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Associations between degree-of-worry, self-rated health and acute hospitalisation after contacting a medical helpline: a Danish prospective cohort study

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ABSTRACT

Objectives Self-rated health (SRH) is a strong predictor for healthcare utilisation among chronically ill patients. However, its association with acute hospitalisation is unclear. Individuals' perception of urgency in acute illness expressed as degree-of-worry (DOW) is however associated with acute hospitalisation. This study examines DOW and SRH, respectively, and their association with acute hospitalisation within 48 hours after calling a medical helpline.

Design A prospective cohort study.

Setting The Medical Helpline 1813 (MH1813) in the Capital Region of Denmark, Copenhagen.

Participants Adult (≥18 years of age) patients and relatives/close friends calling the MH1813 between 24 January and 9 February 2017. A total of 6812 callers were included.

Outcome measures The primary outcome measure was acute hospitalisation. Callers rated their DOW (1=minimum worry, 5=maximum worry) and SRH (1=excellent, 5=poor). Covariates included age, sex, Charlson Comorbidity Score and reason for calling. Logistic regression was conducted to measure the associations in three models: (1) crude; (2) age-and-sex-adjusted; (3) full fitted model (age, sex, comorbidity, reason for calling, DOW/SRH).

Results Of 6812 callers, 492 (7.2%) were acutely hospitalised. Most callers rated their health as being excellent to good (65.3%) and 61% rated their worry to be low (DOW 1–3). Both the association between DOW and acute hospitalisation and SRH and acute hospitalisation indicated a dose–response relationship: DOW 1=ref, 3=1.8 (1.1;3.1), 5=3.5 (2.0;5.9) and SRH 1=ref, 3=0.8 (0.6;1.4), 5=1.6 (1.1;2.4). The association between DOW and acute hospitalisation decreased slightly, when further adjusting for SRH, whereas the estimates for SRH weakened markedly when including DOW.

Conclusions DOW and poor SRH were associated with acute hospitalisation. However, DOW had a stronger association with hospitalisation than SRH. This suggests that DOW may capture acutely ill patients' perception of urgency better than SRH in relation to acute hospitalisation after calling a medical helpline.

Trial registration number NCT02979457.

Strengths and limitations of this study

- This study investigates degree-of-worry and self-rated health and their associations to acute hospitalisation.
- The data comprised both patient-reported data and register data.
- The risk of information bias was low as the data collection did not allow for recall bias, conversely, social desirability bias in the callers' degree-of-worry-rating could not be ruled out.
- The risk of limited representativeness could not be eliminated.
- The degree-of-worry is a novel scale that remains to be fully validated, though the scale shows good face validity and external validity.

INTRODUCTION

Self-rated health (SRH) and its association with chronic illness have been widely studied. There is solid evidence that SRH is an important health indicator predicting morbidity and mortality independent of objective health status and risk factors.[1–6] Further, research shows that SRH predicts healthcare utilisation among older adults and patients with chronic conditions.[7–9] SRH appears to be especially associated with chronic illness and less so with acute conditions,[10 11] but only a few studies have investigated SRH in relation to acute illness. Hence, there is a limited understanding of whether SRH works as a risk assessment indicator in relation to acute non-chronic illness and hospitalisation.[11]

A novel instrument to measure the individuals' own perception of urgency in acute illness is the degree-of-worry (DOW).[12] DOW is the individual's self-evaluated worry about the present acute condition, measured on a 5-point scale with the anchor points 1

(minimum worry) to 5 (maximum worry). The DOW scale has previously been found feasible when used in telephone triage of patients calling a medical helpline. The patients' DOW is strongly associated with face-to-face consultation and acute hospitalisation within 48 hours after placing a call to the medical helpline.[12 13] However, the DOW scale remains to be fully validated.

Conceptionally, it is suggested that SRH is an evaluation of the subjective and contextual perceptions of the biological and physiological state of the individual organism.[1] This intersects the hypothetical conceptual construct of DOW, which is based on a formative model of which biological, psychological, and social elements are thought to influence the rating.[14] However, this remains to be further investigated. Therefore, the hypothesis is, that there is a conceptual overlap between DOW and SRH, but that DOW will show a stronger association to acute hospitalisation than SRH.

This study aims to investigate DOW and SRH, respectively, and their association with acute hospitalisation (hospital stay ≥24 hours) within 48 hours after calling a medical helpline.

METHODS

Study design and setting

This study is nested within a larger prospective cohort study assessing DOW in out-of-hours medical services. The data collection was conducted electronically from 24 January to 9 February 2017 among patients calling the Danish Medical Helpline 1813 (MH1813). Immediately after the automatic welcome greeting—and prior to the telephone triage—callers were invited to participate while waiting in queue. If informed consent was achieved, the caller was directed to an electronic telephone survey on self-rated DOW and SRH before the caller got in contact with the call handler.

The Capital Region of Denmark, Copenhagen, is densely populated with approximately 1,8 million inhabitants.[15] The citizens of the region are strongly encouraged to use one of two access points for acute and emergency healthcare; dial 1-1-2 for emergencies or 1813 for the MH1813 for acute non-life-threatening illness or injury. Physicians or registered nurses answer all MH1813 calls and pre-evaluate the callers' descriptions of symptoms and symptom intensity to triage the patients to either telephone advice, general practitioner, face-to-face consultation at an emergency department, home visit, hospital admission or the dispatch of ambulance.[16 17] The triage decision is guided by a criterion-based electronic triage tool which has not been validated.

Study population

All calls to the MH1813 during the data collection period were deemed eligible if (1) the callers consented to participate; (2) the calls were made by the patients themselves or a relative/close friend and; (3) the callers had a valid personal identification number (PIN). If the caller called multiple times, only the first call was used. Exclusion criteria were: (1) missing informed consent; (2) calls by bystanders (eg, nursing home professionals, neighbours or strangers); (3) missing information on DOW and SRH and; (4) calls regarding children (<18 years of age). A total of 38 787 callers were eligible of which 12 203 gave informed consent to participate. Of these, 5391 callers were excluded; 771 made repeat calls, 73 did not have a valid PIN, 76 had missing values on DOW and SRH, in 94 cases the registers did not link and 4377 calls regarded children. Thus, 6812 callers (4243 (62.29%) patients and 2569 (37.7%) relatives/close friends) were included. A flow chart of the included calls is presented in figure 1.

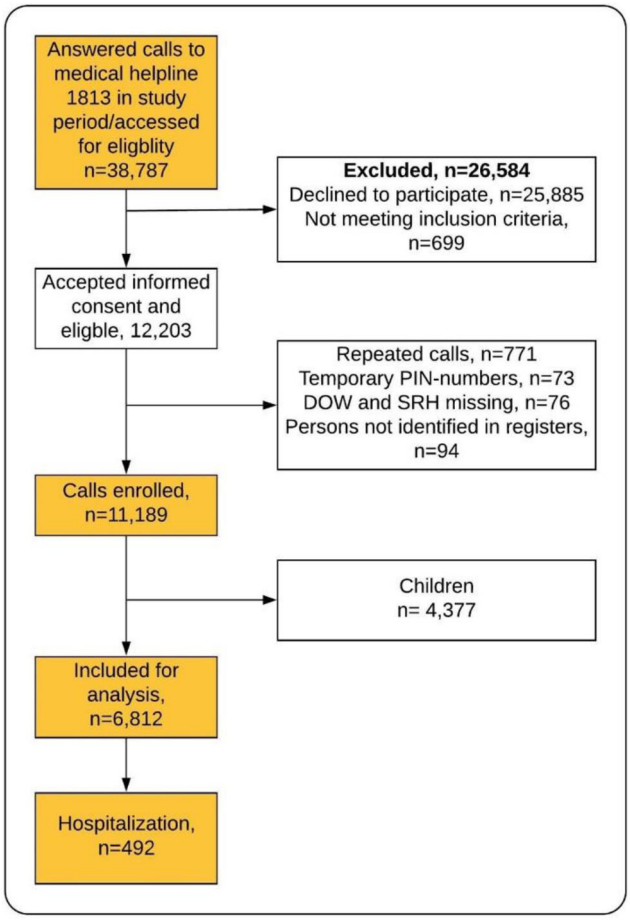

Figure 1 Flow chart of included callers in the cohort study. DOW, degree-of-worry; PIN, personal identification number; SRH, self-rated health.

Measurements

Primary outcome measure

The primary outcome measure was acute hospitalisation defined as a hospital stay ≥24 hours starting within 48 hours after placing the first call to the MH1813. This definition was chosen to avoid or mitigate data anomaly observed in the time-logging part of the hospital data, as the researchers observed that a large number of contacts was registered as ending at exactly midnight.

Exposures

DOW was measured using a self-reported question: 'How worried are you about the situation you are calling about on a scale from 1 to 5, where 1 is minimal worried and 5 is maximum worried?', and SRH: 'How would you rate your general health status on a scale from 1 to 5, where 1 is excellent and 5 is poor?' or if the callers were not the patients themselves: 'How would you rate the general health of the person you are calling about on a scale from 1 to 5, where 1 is excellent and 5 is poor?'.

Covariates

The demographics included age (continuous data) and sex (male, female). Comorbidity was estimated by the Charlson Comorbidity Index[18] from the past 10 years prior to the call. The co-morbidity was categorised into no comorbidity (score 0), low comorbidity (score 1) and moderate or high comorbidity (score 2+). The reason for calling was defined as either somatic illness, injury or other (eg, psychiatric illness and calls regarding transportation).

The data were collected via three different sources (1) the electronic survey (DOW, SRH); (2) the medical record data from the MH1813 (age, sex, PIN, the reason for calling) and (3) the National Patient Register (acute hospitalisation, Charlson score).

Statistical analyses

Descriptive analyses were performed to describe the patients' characteristics using absolute numbers, percentages, mean and 95% CIs, median and IQR. Logistic regression of the association between DOW and SRH, on acute hospitalisation was performed in three models: (1) a crude model; (2) an age-and-sex-adjusted model and (3) a full fitted model (age, sex, Charlson score, the reason for calling and DOW/SRH, respectively). A Spearman correlation between DOW and SRH was calculated. A sensitivity analysis to test the effect of caller identity (differences in estimates depending on who placed the call: the patient her/himself or a relative/close friend) on the association between SRH and acute hospitalisation and DOW and acute hospitalisation was performed with stratified analysis. The results are reported as OR, and 95% CI. A significance level of $p<0.05$ was considered statistically significant. Statistical analyses were carried out using SAS enterprise, V.7.1.

Patient and public involvement

Potential Medical Helpline 1813-callers provided input in relation to item formulation, thus PPI was used in the development of DOW and contributed to the face validity. However, it was difficult to involve patients in other areas of the study due to data protection restrictions.

RESULTS

A total of 6812 calls to the MH1813 were included in the analysis. Of these 492 (7.2%) individuals were hospitalised for 24 hours or more within 48 hours after the call was placed. The median age of all callers was 43.0 (IQR 29.0–61.3), whereas the median age for those hospitalised was 70 (IQR 53.0–79.0). More women than men were included in the study population (58.4%) and were subsequently hospitalised (54%). Only 27.6% of the callers had one or more comorbidity registered in the National Patient Register. Most callers rated their general health as being excellent to good (65.3%) and 61% of the study population rated their DOW between 1 and 3 (table 1). The mean DOW for females was 3.18 (95% CI 3.15 to 3.22) and for men 3.16 (95% CI 3.12 to 3.20). The mean SRH for females was 3.00 (95% CI 2.96 to 3.04), and the mean SRH for males was 2.98 (95% CI 2.93 to 3.03). The Spearman correlation between DOW and SRH was 0.30.

Table 1 Distribution of demographics, self-rated health and degree-of-worry of adults aged 18+ years calling a medical helpline

	All calls, n=6812 (100%)
Sex, n	
Female	3977 (58.4)
Age, median (IQR)	43.0 (29.0–61.0)
Self-rated health, n (%)	
1, excellent	977 (14.3)
2	1695 (24.9)
3	1658 (24.3)
4	1353 (19.9)
5, poor	1129 (16.6)
Degree-of-worry, n (%)	
1, minimal	586 (8.6)
2	1349 (19.8)
3	2278 (33.5)
4	1500 (22.0)
5, maximum	1099 (16.1)
Charlson score	
0	4929 (72.4)
1	907 (13.3)
2+	975 (14.3)
Reason for calling, n (%)	
Somatic illness	3509 (51.5)
Injury	1295 (19)
Other*	344 (5)
Missing†	1664 (24.5)

*Other:For example, psychiatric illness, request for prescription and calls regarding transportation in case of triaged to face-to-face consultation in a previous call.
†Missing: In Denmark it is not mandatory for the healthcare professionals answering the MH1813 to specify the reason for calling.
MH1813, Medical Helpline 1813.

Table 2 Distribution of self-rated health and degree-of-worry in hospitalised and non-hospitalised patients

	No, n (%)	Events, n (%)
Self-rated health		
1, excellent	977 (14.3)	36 (7.3)
2	1695 (24.9)	63 (12.8)
3	1658 (24.3)	82 (16.7)
4	1353 (19.9)	117 (23.8)
5, poor	1129 (16.6)	194 (39.4)
Total	6812 (100)	492 (100)
Degree-of worry		
1, minimal	586 (8.6)	16 (3.2)
2	1349 (19.8)	26 (5.3)
3	2278 (33.5)	114 (23.2)
4	1500 (22.0)	180 (36.6)
5, maximum	1099 (16.1)	156 (31.7)
Total	6812 (100)	492 (100)

The association between SRH and acute hospitalisation indicated a dose–response relationship of SRH on hospitalisation in both the crude and age-and-sex-adjusted logistic regressions. When controlling for age and sex, the association between SRH and acute hospitalisation turned out weaker, with the CI crossing 1 in SRH= 2-4. The same pattern emerged in the fully adjusted analysis (age, sex, comorbidity, the reason for calling, DOW). Likewise, the analysis of the association between DOW and acute hospitalisation indicated a dose–response relationship of DOW in both the crude, age-and-sex-adjusted logistic regression, and in the fully adjusted analysis (age, sex, comorbidity, the reason for calling, SRH) (tables 2 and 3). When controlling the fully adjusted regression for DOW and SRH, respectively, the estimates for DOW only decreased slightly, whereas the association between hospitalisation and SRH weakened markedly. A wider CI but a stronger association with hospitalisation was seen for DOW compared with SRH. The sensitivity analysis of the effect of caller identity (patient or relative/close friend) on SRH and DOW respectively showed that the estimates differed slightly but retained their statistical significance (yes/no) in all estimates except in SRH=3 where the 95% CI for relative/close friend crossed 1 (OR 0.75 (0.75 to 2.97).

DISCUSSION

Main findings

This prospective cohort study aimed to investigate DOW and SRH, respectively, and their association with acute hospitalisation (≥24 hours) within 48 hours following calling the MH1813. Our study found that there was a dose–response relationship between DOW and acute hospitalisation, with higher odds of acute hospitalisation in the crude, age-and-sex-adjusted and fully adjusted analyses. We also found a dose–response relationship between SRH and acute hospitalisation, with higher odds of acute hospitalisation in both the crude and age-and-sex-adjusted analyses, but not in the fully adjusted analysis. However, the dose–response relationship between SRH and acute hospitalisation was weaker than that of DOW and acute hospitalisation. Most importantly, we found that when we adjusted the fully adjusted model for DOW and SRH, respectively, the association between DOW and acute hospitalisation remained stable, whereas, the association between SRH and acute hospitalisation was markedly weakened (table 3).

Strengths and limitations

A strength of this study is that the data comprised of both patient-reported data (DOW and SRH) as well as register data. Also, the risk of information bias was low,

Table 3 ORs for acute hospitalisation according to self-rated health and degree-of-worry (DOW) in a crude, age-and-sex-adjusted and fully adjusted model

	Crude OR (95% CI)	Adjusted for sex and age OR (95% CI)	Adjusted for sex, age, comorbidity, reason for calling and DOW OR (95% CI)
Self-rated health (SRH)			
1, excellent	Ref	Ref	Ref
2	1.0 (0.7 to 1.5)	0.9 (0.6 to 1.4)	0.9 (0.6 to 1.4)
3	1.4 (0.9 to 2.0)	1.0 (0.6 to 1.5)	0.8 (0.6 to 1.4)
4	2.5 (1.7 to 3.6)	1.4 (0.9 to 2.1)	1.1 (0.7 to 1.6)
5, poor	5.4 (3.8 to 7.8)	2.6 (1.8 to 3.9)	1.6 (1.1 to 2.4)
DOW			
1, minimal worry	Ref	Ref	Ref
2	0.7 (0.4 to 1.3)	0.8 (0.4 to 1.6)	0.9 (0.5 to 1.6)
3	1.9 (1.1 to 3.2)	1.8 (1.1 to 3.1)	1.8 (1.1 to 3.1)
4	4.86 (2.9 to 8.15)	3.9 (2.3 to 6.6)	3.5 (2.1 to 6.1)
5, maximum worry	5.9 (3.5 to 10.0)	4.1 (2.4 to 7.0)	3.5 (2.0 to 5.9)

as the data collection did not allow for recall bias. This study also has some limitations. First, DOW is a novel scale that is not fully validated, though the scale shows good face validity and external validity.[12 13] Second, callers agreeing to participate may differ from non-responders which can limit the representativeness and external validity. There is a risk that non-responders have especially poor health and may have a high DOW. However, a non-respondent analysis within the larger prospective cohort study showed that non-responders did not differ from the study population regarding age, sex and triage outcome.[13] Yet, the risk that other socio-demographic factors not adjusted for may have introduced selection bias, thus confounding the results, cannot be ruled out. For example, callers with low SES may be under-represented due to difficulties in engaging this group in survey participation,[19] resulting in an unknown effect on the association between SRH/DOW and acute hospitalisation. Third, the measures in this study are self-reported, and several factors such as the patients' illness behaviour and reporting style may have influenced how the callers rated their health and DOW.[20] Thus, social desirability may have affected the rated DOW to be higher to legitimise the call,[21] potentially affecting the validity of the results presented as the association between DOW and hospitalisation may appear stronger. Fourth, comorbidity was categorised into three main groups. This crude categorisation may have caused residual confounding resulting in biased comorbidity effect estimates. Fifth, it would have been interesting to stratify the analyses on reason for calling to investigate whether the association depended on this factor. However, even though the sample size consisted of 6812 respondents, only few respondents who called concerning injury were acutely hospitalised. Thus, our study lacked statistical power to stratify the analyses on reason for calling.

Comparison with the literature

SRH has been widely studied in chronically ill patients as an important predictor of several outcomes including hospitalisation.[1–11] Therefore, the measurement's capability to illustrate the clinical and subclinical burden of illness is extensive.[22] However, to our knowledge, there is a limited understanding of SRH regarding acute illness.[11] In this study, we indeed found an association between SRH and acute hospitalisation. However, when adjusting for a range of covariates (age, sex, comorbidity, the reason for calling and DOW) the association weakened markedly. This corresponds with the findings in other studies and may reflect the complex ways in which SRH relates to existing comorbidities in shaping health outcomes and health-seeking behaviours.[23] Further, this study suggests that there is a strong association between DOW and acute hospitalisation with increasing odds of being acutely hospitalised with increasing DOW even after adjusting for SRH and comorbidities. Hence, the results of this study seem to confirm our hypothesis that DOW is a stronger indicator of acute hospitalisation than SRH. This may reflect that DOW was specially designed to be used in acute clinical settings and to reflect the acutely ill patients' own perception of urgency.[12] Yet, it remains unknown whether the association between DOW and acute hospitalisation is driven by DOW being a good indicator of severity of symptoms or because the healthcare professionals involved in telephone triage are more inclined to hospitalise individuals who appear more worried, and the results should be interpreted accordingly. However, in an randomised controlled trial (RCT) study with the aim to investigate whether caller's DOW had an impact on the triage response, the researchers did not find any differences between the intervention group and control group (p=0.17). Nevertheless, the risk of error due to inadequate implementation of the intervention in the RCT study may contribute to this result[24].

It appears that both DOW and SRH reflect more than the individuals biological state, by which the individual also evaluates his/her own psychological and physical state. SRH is suggested to be a complex, subjective, cognitive process based on the individual's physical and psychological wellness.[1 25] Thus, the physical and psychological information is received, selected, reviewed and summarised into a subjective rating of one's general health.[1] SRH is connected to the experiences and life situation of the individual making it highly subjective.[26] However, this study suggests that cognitive processing related to SRH is less likely to be related to acute illness. Conversely, the DOW scale has previously been investigated in a mixed-methods study among MH1813-callers in relation to the Common-Sense Model of Self-Regulation, a conceptual framework that describes the illness representations of the individual.[27] The mixed-methods study found that a higher DOW was more likely to be present among callers who had a medium or weak illness identity (label of health threat/diagnosis), an unclear/no cause and no solution for a cure, no control of the illness, and a high perception of consequences,[27] indicating a high perception of acuteness, uncertainty, and urgency. On the other hand, SRH is a good predictor for morbidity and mortality in patients with a chronic illness,[1–6] possibly reflecting a longer time perspective and a higher degree of self-management, personal control and treatment control. Conversely, DOW may reflect the individual's sensations of biopsychosocial deviations from normal functioning predicting acute hospitalisation. DOW may thereby illustrate the mechanisms behind help-seeking behaviour better than SRH when dealing with acute illness.

Recommendations for future research and practices

The findings from this study indicate that DOW may prove a valuable addition to the existing telephone triage, as the scale may be a good indicator of urgency

and acute hospitalisation. Inclusion of DOW in the existing triage has the potential to support healthcare professionals involved in telephone triage in their clinical decision making. Further, DOW can introduce early patient involvement acknowledging the value of the callers' self-evaluation of urgency, which may further increase patient safety. However, investigation into the relationship between DOW and patient compliance with the triage recommendations is important to advance future research within the field. The conceptual model behind DOW has previously been touched on in a mixed-methods study on the DOW and illness representation in telephone triage,[27] and in a mixed-methods study investigating the thematic content of the caller's worry.[12] DOW is most likely a multidimensional construct which represents the patients' subjective average of multiple dimensions, but more insight into the conceptual model is needed. We advise that future studies evaluate the biopsychosocial elements behind the individual's self-evaluation of DOW and decision to seek medical care which may advantageously be guided by the illness perceptions of the individual. Further, we suggest investigation into the implications of socioeconomic status and social support in relation to DOW.

CONCLUSION

DOW and poor SRH were associated with acute hospitalisation (≥24 hours) within 48 hours after calling a medical helpline. However, DOW is more strongly associated with acute hospitalisation than SRH. This suggests that DOW may illustrate acutely ill patients' perception of urgency better than SRH. Further, we found a dose–response relationship of DOW on acute hospitalisation, as the ORs of hospitalisation increased with a higher DOW. The findings from this study indicate that DOW may prove a valuable addition to the existing telephone triage, as the scale may be a good indicator of self-evaluation of urgency and need for acute hospitalisation.

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Competing interests None declared.

Patient consent for publication Not required.

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