

Physical illness leading to absence from work and the risk of subsequent suicide: a national register-based study

Fang Tang^{1,2}, Lars Mehlum¹, Ingrid S. Mehlum³, Ping Qin¹

1 National Centre for Suicide Research and Prevention, Institute of Clinical Medicine, University of Oslo, Oslo, Norway

2 Center for Data Science in Health and Medicine, Qianfoshan Hospital Affiliated to Shandong University, Center for Suicide Prevention Study at Shandong University, Jinan, China

3 Department of Occupational Medicine and Epidemiology, National Institute for Occupation Health, Oslo, Norway

Correspondence: Ping Qin, National Centre for Suicide Research and Prevention, Institute of Clinical Medicine, University of Oslo, Sognsvannsveien 21, N-0372 Oslo, Norway, Tel: +47 2202 9126, Fax: +47 2292 3958, e-mail: ping.qin@medisin.uio.no

Background: Studies have shown that people with physical illness are at increased risk of suicide, but knowledge on the association between absence from work due to specific physical health problems and suicide risk is limited. This study aimed to examine the relationship between suicide risk and physical illness requiring leave from work across a range of specific physical diagnoses, and to study the interactions of mental illness and socioeconomic factors on this relationship. **Methods:** Using a nested case-control design, 9313 suicide cases and 169 235 matched controls were retrieved and interlinked from Norwegian national registries. Data on sick leave and related physical illness were derived from claims for sickness benefit and analyzed using conditional logistic regression. **Results:** For males, the risk of suicide increased progressively with the number of previous physical illness-related absences and the duration of recent physical illness-related absences. Absences related to digestive, musculoskeletal and neurological disorders as well as cancer and accidents/injuries were associated with a significantly increased risk of suicide. In contrast, females with a history of physical illness-related absence and a diagnosis of most organ or system specific illnesses were at a relatively reduced risk of suicide. In both genders, the suicide risk associated with physical illness resulting in absence from work differentiated significantly by history of sickness absence due to mental illness, and by education and income levels. **Conclusions:** The risk of suicide associated with physical illness requiring leave from work varied significantly by gender and by education and income status.

Introduction

People with physical illness not only have to endure symptoms, such as chronic pain and potential functional disability, but also often face a loss of socioeconomic status, an increased burden on social networks and the development of mental distress.^{1,2} Many studies have shown an increased risk for suicide in people with physical illness and disabilities, especially when these problems threaten their sense of autonomy, sense of usefulness and purpose, value, dignity and quality of life.^{3,4} Epidemiological studies have identified a number of hospitalized physical illnesses (e.g. cancer, diabetes) and functional disabilities as risk factors for suicide.^{5,6} However, little research has examined explicitly the association of physical illness resulting in temporal leave from work, which, in most cases, reflect milder physical problems, with suicide in the labour force population.

Sickness absence, or sick leave, is an integrated measure of social, psychological and physical functioning in working populations.⁷ Data on sickness absence are often collected routinely by workplaces and social insurance authorities, minimizing potential recall and response biases^{7,8} and making the database a valuable source for studying subsequent health outcome among the working population.^{9,10}

Males and females play different roles in the family and society,^{11,12} and show different patterns in their utilization of public health services (e.g. women had a higher rate of sickness absence than men).⁸ Although a number of studies have investigated gender differences in the association of physical illness with suicide using hospitalization data, very few studies have examined this association using data on sickness absence^{13,14} and, to our knowledge, no study has disentangled the association in the context of mental illness and socioeconomic status. In this study, we want to use

personal data from several national registers to assess suicide risk in relation to physical illness-related sick leave and relevant diagnoses among males and females separately. We also want to examine the interactions of mental illness and socioeconomic factors on this relationship.

Methods

Data sources

Individual level data were retrieved from Norwegian longitudinal registers and interlinked through the unique personal identification.

The Cause-of-Death Registry, administrated by the Norwegian Institute of Public Health, includes the cause and date of all deaths that have occurred in Norway since 1969. Suicide was coded according to the International Classification of Diseases, ninth Revision for the years 1992–95 (codes E950–E959) and 10th Revision for 1996–2012 (codes X60–X84, Y870).¹⁵ Statistics Norway's Events Database (FD-Trygd), administrated by Statistics Norway, comprises a range of administrative datasets of data on sociodemographic and economic status, such as place of residence, marital status, income, social benefits, etc. since 1992. As a part of this, the Norwegian Labour and Welfare Administration's sickness benefit register records sickness benefits (start and end dates of sickness absence spells) and associated medical diagnoses. The Central Population Register has recorded demographic data such as birthdate, gender, country of birth, citizenship and immigration status since 1964.

Study design and participants

The study was based on the entire national population of 18–66 years old—an age group presumed to be active in the labour

force. All suicide cases aged 18–66 years between 1992 and 2012 were retrieved from the Norwegian Cause-of-Death Registry. Using an incidence density sampling technique for nested case-control design,¹⁶ up to 20 living controls per suicide case, matched on gender and date of birth, were randomly drawn from a 25% representative sample of the Norwegian population as recorded in the Central Population Register. Date of suicide, i.e. the date used to match the controls, is hereafter referred to as the casedate. In total, 9313 suicide cases, representing 81.6% of all national suicides during the study period, and 169 235 living population controls were included in the study.

Sickness absence

The Norwegian sickness absence benefit covers all employed and registered unemployed persons from the first day of absence (from day 17 for self-employed). For sick leave longer than 3 days (8 days in many enterprises), a medical certificate from a physician is required to claim the benefits. The certificate usually specifies the time period for sick leave as recommended by the physician, as well as the primary medical symptom or diagnosis, designated in accordance with the Norwegian version of the International Classification of Primary Care 2nd Edition (ICPC-2).¹⁷

In this study, historical information on physical illness that resulted in leave from job for each participant was derived from sickness absence registration. Number of sick leave spells, length of recent sick leave and time since the most recent sick leave were subsequently constructed. The specified primary diagnosis for recent physical sickness absence was classified into diagnostic groups according to ICPC-2 chapters: digestive (D), cardiovascular (K), musculoskeletal (L), neurological (N), respiratory (R), endocrine/metabolic and nutritional (T) and other physical problems (A, B, F, H, S, U, W, X, Y and Z codes). Sick leave with no information on the diagnosis (11.8%) was combined in the group 'Cause-unrecorded diagnoses' for the analyses.

Covariates

Analyses were adjusted for the following covariates: (i) history of sickness absence due to mental illness (ICPC-2, P codes) before the casedate. (ii) Socioeconomic status on income, education, marital status, place of residence and immigration background. Gross income in the preceding year was categorized as: <150 000, 150 000–249 999, 250 000–349 999, 350 000–449 999, 450 000–549 999, more than 550 000 Norwegian kroner (NOK) and unknown annual income. Income data were only available from 1993, thus, people included in the year 1992 made up more than 90% of subjects with unknown annual income. Educational attainment was classified by the Norwegian Standard Classification of Education NUS2000¹⁸ as: compulsory education, intermediate education, tertiary education and no or unknown education. Marital status was categorized into married, never married, separated, divorced, widowed and unknown marital status. Place of residence was classified into capital area (Oslo county) and other area. Immigration background was categorized into following subgroups: born in Norway with two Norwegian-born parents, Norwegian-born with one foreign-born parent, Norwegian-born to immigrant parents, foreign-born to Norwegian-born parents; Foreign-born with one Norwegian-born parent and First-generation immigrants.¹⁹

Statistical analysis

Conditional logistic regression analysis was used to assess the risk of suicide associated with physical illness resulting in sick leave. The odds ratios (ORs) were estimated from the crude models controlling for the effects of gender, age and calendar year through matching, and from the adjusted models further controlling for the effects of covariates. A Cochran–Armitage trend test was conducted to assess

the dose-response relationship between frequency or duration of physical illness-related absence and suicide risk. The interactions of sickness absence due to physical illness with mental illness, education and income were examined using the likelihood ratio test.

Because our preliminary analyses showed significant differences by gender, we have chosen to focus on analyses made separately for males and females in this study. All analyses were carried out using the SAS statistical package version 9.4.

Ethical approval

The study was approved by the Regional Committee for Medical and Health Research Ethics of Norway and the owners of the relevant individual registers.

Results

The study participants constituted 9313 suicide cases and 169 235 matched living controls aged 18–66 years. Of the 9313 suicide cases, 72.7% were males (mean age: 40.0, SD: 13.5) and 27.3% were females (mean age: 42.4, SD: 13.1).

History, frequency and duration of sickness absence due to physical illness

About 46.8% of male suicide cases had a history of sick leave due to physical illness compared with 37.7% of male controls (table 1). Compared with the controls, male suicide cases also more often had multiple spells of physical illness-related sick leave and a recent long leave (>30 days). In contrast, female suicide cases, compared with their age-matched female controls, less often had a history of sick leave due to physical illness, multiple spells of sick leave (≥ 3 times) and a long duration of recent leave from work due to physical problems.

Conditional logistic regression analyses indicated that, a history of physical illness resulting in sick leave conferred a significant risk factor for subsequent suicide in males (crude OR: 1.58, 95% CI: 1.49–1.66). The associated risk increased progressively with the spells of physical illness-related sickness absence and the duration of the most recent physical sickness absence—the higher the frequency and the longer the duration of the recent sick leave, the higher the risk of subsequent suicide. When the data were adjusted for personal differences in history of mental illness and socioeconomic status, the observed associations were reduced to some extent but remained significant. For females, however, a history of sick leave due to physical illness, multiple physical illness-related sick leave spells (but <10) and the duration of the most recent physical sickness absence were all associated with a significantly reduced risk of suicide.

Specific physical illnesses for recent sick leave

Musculoskeletal disorders were the most common physical problems resulting in sick leave for both suicide cases and the controls of both genders, as shown in table 2. Suicide risk associated with most organ-specific diagnoses differed significantly between males and females (test of difference: $\chi^2 = 82.26$, $P < 0.0001$). For males, a significantly increased risk of suicide was seen across most diagnostic groups with the crude ORs varying from 1.45 to 2.19. When adjusting the data for covariates, diagnoses in digestive, musculoskeletal and neurological systems and the group of other physical illness, remained significant risk factors. For females, physical problems in most systems were linked to a reduced risk of suicide, except neurological and endocrine/metabolic/nutritional illnesses that were linked to an increased risk of suicide. When adjusted the data for covariates, the negative association remained significantly for the diagnoses in digestive, musculoskeletal and respiratory systems and the group of other physical illness. Moreover,

Table 1 Distribution of sickness absence due to physical illness and associated risk for subsequent suicide

| Variables | Distribution, n (%) | | Risk for suicide, OR (95% CI) | |
|--|---------------------|------------------|-------------------------------|--------------------------|
| | Suicide cases | Matched controls | Crude OR ^a | Adjusted OR ^b |
| Males | 6769 (100.0) | 123 227 (100.0) | | |
| History of sickness absence due to physical illness | | | | |
| No | 3602 (53.2) | 76 744 (62.3) | 1 (Reference) | 1 (Reference) |
| Yes | 3167 (46.8) | 46 483 (37.7) | 1.58 (1.49–1.66) | 1.28 (1.21–1.36) |
| Spells of sickness absence due to physical illness ^c | | | | |
| No sickness absence due to physical illness | 3602 (53.2) | 76 744 (62.3) | 1 (Reference) | 1 (Reference) |
| 1–2 | 1158 (17.1) | 19 644 (15.9) | 1.42 (1.34–1.51) | 1.24 (1.16–1.32) |
| 3–5 | 1516 (22.4) | 21 152 (17.2) | 1.81 (1.67–1.97) | 1.33 (1.22–1.45) |
| 6–10 | 356 (5.3) | 4064 (3.3) | 2.17 (1.93–2.43) | 1.46 (1.29–1.66) |
| >10 | 137 (2.0) | 1623 (1.3) | 2.42 (1.98–2.96) | 1.49 (1.20–1.85) |
| Duration of last sickness absence due to physical illness ^c | | | | |
| No sickness absence due to physical illness | 3602 (53.2) | 76 744 (62.3) | 1 (Reference) | 1 (Reference) |
| 1–30 days | 1151 (17.0) | 19 810 (16.1) | 1.34 (1.25–1.44) | 1.15 (1.07–1.24) |
| >30 days | 2016 (29.8) | 26 673 (21.7) | 1.77 (1.66–1.88) | 1.38 (1.29–1.47) |
| Females | 2544 (100.0) | 46 008 (100.0) | | |
| History of sickness absence due to physical illness | | | | |
| No | 1406 (55.3) | 23 198 (50.4) | 1 (Reference) | 1 (Reference) |
| Yes | 1138 (44.7) | 22 810 (49.6) | 0.81 (0.74–0.89) | 0.76 (0.69–0.84) |
| Spells of sickness absence due to physical illness ^c | | | | |
| No sickness absence due to physical illness | 1406 (55.3) | 23 198 (50.4) | 1 (Reference) | 1 (Reference) |
| 1–2 | 348 (13.7) | 7430 (16.2) | 0.79 (0.71–0.87) | 0.78 (0.70–0.87) |
| 3–5 | 543 (21.3) | 11 494 (25.0) | 0.74 (0.65–0.85) | 0.67 (0.58–0.77) |
| 6–10 | 164 (6.5) | 2781 (6.0) | 0.99 (0.84–1.17) | 0.79 (0.66–0.95) |
| >10 | 83 (3.3) | 1105 (2.4) | 1.28 (0.97–1.68) | 1.02 (0.76–1.37) |
| Duration of last sickness absence due to physical illness ^c | | | | |
| No sickness absence due to physical illness | 1406 (55.3) | 23 198 (50.4) | 1 (Reference) | 1 (Reference) |
| 0–30 days | 390 (15.3) | 8503 (18.5) | 0.75 (0.66–0.84) | 0.69 (0.60–0.78) |
| >30 days | 748 (29.4) | 14 307 (31.1) | 0.85 (0.77–0.94) | 0.80 (0.72–0.89) |

a: Crude ORs were adjusted for age, gender and calendar time through matching.

b: Adjusted ORs were further adjusted for history of sickness absence due to mental illness, income, education, marital status, place of residence and immigration background.

c: Cochran–Armitage trend test: frequency of sickness absence due to physical illness: $Z = -16.69$, $P < 0.0001$ for males; $Z = 2.04$, $P = 0.040$ for females; duration of last sickness absence due to physical illness: $Z = -16.70$, $P < 0.0001$ for males; $Z = 3.64$, $P < 0.0001$ for females.

Table 2 Distribution of specific diagnoses of physical illness in the recent sickness absence and associated risk for subsequent suicide

| Diagnostic groups by organ or system of body | Distribution, n (%) | | Risk for suicide, OR (95% CI) | |
|--|---------------------|------------------|-------------------------------|--------------------------|
| | Suicide cases | Matched controls | Crude OR ^a | Adjusted OR ^b |
| Males | | | | |
| No sickness absence due to physical illness | 3602 (53.2) | 76 744 (62.3) | 1 (Reference) | 1 (Reference) |
| Digestive (D) | 168 (2.5) | 2456 (2.0) | 1.57 (1.34–1.85) | 1.24 (1.04–1.47) |
| Cardiovascular (K) | 126 (1.9) | 2360 (1.9) | 1.17 (0.97–1.42) | 1.05 (0.86–1.27) |
| Musculoskeletal (L) | 1345 (19.9) | 21 505 (17.5) | 1.45 (1.35–1.56) | 1.16 (1.08–1.25) |
| Neurological (N) | 151 (2.2) | 1614 (1.3) | 2.19 (1.84–2.60) | 1.58 (1.32–1.90) |
| Respiratory (R) | 177 (2.6) | 2711 (2.2) | 1.51 (1.29–1.76) | 1.08 (0.91–1.27) |
| Endocrine/metabolic/nutritional (T) | 26 (0.4) | 389 (0.3) | 1.53 (1.03–2.28) | 1.15 (0.76–1.75) |
| Other physical problems | 382 (5.6) | 5483 (4.5) | 1.62 (1.45–1.81) | 1.29 (1.15–1.46) |
| Cause-unrecorded | 792 (11.7) | 9965 (8.1) | 1.79 (1.65–1.95) | 1.54 (1.41–1.68) |
| Females | | | | |
| No sickness absence due to physical illness | 1406 (55.3) | 23 198 (50.4) | 1 (Reference) | 1 (Reference) |
| Digestive (D) | 39 (1.5) | 865 (1.9) | 0.72 (0.52–1.01) | 0.56 (0.40–0.79) |
| Cardiovascular (K) | 27 (1.1) | 684 (1.5) | 0.60 (0.41–0.89) | 0.68 (0.45–1.01) |
| Musculoskeletal (L) | 383 (15.1) | 8992 (19.5) | 0.67 (0.59–0.76) | 0.60 (0.52–0.68) |
| Neurological (N) | 72 (2.8) | 912 (2.0) | 1.25 (0.98–1.61) | 1.10 (0.84–1.43) |
| Respiratory (R) | 72 (2.8) | 1234 (2.7) | 0.92 (0.72–1.18) | 0.67 (0.51–0.87) |
| Endocrine/metabolic/nutritional (T) | 28 (1.1) | 304 (0.7) | 1.50 (1.01–2.21) | 1.30 (0.85–1.97) |
| Other physical problems | 207 (8.1) | 5497 (11.9) | 0.60 (0.52–0.71) | 0.62 (0.53–0.74) |
| Cause-unrecorded | 310 (12.2) | 4322 (9.4) | 1.19 (1.04–1.35) | 1.16 (1.01–1.33) |

a: Crude ORs were adjusted for age, gender and calendar time through matching.

b: Adjusted ORs were further adjusted for history of sickness absence due to mental illness, income, education, marital status, place of residence and immigration background.

Table 3 Suicide risk associated with physical illness by mental illness and socioeconomic status

| Variables | Distribution, cases/controls | | Risk of suicide, OR ^a (95% CI) | |
|--|--|--|---|---|
| | Males with sickness absence due to physical illness 3167/46 483 | Females with sickness absence due to physical illness 1138/22 810 | Males with sickness absence due to physical illness | Females with sickness absence due to physical illness |
| Sickness absence due to mental illness | | | | |
| No | 2141/41 051 | 622/18 606 | 1.43 (1.34–1.53) | 0.82 (0.73–0.92) |
| Yes | 1026/5432 | 516/4204 | 0.78 (0.69–0.89) | 0.60 (0.50–0.72) |
| Education attainment | | | | |
| Compulsory education | 1182/13 010 | 302/5402 | 0.95 (0.87–1.04) | 0.47 (0.40–0.55) |
| Intermediate education | 1482/24 767 | 484/10 257 | 1.38 (1.27–1.50) | 0.79 (0.69–0.91) |
| Tertiary education | 437/8177 | 332/6976 | 2.02 (1.77–2.31) | 1.30 (1.08–1.56) |
| Unknown education | 66/529 | 20/175 | – | – |
| Gross income the previous year | | | | |
| <150 000 NOK | 496/4260 | 223/3330 | 0.98 (0.87–1.10) | 0.62 (0.52–0.74) |
| 150 000–249 999 NOK | 883/9861 | 395/6968 | 1.07 (0.96–1.19) | 0.57 (0.49–0.67) |
| 250 000–349 999 NOK | 839/12 108 | 276/6360 | 1.50 (1.32–1.70) | 1.10 (0.85–1.42) |
| 350 000–449 999 NOK | 395/8480 | 124/3400 | 1.37 (1.14–1.65) | 1.40 (0.88–2.25) |
| 450 000–549 999 NOK | 193/4414 | 41/1229 | 2.05 (1.54–2.74) | 1.38 (0.66–2.90) |
| More than 550 000 NOK | 193/5862 | 30/1006 | 1.50 (1.19–1.90) | 2.00 (0.76–5.24) |
| Unknown income | 168/1498 | 49/517 | – | – |

a: ORs were derived from separate models for sickness absence due to mental illness, education and income; the reference was people without physical sick leave within each stratum of mental illness, education or income; the ORs were adjusted for marital status, place of residence, immigration background and the main effect of mental illness, education or income as well as age and calendar time through matching. Interaction test: interaction by mental illness: $\chi^2=72.04$, $P < 0.0001$ for males; $\chi^2=8.00$, $P=0.009$ for females; interaction by education: $\chi^2=60.08$, $P < 0.0001$ for males; $\chi^2=53.95$, $P < 0.0001$ for females; interaction by income: $\chi^2=6.66$, $P = 0.008$ for males; $\chi^2=4.24$, $P = 0.045$ for females.

the group of diagnosis unspecified was associated with an increased risk of suicide in both males and females (table 2).

Additional analyses were performed to ascertain the effect of specific clinical diagnoses, defined according to the Statistic Norway classification,²⁰ including cancer, diabetes, heart diseases, cerebrovascular diseases, allergy-related illnesses and accidents or injuries. A significantly increased risk of suicide was observed among males on leave from work because of cancer (adjusted OR: 2.27, 95% CI: 1.61–3.21) and accidents or injuries (adjusted OR: 1.43, 95% CI: 1.24–1.65). However, such associations were not observed among females (data not shown).

Effect differences by socioeconomic status and mental illness

There were significant differences in the effects of sickness absence due to physical illness on suicide risk by socioeconomic status for both males and females (table 3). For males, a history of physical illness resulting in sick leave was a significant risk factor for suicide across all education and income levels, except those at the lowest education and income levels (under 250 000 NOK per year). For females, a history of physical sickness absence was associated with a reduced risk of suicide for those at the lowest education and income levels, but an increased risk for females with high education (tertiary education) and high income levels (table 3).

At the same time, the association between physical sickness absence and subsequent suicide risk interacted significantly with a personal history of sickness absence due to mental illness (test of interaction: $\chi^2 = 72.04$, $P < 0.0001$ for males; $\chi^2 = 8.00$, $P = 0.009$ for females). Further examination of this interaction revealed that the history of mental sickness absence eliminated the risk associated with physical illness. Specifically, physical sickness absence was a significant risk factor for suicide among males without mental illness, whilst it was associated with a reduced risk of suicide among males with a history of mental illness (table 3).

Discussion

Key findings and interpretations

This national register-based study shows distinct gender-specific associations between sickness absence due to physical illness and subsequent suicide, not only for effect size but also for effect direction. More specifically, physical illness resulting in sick leave is associated with an increased risk of suicide in males but a reduced risk of suicide in females. These findings differed from those of some previous studies, perhaps because those studies mainly considered serious physical illnesses resulting in hospitalization.^{5,6} A possible explanation could be that most people with physical sickness absence are likely to have milder physical problems.^{7,8} This is most pronounced in females, who, at least in the Norwegian context with good access to taking sick leave, have a higher rate of sick leave and for less severe physical illnesses.^{21,22} This could partly explain the gender differences we found. Another explanation could be that, since females more often have physical illness-related sick leave, they would also more frequently be seen by a doctor,⁸ which creates an opportunity to express or disclose problems, e.g. depression, anxiety or substance abuse and get treatment, and this would lead to a reduced risk of suicide. These notions could also help to explain the inconsistency of our findings with other studies linking sickness absence due to some specific somatic diagnoses with an increased risk of suicide for both genders.¹⁴ On the other hand, sickness absence is not only an expression of sickness but also an indicator of the individual's need and willingness to take time off to meet health and other demands,^{10,23} for which there are great gender differences. For instance, females may perceive caregiver roles of higher importance than do males,^{23,24} and thus are more willing to take a sick leave when feeling unwell.^{25,26} Whereas males may see job being more important and have higher thresholds to attend to their own needs.^{24,27,28} Once on temporary leave because of physical problems, females may cope well with the situation whilst males may have more concerns and fears about possible social loss, marginalization and stigmatization induced subsequently.^{29–31}

Our finding of a high suicide risk for males with sickness absence due to physical illness is in line with previous studies.^{13,14} Our study adds the insight that the risk of suicide increased progressively with increasing number of spells of physical sickness absence and with increasing duration of the most recent physical sickness absence. While multiple and long-term sickness absences due to physical illness may be related to the severity of the somatic disorder, the absences might also affect the individual's socioeconomic life situation and mental health.³² Our study also shows that most organ specific diagnoses, including digestive, musculoskeletal and neurological systems as well as cancer and accidents/injuries, were linked to a significantly increased risk of suicide, which are consistent with the findings from early studies on these illnesses.^{4,6,14}

Furthermore, this study finds that people with an unspecified diagnosis for the last sickness absence were at a significantly increased risk for suicide. In the context of Norwegian welfare system, the group with unspecified diagnosis, includes people who are not able to work because they need to take care of seriously ill children or terminally ill family members. The psychological strain of having and caring for seriously ill children and other family members and possibly suffering bereavement might be a reason for the higher suicide risk in this group. While we are aware that this data may represent an exposure differing from own physical illness, these findings are indicative for further studies on suicide associated with sick leave because of family reasons.

For both males and females, a higher education or income entailed a stronger link between physical illness absence and risk of subsequent suicide. For people with good education and income, sick leave due to physical illness may imply that more will be lost in terms of career development, economic situation, social status and self-esteem, and thus have a stronger impact on the risk of subsequent suicide.²⁷ This finding is concordance with the report from Statistics Norway that people with a lower education or lower income levels were more dependent on social assistance, e.g. sickness benefits.³³

Moreover, this study showed that the association between physical sickness absence and suicide interacted significantly and negatively with a history of sick leave due to mental illness. One explanation might be that people with a sickness absence with comorbid mental and physical illness, may receive better attention and treatment. Since physical and mental illnesses are often intertwined, treating one of them may prevent the effects of the other on the risk for suicide.³⁴ These findings are consistent with previous reports that mental illness is an important confounding or mediating factor in the link between physical illness and suicide risk.^{34,35}

Strengths and limitations

A major strength of this study is the use of national longitudinal registers that contain data collected systematically and without any specific research purpose. This enables inclusion of a large and representative sample from the national population and that our data are not prone to, e.g. biases induced by recall of information. To our knowledge, this is the first population-based study investigating suicide in relation to physical illness resulting in sick leave in the context of sickness absence due to mental illness and socioeconomic factors.

The study has several limitations. Firstly, data on illness were based on the sickness benefit register. The diagnostic system used for sick leave certification (ICPC-2) and the context in which it is used, do not allow for fine-grained analysis of different diagnoses.¹⁷ This dataset also contains a high number of sick leaves with unspecified diagnosis, i.e. because of the need to take care of ill family members. Secondly, only the diagnosis for the most recent sick leave spell was used to assess the relationship between the specific physical problems and suicide risk, leaving recurrence of specific physical illness unconsidered. But the recurrent data may reflect the severity of the diseases, and could potentially have better

predictive value for the risk of suicide. Our data covered a long study period but not a lifetime for many participants. Additionally, our study participants comprised a working age population; however, our data were not adjusted for types of occupation.

In conclusion, the association between physical sickness and the risk of suicide appears to vary significantly by gender in the Norwegian labour force. Males with a history of sick leave due to physical illness appear to have a significantly increased risk of subsequent suicide, particularly if they have neurological disease. This study also adds to existing evidence that the link of physical illness resulting in sick leave with subsequent suicide risk interacts significantly with the history of sickness absence due to mental illness, education background and income levels. These results could inform suicide preventive efforts directed at the working population in Norway and in countries with a comparable welfare system. In practice, general practice holds a strong and vital position in the health system in Norway and many other countries.^{17,36} Provision of training to general practices in the early detection of mental illness in patients with physical illness might improve suicide prevention in primary care. Moreover, follow-up by workplaces and occupational health services aimed at employees, who experience health problems, and measures to adjust their working conditions, could shorten sickness absence and might thereby have an effect on preventing suicides. This calls for a close collaboration between workplaces, general practitioners, occupational health services and mental health care services.

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Conflicts of interest: None declared.

Key points

- Physical illness requiring absence from work was linked with an increased risk for suicide among males but not females of 18–66 years old in Norway.
- Suicide risk associated with physical illness was higher in both males and females with higher levels of education and income.
- The association between physical illness-related absence and suicide risk was eliminated by a history of work absence due to mental illness.
- The findings underscore the importance of a close collaboration among the workplace, general practitioners, occupational health services and mental health care services.

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