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Short report

Do workers underreport morbidity? The accuracy of self-reports of chronic conditions

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ABSTRACT

We use matched Danish health survey and register data to investigate discrepancies between register-based diagnoses and self-reported morbidity. We hypothesize that false negatives (medical diagnoses existing in the register but not reported in the survey) arise partly because individuals fear career repercussions of being discovered suffering a chronic or severe illness that potentially lowers productivity. We find evidence of substantial underreporting, which is indeed systematically higher for individuals in the labor market.

Introduction

Reporting error in health interviews has been studied regularly by health and survey researchers, but few epidemiological studies investigate the relationship between labor force status and agreement between self-reports and medical records of chronic conditions. Accuracy is discussed, mostly in terms of estimating disease prevalence for health care and health promotion planning purposes. False negative rates of up to 30% are often considered as evidence for the usefulness of health self-reports. Recently, accuracy of self-reports has come to the attention of social scientists, stressing the consequences of inaccurate responses for the estimation of behavioral models. Many studies of the labor market effects of bad health rely on respondents' self-reports of doctor-diagnosed conditions. These data are usually considered as "objective", as compared to "subjective" data such as self-rated general health. However, the accuracy and usefulness of such self-reports has been questioned, e.g. as predictor for health deterioration (Imlach Gunesekara, Carter, & Blakely, 2012). Furthermore, researchers have identified biases in respondent behavior. For example working age individuals who are currently not working might overplay their health problems in order to rationalize reduced labor supply ("justification bias", cf. Bound, 1991; Kapteyn, Smith, & van Soest, 2009).

We focus on the less studied, complementary hypothesis that individuals in the labor market deny or understate their health problems because bad health signals low productivity. We use matched health survey and administrative data to investigate whether discrepancies arise between register-based diagnoses – made during patient contacts (in-patient and out-patient) in Danish hospitals – and self-reported morbidity. Previous epidemiological studies have compared individual self-reports to medical diagnoses and related misreporting to individual characteristics, but they have hardly been concerned with the link between labor force status and underreporting of morbidity. One exception is a study of self-disclosure of illness at work by employees of a UK university (Munir, Leka, & Griffiths, 2005) that found only half the respondents who admitted to at least one chronic condition in a survey also reported self-disclosure at work.

Our hypothesis is that false negatives i.e., a medical diagnosis recorded in the register but not reported in the survey, arise partly because individuals fear job-related consequences of reporting illnesses that can potentially lower productivity (Corrigan & Watson, 2002; Gray, 2002; McMahon, West, Mansouri, & Belongia, 2005; Petersen, Pere, Sheehan, & Surgernor, 2007). Related mechanisms may be work addiction (Becker & Murphy, 1988; Hamermesh & Slemrod, 2008), feeling indispensable or not wanting to burden colleagues who might have to pick up the slack. This may even give rise to presenteeism, i.e. workers reporting to work even when feeling ill (cf. Johns, 2010, for a review). Presenteeism by some estimates matches sickness absence rates and imposes large costs on employers (Dew, Keefe, & Small, 2005). In sum, these hypotheses suggest that individuals in the labor market

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report fewer illnesses compared to individuals outside. We argue that fear of admitting to possibly productivity-decreasing health conditions at work might carry over to survey responses, e.g. because respondents routinely negate such health conditions. Thus differential accuracy in self-reported morbidity in anonymous surveys might indicate an even larger health underreporting problem in the workplace.

To investigate these hypotheses, data on self-reported morbidity (long-standing illnesses, specific ailments and duration of illness) collected in the Danish Health and Morbidity Survey (SUSY) 2000 is accessed. Medical diagnoses made for all patient contacts in clinical hospital departments in Denmark recorded in the National Patient Registry (*Landspatientregister*) are merged with the SUSY data. Principal diagnoses from the registry are used as the gold-standard when we map the socio-demographic, behavioral and job-related correlates of the deviation between self-reports of health conditions in health surveys and this criterion standard.

We show that underreporting is substantial, and that it is higher for individuals in the labor market than individuals outside. This raises a question as to the accuracy of so-called "objective" survey-based morbidity measures especially if workers' reports differ systematically from non-workers' reports. It also raises the issue of how to identify (and eliminate) statistical discrimination of diseased individuals at the workplace. Workers may fear disclosing a condition precisely because employers cannot know with certainty the individual worker's productivity (which may be as high as before due to receiving neutralizing treatment for the condition) and therefore will tend to assume that they are less productive based on a lower group average productivity of individuals with the same condition.

Related literature

Here we give a selective overview of epidemiological and socio-economic studies on reporting accuracy with regard to chronic conditions and concentrate on findings related to false negatives. Although studies are heterogeneous in terms of study population, sample size, collection mode, diseases, criterion standards, etc., they generally find a substantial amount of underreporting, i.e. high false negatives rates. In line with the literature on survey recall (e.g. Tourangeau, Rips, & Rasinski, 2000), the degree of underreporting varies with the severity of the condition, i.e. with the salience of the health event. Co-variation with socio-demographic characteristics, however, appears to be less systematic, except that women's self-reports seem to be more accurate.

Many validation studies deal with cardiovascular disease or related risk factors and cancer. For instance, Robinson, Young, Roos, and Gelskey (1997) compare Canadian data from a health survey with health insurance claims data and find 21% false negative rates for hypercholesterolemia, 22% for hypertension, 28% for diabetes, 31% for heart attack, 46% for stroke, and 58% for "other" heart disease. No differences were found by gender, age, and place of residence. Okura, Urban, Mahoney, Jacobsen, and Rodeheffer (2004) compare older community residents' self-reports of doctor-diagnosed heart failure, diabetes, stroke, hypertension and heart attack with medical records. False negative rates were 32% for heart failure, 34% for diabetes, 18% for hypertension, 10% for heart attack and 22% for stroke. Further, younger (aged 45–62) and better educated (>12 years of education) respondents had higher agreement rates. Schrijvers, Stronks, van de Mheen, Coebergh, and Mackenbach (1994) compare cancer self-reports in a postal survey with data from the Dutch cancer registry. The overall false negative rate was 45% but varied substantially by site. Breast cancer (16% false negatives) was the most reliably reported, non-melanoma skin cancer was least often reported (78% false negatives). Moreover, women, better educated, younger respondents, and respondents in urban areas had lower false negative rates. Mackenbach, Looman, and van der Meer (1996) compare self-reports with general practitioner diagnoses. They find 23% false negatives for chronic lung disease, 49% false negatives for heart disease, and 13% false negatives for diabetes. Significant relationships are also found between the false negative rates and education. Better educated respondents underreport heart disease less often, but the relationship for lung disease is inverted U-shaped, i.e. the middle categories underreport the most.

Social scientists are concerned with the relationship between labor market behavior and health self-reports (see the review by Currie & Madrian, 1999). Butler, Burkhauser, Mitchell, and Pincus (1987) compare survey self-reports of diagnosed arthritis and a *simulated* clinical measure. (The measure is simulated because it replicates a doctor's diagnosis on the basis of respondent-reported symptoms such as pain and swelling in joints.) They find 50% false negatives and 7% false positives with higher accuracy among employed respondents. Bound's (1991) work on how accuracy in health variables affects labor supply models shows that self-reports, though error prone, may actually be preferable to objective health measures. The negative error bias in the self-report can be offset – in theory – by a positive justification bias, i.e., the tendency of respondents out of the labor force to overstate health problems. In the case of objective measures, however, only attenuation bias (tilting estimated effects toward zero) is present. Baker, Stabile, and Armstrong (2004) compare Canadian survey data with health insurance records. False negative rates range from 41% for arthritis to 82%for cancer. The conditions with the highest rates of false positives are back pain (11%) and arthritis (17%). Baker et al. are mainly concerned with justification bias. In line with expectations, those who currently work have lower false positive rates (which does not contradict our main supposition that those in the labor force are less likely to report conditions). However, the authors do not analyze differences in false negative rates for workers and non-workers.

Data

Our main source of data is the Danish Health and Morbidity Survey (SUSY) 2000. The aim of this survey was to describe the prevalence and distribution of health and morbidity in the population for providing a baseline for public health evaluation and research purposes. Of 22,486 randomly sampled individuals aged 16 years and over, 16,690 could be interviewed (response rate 74.2%). Further details are described elsewhere (cf. Elkholm, Hesse, Davidsen, & Kjøller, 2009).

Two sets of questions aimed at estimating the prevalence of chronic conditions. *First*, a screening question asked: "Do you suffer from any long-standing illness, long-standing after effect from injury, any disability or other long-standing condition?" If yes, an open-ended question followed: "Which illness or condition do you suffer from?" Up to four conditions could be named. The *second* question was in closed format: "Do you now, or have you previously suffered from any of the illnesses listed on card 1?" The card contained 22 conditions, of which we consider all except "amputation of leg or arm", and "has had an organ removed" (see Table 1 for the remaining conditions). As objective measures of health, we merged medical diagnoses in the Danish National Patient Registry to the SUSY data (details on our matching algorithm are supplied as Supplementary Material, Table A2). While we consider register diagnoses as the gold standard, we are aware that physicians may under or over-assess conditions or severity depending on patient characteristics (Van Ryn, Burgess, Malat, & Griffin, 2006) or physician–patient match (Gross et al., 2008).

Table 1
Diagnoses in register and degree of survey underreporting, by labor force status.

Condition	Diagnoses total		Out of LF		In the LF	
	# in register	% not reported	# in register	% not reported	# in register	% not reported
Diabetes	157	22	89	25	68	19
Nervous illness	26	65	12	58	14	71
Epilepsy	58	40	30	53	28	25
Migraine	53	53	19	53	34	53
Paralysis	43	67	35	69	8	63
Hypertension	151	35	82	43	69	26
Heart attack	217	45	138	45	79	46
Stroke	95	44	61	44	34	44
Bronchitis/asthma	158	42	93	39	65	48
Eczema	7	43	3	33	4	50
Allergy	88	86	29	86	59	86
Peptic	66	48	29	34	37	59
Gallstone	100	22	37	24	63	21
Kidney	55	31	18	28	37	32
Pelvic	212	67	63	68	149	67
Dysmenorrhea	176	76	45	82	131	74
Psoriasis	22	41	11	45	11	36
Back problems	383	41	164	22	219	55
Cancer	334	49	160	46	174	52
Total	2401	48	1118	43	1283	52

We use medical diagnoses from the three years preceding the survey year (i.e. 1997–1999). Of the original 16,690 respondents, we drop 1683 because their age exceeds 72 (our arbitrary upper age limit for labor force participation). When we restrict the sample to individuals with at least one registered diagnosis in 1997–1999, we drop another 13,087 observations. Hence individuals with a diagnosis prior to 1997 but with no hospital contacts in 1997–1999 are not included. By construction, therefore, we cannot address the issue of false positives.

To summarize, our analytical sample consists of all SUSY respondents aged 16–72 years who had at least one clinical diagnosis in the register that matches one of the diagnoses for which information is collected in SUSY. The data are anonymized. It consists of 1915 respondents with a total of 2401 unique register diagnoses. 59% of this sample were in the labor force (i.e. either employed or unemployed/under activation) at the time of the survey (detailed sample description is supplied as Supplementary Material, Table A1). The employed include self-employed agricultural workers, other self-employed, spouses assisting in the family business, skilled, unskilled and salaried wage earners and apprentices. The most frequent diagnoses in the register are back problems (20.0%) and the least frequent are eczema (0.4%).

Respondents in the labor force are on average younger, better educated and more often married. They are also healthier – having lower rates of diabetes, paralysis, hypertension, stroke, heart attack, bronchitis/asthma and cancer. They also have fewer doctor visits, hospital bed days, and number of diagnoses (information based on registers). However, they have similar or higher rates of pelvic diseases, dysmenorrhea, migraine, and back problems than non-workers.

Analysis

Table 1 describes underreporting at the diagnosis level. In total, 48% of diagnoses found for individuals in the 1997–1999 registers are not reported in the 2000 survey. Overall, mismatch is highest for allergy (86%), dysmenorrhea (76%), pelvic diseases (67%), paralysis (67%) and nervousness (65%). Mismatch is lowest for diabetes (22%), gallstones (22%), kidney disease (31%) and hypertension (35%), most of these being diseases requiring periodic treatment or surgery, which can potentially reduce recall errors.

Table 1 also shows underreporting of conditions by labor market status. Overall underreporting rates are 43% among those out of the labor force and 52% among those in the labor force, i.e. those in the labor force do in fact underreport more. On the diagnosis level, we find the largest difference in underreporting rates for back problems, where labor force participants are 33 percentage points (pp) more likely to underreport than non-participants, peptic ulcers (25pp), eczema (17pp), and nervousness (13pp). Other ailments, such as epilepsy (28pp), hypertension (17pp) and psoriasis (9pp) are *less* often underreported by working individuals.

Fig. 1 illustrates the relationship between disease severity and the degree of underreporting, separately for those in and out of the labor force. Severity is estimated by a "hedonic" regression of self-

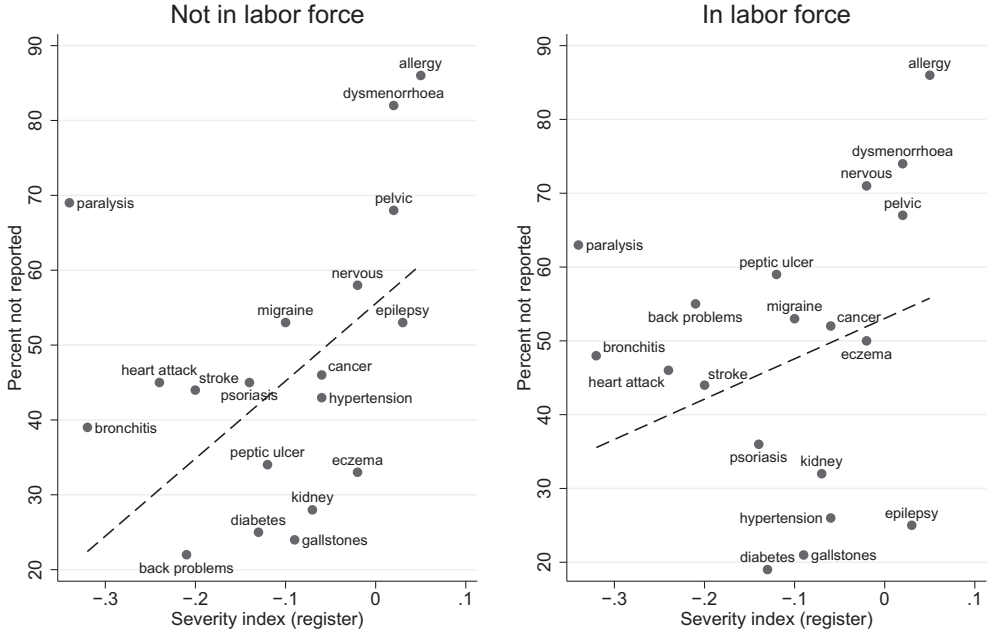

Fig. 1. Relationship between disease severity and underreporting, separately for survey respondents in and out of the labor force. The severity index indicates the percentage point effect of each register-based condition on the likelihood of reporting to be in good or very good health.

rated health on a set of disease dummy variables. For instance, paralysis and bronchitis have the strongest independent negative effect on self-rated health, reducing the probability of reporting good health by more than 30pp. Eczema and epilepsy have zero or even slightly positive effects on health self-ratings (detailed regression results are supplied as Supplementary Material, Table A3). In general, Fig. 1 shows that more severe diseases are underreported less. This is plausible, as more salient "events" are recalled better and reported more often (e.g. Eisenhower, Mathiowetz, & Morganstein, 1991; Tourangeau et al., 2000).

Comparing the two panels of Fig. 1 reveals that the underreporting differential between respondents in and out of the labor force is related to disease severity. More severe conditions (such as heart attack, bronchitis and back pain) tend to be underreported more by those in the labor force. This is consistent with the notion that individuals in the labor force are less prone to admitting that they have potentially severe or disabling illnesses.

All comparisons reported so far are raw gaps and do not take into account other differences between those in and out of the labor market. Table 2 shows the results of linear probability regressions *on the respondent level* of individual determinants of underreporting (probit regressions with marginal effects give essentially the same results). Thus we model the probability of a respondent to *not* report her register-diagnosed condition in the SUSY survey. In Model (1), where no covariates are included, we find that those in the labor force are 7.7pp more likely to underreport a condition. Controlling for (register-based) conditions in Model (2) increases the difference to 8.2pp. Conditions themselves are highly significant and substantial predictors of underreporting. Next, we control for socio-demographic characteristics: age, age squared, gender, marital status interacted with gender, and education. This reduces the underreporting gap between those in the labor force and those out of the labor force to 6.6pp. Individually, none of the socio-demographic variables shows a significant association with underreporting. Age however, is a significant predictor at the 5% significance level (the parameters of the quadratic function are jointly significant). Across the 16–72 age range, the predicted underreporting rates decrease with age. Notably, education has no discernible effect on underreporting rates.

The final specification is Model 4. Here we also control for overall health status as a measure of the severity of a condition. We refrain from using self-rated general health because it is a subjective measure. Instead we rely on register information on health care utilization: number of doctor visits in the current year, hospital bed days and number of recorded diagnoses in the past three years. Both doctor visits and hospital bed days prove to be substantive and significant predictors of underreporting: the more visits and bed days, the lower the underreporting rate. Adding these control variables reduces the effect of labor force status on underreporting rates to 4.7pp (but still significant). This is because models (1)–(3) are likely plagued by unobserved severity differences even when those outside the labor force have the same conditions and socio-demographic characteristics.

Table 2
Linear probability regressions of a survey-register mismatch on labor force status.

	Model (1)		Model (2)		Model (3)		Model (4)	
	b	se	b	se	b	se	b	se
In the labor force	0.077*	0.023	0.082*	0.021	0.066*	0.025	0.047*	0.025
Diabetes			0.025	0.034	0.030	0.035	0.063	0.036
Nervous illness			0.445*	0.092	0.427*	0.090	0.456*	0.092
Epilepsy			0.193*	0.064	0.179*	0.066	0.203*	0.068
Migraine			0.271*	0.064	0.258*	0.065	0.265*	0.066
Paralysis			0.533*	0.073	0.516*	0.074	0.562*	0.074
Hypertension			0.070*	0.036	0.083*	0.036	0.091*	0.036
Heart attack			0.282*	0.036	0.310*	0.038	0.359*	0.039
Stroke			0.219*	0.049	0.239*	0.049	0.307*	0.050
Bronchitis/asthma			0.149*	0.036	0.152*	0.036	0.175*	0.037
Allergy			0.668*	0.041	0.647*	0.042	0.640*	0.042
Eczema			0.160	0.131	0.132	0.140	0.142	0.154
Peptic			0.295*	0.063	0.317*	0.063	0.329*	0.064
Gallstones			0.028	0.040	0.022	0.040	0.065	0.041
Kidney			0.144*	0.064	0.147*	0.064	0.186*	0.065
Pelvic			0.427*	0.036	0.401*	0.038	0.433*	0.038
Dysmenorrhea			0.471*	0.035	0.457*	0.037	0.469*	0.037
Psoriasis			0.199*	0.097	0.200*	0.099	0.217*	0.098
Back pain			0.247*	0.030	0.247*	0.031	0.265*	0.031
Cancer			0.317*	0.031	0.324*	0.031	0.342*	0.033
Diagnosis in 98			−0.007	0.029	−0.005	0.029	0.003	0.029
Diagnosis in 99			−0.056*	0.027	−0.057*	0.027	−0.039*	0.027
Age/10					−0.038	0.049	−0.003	0.005
Age squared/100					0.002	0.005	0.000	0.000
Male					−0.029	0.050	−0.030	0.050
Married					−0.010	0.033	−0.014	0.032
Married *male					−0.012	0.054	−0.013	0.054
Medium education					0.004	0.023	0.002	0.023
Higher education					0.023	0.029	0.010	0.029
Log doctor visits 2000							−0.031*	0.012
Log bed days 1997–1999							−0.057*	0.010
Total # of diagnoses 1997–1999							0.002	0.001
Constant	0.375*	0.017	0.063*	0.033	0.233*	0.108	0.292*	0.110
N	1915		1915		1915		1915	

Note: Dependent variable equals one if respondent fails to report a condition for which she was treated either as in-patient or out-patient in a Danish hospital in the three years preceding the survey.
Heteroskedasticity-consistent standard errors; *$p < 0.1$.

In further regressions estimated on workers only, we successively tested the effect of job characteristics, such as sector, tenure, job levels, permanent/temporary job, part-time, overtime and having subordinates, on misreporting behavior (estimation details not shown). Job characteristics in general were not significantly associated with underreporting rates among workers, except for having subordinates. 25% of workers had subordinates, and having subordinates increased underreporting by 5.9pp (controlling for type of condition, socio-economic characteristics and health). One interpretation of this finding could be that individuals in positions of responsibility fear being moved to less challenging positions if discovered suffering from a chronic or acute condition. Alternatively, it may signal a higher preference for work among supervisors (see e.g. Lund et al., 2005, who show that rewarding work influences sickness absence) or feeling pressure because their work cannot be done by someone else.

Discussion and conclusion

In this paper, we contribute to the literature on reporting accuracy in health surveys or socio-economic surveys with strong health components (see e.g. the review in Currie & Madrian, 1999). Whereas health self-ratings may be particularly error prone due to their subjective nature, "objective" health information provided by respondents may also be biased, for instance because of recall problems (e.g. Tourangeau et al., 2000). Validation studies in the medical literature generally find that survey responses on diagnosed acute or chronic conditions understate the true prevalence of disease and that the degree of underreporting is related to disease severity or salience (Mackenbach et al., 1996; Okura et al., 2004; Robinson et al., 1997; Schrijvers et al., 1994). Our study confirms these findings.

A gap exists in the literature as to whether the degree of misreporting is associated with labor force status. Earlier studies have looked at overreporting of individuals out of the labor force motivated by the desire to justify their labor force status (cf. Bound, 1991). Our paper, however, studies the complementary hypothesis that "false negatives" (i.e., medical diagnoses in administrative records not reported in a survey) are more common among respondents who are in the labor force than among respondents outside the labor force. This is indeed what we find, even after controlling for socio-demographic characteristics, actual diseases, and severity of the condition. Our explanation for these findings is that individuals in the labor force fail to disclose bad health because they fear job-related consequences, for instance because illness signals lower productivity or for fear of stigmatization (cf. Munir et al., 2005).

An important ancillary finding of our study is that – in contrast to existing studies that often found less underreporting among the better educated (Okura et al., 2004; Schrijvers et al., 1994) – underreporting rates do not vary systematically by education levels. Thus in our data, measures of education-related inequality in health based on the prevalence of chronic conditions are not subject to bias due to differences in reporting accuracy across education groups. Our study further reveals that while a sizable share of the gap in mismatch rates can be explained by overall health (severity) differences between those in the labor force and those outside, the greater part of it remains unexplained, leaving room for explanations such as preferences for work affecting health self-reports, competitive pressure to perform or a fear of discrimination following disease disclosure.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.socscimed.2012.07.013.

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