Sickness Absence and Disability Pension Among Patients With Chronic Pain in Interdisciplinary Treatment or Unspecified Interventions

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Abstract: Interdisciplinary treatment is a widely implemented strategy for the rehabilitation of patients with chronic pain. A primary treatment objective is to decrease the load on the social insurance system; however, it is questionable whether interdisciplinary treatment reduces sickness absence and disability pension (SA/DP). This register-based observational study compared SA and DP between patients in interdisciplinary treatment and unspecified interventions. With data from 7,752 Swedish specialist health care patients in their prime working age, we analyzed total net SA/DP days over 3 years from the first visit to a pain rehabilitation center. A zero-one-inflated beta model, adjusted for theoretically substantiated confounders, was used to estimate the mean differences in total days and the proportions of patients with both zero and maximum days. Compared with unspecified interventions, interdisciplinary treatment resulted in a mean (95% confidence interval) absolute increase of 50 (37, 62) total days, a 13.0% (11.3%, 14.6%) decrease in patients with zero days, and a 1.5% (0.2%, 2.8%) decrease in patients with the maximum days. These findings support that interdisciplinary treatment increases SA/DP compared to less intensive interventions but reduces the risk of maximum days, implying that it is advantageous for patients with the highest absence. This highlights the need for improved patient selection procedures and the adaptation of interdisciplinary treatment programs to more adequately target SA/DP reduction.

Perspectives: This study provides an accessible overview of SA/DP among working-age patients with chronic pain in Swedish specialist health care. It also shows that interdisciplinary treatment does not decrease SA/DP more than alternative treatments in most patients but is advantageous for the patients with the longest absence.

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E very third to forth adult suffers from a chronic pain condition.1,2 It is a highly variable experience, that, beyond the physical sensations, encompasses everyday impairments, emotional distress, and social deprivation.1,3 From a societal perspective, its consequences represent a burden corresponding to 3 to 10% of gross domestic product in Western economies, most of which typically is attributed to productivity loss from absenteeism.4,5 Further, prolonged sickness absence and disability pension (SA/DP) are itself associated with decreased well-being.5 Consequently, the reduction of
SA/DP is an established public health priority in the Western world. In Sweden, a 2009 government policy was implemented to facilitate access to evidence-based treatment of chronic pain specifically for this purpose.

Interdisciplinary treatment (IDT) is the most comprehensive chronic pain intervention offered in Sweden today, nationally funded with the specific aim to decrease SA/DP.

IDT is recognized as a chronic pain core intervention by field experts internationally. It is theoretically grounded in the biopsychosocial model of illness, which postulates that natural course depends on dynamic interactions between multifactorial processes. Adapted to the patient’s individual needs, IDT programs consist of physical, psychological, and social measures concurrently directed at the different facets of chronic pain. However, the heterogeneity of chronic pain combined with the flexibility of IDT programs has posed a problem for methodologically sound effectiveness evaluations. For this reason, the evidence in support of IDT remains limited, despite its strong theoretical foundation and the numerous studies conducted over time.

In a recent publication, we reported that patients in IDT received more SA/DP than patients in other interventions over a 5-year period from specialist health care entry. Our findings raised valid concerns by active members of the Swedish Pain Society in 2 editorial letters. Most comments pertained to unfamiliarity with our methodological approach of target trial emulation, which we addressed elsewhere. Otherwise, 2 important shortcomings included the pooling of full and partial SA/DP days into a gross total and the inclusion of clinics without reference treatments. Indeed, both the failure to consider the degree of SA/DP and the intervention overlap due to variable IDT programs across clinics could have introduced meaningful bias. Besides these concerns, it is plausible that SA/DP is captured less accurately in individuals under education or near retirement than in those active on the labor market. In light of these limitations, this study compared net SA/DP days between patients with chronic pain in their prime working age in IDT or unspecified interventions at moderate-to-high volume clinics.

### Methods

#### Design

This register-based observational cohort study examined the net SA/DP days among patients in IDT programs and unspecified interventions from 3 years before to 3 years after Swedish specialist health care entry. The total SA/DP days for the final 3 years were contrasted between the 2 treatment types by emulating a hypothetical scenario where all patients entered both IDT and unspecified interventions. The sampling frame was the Swedish Quality Registry for Pain Rehabilitation, which covers patients with chronic pain, referred from mainly primary care to pain specialist clinics nationally. Patients with chronic pain for at least 90 days in the ages 30 to 50 years that had visited a specialist clinic with an annual volume of a minimum 20 patients in both IDT programs and unspecified treatments during the period 2011 to 2015 were included. Patients with a registered ICD-10 neoplasm diagnosis (C00-D49) in the previous 5 years, any amount of DP in the previous 5 years, or a visit to an IDT specialist clinic in the previous 2 years were excluded. Information on SA/DP, stored in the Micro Data for Analysis of the Social Insurance register, was obtained from the Swedish National Board of Health and Welfare.

Registers were linked via the unique personal identification number held by all Swedish residents. This study was approved by Uppsala’s Medical Research Ethics Committee (DNR 2018/036) and all patients signed a written informed consent. The Supplementary Materials contain study details: the patient selection procedure in Supplementary Fig 1.1; SA/DP trends by clinic in Supplementary Fig. 2.1 to 2.3; our conceptual model in Supplementary Fig 3.1; the outcome distribution in Supplementary Fig 4.1; the confounder distribution in Supplementary Fig. 5.1 to 5.2; missing data management in Supplementary Fig. 6.1 to 6.3; statistical analyses in Section 7.1, Supplementary Tables 7.1 to 7.9, and Supplementary Fig. 8.1 to 9.10.

### IDT and Unspecified Interventions

IDT is defined here according to the criteria by the International Association for the Study of Pain. In Swedish specialist health care, IDT is offered to patients by approximately 40 clinics nationwide that report data to the Swedish Quality Register for Pain Rehabilitation. National guidelines imply that the intervention is administered in cohesive multimodal programs by experienced interprofessional teams that collaborate to personalize care based on a biopsychosocial perspective. In practice, IDT programs vary across clinics and focus primarily on group-based activities such as cognitive behavioral therapy, physical therapy, and occupational training that are concurrently administered by a team of physicians, physiotherapists, occupational therapists, and social workers. Nearly all patients participate in modules focused at return-to-work. Although details of IDT programs for individual patients are not recorded, they typically consist of 30 to 100 hours in total that are delivered between 2 and 5 days per week over a 4 to 12-week period.

Not everyone who visits a specialist clinic is included in an IDT program. As a rule, patients are initially evaluated by the team and may be offered other unspecified interventions or simply recommendations,
depending on the outcome of the evaluation, their own preferences, health care resources, and other undetermined factors. The unspecified interventions vary in intensity but are systematically less comprehensive than the IDT programs.

**Social Insurance**

In Sweden, the typical working age is 18 to 65 years, with retirement possible from the age of 61. The Swedish social insurance system was implemented to provide economic stability in case of work incapacity. All Swedish residents aged 16 to 64 with minimum income from employment or unemployment are eligible for social insurance benefits if their ability to work is reduced due to illness or disease. SA is possible from age 16 and is granted as full or part-time (25%, 50%, or 75%) of ordinary work hours.22 Episodes of SA are generally compensated for by the employer during the first 14 days, including a qualifying period with no compensation on the first day. From the 15th day, episodes are reimbursed and recorded by the Swedish Social Insurance Agency. DP can be granted either full or part-time to individuals aged 30 to 64 when their working capacity is permanently impaired, which is recorded by the Swedish Social Insurance Agency from the first day. In this study, SA/DP included net days of registered SA and DP combined, meaning that partial days were summed into full days (e.g., 2 days with 50% SA/DP were summed to 1 full day with SA/DP).

**Conceptual Model of Intervention Group Equivalence**

Observational studies that evaluate treatment effectiveness are subject to bias when the intervention groups are baseline nonequivalent.17 To enhance comparability, it is recommended that common causes (confounders) of intervention and outcome are adjusted for in the analysis.17 In this study, we identified important confounders in the scientific literature that likely influenced both the possibility of participating in an IDT program and the SA/DP reception under the domains of SA/DP history, policy, sociodemographics, and disability (Supplementary Fig 3.1). SA/DP history is an important indicator of IDT and a strong predictor of future SA/DP, while the policy of both health care and SA/DP varies over time and with geographical region.7,27,29–33 Meanwhile, sociodemographic factors of importance included age, sex, socioeconomic status, employment status, and country of birth. It is well-known that health care utilization and SA/DP are greater among females and increase with age, while low socioeconomic status is inversely related to adequate health care and SA/DP.34–43 Employment status is likely to influence access to IDT as rapid return-to-work is prioritized by stakeholder, and unemployment reportedly increase the risk of future SA/DP.7,27,44,45 Differences in health care utilization and SA/DP patterns between foreign-born and natives are also well-documented.46–49 Finally, we considered 4 aspects of disability. Psychiatric comorbidities reportedly impact both health care access and SA/DP.27,50–54 Emotional distress and interference in everyday activities are essential dimensions of chronic pain that are positively associated with both IDT and SA/DP, while high confidence in recovery both indicates IDT and influences SA/DP.27,55–58

**Statistical Analysis**

The analysis comprised a descriptive overview and an analytical comparison. In the descriptive overview, we visualized the daily trend of mean net SA/DP days per 1,000 patients from 3 years before to 3 years after specialist health care entry for the overall sample and described the daily mean differences between groups per clinic. We also visualized the distribution of total SA/DP days for the 3-year period following specialist health care entry and constructed empirical Lorenz curves. The Lorenz curve is widely used to depict wealth inequality; it shows the cumulative percent of wealth in a given percent of the population, sorted by their wealth.59 In the analytical comparison, we focused on the total net SA/DP days over the 3-year period (1,096 days) following specialist health care entry. SA/DP differences between intervention groups were estimated conditionally on the theory-driven confounders previously described (Supplementary Fig 3.1 and Supplementary Table 7.1), applying a zero-one-inflated beta model to 0 to 1-normalized SA/DP data (gamlss 5.4-3 in R v4.2.2; R: R Foundation for Statistical Computing, Vienna, Austria).60 The zero-one-inflated beta model is a discrete-continuous mixture of the Bernoulli and the Beta distributions that allows separate modeling of the minimum, the maximum, and the in-between range.61,62 In our context, the minimum corresponded to zero SA/DP days, the maximum to 990 SA/DP days (censored from 1,096 days due to the irregular outcome distribution presented in the results), and the in-between range 1 to 989 SA/DP days. Based on the fitted model, we predicted the SA/DP for all patients first set at IDT and then set at unspecified interventions, followed by a comparison in the marginal distributions to extract relevant information. In specific, we calculated the mean difference (and ratio) in total SA/DP days and the risk differences (and ratios) in both zero SA/DP days and the ≥990 SA/DP days between the intervention groups.63,64 Continuous confounders were included with restricted cubic splines, while categorical confounders were included as dummy-coded factors (Supplementary Tables 7.2–7.8).65 Multiple imputations were used to manage confounder missingness (mice v3.14.0 in R v4.2.2).66,67 In total, we constructed 20 datasets based on an imputation model configuration that mirrored our analysis model, using predictive mean matching for continuous variables, and binary as well as polytomous logistic regression for dichotomous and ordinal variables, respectively.68 Inference was based on...
the pooled distribution of 10,000 empirical bootstrap replicates for each imputed dataset (ie, the first method in Schomaker and Heumann). Finally, we examined the robustness of our results in 3 sensitivity analyses on complete cases: 1) excluding SA/DP in the first year after specialist health care entry, 2) stratified by employment status, and 3) stratified by patients with and without SA in the year before entry.
Results

Sample Characteristics

In total, 7,752 (24.4%) of the 31,707 patients that visited a Swedish specialist clinic in 2011 to 2015 met our eligibility criteria (Supplementary Fig 1.1). Approximately half of them were included in an IDT program (n = 4,009) and the other half in an unspecified intervention (n = 3,743). Noteworthy was that IDT patients tended to have a socioeconomic advantage over the other patients, a higher degree of employment, a higher confidence in recovery, and more SA in the year before specialist health care entry (Table 1; Supplementary Fig. 5.1–5.2). Whereas data on SA/DP were complete for all patients, 427 (10.7%) of the IDT patients and 565 (15.1%) of the patients in an unspecified intervention had missingness in some covariate of the conceptual model, which decreased to 3.4% and 5.1% when confidence in recovery was excluded, respectively.

Descriptive Overview of SA/DP

The descriptive overview supported that IDT patients received more net SA/DP days than patients in unspecified interventions over the 3 years following specialist health care entry (Fig 1). As illustrated by Fig 1A, the mean SA/DP days per 1,000 patients were initially similar in both groups (IDT = 92 vs other = 104), but distinctly increased for IDT patients in the year before entry, to peak during the intervention period (IDT = 471 vs other = 352) and then converge toward the end of follow-up (IDT = 277 vs other = 269). Ultimately, SA/DP had decreased in both groups to approximately the same level as 6 months before the intervention started. The overall trend was consistent with the clinic-specific trends (Fig 1B; Supplementary Fig. 2.1–2.3). On average, mean differences in SA/DP between intervention groups across clinics were negligible at the start of the observation period with 1 day less for IDT, reached its maximum of 142 additional days for IDT adjacent to the entry, and subsequently decreased until the end to 52 additional days for IDT.

Figure 1. Descriptive overview of SA/DP. (A) Mean net SA/DP days per 1,000 patients with daily resolution. The thicker solid line represents SA/DP combined, whereas the thinner solid and dotted lines present SA/DP, respectively. The dotted vertical line and the gray box denote specialist health care entry and the assumed IDT program period, respectively. (B) Mean difference between intervention groups in net SA/DP days per 1,000 patients with daily resolution (unspecified intervention is the reference). The thinner lines represent estimates for individual clinics, and the thicker line the clinics’ unweighted mean. (C) Distribution of total net SA/DP days for the 3-year period following specialist health care entry. Bars indicate the percent of patients with SA/DP. (D) Lorenz curves in the total net SA/DP days for the 3-year period following specialist health care entry. The curves depict the cumulative percent of SA/DP for a given percent of the patients. The dotted diagonal line represents perfect equality, while a more pronounced curve signifies a more uneven SA/DP distribution.
## Table 2. Marginal Point Estimates (95% CI) From Analytical Comparison of Intervention Groups

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<tr>
<td>INTERDISCIPLINARY TREATMENT</td>
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<td><strong>Primary analysis on imputed data (n = 7,752)</strong>*</td>
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<td>Total SA/DP days</td>
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<td>% Patients with zero SA/DP days</td>
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<td><strong>Primary analysis on complete cases (n = 6,760)</strong>*</td>
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<td>Total SA/DP days</td>
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<td>% Patients with ≥990 SA/DP days</td>
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<td><strong>Sensitivity analysis on complete cases†</strong></td>
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<td>Total SA/DP days with CIs based on empirical bootstrap with 1,000 replicates.</td>
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<td>Total SA/DP days</td>
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<td>% Patients with zero SA/DP days</td>
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<td>% Patients with ≥990 SA/DP days</td>
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<td><strong>No sickness absence in the year before entry (n = 2,378)</strong>‡</td>
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<tr>
<td>Total SA/DP days</td>
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<td>% Patients with zero SA/DP days</td>
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*Estimates are based on a zero-one-inflated beta model, adjusted for the confounders described in our conceptual model. CIs are based on empirical bootstrap with 10,000 replicates.

†Estimates of total SA/DP days with CIs based on empirical bootstrap with 1,000 replicates.

‡SA/DP truncated at 620 days.

§Employment status excluded as covariate.

**Zero days of sickness absence and total days of sickness absence in the year before entry excluded as covariates from all parts of the model; covariates in model component for maximum SA/DP days reduced to IDT, sex, country of birth, employment status, confidence in recovery, and psychiatric comorbidity due to few outcome events.

††Zero days of sickness absence excluded as covariate.
Restricted to the 3-year period following entry, the distribution of total SA/DP days was positively skewed, with a large mass at zero and lesser masses at 990 and 1,096 days (Fig 1C; Supplementary Fig 4.1). The total SA/DP days were more evenly distributed in IDT patients than other patients (Fig 1D); the latter having both twice the proportion of patients with no SA/DP days and a noticeably higher proportion of maximal SA/DP days (0 days: 13.1% vs 32.0%; 1–180 days: 31.9% vs 24.0%; 181–730 days: 33.3% vs 22.9%; 731–1095 days: 19.5% vs 16.9%; 1096 days: 2.6% vs 4.7%). Overall, IDT patients received a mean (standard deviation) of 369 (361) SA/DP days per patient compared to 321 (389) SA/DP days in other patients over the 3-year period, which, on an annual basis, translated into 150 (135) versus 118 (141), 116 (138) versus 103 (141), and 103 (135) versus 100 (143) for the first, second, and third year, respectively.

**Analytical Comparison of SA/DP**

The analytical comparison supported that IDT patients received more net SA/DP days than other patients over the 3 years following specialist health care entry (Table 2). In total, the mean (95% confidence interval [CI]) SA/DP days were 371 (361, 381) for IDT patients compared to 322 (311, 332) for patients in other interventions, which corresponded to a difference of 50 (37, 62) SA/DP days. Part of the difference could be attributed to a lower proportion of IDT patients with zero SA/DP days (15.5% [14.3%, 16.6%] vs 28.4% [27.1%, 29.8%]); however, differences were not constant across the range of the outcome, as IDT simultaneously decreased the proportion of patients with ≥990 SA/DP days (9.9% [8.9%, 10.8%] vs 11.4% [10.4%, 12.4%]). Finally, all sensitivity analyses supported that IDT patients had a higher total SA/DP absence than patients in other interventions.

**Conclusions**

Our results support that IDT increases SA/DP compared to less intensive interventions, even when excluding SA/DP during the year of the intervention. After 3 years from specialist health care entry, SA/DP levels corresponded to that of 6 months prior to entry, irrespective of intervention. However, our results simultaneously suggest that IDT reduces the risk of maximum SA/DP days and proves advantageous for patients with the highest absence.

The state of evidence is inconclusive regarding IDT’s effectiveness on SA/DP. Evidence summaries report no-to-moderate effects based on mostly low-quality studies.2,9,12 One randomized experiment from 2011 provided convincing support for IDT when compared to usual care over a 10-year period (mean difference [95% CI]: 436 [1, 870] net SA/DP days).11 Contrariwise, 4 of 6 identified experiments from the past 5 years reported no advantage for IDT over usual care or brief interventions in terms of total SA/DP duration (mean difference [95% CI]: 1.3 [–9.9, 12.4] SA/DP days over 12-months; 10.8 [–6.7, 28.4] SA/DP weeks over 5 years) and 1-year return-to-work (hazard ratio [95% CI]: .94 [.63, 1.41]; .73 [.55, .96]).12–15 The 2 remaining studies found that a higher proportion of patients returned to work during the first year after treatment in IDT compared to either a brief intervention (risk ratio by month: 1.3–2.3, P ≤ .02 for 3 of 12 estimates) or usual care (absolute difference: 15.3%, P < .01).16,17 Plausible explanations for the observed disparities are the variable patient characteristics across studies, covering patients with subacute to chronic pain, and highly variable IDT intensities. More specifically, our findings suggest that positive IDT effects may be concentrated in patients with a poor prognosis, which aligns with the reports of a previous study.18 Patients that received the maximum SA/DP days had a less favorable baseline status in all the prognostic variables considered in our conceptual model, save the country of birth.

Our results are based on high-quality register data from a large population-representative sample of patients with chronic pain in Swedish specialist health care. The results are generalizable to comparable patients in their prime working age that do not receive DP at intervention start in Sweden or similar social insurance systems. The conclusions of our study are limited due to the presence of untestable assumptions. Most importantly, we assumed that the intervention groups were baseline equivalent after adjustment for our conceptual model. In practice, the intervention of individual patients is decided following a specialist team assessment, and remaining group differences due to complex arrangements of unmeasured factors are likely but would need to be considerable to reverse our findings into a clinically meaningful effect in favor of IDT. Another conceivably problematic assumption was that the compared interventions were sufficiently well-defined for consistent treatment effects. The inherent flexibility of IDT combined with the unknown characteristics of the unspecified treatments render some violations likely; however, it is reasonable to assume that IDT systematically represented a higher level of engagement with the patient. Apart from this, the methodological modifications to this study redeemed several debated limitations highlighted from our previous investigation.13–15 First, the comparison of the net rather than gross SA/DP eliminated registered SA/DP intensity differences as a source of uncertainty. Second, the consistency between sample-level and clinic-level SA/DP trends confirmed that our findings were general for Swedish specialist clinics. Third, the selected calendar period of 2011 to 2015 did not overlap with any major regulatory social insurance system changes, left a 2-year gap from the 2009-policy, and enabled complete SA/DP coverage with no outcome missingness on all patients. Fourth, by restricting the sample age range to the prime working age of 30 to 50, we avoided most patients in the educational system, left over a decade’s margin to possible retirement from age 61, and de- increased SA/DP inconsistencies due to age-related mortality to negligible levels. Finally, by adjusting for country of birth in our analyses, we mitigated potential differences in unregistered SA/DP due to emigration.
Information on ethnicity would have been preferable for this purpose, but such data is not available in the Swedish public registers; results generalizability could be impaired with population changes in the ethnicity composition.

The future of IDT evaluation presents a challenge. Sound assessment of pain interventions is methodologically difficult due to the complexity of the field of study, including broad outcome definitions, un-standardized interventions, and the inherent variability of the target population. These difficulties have brought some researchers to propose un-controlled designs over more rigorous alternatives, against the advice of research methodologists. This is an alarming practice that risks introducing bias in evidence summaries, which, in turn, could result in misdirected or diluted resources to the detriment of the patient that IDT is intended to help.

In conclusion, we compared the net SA/DP days over a 3-year period between patients with chronic pain in their prime working age that were included in IDT programs or unspecified interventions at moderate-to-high volume specialist clinics. Our results support that IDT increases SA/DP compared to less intensive interventions. Simultaneously, they show that IDT reduces the risk of maximum SA/DP days, implying that it is advantageous for patients with the highest absence. This highlights the need for improved patient selection procedures and adaptation of IDT programs to more adequately target SA/DP reduction.

Author Contributions

RLM: Designed the study, processed and analyzed the data, and drafted the manuscript. PF: Supervised the analytical procedure. PF and PJ: Discussed the results and commented on the manuscript. RLM, PJ, and PF: All approved the final version.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jpain.2023.06.009.


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40. Sumanen H, Laelma E, Lahti J, Pietilainen O, Rahkonen O: Educational differences in sickness absence trends among young employees from 2002 to 2013 in...


