17$; $p < .001$). Role conflict was associated with somatic complaints among both stayers ($b = .30$; $p < .001$)

and dropouts ($b = .29$; $p < .001$). Role clarity was not significantly associated with somatic complaints in both groups. The size of the significant coefficients suggests that the magnitude of the established associations was small to moderate. The highly significant p values are a result of the large sample size. Pairwise tests of path coefficients showed that the differences between stayers and dropouts in the above associations were all nonsignificant (see Table 3).

Discussion

The main aim of this study was to determine the impact of the HWE on participation in the follow-up assessment of a prospective questionnaire survey and thereby to establish whether the HWE is a bias for the external and internal validity of findings. With regard to external validity, the findings showed only minor differences between persons with and without somatic health problems and response rate at the follow-up assessment. Persons with mental health problems were equally likely to respond to the follow-up assessment as persons without mental health problems. Taken together, the findings provide no systematic patterns between health complaints and survey response. The rather small differences in response rate between persons with and without health problems suggest that the health status of respondents at baseline has limited impact on the representativeness, and thereby external validity, of a follow-up assessment in prospective surveys and do therefore not support a HWE. As previous studies from the sample have shown that levels of mental distress and somatic complaints are highly stable from baseline to follow-up in the prospective sample (Christensen and Knardahl 2010, 2012a, b, 2014; Nielsen and Knardahl 2014), we can rule out that the limited impact of the HWE is explained by reports of short-term pain.

In line with previous research (Sonne-Holm et al. 1989), socio-educational level was strongly associated with response rate at the follow-up assessment. The findings showed that participation in the follow-up survey increased incrementally with higher levels of education. Whereas a response rate of 59.5 % was found for respondents with less than 10 years of education, respondents with more than 15 years of education exhibited a response rate of 79.8 %. Hence, a difference in survey response of 20.3 % points at the follow-up assessment was found between respondents with low and high education. This suggests that there is socio-educational effect on survey response that needs to be taken into consideration in research on occupational factors and health.

We hypothesized that the HWE would pose a threat to internal validity in that there would be a stronger relationship between work strain and health outcomes at the baseline assessment among dropouts than among stayers. The findings showed that the associations were similar in the two groups. As these findings are based on cross-sectional data from the baseline assessment, we cannot claim with full certainty whether any actual differences in associations do exist between stayers and dropouts at follow-up. However, considering that previous research has established that there is a very high stability in both health problems and role expectations over time in the current sample (Christensen and Knardahl 2014), and the fact that there were no indications of any differences in relationships between the stayers and dropouts at baseline in this study, it seems likely that a consistent magnitude of the associations should exist at the follow-up assessment. Hence, there is little support for the HWE as a significant threat to internal validity due to differential attrition of prospective studies.

Methodological implications

A significant strength of this study is that it investigated the impact of the HWE on the external and internal validity of follow-up study in a rather large sample. All factors were measured with psychometrically documented measurement instruments. In addition, the acquired response rate is in accordance with the average response rate established in this kind of survey research (Baruch and Holtom 2008). However, as all included measurement instruments are self-report measures, the study suffers from the problems that are specific to self-report instruments such as response-set tendencies. Still, the QPS_{Nordic} instrument used in the current study should be fairly insensitive to respondents' emotions or personality dispositions. QPS_{Nordic} items are constructed with the aim of avoiding emotive content and social desirability bias in that subjects report frequency of occurrence rather than degrees of agreement or satisfaction and items do not address issues that are inherently negative or positive (Christensen and Knardahl 2012b).

It should be noted that our design was based on only two measurement points with a two-year time lag. Longitudinal studies using several measurement points with varying time lags over an extended period of time might add to our further knowledge of survey participation and attrition. Although the study sample can be considered as randomized at the individual level as all employees in the included organizations were invited to participate, the sample is not random at an organizational level. Following research which show that non-random and random sample produce quite different results (Nielsen and Einarsen 2008), the present study should therefore be replicated in samples that rely on other kinds of sampling techniques.

Conclusion

The findings of this study indicate that the health status of respondents has little impact on the external and internal validity of a follow-up assessment in prospective research within occupational health. Hence, while the HWE is frequently cited sampling problem in occupational research, this potential bias seems to have little influence on actual survey response at a follow-up assessment. However, while health status do not influence response rate, the results do highlight educational level as an important predictor of participation. An implication of the findings is therefore that future organizational research acknowledges that results and conclusions may be biased by the educational level of participating respondents.

Although the HWE seems to have little impact on survey response, non-response is and will always be a challenge in survey research. Based on the knowledge about educational level as a predictor of participation rates, statistical weighting procedures could be used to counterbalance non-response. As response levels increase incrementally with educational level, future surveys could use the findings of this study for weighting respondents with lower levels of education. As an alternative procedure, one may consider to oversample persons with low level of education in order to adjust the distribution of education in the data set.

It must be emphasized that while we did not find strong evidence for the HWE as a significant bias at a follow-up survey assessment, it is plausible that the HWE may have influenced the participation at the baseline assessment since the workers with the most severe health problems already dropped out before the first survey time point. The HWE should therefore under no circumstances be disregarded as a potential bias based on the findings of the current study alone. To further understand how the HWE can bias research, future studies should investigate the impact of health on initial survey participation, for instance, through the use of registry data on sickness absence (Thygesen et al. 2011).

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