Mental health assessment in health checks of participants aged 30–49 years: A large-scale cohort study

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ABSTRACT
Mental distress is an independent risk factor for illness related impairment. Awareness of mental health (MH) allows prevention, but early detection is not routinely performed in primary care. This cohort study incorporated MH assessment in a health promoting programme. We described the level of poor MH among health check participants, explored the potential for early intervention, and the potential for reducing social inequality in MH. The study was based on 9767 randomly selected citizens aged 30–49 years invited to a health check in Denmark in 2012–14. A total of 4871 (50%) were included; 49% were men. Poor MH was defined as a mental component summary score of ≤35.76 in the SF-12 Health Survey. Data was obtained from national health registers and health check. Participants with poor MH (9%) were more socioeconomic disadvantaged and had poorer health than those with better MH. Two thirds of men (64%) and half of women (50%) with poor MH had not received MH care one year before the health check. Among those with (presumably) unrecognized MH problems, the proportion of participants with disadvantaged socioeconomic characteristics was high (43–55%). Four out of five of those with apparently unacknowledged poor MH had seen their GP only once or not at all during the one year before the health check. In conclusion, MH assessment in health check may help identify yet undiscovered MH problems.

1. Introduction
Poor mental health (MH) is a growing public health concern with considerable human, social, and economic costs due to its correlation with mortality (Christensen et al., 2017), physical comorbidity (Dong et al., 2012; Mezuk et al., 2008; Prince et al., 2007; Gunn et al., 2012), socioeconomic deprivation (Korkeila et al., 2003; Kuruvilla and Jacob, 2007; Gunn et al., 2008), unhealthy behaviour (Hamer et al., 2009; Pisinger et al., 2009), and poor quality of life (Moussavi et al., 2007). Moreover, social inequality in MH is evident (Pinto-Meza et al., 2013). The risk of poor MH peaks during early- to mid-life (Kessler et al., 2003), and mental illness is one of the leading causes of disability in this age span (Murray et al., 2012). The prevalence of poor MH among Danish adults is 10% (Christensen et al., 2014). Early detection of poor MH is essential to improve both mental and physical health status and to prevent development of manifest mental disease (World Health Organization, 2004). Despite promotion of MH as a key priority for public health policy in Europe (Wahlbeck, 2011), real community-based collaboration and research on MH promotion in a primary care setting are sparse (Fernandez et al., 2015).

Routinely offered health checks have been proposed as a means to improve the public health (Cochrane et al., 2012; Royal Australian College of General Practitioners, 2012), but the effects and the optimal content remain to be determined. Few studies on health checks including MH assessment have, to our knowledge, been published (Bjerkeset et al., 2006; Crisp and Priest, 1971), and in those cases the purpose was to identify mental disorders. However, MH ought to be considered as a broader concept than merely the presence or absence of mental disorders. The World Health Organization (WHO) defines good MH as 'a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community' (World Health Organization, 2001). If the means of MH assessment is to improve MH, and not only detect mental disorders, a...
generic measure of poor MH may be required.

In a cohort study, we evaluated the use of the Mental Component Summary (MCS) of SF-12 in a community-based health check with close links to primary care. Overall, we aimed to investigate the level of poor MH among health check participants aged 30–49 years, the potential for early intervention, and the potential for reducing social inequality in MH. Based on literature on poor MH in the Danish general population (Christensen et al., 2014) we hypothesized that poor MH among health check participants would be associated with disadvantaged socioeconomic characteristics, health behaviour, and health status. We further expected a higher proportion of participants with disadvantaged than of advantaged socioeconomic characteristics among those with presumably undetected poor MH (Packnes et al., 2017). The objectives were (i) to describe associations between poor MH and socioeconomic characteristics, health behaviour, and health status among participants in a general health check, and (ii) to describe the socioeconomic characteristics of participants with presumably yet undetected poor MH.

2. Methods

2.1. Study design and population

The Check Your Health health promotion programme (Maindal et al., 2014) features a population-based preventive health check in the local health centre followed by a face-to-face consultation with the person’s general practitioner (GP). The health check is offered to all citizens aged 30–49 years in Randers Municipality, Denmark in 2012–2017. The Check Your Health health promotion programme aimed at this age range because of the potential for prevention of development of both mental and physical diseases and possible complications. The health check focuses on risk factors for long-term conditions, e.g. cardiovascular disease (CVD) and diabetes, and on MH.

Except patients with terminal illness, all citizens in Randers Municipality at the age of 30–49 years at January 1, 2012 were randomised to an individual invitation date to the Check Your Health programme (n = 26,216). Citizens who were invited within the first approximately 2½ years (18 April 2012 to 1 October 2014), n = 9767, were eligible for the present retrospective cohort study. In the cohort, we included participants in the health check examination who completed a survey on MH (Fig. 1). A total of 4871 were included in the cohort (50% of the invited); men composed 49% of the study population. Informed consent was obtained from all participants in the study. The study was approved by the Danish Data Protection Agency. Approval from The National Committee on Health Research Ethics was not required since the study used data from the ongoing Check Your Health programme.

2.2. Data sources

Survey data and clinical data were obtained from Check Your Health and linked to Danish registers through each participant’s unique personal identification number, which is assigned to all persons with permanent residence in Denmark (Pedersen, 2011).

2.2.1. Mental health

MH was measured by the Mental Component Summary (MCS) score of the validated Danish version of the 12-item Short Form Health Survey (SF-12), version 2 (Gandek et al., 1998; Ware et al., 1996; Ware et al., 2002). MSC is based on 12 items on general self-rated health, mood and anxiety symptoms, physical health, and functional limitations during the past four weeks (Ware et al., 1996). For each item there are three to five response options (e.g. ‘all/most/some/a little-none of the time’). Standard general population norms and scoring algorithm (US norms of 1998) were used to calculate MCS score (Ware et al., 2002). Calculation of MCS score is dependent on full completion of SF-12. The MCS score is measured on a continuous scale between 0 and 100; higher score reflects better MH. MCS score was categorised into poor (< 35.76), good (≥ 48.26), and moderate MH (in between) based on a Danish national health survey (Christensen et al., 2010). Rather than targeting specific psychiatric diagnoses, MCS provides a generic measure of MH. However, MCS is also validated against diagnoses of mental disorders (Vilagut et al., 2013; Kiely and Butterworth, 2015; Gill et al., 2007). A cut-point of ≤ 36 has a sensitivity of 0.62 for 30-day diagnosis of any depressive disorder and a sensitivity of 0.73 for 30-day generalized anxiety disorder (Kiely and Butterworth, 2015). The corresponding specificities are 0.88 and 0.90 (Kiely and Butterworth, 2015).

2.2.2. Mental health care

MH care was defined as at least one of the following within a year before completing the survey questionnaire: psychometric test or talk therapy by GP, contact to psychologist or psychiatrist, or psychotropic medication as recorded in the Danish national health registers (Table 1). These will hereafter be referred to collectively as ‘MH care’.

2.2.3. Health behaviour and physical health

Data on smoking, alcohol risk behaviour, and self-rated health was collected from the health check survey. From April 2012 to July 2013, alcohol risk behaviour was calculated by CAGE-C and defined as ≥ 2 positive answers to items 1–4 and 6, or one positive answer to items 1–4 and 6 plus alcohol intake on > 4 days per week (Zierau et al., 2005). From August 2013 to October 2014, alcohol risk behaviour was calculated by AUDIT (Saunders et al., 1993) and defined as ≥ 8 points for women or ≥ 8 points plus alcohol intake ≥ 2 times per week for men. Self-rated health was categorised into good and fair/poor measured by the Mental Component Summary (MCS) of SF-12 in a community-based health check with close links to primary care.
Table 1
Mental health care one year before health check.

| Variable                  | National health registers | Notes                                             |
|---------------------------|---------------------------|---------------------------------------------------|
| Psychometric test by GP   | NHSR                      | Approved psychometric tests, e.g. diagnostic tests for depression or anxiety. |
| Talk therapy by GP        | NHSR                      | By GPs under psychological supervision.           |
| Contact to psychiatrist   | NHSR                      | After referral from GP                             |
| Psychotropic medication   | DNPR                      | Redeemed prescription of the following medication (ACT codes): antipsychotics (N05A), anxiolytics (N05B), hypnotics and sedatives (N05C), antidepressants (N06A), psychostimulant medication (N06B), anti-dementia drugs (N06D). |
| Contact to psychiatrist   | NPR                       | Private psychiatrists                              |

ACT: Anatomical Therapeutic Chemical Classification. NHSR: Danish National Health Service Register (Andersen et al., 2011). DNPR: Danish National Prescription Register (Kildemoes et al., 2011). NPR: Danish National Patient Register (Lyne et al., 2011).

the SF-12 (item 1: In general, would you say your health is...) (Ware et al., 1996).

Height and weight were measured at the health check, and body mass index (BMI) was categorised according to standard cut-off points into < 18.5, 18.5–24.9 kg/m², 25–29.9 kg/m², and ≥ 30 kg/m² (World Health Organization - Europe, 2017). Since only 30 participants had a BMI < 18.5 kg/m², the two lower categories were collapsed. Blood pressure was measured with Omron M6, Omron Healthcare Europe B.V. Cholesterol and low-density lipoprotein (LDL) was measured by finger blood test with Alere Cholestech LDX System, Alere Denmark. Glycated haemoglobin (HbA1c) was measured by finger blood test with DCA Vantage Analyzer, Siemens Healthcare, Siemens AG, Germany. High risk of CVD was defined in line with the guidelines by the Danish Society of Cardiology (Danish Society of Cardiology, 2017a,b) as at least one of the following: systolic or diastolic blood pressure > 160/100 mm Hg, total cholesterol > 8 mmol/L, LDL > 6 mmol/L, HbA1c ≥ 48 mmol/mol, or 10-year risk of fatal CVD ≥ 5% based on gender, age, systolic blood pressure, total cholesterol, and smoking status (SCORE, low-risk chart) extrapolated to age 60 years (Perk et al., 2012). Trained healthcare staff performed the measurements by standardised methods, e.g. height measured at deep inspiration with heels touching wall, mean systolic and diastolic blood pressure from three measurements on left arm with 1 min intervals after 5 min rest.

Face-to-face contacts to GP, except pregnancy consultations, were obtained from the NHIS and were categorized into 0, 1, 2–4, or ≥ 5 contacts within a year before completing the survey questionnaire.

2.2.4. Demographic and socio-economic characteristics

Demographic and socio-economic data for the year before invitation was obtained from administrative registers managed by Statistics Denmark (Pedersen, 2011; Statistics Denmark, 1991; Pedersen et al., 2011).

Country of origin was grouped into western or non-western countries (Statistics Denmark, 2016). Cohabitation was dichotomised into cohabitant (married or living with a partner) or living alone (including widows and divorced). Education was categorised into ≤ 10, 11–15, and > 15 years of education according to the International Standard Classification of Education by the United Nations’ Educational, Scientific and Cultural Organization (UNESCO) (International Standard Classification of Education, 2012). Equivalence weighted household income was calculated as recommended by the Organization for Economic Co-operation and Development (OECD) (OECD, 2013) and categorised into tertiles. Employment was grouped into ‘employed’, ‘unemployed/benefits’ (unemployed at least half of the year, being on activation, or receive sickness benefit or parental benefit), and ‘social welfare recipients’ (receiving early disability pension or social security).

2.3. Statistical analyses

Prevalence was reported with 95% confidence interval (CI) and compared using Chi-square tests. Logistic regression models were used for estimating odds ratios (OR) (with 95% CI) associated with poor MH (Table 3). Model 1 presents crude estimates. Model 2 presents estimates adjusted for all variables in Table 3, except alcohol risk behaviour due to a large number of missings. P-values of < 0.05 were considered as statistically significant. Cells containing less than five observations were reported as ‘< 5’, in line with the regulations of Statistics Denmark. The statistical analyses were performed using Stata, version 14.0 (StataCorp, College Station, Texas) on the available data only. Thus, missing data were not imputed.

3. Results

Poor MH was identified in 8.8% of the participants (Table 2). More women (11.0%) than men (6.6%) had poor MH (data not shown). One in four (27.3%) non-Western participant was identified with poor MH. Less than six % of participants with good self-rated general health had poor MH. Participants with poor MH were more than twice as likely to have visited their GP five times or more as participants with good MH (Table 2). Nine % of those with poor MH had not visited their GP at all within the year before the health check.

Female sex, age younger than 45 years, and non-Western country of origin were associated with poor MH (Table 3). The multivariate analysis did not alter these estimates. Poor MH was associated with socioeconomic disadvantage, although education lost its association in the multivariate analysis. Daily smoking, alcohol risk behaviour, and high 10-year risk of fatal CVD were all associated with poor MH. BMI according to overweight (25–29.9 kg/m²), but not obesity (≥ 30 kg/m²), was associated with lower odds for poor MH compared to BMI < 25 kg/m². A sensitivity analysis including alcohol risk behaviour in the multivariate analysis, showed no major changes of direction or magnitude of associations, but confidence intervals widened (data not shown).

3.1. Mental health care

More than half (55.5%) of participants (two in three men and half of women) with poor MH had not received any of the recorded MH care within the year before the health check (Table 4). The proportion of participants with poor MH who had not received MH care was lower in the most disadvantaged socioeconomic groups compared to the highest socioeconomic groups: Poor MH and no MH care was observed in 52.4% of the lowest income group vs. 61.6% of the highest income group; in 50.0% of those with 0–10 years of education vs. 67.4% of those with > 15 years of education; and in 42.9% of social welfare recipients vs. 59.7% of employed persons. No statistically significant differences was seen between participants living alone (55.0%) and cohabiting (55.7%). Four fifth of participants with poor MH who had one visit (or no visits) to the GP during the year before the health check had not received any MH care. Of participants with poor MH who
4. Discussion

1. Main findings

We found that 8.8% of participants in the health check had poor MH. Poor MH was associated with low socioeconomic status (except education in the multivariate analysis), risky health behaviour, and increased risk of CVD. Two in three men and half of the women identified with poor MH had not received any of the investigated types of MH care as recorded in the national registers within the year before the health check. In contrast to what we expected, we found lower proportions of the most disadvantaged socioeconomic groups among those with (presumably) unrecognised MH problems. Still, around half of participants with poor MH from the most disadvantaged socio-economic groups had not received any of the investigated types of MH care.

were frequent GP visitors (≥ 5 visits), 38% had not received MH care.
Table 3
Odds ratios (OR) for poor mental health among participants in Check Your Health, Denmark, 2012–2014.

| Variables                        | Model 1 (OR (95% CI)) | Model 2 (OR (95% CI)) |
|----------------------------------|-----------------------|-----------------------|
| Demographic variables           |                       |                       |
| Sex                              |                       |                       |
| Men                              | 0.57 (0.46–0.70)      | 0.60 (0.48–0.76)      |
| Women                            | 1                     | 1                     |
| Age                              |                       |                       |
| 30–34                            | 1.63 (1.18–2.24)      | 1.92 (1.36–2.72)      |
| 35–39                            | 1.72 (1.32–2.24)      | 1.88 (1.41–2.52)      |
| 40–44                            | 1.53 (1.19–1.98)      | 1.50 (1.13–1.98)      |
| ≥ 45                             | 1                     | 1                     |
| Country of origin                |                       |                       |
| Western                          | 1                     | 1                     |
| Non-Western                      | 4.35 (3.17–5.98)      | 3.65 (2.49–5.35)      |
| Socioeconomic variables          |                       |                       |
| Living alone                     |                       |                       |
| No                               | 1                     | 1                     |
| Yes                              | 1.95 (1.57–2.41)      | 1.42 (1.11–1.83)      |
| Education (years)                |                       |                       |
| 0–10                             | 2.03 (1.54–2.67)      | 1.05 (0.75–1.48)      |
| 11–15                            | 0.96 (0.76–1.22)      | 0.87 (0.67–1.11)      |
| > 15                             | 1                     | 1                     |
| Occupational status              |                       |                       |
| Employed                         | 1                     | 1                     |
| Unemployed/benefits              | 3.89 (2.64–5.74)      | 2.93 (1.94–4.41)      |
| Social welfare recipients        | 7.25 (5.53–9.51)      | 5.16 (3.70–7.22)      |
| Health                           |                       |                       |
| Daily smoker                     |                       |                       |
| No                               | 1                     | 1                     |
| Yes                              | 2.06 (1.65–2.58)      | 1.48 (1.14–1.92)      |
| Alcohol risk behaviour           |                       |                       |
| No                               | 1                     | 1                     |
| Yes                              | 1.44 (1.00–2.07)      | 1.75 (1.17–2.61)      |
| Body Mass Index (kg/m²) ≤ 25     |                       |                       |
| Yes                              | 0.68 (0.54–0.86)      | 0.73 (0.57–0.95)      |
| ≥ 25                             | 1.14 (0.89–1.45)      | 0.93 (0.70–1.23)      |
| High 10-year risk of fatal CVD   |                       |                       |
| No                               | 1                     | 1                     |
| Yes                              | 1.35 (1.05–1.73)      | 1.31 (0.99–1.74)      |

* Crude ORs.
* Adjusted for all variables in Table 3 (N = 4658), except alcohol risk behaviour. Alcohol risk behaviour adjusted for all other variables in Table 3 (N = 3420).

4.2. Strengths and limitations

A major strength of this large-scale population-based study is that it was implemented in the existing healthcare system. Thus we may have explored the realistic potential for further preventive interventions: The proportion of poor MH and the risk profiles of health check attendees are likely to be realistic, and the results are applicable for the development of future health initiatives in Denmark.

4.2.1. Definition of poor mental health

Although SF-12 is widely used in population studies to estimate the MH status, there is no consensus on a cut-point for poor MH. The cut-point of ≤ 35.76 for MCS score in the present study was based on a Danish national health survey, where this definition corresponded to the 10% of the general population with worse MH (Christensen et al., 2010). With the previously mentioned relatively low sensitivities for depressive disorders and anxiety disorders (Kiely and Butterworth, 2015), one may argue that the cut-point may omit too many with psychiatric symptoms. However, the present study is not a population study that aims to assess the prevalence of any mental disorder in the population. It is rather an initiative that seeks to find clinically relevant cases in need of MH intervention. In addition, the cut-point seem appropriate for excluding persons without depressive or anxiety symptoms (Kiely and Butterworth, 2015), and including persons with severe psychiatric symptoms and/or severe impairment (Gill et al., 2007; Sanderson and Andrews, 2002). This suggests that participants identified with poor MH with the cut-point used in Check Your Health are likely to be in need of MH intervention. We do not argue that another cut-point may be more favourable. Yet, in consideration of the GPs’ limited capacity to perform follow-up on risk patients from the health check, it would be advisable that the persons with the worst symptoms are prioritised first.

4.2.2. Mental health care

A strength of the study is that we have complete data of all participants on the recorded MH care from national registers. The coverage of MH services is assumed to be good as the registers are used for reimbursement (Andersen et al., 2011), and registers have been shown to be better than surveys to inform on MH service utilization (Drapeau et al., 2011). A limitation is that the registers do not obtain information on informal or unrecorded MH care, such as counselling outside of the health services, visits to psychologist without referral from GP (for example self-financed or covered by private health insurance), talk therapy by the GP beyond seven consultations per year, or psychological support by GPs who do not have access to psychological supervision (Danish GPs under psychological supervision get additional reimbursement for up to seven talk therapy consultations per patient per year). The true proportion of MH care may, therefore, be underestimated. Unrecorded talk therapy by the GP may be skewed towards persons with poor income because GP consultations are free of charge for Danish patients, whereas there is a user fee of 40% for therapy by a psychologist after referral from GP. Still, unrecorded visits to psychologists may more likely be skewed towards persons of better socioeconomic status as they more often have private health insurance, or they can afford to pay a psychologist without referral from the GP despite a user fee of 100% (Gundgaard, 2006; Simon et al., 1996). Hence, unrecorded MH care may occur both among participants with lower socioeconomic status and among participants with higher socioeconomic status.

Another limitation is that we cannot be sure that the participant’s MH care within the last year is related to the present episode of poor MH measured at the health check. SF-12 assesses MH status within the last four weeks. It would not seem advantageous to obtain data on MH care within the same time frame as MH care can occur with large time gaps and still be related to the actual occurrence of poor MH. We found it reasonable to extend the observation period to one year in order to capture most of the MH care related to the present poor MH status. This choice inevitably means that some MH care was related to previous, and not to the present, episode of poor MH. The extent of MH care is thus most likely an overestimation, and the true proportion of unaddressed MH problems may be greater.

4.3. Comparison with other studies

To our knowledge, only few other studies have included MH as a part of the risk assessment in a health check of the general population (Bjerke et al., 2006; Crisp and Priest, 1971). However, some studies have reported MH status in the baseline characteristics of participants in health checks of the general population (Hildrum et al., 2007; Chang et al., 2013; Gil et al., 2006; Jørgensen et al., 2009).

4.3.1. Characteristics of health check participants with poor mental health

Other studies on health check participants have found similar associations with mental distress: female gender (Bjerke et al., 2006; Crisp and Priest, 1971; Hildrum et al., 2007; Gil et al., 2006; Jørgensen et al., 2009), low education (Bjerke et al., 2006; Hildrum et al., 2007; Gil et al., 2006; Jørgensen et al., 2009), unemployment (Bjerke et al., 2006; Jørgensen et al., 2009), risky health behaviour (Pisinger et al., 2009; Bjerke et al., 2006; Hildrum et al., 2007), and high risk for development of ischemic heart disease (Jørgensen et al., 2009).
Table 4
Sociodemographic characteristics and health care utilization of participants aged 30–49 years identified with poor mental health in Check Your Health, stratified by having received mental health care prior to health check (no/yes). Denmark, 2012–2014.

| Mental health care | No |  | Yes | | Total |  | Missing |
|--------------------|----|---|-----|---|-------|---|---------|
|                    | n  | % (95% CI) | n  | % (95% CI) | N  | |
| n                  | 239 | 55.5 | 192  | 44.5 | 431  | 0  |
| Demographic characteristics |   | | | | | |
| Sex                 |    | | | | | |
| Men                 | 102 | 64.2 (56.3–71.3) | 57  | 35.8 (28.7–43.7) | 159 | 0  |
| Women               | 137 | 50.4 (44.4–56.3) | 135 | 49.6 (43.7–55.6) | 272 | |
| Socioeconomic characteristics |   | | | | | |
| Living alone        |    | | | | | |
| No                  | 162 | 55.7 (49.9–61.3) | 129 | 44.3 (38.7–50.1) | 291 | 0  |
| Yes                 | 77  | 55.0 (46.6–63.1) | 63  | 45.0 (36.9–53.4) | 140 | |
| Income tertile      |    | | | | | |
| Low                 | 110 | 52.4 (45.6–59.1) | 100 | 47.6 (40.9–54.4) | 210 | 0  |
| Medium              | 68  | 55.7 (46.7–64.4) | 54  | 44.3 (35.6–53.3) | 122 | |
| High                | 61  | 61.6 (54.5–70.8) | 38  | 38.4 (29.2–48.5) | 99  | |
| Education (years)   |    | | | | | |
| 0–10                | 51  | 50.0 (40.3–59.7) | 51  | 50.0 (40.3–59.7) | 102 | 13/431 |
| 11–15               | 93  | 49.7 (42.6–56.9) | 94  | 50.3 (43.1–57.4) | 187 | |
| > 15                | 87  | 67.4 (58.8–75.1) | 42  | 32.6 (24.9–41.2) | 129 | |
| Occupational status |    | | | | | |
| Employed            | 172 | 59.7 (53.9–65.3) | 116 | 40.3 (34.7–46.1) | 288 | 9/431 |
| Unemployed/benefits | 19  | 52.8 (36.0–69.0) | 17  | 47.2 (31.0–64.0) | 36  | |
| Social welfare recipients | 42 | 42.9 (33.3–53.0) | 56  | 57.1 (47.0–66.7) | 98  | |
| Healthcare utilization |   | | | | | |
| Number of GP contacts one year before health check | | | | | | |
| 0                   | 30  | 78.9 (62.4–89.5) | 8   | 21.1 (10.5–37.6) | 38  | 0  |
| 1                   | 43  | 78.2 (64.9–87.4) | 12  | 21.8 (12.6–35.1) | 55  | |
| 2–4                 | 92  | 64.3 (56.1–71.8) | 51  | 35.7 (28.2–43.9) | 143 | |
| ≥ 5                 | 74  | 37.9 (31.4–45.0) | 121 | 62.1 (55.0–68.6) | 195 | |

Mental health care: Psychometric test by GP, talk therapy by GP, contact to psychologist, contact to psychiatrist, or psychotropic medication. Poor mental health: MCS score ≤ 35.76 (SF-12, version 2, US norms of 1998). GP: General practitioner. MCS: Mental component summary. SF-12: 12-item short-form Health Survey.

Although the age groups and the tools for assessing MH in these studies differed from the ones in Check Your Health, the results support our findings: Poor MH found in health check participants is associated with disadvantaged socioeconomic status, health behaviour, and high risk of CVD. Similar associations between poor MH measured with the MCS of SF-12 and socioeconomic and health variables are also seen in the general Danish population (Christensen et al., 2014). This could indicate that MH assessment in a health check has the potential for reducing social inequality in MH. However, the proportion of poor MH among approximately same-aged persons (25–44 years) in the general population in a national Danish survey from 2013 was considerably larger (11.5%) (Christensen et al., 2014) than the proportion of poor MH in the health check (8.8%). This indicates that persons with poor MH are less likely to attend a health check.

4.3.2. Potential for early intervention

Only 45% of participants identified with poor MH had already received MH care. This is in line with a meta-analysis, which showed that 47% of patients with major depression were recognised by the GP (Mitchell et al., 2009). General practice is the main provider of MH services (Bijl and Ravelli, 2000). Although persons with poor MH seem less likely to attend a health check, it seemed that a health check, after all, could reach persons with no or little contact to their own GP: Four out of five of those with apparently unacknowledged poor MH had seen their GP only once or not at all during the one year before the health check; this support our hypothesis: a health check might hold a potential for early intervention on MH problems.

4.3.3. Social inequality in mental health care

Our findings of higher proportions of low socioeconomic status among participants who had received MH care were in contrast to other studies on the general population, including a Danish study that found lower use of MH services among persons of low socioeconomic status (Packness et al., 2017; Bijl and Ravelli, 2000; Have et al., 2003; Jokela et al., 2013; Hansen and Haye, 2015). However, links between socioeconomic factors and MH care in Europe are inconsistent in the literature. Some studies found higher use of MH services among persons of low socioeconomic status (Packness et al., 2017; Bijl and Ravelli, 2000; Have et al., 2003; Jokela et al., 2013; Aro et al., 1995; Ten Have et al., 2013; Davidsen et al., 2016), whereas others found no differences (Hansen and Haye, 2015; Ten Have et al., 2013). The studies are hard to compare due to methodological differences in applied socioeconomic parameters, MH care, MH status, and variations in the access to MH care in the different countries. As we did not have access to MH status on non-participants, we cannot be sure that our findings reflect that the GPs offer MH care to patients in highest need, including the socioeconomic disadvantaged groups. However, persons with low socioeconomic status are less likely to participate in the health check, and the health check attenders have a higher use of preventive services (Bjerregaard et al., 2017). Hence, our result may also be explained by a bias caused by a surplus of mental resources among the socioeconomic disadvantaged persons with poor MH who attended a health check compared to those that did not attend. Their participation in the health check may thus reflect stronger help-seeking behaviour in general.

5. Conclusion

Assessing the generic MH status in a health promoting program may hold a potential for improving MH. A total of 8.8% of health check participants were identified with poor MH with the use of the MCS of SF-12. They were more disadvantaged in terms of socioeconomic status and health status than those identified with moderate or good MH. More than half (55%) of participants identified with poor MH had not received any MH care as recorded in national health registers during
the year before the health check. The proportions of participants with disadvantaged socioeconomic characteristics were high (43–55%) among those with (presumably) unrecognised MH problems.

Further studies are needed on how a coherent health system can best provide support for, not only identify, persons with poor MH. Additionally, we need more knowledge on which healthcare services may best target both mental and physical challenges.

Conflict of interest

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Author contributions

CG, HTM, KC, EMD, and AS all contributed with developing the design of the study, interpretation of the work and critical revision of the scientific paper. CG is the guarantor of this work and accepts full responsibility for the conduct of the study; she had access to the data and controlled the decision to publish.

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References

Andersen, J.S., Oliviarius, N.F., Krasnik, A., 2011. The Danish national health service register. Scand. J. Public Health 39 (7), 34–37.
Aro, S., Aro, H., Salinio, M., Keskimäki, I., 1995. Educational level and hospital use in mental disorders. A population-based study. Acta Psychiatr. Scand. 91 (5), 305–312.
Bjelland, Ø., Dahl, A.A., Stordal, E., Dahl, N.H., Kruger, M.B., Linaker, Ø., 2006. Feasibility of mental health screening and intervention in the HUNT population study. Soc Psychiatry Psychiatr Epidemiol. 41 (3), 191–198.
Bjerregaard, A., Maindal, H.T., Bruun, N.H., Sandbæk, A., 2017. Patterns of attendance to primary health care services in Denmark: evidence from Funen County. Scand. J. Public Health 43 (9), 576–581.
Gunn, J.M., Gilchrist, G.P., Chondros, P., et al., 2008 Jun 16. The association between chronic illness, multimorbidity and depressive symptoms in an Australian primary care cohort. Soc Psychiatry Psychiatr Epidemiol. 42 (2), 175–181.
Hansen, A.H., Høye, A., 2015. Gender differences in the use of psychiatric outpatient specialist services in Tromsø, Norway are dependent on age: a population-based cross-sectional survey. BMC Health Serv. Res. 15 (1), 477.
Hele, M., Oldehinkel, A., Vollebergh, W., Orem, J., 2003. Does educational background explain inequalities in care service use for mental health problems in the Dutch general population? Acta Psychiatr. Scand. 107 (3), 178–187.
Hildrum, B., Myklebust, A., Stordal, E., Bjelland, I., Dahl, A.A., Holmen, J., 2007 Jan. Association of low blood pressure with anxiety and depression: the Nord-Trøndelag Health Study. J. Epidemiol. Community Health 61 (1), 53–58.
Jørgensen, T., Ladelund, S., Borch-Johnsen, K., et al., 2009. Screening for risk of cardiovascular disease is not associated with mental distress. Prev. Med. 48 (3), 242.
Kessler, R.C., Angermeyer, M., Anthony, J.C., et al., 2007. Lifetime prevalence and age-of-onset distributions of mental disorders in the World Health Organization’s World Mental Health Surveys Initiative. World Psychiatry 6 (3), 168–176.
Kiel, K.M., Butterworth, P., 2015. Validation of four measures of mental health against depression and generalized anxiety in a community based sample. Psychiatry Res. 225 (3), 291–298.
Kildemoes, H.W., Sørensen, H.T., Hallas, J., 2011. The Danish national prescription registry. Scand. J. Public Health 39 (7), 38–41.
Korkeila, J., Lehtinen, V., Bjelland, E., et al., 2003. Establishing a set of mental health indicators for Europe. Scand. J. Public Health 31 (6), 451.
Kurkvikka, A., Jacob, K.S., 2007. Poverty, social stress & mental health, Indian J. Med. Res. 126 (4), 273.
Lyne, E., Sandegaard, J.L., Rebolj, M., 2011. The Danish national patient register. Scand. J. Public Health 39 (7), 30–33.
Maindal, H.T., Steving, H., Sandbæk, A., 2014. Effectiveness of the population-based check your health preventive programme conducted in primary care with 4 years follow-up [the CORE trial]: study protocol for a randomised controlled trial. Trials 15 (1), 341.
Menz, B., Eaton, W.W., Albrecht, S., Golden, S.H., 2008. Depression and type 2 diabetes over the lifespan: a meta-analysis. Diabetes Care 31 (12), 2383.
Mitchell, A.J., Vase, A., Rao, S., 2009. Clinical diagnosis of depression in primary care: a systematic review and meta-analysis. Lancet 374 (9690), 699.
Mounavi, S., Chatterji, S., Verdes, E., Tandon, A., Patel, V., Ustun, B., 2007. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. Lancet 370 (9590), 851–858.
Murray, C.J.L., Vos, T., Lopez, A.H., et al., 2012. Disability-adjusted life years (DALYS) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380 (9859), 2197.
OECD, 2013. Mental Health and Work. OECD, Denmark. Paris.
Packness, A., Waldfor, F.B., Rd, Christensen, et al., 2017. Impact of socioeconomic
position and distance on mental health care utilization: a nationwide Danish follow-up study. Soc. Psychiatry Psychiatr. Epidemiol. 52 (11), 1405–1413.

Pedersen, C.B., 2011. The Danish civil registration system. Scand. J. Public Health 39 (7), 22–25.

Pedersen, J., Villadsen, E., Burr, H., Martin, M., Nielsen, M., Meinertz, L., 2011. The Danish register of sickness absence compensation benefits and social transfer payments. National Research Centre for the Working Environment, Copenhagen.

Perk, J., De Backer, G., Gohlke, H., et al., 2012. European guidelines on cardiovascular disease prevention in clinical practice (version 2012). The fifth joint task force of the European society of cardiology and other societies on cardiovascular disease prevention in clinical practice (constituted by representatives of nine societies and by invited experts). Eur. Heart J. 33 (15), 1635.

Pinto-Meza, A., Moneta, M.V., Alonso, J., et al., 2013. The mental component of the short-form 12 health survey (SF-12) as a measure of depressive disorders in the general population: results with three alternative scoring methods. Value Health 16 (4), 564–573.

Wahlbeck, K., 2011. European mental health policy should target everybody. Eur. J. Pub. Health 21 (5), 551–553.