

# Poor physical and mental health predicts prolonged grief disorder: A prospective, population-based cohort study on caregivers of patients at the end of life

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## Abstract

**Background:** The health of caregivers can be affected during end-of-life caregiving. Previous cross-sectional studies have indicated an association between poor health status and prolonged grief disorder, but prospective studies are lacking.

**Aim:** To describe physical and mental health status in caregivers of patients at the end of life, and to investigate whether caregivers' health status during caregiving predict prolonged grief disorder.

**Design:** A population-based prospective survey was conducted. Health status was measured in caregivers during caregiving (SF-36), and prolonged grief disorder was assessed 6 months after bereavement (Prolonged Grief-13). We calculated mean scores of health status and explored the association with prolonged grief disorder using logistic regression adjusted for age, gender and education.

**Setting/participants:** The health in caregivers of patients granted drug reimbursement due to terminal illness in Denmark in 2012 was assessed during caregiving and 6 months after bereavement ( $n = 2125$ ).

**Results:** The SF-36 subscale 'role-physical' concerning role limitations due to physical health, the 'mental health' component score, and all 'mental health' subscales showed significantly worse health in the participants than in the general population. Both poor physical health (adjusted OR: 1.05 (95% CI: 1.04–1.07)) and poor mental health (adjusted OR: 1.09 (95% CI: 1.07–1.11)) predicted prolonged grief disorder.

**Conclusion:** Caregivers scored lower on one physical subscale and all mental health measures than the general population. Prolonged grief disorder was predicted by poor physical and mental health status before bereavement. Future research is needed on the use of health status in systematic assessment to identify caregivers in need of support.

## Keywords

Caregivers, palliative care, health status, mental health, bereavement, grief, surveys and questionnaires

### What is already known about the topic?

- End-of-life caregiving may affect the physical health in the caregivers, but the role of physical health status as a predictor of prolonged grief disorder remains unclear.
- Previous studies have revealed poorer mental health in caregivers of end-of-life patients than in the general population and several aspects of poor mental health have been shown to predict prolonged grief disorder.
- Cross-sectional studies have indicated a link between health status and prolonged grief disorder, but the association has not been examined prospectively.

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**What this paper adds?**

- Caregivers providing end-of-life care were limited in the daily activities due to their physical health compared to the general population.
- Poor physical health during caregiving predicted prolonged grief disorder.
- The mental health was worse in caregivers than in the general population, and poor mental health during caregiving predicted prolonged grief disorder.

**Implications for practice, theory or policy**

- Both physical and mental health status of caregivers in end-of-life trajectories should be addressed in the care for caregivers.
- Future research should include systematic assessments of health status to identify caregivers at risk of developing prolonged grief disorder.
- Early identification of caregivers in need of support may provide new opportunities for early prevention.

**Background**

Losing a close relative will naturally cause grief. For most people, the grief reaction will decrease over time.<sup>1</sup> However, some people are at risk of developing prolonged grief disorder (PGD), which is characterised by an intense emotional response that persists for an unusual long time and impairs daily functioning.<sup>1,2</sup> Moreover, the World Health Organization (WHO) has included PGD as a diagnosis in the 11th revision of the International Classification of Diseases (ICD-11).<sup>2-4</sup> Up to 6–10% of bereaved people suffer from the condition<sup>5-8</sup> with severe consequences for the physical and mental health, that is, heart disease, depression and suicidal behaviour.<sup>2,9-12</sup>

To limit negative health impact of grief reactions, it is essential to identify people at risk of PGD already in the caregiving period, which will allow initiation of preventative interventions.<sup>13-16</sup> One prior review indicated that interventions pre-death might lead to lower levels of PGD.<sup>13</sup> Hence, studies are needed to investigate how to identify caregivers at risk of PGD. Previous studies have identified several risk factors of PGD, including female gender,<sup>15,17,18</sup> close relationship with the deceased, specifically being a partner,<sup>5,6,15,17,19</sup> and low income or low educational level.<sup>5,6,15</sup> Other risk factors are level of depression or anxiety in the caregiver before bereavement,<sup>5,15,17,20</sup> severe pre-death grief symptoms,<sup>5,6,21</sup> lack of preparedness for death,<sup>17,18,20,21</sup> young age of the deceased<sup>6,17</sup> and insecure attachment style.<sup>17,19,22</sup>

Previous studies have explored the health status of caregivers in end-of-life trajectories and indicated poorer health status in caregivers than in the general population.<sup>23-26</sup> However, only two previous studies have indicated an association between poor self-reported health in caregivers and PGD.<sup>18,27</sup> Both studies were cross-sectional and conducted after bereavement; one assessed

health status before bereavement in a retrospective study design, whereas the other only examined health status after bereavement. Hence, a prospective study investigating whether caregivers' health status during caregiving is a predictor of PGD could increase knowledge in this area and support prevention.

We aimed to describe the physical and mental health status in caregivers of patients at the end of life and to investigate whether health status may predict PGD. Based on previous research,<sup>18,27</sup> we hypothesised to find an association between poor physical and mental health in caregivers before bereavement and development of PGD after bereavement.

**Methods***Design*

The study was a population-based prospective cohort study and was based on data from caregivers to terminally ill patients in Denmark.

*Setting*

All residents in Denmark have free access to public health-care, which is tax-funded. Medications are free of charge during hospital admission, whereas medications bought at pharmacies are part of a reimbursement system depending on pharmaceutical consumption per person.<sup>28</sup> If a patient is incurably ill with a life expectancy of a few months, a physician can apply for full drug reimbursement for the patient to the Danish Medicines Agency.<sup>29</sup> In 2012, approximately 12.000 Danish citizens received drug reimbursement due to terminal illness.<sup>30</sup> A prior Danish study found that 27.9% of all dying patients in the period 2006–2015 received full drug reimbursement.<sup>31</sup>

### Participants and sampling period

From 1 January to 31 December 2012, an invitation letter with a baseline questionnaire was systematically sent to eligible patients receiving full drug reimbursement due to terminal illness.

Approximately 9000 patients were expected to be eligible<sup>29</sup> and to enable a sample size with the possibility of identifying meaningful clinical differences.

The patients were asked to request their closest adult caregiver to return a completed questionnaire, including written informed consent.<sup>30</sup> Vital status of patients to participating caregivers were continuously checked in the Danish Civil Registration System and caregivers to patients who had died within 6 months was sent a follow-up questionnaire. Follow-up ended in January 2014.

### Data sources and variables

Questionnaire data and register-based data were merged through the Danish personal identification number (CPR).<sup>32</sup> Data was linked at the individual level and anonymised through an authorised connection at Statistics Denmark.<sup>33</sup>

**Outcome measure.** The outcome measure was PGD in caregivers 6 months after bereavement measured using the five criteria (A-E) of the 13-item Prolonged Grief-13 scale (PG-13) and dichotomised according to whether or not the criteria for PGD were met (yes, no).<sup>3,6,34</sup> To meet the criteria, the caregiver must (A) have experienced a loss, (B) experience grief-related yearning daily and (C) daily grief-related yearning must be present at least 6 months after the loss (D). Presence of at least five cognitive, emotional and behavioural symptoms on a daily basis (E) and significant impairment in social, occupational or other important areas of functioning are also mandatory criteria.<sup>3,6,34</sup>

**Questionnaire data.** The exposure variable was caregivers' health status before bereavement measured by the Short Form Health Survey-36 (SF-36).<sup>35,36</sup> The SF-36 consists of 36 items, which generate eight subscales: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE) and mental health (MH). Furthermore, SF-36 scores can be divided into a Physical Component Summary (PCS) and a Mental Component Summary (MCS). Raw scores were reported according to the manual with a range between 0 (worst) and 100 (best) for each subscale. The physical subscale scores (PF, RP, BP, GH) are negatively weighted in calculation of MCS, and the mental subscale scores (VT, SF, RE, MH) are negatively weighted to calculate PCS.<sup>35,36</sup> The caregiver's relation to the patient (partner, adult child, other) was self-reported at baseline.

**Register data.** Caregivers' age and gender were calculated from the CPR numbers. Age was divided into four groups

(<50, 50–59, 60–69, >70 years old). Information on caregivers' educational level was categorised into three groups according to the International Standard Classification of Education<sup>37</sup> (<10 years, 10–15 years, >15 years of education), and their employment status (working, unemployed, outside the workforce (pensioners, cash beneficiaries, students)) was obtained for 2012. Information on caregivers' number of chronic diseases (none, one or more) based on the Charlson Comorbidity Index (CCI) was retrieved through the Danish National Patient Register (NPR).<sup>32,38</sup>

### Statistical methods

Descriptive analyses were performed and presented as proportions for categorical variables and as means with 95% confidence intervals (CIs) for continuous variables. Mean scores and CIs for health status were calculated and compared with SF-36 mean scores from the general population aged 55–64 years (corresponding to the mean age of the study population).<sup>39</sup>

The association between health status and PGD was estimated in a multivariable logistic regression model. Adjustments were made for caregivers' age, gender and educational level, as these were not intermediate variables and had previously been found to predict PGD.<sup>5,6,15,17,18</sup> The analysis was further stratified on caregivers' relation to the patient and number of chronic diseases at baseline, as health status during caregiving was hypothesised to have different importance in these groups. Estimates were presented as odds ratios (ORs) with 95% confidence intervals (CIs). SF-36 was interpreted based on a continuous scale, which made the interpretation of ORs based on one-unit difference in the SF-36 scores. Statistical analyses were performed using Stata, version 15.1.

### Ethics

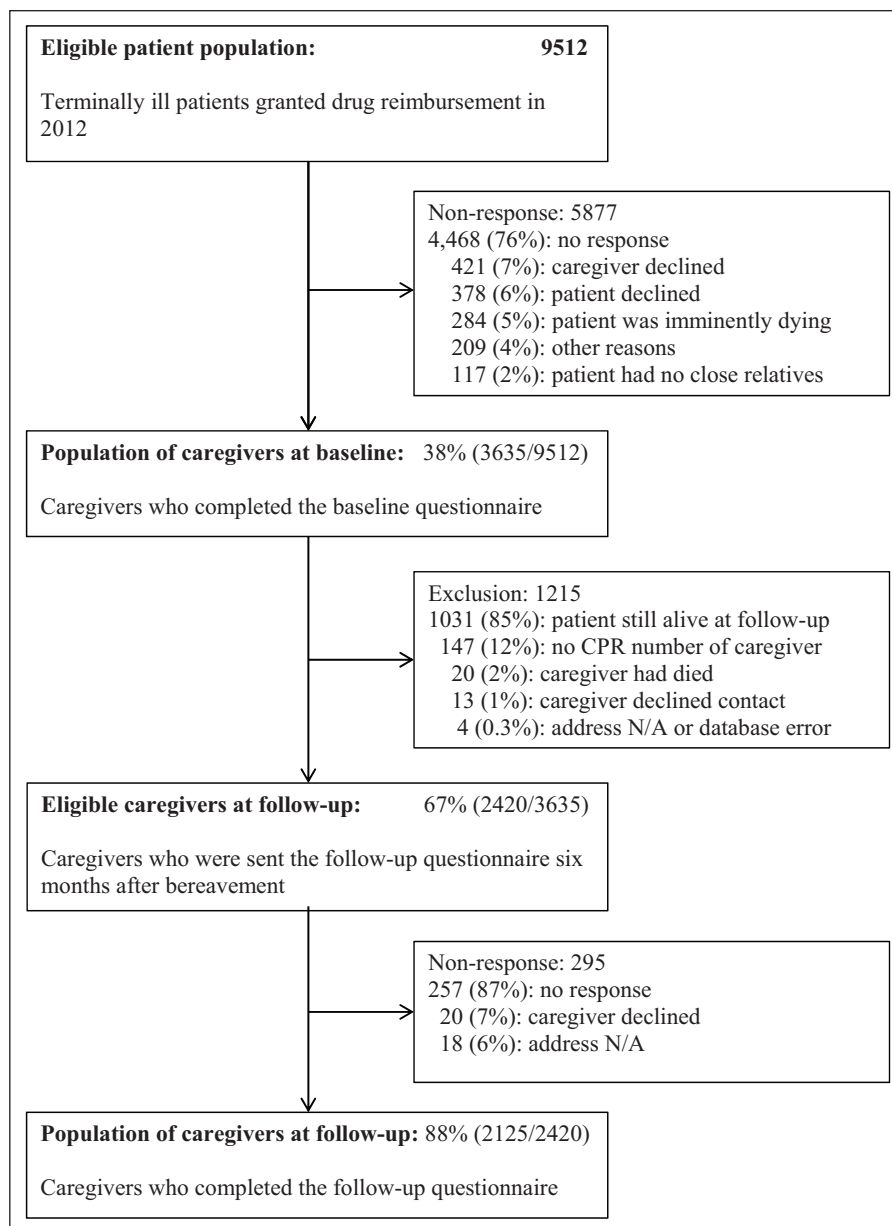
The study was approved by the Danish Data Protection Agency (file no.: 2013-41-2603).<sup>5,30</sup>

The study was not subject to ethical clearance according to The Danish Act on Research Ethics Review of Health Research Projects. The study was conducted according to the International Committee of Medical Journal Editors (ICMJE) guidelines. Results are reported in accordance with the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines for observational studies.<sup>40</sup>

## Results

### Participants

The baseline questionnaire was completed by 3635 caregivers. After 6 months, 2420 caregivers were bereaved and contacted for follow-up. A total of 2125 (88%) caregivers completed the follow-up questionnaire; this group constituted the study population (Figure 1).<sup>5</sup>



**Figure 1.** Flowchart of participating caregivers.

### *Descriptive data*

Mean age of the caregiver cohort was 62 years (95% CI: 61.5–62.6). The majority were females (70%), partners of the patients (64%), and outside the workforce (52%) (Table 1). Approximately 90% of the patients had a cancer diagnosis (lung, colorectal, breast, prostate, haematological, other), and the remaining group predominantly had heart or lung disease.<sup>30</sup>

### *Outcome data*

The mean PCS score was 51.5 (95% CI: 51.1;51.9) with an absolute difference of 4.1 compared to the general population.<sup>39</sup> (Table 2). The mean RP score, that is, role

limitations due to physical health, was significantly lower in the caregivers than in the general population, whereas the mean scores in the remaining physical subscales (PF, BP, GH) were non-significantly higher than the corresponding mean scores in the general population.<sup>39</sup>

The mean MCS score in the caregivers was 40.8 (95% CI: 39.9;41.0) with an absolute difference of 14 compared to the mean score in the general population.<sup>39</sup> (Table 2). All scores on the mental subscales (VT, SF, RE, MH) were significantly lower in the caregivers than in the general population.<sup>39</sup>

### *Health status as predictor of PGD*

At follow-up, 152 (7.6%) met the criteria for PGD and had a mean PCS score of 46.3 (95% CI: 44.5;48.2) compared to

**Table 1.** Baseline characteristics in the study population of caregivers ( $N=2125$ ).

Characteristics of the caregivers		
	Mean	95% CI
<b>Age<sup>a</sup></b>	62.0	61.5–62.6
	<b>N</b>	<b>%</b>
<b>Age group (years)</b>		
<50	354	17
50–59	510	24
60–69	692	32
>70	569	27
<b>Gender</b>		
Male	638	30
Female	1,487	70
<b>Personal relation to the patient</b>		
Partner	1,360	64
Adult child	602	28
Other	163	8
<b>Educational level<sup>b</sup> (years of education)</b>		
<10	558	26
10–15	896	42
>15	644	30
<b>Employment status<sup>b</sup></b>		
Working	989	47
Unemployed	22	1
Outside the workforce	1,114	52
<b>Number of chronic diseases<sup>c</sup></b>		
None	1,428	67
One or more	697	33

CI: confidence interval.

<sup>a</sup>Age at inclusion.

<sup>b</sup>Register-based data for 2012 from national health registers.

<sup>c</sup>Number of chronic diseases based on the Charlson Comorbidity Index (CCI) retrieved through the Danish National Patient Registry (NPR).

52.1 (95% CI: 51.7;52.6) in caregivers without PGD. The absolute difference between groups was 5.8.

The mean MCS score was 29.9 (95% CI: 28.2;31.6) in those with PGD compared to 41.4 (95% CI: 40.8;42.0) in caregivers without PGD corresponding to an absolute difference of 11.5. Poor pre-death physical health status (low PCS) (adjusted OR: 1.05 (95% CI: 1.04;1.07)) and poor pre-death mental health status (low MCS) (adjusted OR: 1.09 (95% CI: 1.07;1.11)) predicted PGD on a continuous SF-36 scale. For all SF-36 subscales, lower scores predicted higher risk of PGD (Table 3).

The stratified analyses revealed that the association was statistically significant in both partners and non-partners and in caregivers with and without chronic illnesses (Supplementary Material A, Tables A1 and A2).

## Discussion

### Main findings

The 2125 caregivers in this nationwide prospective cohort study reported more limitations due to physical health

(RP) than reported by the general population sample aged 55–64 years.<sup>39</sup> Compared to the health status of the general population, the overall physical health status of the caregivers was non-significantly better, but the overall MCS score and all SF-36 mental subscale scores were significantly worse than in the general population.<sup>39</sup>

Poor physical and mental health status during caregiving predicted PGD, and the association was independent of the caregivers' chronic illnesses and personal relations to the patients.

### Strengths and limitations

The large study size and the population-based design were an advantage. Furthermore, the prospective study design made it possible to examine predictors of PGD. The risk of information bias of self-reported health status was low as our study used the validated SF-36 scale. Yet, the PG-13 scale has not been validated in the Danish version, but the translation followed WHO's recommendation for translating questionnaires.<sup>41</sup> Our use of PG-13 to measure PGD was in line with most recent grief studies, which ensure a basis for comparison with prior studies. An additional advantage was the high quality of Danish registers and the low level of missing data with 223 (10.5%) missing responses on either SF-36 or PG-13 ( $n=199$ ) or one of the adjusting factors ( $n=24$ ). Estimates of associations between health status and PGD tend to be low, which is probably due to the analyses of SF-36 scores continuously. However, significant differences were present and interpreted according to the principle of minimal clinical important difference (MCID).<sup>42</sup>

Goodness of fit for SF-36 scores indicated that our model fitted the scale, although we did find a misfit on one subscale (PF).

At baseline, the participating caregivers corresponded to 38% of the contacted patients. This is in line with other bereavement studies in national samples.<sup>23,43</sup> However, selection bias might affect the generalisability of our study as participating caregivers may have a higher educational level than the non-responding; this is consistent with other western cohort studies, which have shown to underrepresent people of low educational level.<sup>44,45</sup> This should be taken into account in the comparison with a standardised general population sample. Nevertheless, we believe that the study results can be generalised to other caregivers of patients in the late terminal phase in similar healthcare systems. Although data for the current analysis was collected 5 years ago, we consider the study highly relevant as it is still ongoing,<sup>46</sup> and the setting, including the Danish healthcare system, has not changed significantly. However, the general population sample for comparison was conducted in 1994 and the interpretation must be made with caution as the health status in the general Danish population might have changed.

**Table 2.** Health status<sup>a</sup> of the caregivers and an age-matched sample of the general population.<sup>b</sup>

	Study population (n = 2125)			General population (n = 494)		
	Mean	(95% CI)	SD	Mean	(95% CI)	SD
<b>Overall physical health</b>						
Physical Component Summary (PCS)	51.5	(51.1–51.9)	10.0	47.4	(43.2–51.6)	10.4
<b>Physical subscales</b>						
Physical functioning (PF)	84.7	(83.9–85.6)	20.7	80.7	(73.6–87.8)	23.5
Role-physical (RP)	59.8	(58.0–61.6)	41.4	75.2	(68.6–81.8)	36.5
Bodily pain (BP)	77.3	(76.3–78.4)	24.4	74.9	(68.3–81.5)	25.1
General health (GH)	70.2	(69.3–71.1)	21.9	68.2	(62.2–74.2)	22.3
<b>Overall mental health</b>						
Mental Component Summary (MCS)	40.8	(39.9–41.0)	12.5	54.8	(50.0–59.6)	9.1
<b>Mental subscales</b>						
Vitality (VT)	50.2	(49.1–51.2)	23.8	68.6	(62.6–74.6)	23.1
Social functioning (SF)	76.9	(75.9–78.0)	24.6	89.9	(82.0–97.8)	19.4
Role-emotional (RE)	47.9	(46.1–49.8)	43.1	85.1	(77.6–92.6)	29.0
Mental health (MH)	60.8	(59.9–61.7)	21.0	81.8	(74.6–89.0)	17.6

CI: confidence interval; SD: standard deviation.

<sup>a</sup>Health status based on the 36-item Short-Form Health Survey (SF-36) (scores 0–100; higher score indicates better health status).

<sup>b</sup>Health status of the general population-based on the SF-36 in a representative sample of the Danish population in 1994.

**Table 3.** Multivariable regression analysis of the association between health status<sup>a</sup> before the patient's death and prolonged grief disorder<sup>b</sup> in a population of caregivers (N = 2125).

	Caregivers with prolonged grief disorder (n = 152)	Caregivers without prolonged grief disorder (n = 1973)	Crude OR (95% CI)	Adjusted <sup>c</sup> OR (95% CI)
	Mean (95% CI)	Mean (95% CI)		
<b>Physical health</b>				
Physical Component Summary (PCS)	46.3 (44.5–48.2)	52.1 (51.7–52.6)	1.05 (1.04–1.07)	1.05 (1.04–1.07)
<i>Physical subscales</i>				
Physical functioning (PF)	74.0 (70.0–78.1)	86.1 (85.2–87.0)	1.02 (1.02–1.03)	1.02 (1.02–1.03)*
Role-physical (RP)	31.9 (25.5–38.4)	62.9 (61.0–64.7)	1.02 (1.01–1.02)	1.02 (1.01–1.02)
Bodily pain (BP)	62.1 (57.9–66.4)	78.9 (77.9–80.0)	1.03 (1.02–1.03)	1.03 (1.02–1.03)
General health (GH)	53.1 (49.5–56.6)	72.0 (71.1–73.0)	1.04 (1.03–1.04)	1.04 (1.03–1.04)
<b>Mental health</b>				
Mental Component Summary (MCS)	29.9 (28.2–31.6)	41.4 (40.8–42.0)	1.08 (1.06–1.10)	1.09 (1.07–1.11)
<i>Mental subscales</i>				
Vitality (VT)	30.5 (27.4–33.6)	52.1 (51.0–53.1)	1.04 (1.04–1.05)	1.05 (1.04–1.06)
Social functioning (SF)	57.5 (53.5–61.5)	78.7 (77.6–79.8)	1.03 (1.02–1.04)	1.03 (1.02–1.04)
Role-emotional (RE)	20.5 (15.2–25.8)	50.6 (48.6–52.6)	1.02 (1.01–1.02)	1.02 (1.01–1.03)
Mental health (MH)	41.6 (38.7–44.4)	62.5 (61.7–63.5)	1.05 (1.04–1.06)	1.05 (1.04–1.06)

OR: odds ratio; CI: confidence interval.

<sup>a</sup>Health status based on the 36-item Short-Form Health Survey (SF-36).

<sup>b</sup>Prolonged grief disorder based on the Prolonged Grief-13 scale (PG-13).

<sup>c</sup>Adjusted for age, gender and educational level of the caregivers.

\*On the subscale score PF, goodness of fit was  $p = 0.03$ . In all other subscale scores goodness of fit was  $p > 0.05$ .

### *What this study adds*

*Health status of the caregivers.* Our study showed that caregivers experienced limitations in their roles due to their physical health. The RP subscale score was significantly worse in caregivers than in the general population, indicating that caregivers struggle to combine their caregiver role with work-related duties and other daily activities.<sup>47</sup> Previous studies point at high caregiver burden among caregivers, which includes a dimension of physical impairment.<sup>48</sup> Thus, our finding of limitations in the roles and daily activities due to physical health might reflect caregiver burden that may prompt a need for healthcare interventions in caregivers.

The PCS score of the caregivers was non-significantly better than the score of the general population sample. One explanation might be that the responding caregivers comprised a selected group with a higher educational level than the non-responding caregivers, which has been associated with better health status.<sup>49</sup> This finding is in line with previous studies that have shown similar or better overall physical health in participating caregivers than in the general population.<sup>24,25</sup>

The caregivers had worse overall MCS score than the general population sample, which is in line with previous findings that caregiving negatively affects the caregivers' mental health.<sup>23–26</sup> Two of the previous studies used the SF-36 to assess mental health,<sup>25,26</sup> and our study confirmed poor mental health in caregivers in a prospective population-based study with a robust study design. Furthermore, we found that caregivers scored lower than the general population on all SF-36 mental health subscales. The findings seem to underline the exhausting and demanding situation of caregivers to severely ill patients.<sup>50</sup>

*Health status as a predictor of PGD.* To our knowledge, our study is the first to examine self-reported physical health status before bereavement as a predictor of PGD in caregivers. As a novel finding, PGD was predicted by poor physical health status during caregiving as measured by the validated SF-36 scale. Previous studies conducted after bereavement found similar associations.<sup>18,51</sup> A large-scale retrospective study of 9123 bereaved persons due to cancer found that retrospectively reported poor physical health status before bereavement was associated with PGD.<sup>18</sup> Likewise, a study of 328 bereaved persons found that poor health status 3 months after bereavement was associated with PGD 15 months after bereavement.<sup>51</sup> Hence, poor self-rated physical health appear to be a contributory factor to the development of PGD. Allostatic load, the long-term effect of continued exposure to stress,<sup>52</sup> may be a possible explanation for this association, as caregiving and bereavement are stressors that may cause biological dysregulation or overstimulation of the allostatic system.<sup>52</sup> This is supported by a previous study showing an association between poor self-rated

health and allostatic load operationalised as a measure of biometrics, including BMI, blood pressure and blood tests.<sup>53</sup> Continuous allostatic load constitutes a risk of disease development, including mental illness,<sup>52</sup> and may be a factor in the development of PGD.

Several poor mental health measures are well-documented predictors of PGD among caregivers. For instance, previous studies have identified depression, anxiety and severe grief reaction before bereavement as risk factors of PGD.<sup>5,15,17,20</sup> Our study supports that poor mental health status predicts PGD in caregivers. Interpreting our results from a perspective of the theory of network, symptoms of psychopathology can be multi-causally connected through biological, psychological and societal stressors and complex mechanisms.<sup>54</sup> Hence, poor health status may be a contributing factor to the pathological symptomatology and the development of PGD.

### *Clinical implications and future studies*

Providing care for terminally ill patients affects mental health of caregivers. Prior studies suggested a MCID of 3–5 points when using SF-36.<sup>42</sup> The caregivers in our study had a 14 points lower mean score of MCS than the general population indicating high clinical relevance. Likewise, the caregivers' physical performance may be impaired, which is reflected by limitations in work-related or daily activities and a 15.4 points mean difference between the RP score of the caregivers and the general population.

Importantly, both poor physical and mental health before bereavement appear to increase the risk of PGD in caregivers. This calls for focus on caregivers' health status and provision of healthcare interventions aiming to promote caregivers' health. In addition, professional support is needed to ensure practical help, support from the network and that caregivers with a job consider the opportunity for compassionate leave.

Identification of risk factors of PGD provides an opportunity to target support at high-risk caregivers. Hence, development of risk assessment tools is necessary.<sup>55,56</sup> In future studies measures of anxiety, depression, health status by SF-36 and associations between these factors should be included. Furthermore, future research is needed, which include caregivers' health status after the patients' death, as this might extend our understanding of caregivers being vulnerable to PGD and add to the understanding of allostatic load.

### **Conclusion**

In this nationwide prospective cohort study, poor self-reported physical and mental health status in caregivers providing end-of-life caregiving was found to predict PGD, which suggests allostatic load. Furthermore, caregivers were found to be limited in their daily activities because

of their physical health status; they also had significantly worse mental health than a comparable general population sample. Our findings highlight that caregivers of patients at the end of life are in a highly demanding situation, which calls for support from their surroundings, including health professionals.

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### Authorship

The study was predominantly conceived by MKL and MKN. Data was collected by MKN, MBG and MAN. Data was analysed by MKL and interpreted by all authors. MKL and MKN made the first draft, and all authors contributed to the critical revision and approved the final manuscript.

### Declaration of conflicting interests

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### Data management and sharing

Data is stored on a secure network at Statistics Denmark and may be accessed only through an authorised connection. Data sharing is not possible according to the EU General Data Protection Regulation.

### Supplemental material

Supplemental material for this article is available online.

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