Article

The association of self-reported discrimination to all-cause mortality: A population-based prospective cohort study

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ABSTRACT

Discrimination has is an important social determinant of health and though some research has been carried out on this it is mostly from the United States, which may not be generalisable to Europe and Sweden. This study investigated the association between self-reported experiences of repeated discrimination and all-cause mortality in Scania, Sweden. The Scania Public Health survey was sent out in 2008 with a follow-up in 2013 through the Swedish national cause of death register (N = 28,062). The exposure variable under investigation was self-reported discrimination and the outcome variable was all-cause mortality. Additional variables included demographics (age, sex, marital status, immigrant status), health behaviours (smoking, alcohol consumption, physical exercise), BMI, social participation, economic stress, and mental health. Time was measured as total number of days. Statistical analysis included association of the different variables to discrimination (ORs) and to all-cause mortality (HRs) adjusting for different covariates. Effect modification was tested for social participation, economic stress and mental health. The odds of discrimination was higher among the most vulnerable groups in society. All-cause mortality was strongly associated to age and sex, with a much higher risk among men than women. The association of repeated discrimination to all-cause mortality remained significant after adjusting for demographic variables, health behaviours and either social participation or economic stress, but not both. The association was non-significant after adjusting for demographic variables and mental health. Social participation was found to be an effect modifier with low participation strengthening the effect of the association of repeated discrimination to all-cause mortality. Repeated discrimination clearly has a strong impact on mental health but also on economic stress and social participation which in turn have a strong impact on mortality.

Introduction

Background

In the last decade or so there has been increasing attention paid to discrimination as an important social determinant of health. The World Health Organization defines social determinants of health as "the conditions in which people are born, grow, work, live and age, and the set of forces and systems shaping the conditions of daily life" (CSDH, 2008). On an individual level these include lifestyles, living and working conditions, neighbourhood characteristics, poverty, pollution, income, education, and occupation. These individual factors are influenced by broader conditions such as economic factors including unemployment levels and whether there is a recession; by political factors including government policies and programmes and social insurance systems; and by religious factors including norms and proscriptions

(Cockerham, Hamby, & Oates, 2017). Social determinants of health have been used to discuss health inequalities between countries but are an especially important concept to describe, explain and address health inequalities within countries and between communities.

Discrimination refers to the practice of treating a person or group less well than others on the basis of membership or perceived membership of specific group such as race, ethnicity, religion, sex, sexual orientation, age, or disability, amongst others. Discrimination is itself a social determinant of health while simultaneously negatively impacting other determinants of health including where people live, access to education and employment, and access to social welfare. In line with this, discrimination has been associated with a number of negative physical and mental health outcomes, including breast cancer (Taylor et al., 2007), low birth weight (Mustillo, Krieger, Gunderson, Sidney & McCreath, 2004), hypertension (Sims et al., 2012; Taylor et al., 2017), cardiovascular disease (Everson-Rose et al., 2015; Williams & Leavelle,

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2012), BMI (Brody, Yu, Chen, Ehrlich & Miller, 2018; Stapanikova et al., 2017; Sutin & Terracciano, 2013), psychological distress (Wamala, Boström & Nyqvist, 2007), cognitive function (Barnes, Lewis, Begency, Yu, Bennett & Wilson, 2012), pain (Dugan, Lewis, Everson-Rose, Jacobs, Harlow & Janssen, 2017), biological dysregulation (Allen et al., 2018), systemic inflammation (Stepanikova, Bateman, & Oates, 2017), self-rated health (Mohseni & Lindström, 2009; Rask, Elo, Koskinen, Lilja, Koponen & Castaneda, 2018), chronic disease (McDonald, Terry & Tehranifar, 2014), and mortality (Barnes, Mendes de Leon, Lewis, Bienias, Wison & Evans, 2008; LaVeist, Sellers, & Neighbors, 2001).

There have been a number of theories and models that have attempted to explain the association between discrimination and health, though maybe none so comprehensive as Nancy Krieger's Ecosocial Theory (2012). According to this theory people literally embody their lived experiences, which refers to the literal biological incorporation of societal and ecological context. This embodiment can take place through multiple concurrent pathways or mechanisms including social or economic deprivation, exogenous hazards, social trauma, targeted marketing of harmful commodities, and inadequate healthcare. Health outcomes are the result of a cumulative interchange between exposure, susceptibility and resistance, creating population of health and disease shaped by access to wealth, power and resources. In fact, the ecosocial inverse hazards law posits that "the accumulation of health hazards tend to vary inversely with the power and resources of the population affected" (Krieger et al., 2008).

There has been some research supporting the individual elements of this theory including that discrimination is associated with: a) lack of access to socioeconomic resources that are beneficial to health including access to education and employment (Barnes et al., 2008); b) exposure to environmental hazards, including living in segregated neighbourhoods and poorer housing (Gee, Spencer, Chen & Takeuchi, 2007); c) poor health behaviours, such as smoking, alcohol and lack of physical exercise (Barnes et al., 2008); d) stress (Barnes et al., 2008, Cockerham et al., 2017); and e) lack of access to health benefitting institutions (Cockerham et al., 2017, Gee et al., 2007) including for health promotion, maintenance and treatment. In fact, in terms of access to healthcare, people who report discrimination are more likely to postpone medical tests and treatments, have poorer communication with health care providers, have lower trust in medical services, lower adherence to medical recommendations, lower usage of preventive and treatment services, receive lower quality of care and, perhaps unsurprisingly, have lower satisfactions with care (Cockerham et al., 2017). Research has found, for example, that African Americans receive fewer diagnostic and treatment procedures and poorer quality of care regardless of their health insurance status, the stage or severity of disease, existence of comorbidities, the income or education levels, or the type of health care sought (Williams & Wyatt, 2015). There has been a particular focus on the association between Cardiovascular Disease (CVD) and discrimination in the United States, as the highest levels of CVD among white Americans is still lower than the lowest level among African Americans (Williams & Leavelle, 2012). African Americans have higher rates of CVD, earlier onset, greater severity and poorer outcomes, including lower survival rates (Williams & Leavelle, 2012).

In fact, most of the research on the association between discrimination and health comes from the United States and focuses in particular on racial discrimination but also, to a more limited extent, on gender discrimination and age discrimination. Given the special history of the United States, in particular in terms of ethnic and racial discrimination with its roots in slavery, these findings could probably not be generalised to the European context in general or the Swedish context in particular. Unlike the United States, Sweden has made the transition from a relatively homogenous society to a multi-cultural and multi-ethnic society over the space of the past 30 years with approximately 20% of the population being made up of foreign-born immigrants today. Also in contrast to the United States, Sweden has a

universal health insurance system which is 94% publicly financed (Wamala, Merlo, Boström & Hogstedt, 2007) and a public health policy based on the principle of good health on equal terms for the entire population regardless of age, gender, sexual orientation, race, ethnicity, disability, socioeconomic status, religion or other distinction (News on Health Policy and Public Health, 2011). In addition, Sweden has a strong social welfare system more broadly, all of which could potentially mitigate the effect of discrimination on economic vulnerability and access to social welfare and health services, which in turn could mitigate the impact on health.

Research on the association of discrimination to health in Sweden and in Europe is particularly critical for a number of reasons: 1) there is a paucity of this research in these contexts in general; 2) there is increased polarisation between communities in Sweden and on the rest of the European continent, which in turn can lead to an increase in discrimination based on ethnicity, religion, language, age, sex, gender identity and sexual orientation; 3) there is evidence on an increase in health inequalities within Swedish society (Molarius, Simonsson, Linden-Broström, Kalander-Blomqvist, Feldman & Eriksson, 2014; Commission for a Socially Sustainable Malmö, 2013); and 4) the increase in migration to Sweden and Europe is likely to remain high or increase placing additional strain on an already burdened system.

This study does not focus on any particular type of discrimination, nor on the grounds of discrimination, rather it uses the perception of having repeatedly been treated unjustly as an indicator of having experienced discrimination. Given the multiple mechanisms and broad potential health effects of discrimination this study will focus on all-cause mortality as the ultimate negative health outcome. Though the follow-up period is only 5 years, most grounds for discrimination are stable over time, except for the case of age and, in some cases, disability, and as such discrimination in 2008 can presume, in most cases, to have been present earlier. Covariates under investigation include demographic variables such as age, gender, marital status and immigrant status, as well as health behaviours including smoking, alcohol consumption, physical exercise and BMI, all of which have health implications. In addition, the role of social participation, economic stress and mental health will be investigated as they have all been associated both to discrimination and to health outcomes (Barnes et al., 2008; Dunlay et al., 2017; Cockerham et al., 2017; LaVeist et al., 2001; Everson-Rose et al., 2015; Williams & Wyatt, 2015; Williams & Leavelle, 2012; Sims et al., 2012; Mustillo et al. 2004; Gee et al., 2007, Wamala et al., 2007).

The research questions to be investigated are:

1. Investigate whether there is an association between self-reported experiences of repeated discrimination and all-cause mortality in Scania, Sweden
2. Investigate potential mediators of this association.

Methods

Study population

The study population consisted of respondents to the 2008 Scania Public Health Survey. This survey is carried out to investigate the distribution of ill health and health risks in the region. This includes both environmental and behavioural health risks, use of health services as well as demographic, socioeconomic and psychosocial background questions. The questionnaire was sent out to a random sample of residents of Scania aged 18–80, stratified by sex and place of residence. Seventy-one geographical regions were specified and equal numbers of men and women were sampled for each region. Individuals in each stratum had equal chance of being selected for participation in the study. Of the 52,142 persons who were sent the questionnaire a total of 28.198 responded, corresponding to a response rate of 54.1%. Of these respondents to the 2008 Scania Public Health Survey a total of 28,062

were followed up in 2013 through the national cause of death register and were included in this study.

This study was approved by the Ethical Committee in Lund (2010/343).

Outcome variable

The outcome being measured in this study all-cause mortality as measured on 31 December 2013 through the Swedish national cause of death register.

Exposure variable

The exposure of interest is discrimination. This was measured through asking the question "In the past 3 months have you been treated in a way that you feel is unjust". Response alternatives were: a) no, b) yes once and c) yes, several times. For the multivariate analysis, discrimination was recoded into a binary variable with response alternatives a) no and b) yes once were recoded as "no" and response alternative c) yes, several times, was recoded as "yes". As such discrimination in this study refers to repeated experiences of perceived unjust treatment. This question originates from the National Public Health Authority "National Public Health Survey – Health and Equal Terms" in 2004 and has been incorporated in Swedish public health surveys since (Folkhälsomyndigheten, 2016).

Covariates

All covariates were measured at baseline in 2008.

Age: measured by the question "In which year were you born?". Aged 18–81

Sex: measured by the question "Are you a man or a woman?" with the response alternatives a) man and b) woman.

Marital status: as measured by the question "What is your marital status?" with the response alternatives: a) married/cohabiting; b) unmarried; c) separated; d) widowed.

Immigrant status: as measured by the question "Were you born in Sweden" (yes, no).

Smoking was assessed through the question: "Do you smoke?". Response alternatives were a) yes, every day; b) yes but not every day; and c) no.

Alcohol consumption was measured by the question "How often have you consumed alcohol in the past 12 months". Response alternatives were a) 4 times per week or more; b) 2–3 times per week; c) 2–4 times per month; d) once a month or less; and e) never.

Physical activity was assessed through the question: "How much physical activity have you undertaken during your leisure time over the past 12 months? If your activity varies seasonally, for example between summer and winter, try to provide an average. Only select one alternative". Response alternatives were: a) Regular exercise – you run, swim, play tennis, badminton, do aerobics or other similar physical activity for at least 30 min at least 3 times a week; b) Moderate regular exercise – you do regular exercise at least 1–2 times per week for at least 30 min each time involving running, swimming, tennis, badminton or other activity that makes you sweat; c) Moderate exercise – you walk, cycle or otherwise move your body for at least two hours per week, usually without sweating. This includes walking and cycling to work, other walks, gardening, fishing, table tennis and bowling; d) Sedentary leisure time – you spend most of your time reading, watching TV, going to the cinema or carrying out other sedentary activities during your leisure time. You walk, cycle or otherwise move your body for less than 2 h per week.

Social participation was measured through the question "In the past 12 months have you participated in…" and 13 different social activities are listed as well as the alternative "none of the above". High social participation was defined as having participated in 4 or more activities

while low social participation was defined as having participated in 3 or less.

Economic stress was measured through the question "How often in the past 12 months have you had difficulties in paying your bills?". Response alternatives were: a) every month; b) approximately half of the moths of the year; c) maybe once; and d) never.

Mental health was assessed through the General Health Questionnaire (GHQ12) instrument comprised of 12 questions. These are:

1. In the past few weeks, have you been able to concentrate on everything you have done? (Better than usual, as usual, worse than usual, much worse than usual).
2. Have you had difficulties sleeping due to worry in the past few weeks? (Not at all, not more than usual, more than usual, much more than usual).
3. Do you feel that you have been effective in the past few weeks? (More than usual, as usual, less than usual, much less than usual).
4. Have you been able to make decisions on different issues in the past few weeks? (Better than usual, as usual, worse than usual, much worse than usual).
5. Have you constantly felt stressed in the past few weeks? (Not at all, not more than usual, more than usual, much more than usual).
6. In the past few weeks, have you felt that you have not been able to manage your problems? (Not at all, not more than usual, more than usual, much more than usual).
7. Have you, in the past few weeks, felt that you can appreciate what you have done during your days? (More than usual, as usual, less than usual, much less than usual).
8. Have you, in the past few weeks, felt that you have been able to deal with your problems? (Better than usual, as usual, worse than usual, much worse than usual).
9. Have you, in the past few weeks, felt unhappy or down? (Not at all, not more than usual, more than usual, much more than usual).
10. Have you lost faith in yourself in the past few weeks? (Not at all, not more than usual, more than usual, much more than usual).
11. Have you felt worthless in the past few weeks? (Not at all, not more than usual, more than usual, much more than usual).
12. Have you, in general, felt somewhat happy in the past few weeks? (More than usual, as usual, less than usual, much less than usual).

The 0-0-1-1 scoring method was used with poor mental health defined as a score of 2 or above.

Body Mass Index (BMI) was calculated through self- reported height (How tall are you? – response in full centimetres) and weight (How much do you weigh? – response in full kilograms). BMI was calculated based on this and classified into three categories – normal, overweight and obese.

Time variable

Time was measured as the number of days between receiving the response of the questionnaire between August and December 2008 and either death or the end of the study (December 31, 2013).

Statistical analysis

The prevalence of discrimination was calculated for age, sex, immigrant status, marital status, smoking, alcohol, physical activity, BMI, social participation, economic stress and mental health as measured in 2008.

Bivariate survival analysis (Cox Regression) was carried out to test the age-adjusted association for each variable measured at baseline in 2008 to the risk of all-cause mortality in 2013 and stratified by sex due to the higher risk of mortality experienced by men than by women.

Several multivariate analyses (Cox Regressions) were carried out to

generate different models of association between repeated discrimination and all-cause mortality. All models adjusted for demographic variables including age, sex, immigrant status and marital status. The first model looked at the association of repeated discrimination to mortality. The second model adjusted for health behaviours, including smoking, drinking alcohol and physical activity. The third model adjusted for health behaviours and social participation. The fourth model adjusted for health behaviours and economic stress and the fifth model adjusted for mental health. The final model adjusted stepwise for 1) age, sex, immigrant status and marital status, 2) health behaviours: smoking, alcohol, and physical activity; 3) social participation, 4) economic stress, 5) mental health.

Effect modification, using the more than additivity method and synergy index was calculated for mental health, social participation and economic stress. First a dummy variable was created for each variable. In the case of mental health those who experienced neither discrimination nor poor mental health were identified $(0+0)$ and these were compared to those who experienced discrimination but had good mental health $(1+0)$ and those who did not experience discrimination but had poor mental health $(0+1)$ and to those who experienced both discrimination and had poor mental health $(1+1)$. Effect modification is thought to take place when the HR of those exposed to both is greater than HR of those exposed to one or the other as described in the equation below:

$$HR_{(1+1)} > (HR_{(1+0)}-1) + (HR_{(0+1)}-1)+1$$

Once the additive effect was established the calculation for the synergy index was carried out in accordance with the following formula:

$$SI = \frac{(HR_{(1+1)}-1)}{(HR_{(1+0)}-1) + (HR_{(0+1)}-1)}$$

Where:

SI is the Synergy Index
HR$(1+1)$ is the hazard ratio of the dummy variable exposed to both variables
HR $(0+1)$ is the hazard ratio of the dummy variable exposed to one variable
HR $(1+0)$ is the hazard ratio of the dummy variable exposed to the other variable
This same analysis was then carried out for social participation and economic vulnerability as well.

Externally missing

Not all participants responded to all covariates under investigation and as such the N differs in the presentation of results. For example, of the 28,062 total respondents only 27,349 responded to the question on perceived discrimination. The total number of participants who responded to all of the covariates was 24,767. A sensitivity analysis was carried out using this restricted sample for the multivariate analysis which resulted in very similar findings indicating that the results are robust (not shown in tables).

Results

Discrimination

The prevalence of discrimination in this population was significantly higher among the most socially vulnerable in society (Table 1): it was higher among the youngest age category (6.5% in those aged 18–24 years, only slightly higher among women (3.9% compared to men at 3.3%)), among those not born in Sweden (5.4%), and those who are unmarried (5.4%) or separated (5.2%). It was higher among smokers (5.8 for daily smokers and 5.9% among not daily

smokers), among those who consume little or no alcohol (4.3% and 5.6% respectively), those who do not exercise (5.3%), are obese (4.9%),and have low social participation (4.3%). All of these categories reported relatively low prevalences of repeated discrimination, at around 5%. However, discrimination was much more prevalent among those who experienced economic stress, with14.4% among those experienced economic stress every month, and 9.4% among those experienced economic stress about half of the months of the year. It was also much more prevalent among those who reported poor mental health at 12.3%.

All-cause mortality

All bivariate analyses were adjusted for age due to the strong association of age to increased risk of mortality (Table 2). The calculations are disaggregated by sex as men had a 1.7 times (CI 95% 1.49–1.93) higher risk of mortality than women in this population. The experience of discrimination several times was associated with an increased risk of mortality (HR = 2.09 CI 95% 1.28–3.4 for men and HR = 2.08 CI 95% 1.21–3.57 for women). Increased risk of mortality followed similar patterns for men and for women being associated with older age, daily smoking, never consuming alcohol, sedentary lifestyle, low social participation and higher economic stress. Differences between the sexes include that being of immigrant background was only significantly associated with an increased risk of mortality for women (HR = 1.46 CI 95% 1.11–1.92) while being married seems to have been only significantly protective for men. High BMI did not seem to be associated with a significantly increased risk of mortality among either sexes and was consequently not included in further analysis.

Multivariate analysis

The multivariate analysis investigated the association between repeated discrimination, answering "yes, several times", and all-cause mortality as well as the stepwise addition of covariates as described in Table 3. All models adjusted for demographic variables including age, sex, immigrant status and marital status. These analyses were not disaggregated by sex as the results for men and women were not particularly different from each other and keeping the sexes together in the outcome increased the number of cases and consequently decreased random error. Model 1 looked at the association of repeated discrimination to all-cause mortality after adjusting for demographic variables (age, sex, immigrant status and marital status) where there was a 1.97 times increased risk of mortality (CI 1.37–2.83) as compared to those who did not experience repeated discrimination. Model 2 included the step-wise adjustment for the health behaviours including smoking, alcohol consumption and physical activity which decreased the strength of the association of repeated discrimination to mortality to HR = 1.76 (CI 95% 1.2–2.57). Model 3 adjusted for health behaviours and then for social participation (HR = 1.57 CI 95% 1.05–2.35). Model 4 adjusted for health behaviours and then for economic stress (HR = 1.5 CI 95% 1.01–1.16). Adjusting for demographic variables and mental health eliminated the significance of the association entirely (HR = 1.38 CI 95% 0.94–2.02). Model 6 included all of the variables step-wise into a single model in which the association of discrimination to all-cause mortality remained significant after adjusting for all demographic variables, health behaviour variables and social participation (HR = 1.57 CI 95% 1.05–2.35) but was no longer significant after adjusting for economic stress (HR = 1.39 CI 95% 0.92–2.11) and mental health (HR = 1.18 CI 95% 0.77–1.8).

Effect modification

Effect modification was demonstrated for social participation where:

Table 1

Association (ORs) of age, sex, born in Sweden, marital status, smoking, alcohol, physical activity, BMI, social participation, economic stress and mental health to self-reported experience of discrimination in the past 3 months all measured in 2008 among residents of Scania, Sweden aged 18–81 (N = 27,349).

Variable		N	Discrimination	Prevalence	OR	CI(95%)
Age	18–24	2413	158	6.5%	1	
	25–34	3640	161	4.4%	0.66	0.53–0.83
	35–44	4656	210	4.5%	0.67	0.55–0.83
	45–54	4992	214	4.3%	0.64	0.52–0.79
	55–64	5540	163	2.9%	0.43	0.35–0.54
	65–74	4400	64	1.5%	0.21	0.16–0.28
	75–81	1708	21	1.2%	0.18	0.11–0.28
	Total	27,349	991	3.6%		
Sex	Male	12,311	402	3.3%	1	
	Female	15,038	589	3.9%	1.21	1.06–1.37
	Total	27,349	991	3.6%		
Born in Sweden	Yes	23,584	789	3.3%	1	
	No	3765	202	5.4%	1.64	1.4–1.92
	Total	27,349	991	3.6%		
Marital Status	Married	14,436	342	2.4%	1	
	Unmarried	8368	448	5.4%	2.33	2.02–2.69
	Separated	3429	180	5.2%	2.28	1.9–2.75
	Widowed	1116	21	1.9%	0.79	0.51–1.23
	Total	27,349	991	3.6%		
Smoking	No	22,250	700	3.1%	1	
	Yes	3755	216	5.8%	1.88	1.61–2.2
	Yes, not daily	1210	71	5.9%	1.92	1.49–2.47
	Total	4965	287	5.8%		
	Missing	134	4	3.0%		
Alcohol	Never	3188	177	5.6%	1	
	1 time/month >	6196	268	4.3%	0.77	0.63–0.94
	2–4 times/month	9380	289	3.1%	0.54	0.45–0.66
	2–3 times/week	6239	166	2.7%	0.47	0.38–0.58
	4 times/week <	2135	82	3.8%	0.68	0.52–0.89
	Total	25,003	982	3.9%		
	Missing	211	9	4.3%		
Physical Activity	Sedentary	3540	188	5.3%	1	
	Moderate	12,330	390	3.2%	0.58	0.49–0.7
	Moderate regular	6226	213	3.4%	0.63	0.52–0.77
	Regular	4782	173	3.6%	0.67	0.54–0.83
	Total	11,008	964	8.8%		
	Missing	1184	27	2.3%		
BMI	Normal	13,049	450	3.4%	1	
	Overweight	9628	307	3.2%	0.92	0.8–1.07
	Obese	3930	193	4.9%	1.45	1.22–1.72
	Total	26,607	950	3.6%		
	Missing	742	41	5.5%		
Social Participation	High	15,928	489	3.1%	1	
	Low	11,181	485	4.3%	1.43	1.26–1.63
	Total	27,109	974	3.6%		
	Missing	240	17	7.1%		
Economic Stress	Never	21,024	526	2.5%	1	
	Once or twice	4036	213	5.3%	2.17	1.85–2.56
	6 months/year	908	85	9.4%	4.03	3.17–5.11
	Monthly	1020	147	14.4%	6.56	5.4–7.98
	Total	5964	445	7.5%		
	Missing	361	20	5.5%		
Mental Health (GHQ12)	Good	22,183	430	1.9%	1	
	Poor	4300	530	12.3%	7.11	6.23–8.11
	Total	26,483	960	3.6%		
	Missing	866	31	3.6%		

$$3.41 - 1 > (1.47 - 1) + (1.86 - 1) \rightarrow 2.41 > 1.33$$

The excess risk of all-cause mortality associated with exposure to both discrimination and low social participation was 1.81 as compared to those exposed to neither.

There was a very modest effect for mental health where:

$$3.13 - 1 > (1.53 - 1) + (2.42 - 1) \rightarrow 2.13 > 1.95.$$

The excess risk of exposure to both poor mental health and

discrimination as compared to those exposed to neither was only 9% (SI = 1.09) (Table 4)

Economic vulnerability was not found to be an effect modifier.

Discussion

Principle findings

This study underlines the importance of the experience of repeated

Table 2

Age-adjusted bivariate associations (HRs) of discrimination, age, immigrant status, marital status, smoking, alcohol, physical activity, BMI, social participation, economic stress and mental health measured in 2008 to all-cause mortality measured in 2013 in residents of Scania, Sweden aged 18–81 (N = 12,618 males and N = 15,444 females).

Variable (age adjusted)		Male			Female		
		N	HR	CI 95%	N	HR	CI 95%
Discrimination	No	9307	1		10,350	1	
	Yes, once	2602	1.19	0.93–1.52	4099	1.04	0.77–1.4
	Yes, several times	402	2.09	1.28–3.4	589	2.08	1.21–3.57
Age	18–24	1038	1		1406	1	
	25–34	1539	0.45	0.08–2.69	2153	0.65	0.04–10.44
	35–44	2058	2.70	0.79–9.27	2660	6.89	0.9–52.64
	45–54	2236	5.46	1.68–17.76	2859	8.87	1.19–66.47
	55–64	2684	14.07	4.47–44.33	2985	35.21	4.89–253.25
	65–74	2214	35.41	11.33–110.65	2377	82.84	11.59–592.34
	75–81	849	83.47	26.67–261.22	1004	213.77	29.92–1528.09
Born in Sweden	Yes	10,866	1		13,251	1	
	No	1752	1.05	0.81–1.37	2193	1.46	1.11–1.92
Marital Status	Married	7006	1		7791	1	
	Unmarried	3967	2.17	1.69–2.78	4553	1.16	0.79–1.71
	Separated	1370	1.81	1.45–2.27	2177	1.11	0.85–1.45
	Widowed	275	1.51	1.1–2.61	923	1.14	0.87–1.49
Smoking	No	10,298	1		12,343	1	
	Yes, not daily	587	2.29	1.47–3.56	638	0.58	0.22–1.55
	Yes, daily	1568	2.43	1.96–3.01	2280	2.08	1.61–2.69
Alcohol	Never	1104	1		2220	1	
	1 time/month >	2277	0.9	0.68–1.18	4066	0.76	0.58–1
	2–4 times/month	4413	0.57	0.44–0.76	5065	0.53	0.39–0.72
	2–3 times/week	3266	0.49	0.37–0.66	3051	0.48	0.34–0.68
	4 times/week <	1343	0.71	0.53–0.96	818	0.75	0.51–1.11
Physical activity	Sedentary	1774	1		1849	1	
	Moderate	5340	0.37	0.3–0.45	7210	0.3	0.24–0.38
	Moderate regular	2931	0.3	0.23–0.4	3379	0.22	0.15–0.32
	Regular	2261	0.3	0.22–0.41	2577	0.24	0.16–0.36
BMI	Normal	4951	1		8337	1	
	Overweight	5481	0.75	0.62–0.91	4340	1.14	0.91–1.43
	Obese	1863	1.24	0.99–1.56	2164	0.86	0.62–1.17
Social participation	High	6948	1		9055	1	
	Low	5330	1.83	1.51–2.22	6007	1.9	1.5–2.4
Economic stress	Never	9801	1		11,563	1	
	Once or twice	1731	1.65	1.28–2.14	2369	1.28	0.9–1.83
	6 months/year	378	2.72	1.71–4.32	542	2.53	1.48–4.33
	Every month	408	2.63	1.77–3.92	637	2.41	1.54–3.75
Mental Health	Good	10,427	1		12,120		
	Bad	1684	3.02	2.46–3.71	2698	2.18	1,7-2.79

discrimination on health and all-cause mortality. Though the association between repeated discrimination to all-cause mortality was no longer significant after adjusting for demographic variables, health behaviours, social participation and economic stress, it is likely that repeated discrimination itself impacts mental health, economic stress and social participation. The association between repeated discrimination and all-cause mortality remained significant when adjusting for demographic variables, health behaviours and social participation and for demographic variables, health behaviours and economic stress separately. Adjusting for social participation had a small effect on decreasing the strength of the association between repeated discrimination and all-cause mortality, however, it was identified as an effect modifier. This means that people who have experienced repeated discrimination and have low social participation are at higher risk of death than those experiencing either only repeated discrimination or only having low social participation. Adjusting for mental health eliminated the significance of the association. People who experience repeated discrimination are more likely to have poor mental health, experience economic stress and to have low social participation, and this in turn is likely to lead to negative health effects, the ultimate

outcome of this being death. The association of repeated discrimination to all-cause mortality was not greatly impacted by any of the health-related behaviours by themselves but adjusting for smoking, alcohol and physical activity together did decrease but not eliminate the strength of the association. In terms of the increased risk of mortality, this was closely and significantly associated with increased age but also with a much higher risk among men as compared to women though at each age category women were at higher risk of mortality but which much broader confidence intervals.

Findings in relation to previous research

These findings are supported by previous research, mainly from the U.S. Firstly, that it is the most socially vulnerable groups reporting discrimination has been found in previous studies such as that carried out by Everson-Rose et al. (2015) that found that reported discrimination was more prevalent among the young, unmarried, smokers, with high BMI (Everson-Rose et al., 2015). Unlike the current study they also found that discrimination was higher among those who are black, male, those who have higher socioeconomic status and those

Table 3

Multiple adjusted associations (HRs) of perceived discrimination measured in 2008 to all-cause mortality measured in 2013 among men and women aged 18–81 in Scania, Sweden, adjusted for demographic variables: age, sex, immigrant status, and marital status; as well as the stepwise adjustment of other covariates including health behaviours (smoking, alcohol, physical activity), social participation, economic stress, and mental health (N = 12,311 males and N = 15,038 females).

	Total		
	Event	HR	CI(95%)
Models			
Model 1			
Adjusted for demographics	867	1.97	1.37–2.83
Model 2 - Health behaviours			
Model a = Smoking	853	1.89	1.31–2.73
Model b + alcohol	843	1.84	1.28–2.66
Model c + physical activity	809	1.76	1.2–2.57
Model 3 - social participation			
Model a = adjusted for demographics	867	1.97	1.3–2.83
Model b = model a + health behaviours	809	1.76	1.2–2.57
Model c = model b + social participation	787	1.57	1.05–2.35
Model 4 - economic stress			
Model a = adjusted for demographics	867	1.97	1.3–2.83
Model b = model a + health behaviours	809	1.76	1.2–2.57
Model c = model b + economic stress	788	1.5	1.0–1.16
Model 5 - mental health			
Mental health (total)	825	1.38	0.94–2.02
Model 6			
Model a = adjusted for demographics	867	1.97	1.3–2.83
Model b = model a + health behaviours	809	1.76	1.2–2.57
Model c = model b + social participation	787	1.57	1.05–2.35
Model d = model c + economic stress	768	1.39	0.92–2.11
Model e = model d + mental health	739	1.18	0.77–1.8

Table 4

Hazard ratios and synergy indexes (SI) of CVD mortality measured in 2013 as a result of the interaction of discrimination and mental health, economic vulnerability and social participation as measured in 2008 among 18–81 year olds resident in Scania, Sweden (n = 28,062).

Variable	HR	CI (95%)	SI
Mental health			
Neither	1		
Discrimination, good mental health	1.53	0.82–2.86	
No discrimination, poor mental health	2.42	2.04–2.87	
Discrimination and poor mental health	3.13	1.98–4.95	1.09
Social participation			
No discrimination and high social participation	1		
Discrimination, high social participation	1.47	0.65–3.31	
No discrimination, low social participation	1.86	1.6–2.16	
Discrimination and low social participation	3.41	2.21–5.28	1.81
Economic vulnerability			
No discrimination, no economic vulnerability	1		
Discrimination, no economic vulnerability	1.91	1.23–2.94	
No discrimination, economic vulnerability	2.27	1.76–2.94	
Discrimination and economic vulnerability	2.69	1.34–5.4	n/a

who consume more alcohol, which underlines the importance of context to discrimination.

There has also been support for the notion that the amount of discrimination is critical to health outcomes (Everson-Rose et al., 2015, Sims et al., 2012) which was also found in this study as the association was only found for those reporting having experienced repeated discrimination and not for those reporting it once.

The important role of mental health as a mediator of the association between discrimination and negative health impacts has also been established in previous studies in different forms including depressive symptoms (Everson-Rose et al., 2015, Barnes et al. 2008, Brondolo et al. 2011), stress (Everson-Rose et al., 2015, Sims et al., 2012) and emotional distress (Pavalko, Mossakowski & Hamilton, 2003).

These findings support a stress model of disease in which a psychosocial stimulus interacts with a psychobiological programme (influenced by past experience and genetics) to invoke a stress mechanism. This stress mechanism is by itself a precursor of disease which in turn can lead to morbidity and mortality (Levi, 1997). This association is mediated by social support and coping mechanisms. In this context, experienced discrimination is the psychosocial stimulus which in combination with individual characteristics can invoke a stress response. This stress response is reflected in the poor mental health which in turn can cause disease and lead to mortality. This model can account for the role of economic stress as an additional stressor. In terms of coping mechanisms, these can either be negative or positive, (Dunlay et al., 2017) and this study would indicate that those experiencing discrimination have higher prevalences of negative coping behaviours such as smoking, very high or very low alcohol consumption and a lack of physical activity. The buffering effect of social support is also clear through the importance of social participation to the association.

In fact, social participation is a central aspect of social capital. Social capital refers to the benefits that individuals receive due to their membership of cohesive groups or social networks. Social capital is thought to impact health through five psychosocial mechanisms: 1) social support; 2) social influence; 3) social participation; 4) person-to-person (intimate) contact; and 5) access to resources (Berkman, Glass, Brissette & Seeman, 2000). Berkman and colleagues (2000) posit that these psychosocial mechanisms influence health through three pathways: the health behavioural pathway, the psychological pathway and the physiological pathway. The health behaviour pathway refers to the influence of social capital on health-related behaviours such as smoking, alcohol consumption, diet, exercise, treatment adherence and health-seeking behaviour (Berkman, Glass, Brissette & Seeman, 2000). The psychological pathway refers to concepts such as self-efficacy, self-esteem, coping effectiveness, depression and wellbeing (Berkman et al., 2000). Finally, the physiologic pathway refers to aspects such as the Hypothalamus-Pituitary-Adrenal (HPA) axis response, allostatic load, immune system function, cardiovascular reactivity, cardio pulmonary fitness and transmission of infectious disease (Berkman et al. 2000). In addition, social capital can have an impact on other social determinants of health, such as access to education and employment which in turn can impact health. It is important to keep in mind that there is inequality in social capital, not all networks are created equally, and some are more powerful and confer more benefits than others. People experiencing discrimination are likely to be a part of less powerful network or lack access to networks more generally though this study would indicate that even weaker social networks are beneficial as compared to a lack thereof. There is also a negative side to social capital in which the same processes that give rise to positive health results can be a source of negative health-behaviours (Cockerham et al., 2017). This is not supported by this study.

Lastly, these findings do provide further support for the Ecosocial Theory (Krieger, 2012) and inverse hazards law (Krieger et al., 2008). Firstly, that it is the most vulnerable groups in society that are likely to report discrimination, including those who are foreign born, have negative health behaviours (including smoking, alcohol and sedentary lifestyles), who experience economic stress, have low social participation and poor mental health. It is the increased exposure to greater health hazards associated with discrimination which causes the increased risk for all-cause mortality.

Public health implications

Discrimination is associated with all-cause mortality and this association seems to be mediated by its impact on mental health in particular, but also economic stress and social participation to a more

limited extent. The experience and perceptions of discrimination are context specific highlighting the need for further research into both the manifestations of discrimination and its health consequences in Europe and in Sweden where little research has been carried out. In fact, Sweden does not collect data on race, ethnicity, religion, sexual orientation, gender non-conformity in the regular population-based health research, all of which are used as basis for discrimination and which could provide a more nuanced interpretation of discrimination as well as on its health impacts.

In fact, research on the health impacts on discrimination is particularly timely in Europe and Sweden which is currently dealing with the aftermaths of the 2015 refugee crisis and the attendant social and political consequences of the same. The current study looks at discrimination as experienced before the refugee crisis yet the importance of discrimination on health is clear and should be further investigated in the current context. In addition, as the outcome investigated in this study is all-cause mortality it is probable that the experience of discrimination could be more strongly associated with other more specific, if less dire, health outcomes.

This study also underlines the importance of mental health for health more broadly and mortality more specifically. On the one hand discrimination may be causally linked to poor health, however, people who have poor mental health may also be more likely to perceive and report discrimination. However, given the association of discrimination to mortality found in this study, the implication is that tackling discrimination could decrease the burden or poor mental health, particularly among more vulnerable groups in the population. Additionally, it highlights the importance of services for addressing poor mental health and its impact on morbidity and mortality.

Methodological considerations

The principle strength of this study is that it is a population-based, prospective cohort study collecting a wide-selection of health-related data from a large group of randomly selected participants. This allowed the study to adjust for a large number of covariates.

One potential short-coming is the non-response of persons not born in Sweden in the sample. In Scania, just over 17% of the population was born outside of Sweden in 2008 (Wigvall, 2009) while the corresponding figure in this sample is approximately 13%. It is conceivable that those with immigrant status may be more likely to experience discrimination and therefore the strength of this association would be greater. It would also impact the generalisability of the findings of the study to the entire population of Scania.

A related issue is the non-response rates for particular variables of interest in the study. For all the variables looked at in this study, the prevalence of mortality was higher among non-respondents than the different groups of respondents. This would indicate that it is those most at risk that do not respond, and this would lead again to an underestimation of the strength of the association.

In terms of causation, the exposure data and covariates are measured in 2008 with a five-year follow-up at the end of 2013 and although causality cannot be explicitly determined it does fulfil Hill's critical condition of temporality. As the outcome is mortality however, a 5-year time period is rather short, the association could potentially be strengthened by extending the follow-up period.

Another potential short-coming is the measurement of discrimination. This study explores the experience of perceived as opposed to experienced discrimination. One reason is that the difficulty of assessing objective measures of personal experiences of discrimination which is also a reason why there is no validated measure of discrimination. Additionally, this study supports the importance of one's own perceptions of discrimination for health outcomes and all-cause mortality, particularly when taking into account the importance of mental health to the association.

In addition, this study did not explore quantities or amount of discrimination. Rather, the experience of frequent experiences of being treated unjustly was taken as an indicator of experiencing discrimination while not having that experience or having it only once was treated as not experiencing discrimination. This is supported in our results in which there was no significant difference between the groups that reported no experience of unjust treatment and the group that reported a single experience of unjust treatment. In terms of quantities of discrimination, some studies have found similar reports of discrimination between groups but with different attributions for the cause of discrimination (e.g. Pavalko et al., 2003) however they have explored very similar samples which may not reflect differences found in the general population. In fact, there is ample evidence that certain groups, such as those of African descent (EU-FRA, 2018) and the Roma (EU-FRA, 2017) are much more likely to experience pervasive discrimination in all aspects of their lives in Europe, and in Sweden, than the general population.

In fact, the burden of discrimination is more important to health than the type of discrimination (Everson-Rose et al., 2015; Sims et al., 2012)". Relevant here is the concept of multiple discrimination which refers to a combination of sources of discrimination based on age, gender, race, ethnicity, religion, sexual orientation, disability or other characteristic. This can take two forms, additive or compound discrimination in which the multiple grounds for discrimination can be separated out and intersectional discrimination where the grounds cannot be disentangled from each other (Burri & Schiek, 2009). As this study does not take into account either the type nor the level of discrimination this is not addressed here though we could suppose the persons who face discrimination on multiple grounds may be more likely to report frequent experiences of having been treated unjustly.

This study also does not investigate difference in terms of attribution of discrimination. Some studies have found no differences in attribution of discrimination (Sims et al., 2012) while others have found that attribution of negative events to racism is better for health than attributing them to individual characteristics (LaVeist et al. 2001). This is not addressed in this study and could be a potential moderator. Further studies could also look at the time aspect of discrimination as previous studies have found that long-term discrimination could be associated with different coping mechanisms which could decrease the association to health outcomes (Barnes et al., 2008).

Conclusion

Though the association between repeated discrimination to all-cause mortality was no longer significant after adjusting for demographic variables, health behaviours, social participation and economic stress, it is likely that repeated discrimination itself impacts mental health, economic stress and social participation. It would also seem that the causes, experiences and outcomes of discrimination would seem to be context specific though there seems to be little doubt that it has important health impacts. Further research is required in Sweden to looks at the nuances of the experiences and the outcomes, particularly given the current social and political discourse and trends.

Ethical approval

This study was approved by the Ethical Committee in Lund (2010/343).

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