

Influence of Weekday of Admission and Level of Distress on Length of Hospital Stay in Patients With Low Back Pain: A Retrospective Cohort Study

Emanuel Brunner (✉ emanuel.brunner@ksw.ch)

Kantonsspital Winterthur

André Meichtry

Zurich University of Applied Sciences

Davy Vancampfort

KU Leuven

Reinhard Imoberdorf

Kantonsspital Winterthur

David Gisi

Kantonsspital Winterthur

Wim Dankaerts

KU Leuven

Anita Graf

Kantonsspital Winterthur

Stefanie Rebsamen

Kantonsspital Winterthur

Daniela Suter

Kantonsspital Winterthur

Lukas Wildi

Kantonsspital Winterthur

Stefan Buechi

Clinic for Psychotherapy and Psychosomatics "Hohenegg"

Cornel Sieber

Kantonsspital Winterthur

Research Article

Keywords: pain management, mental health, primary care, low back pain, primary care hospital

Posted Date: November 25th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-111329/v1>

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Version of Record: A version of this preprint was published at BMC Musculoskeletal Disorders on August 5th, 2021. See the published version at <https://doi.org/10.1186/s12891-021-04529-6>.

Abstract

Background

Low back pain (LBP) is often a complex problem requiring interdisciplinary management to address patients' multidimensional needs. The inpatient care for patients with LBP in primary care hospitals is a challenge. In this setting, interdisciplinary LBP management is often unavailable during the weekend. Delays in therapeutic procedures may result in prolonged length of hospital stay (LoS). The impact of delays on LoS might be strongest in patients reporting high levels of psychological distress. Therefore, this study investigates which influence the weekday of admission and distress have on LoS of inpatients with LBP.

Methods

Retrospective cohort study conducted between 1 February 2019 and 31 January 2020. ANOVA was used to test the hypothesized difference in mean effects of the weekday of admission on LoS. Further, a linear model was fitted for LoS with distress, categorical weekday of admission (Friday/Saturday vs. Sunday-Thursday), and their interactions.

Results

We identified 173 patients with LBP. Mean LoS was 7.8 days (SD=5.59). Patients admitted on Friday (mean LoS=10.3) and Saturday (LoS=10.6) had longer stays but not those admitted on Sunday (LoS=7.1). Analysis of the weekday effect (Friday/Saturday vs. Sunday-Thursday) showed that admission on Friday or Saturday was associated with significant increase in LoS compared to admission on other weekdays ($t=3.43$, $p<0.001$). 101 patients (58%) returned questionnaires, and complete data on distress was available from 86 patients (49%). According to a linear model for LoS, the effect of distress on LoS was significantly modified ($t=2.51$, $p=0.014$) by dichotomic weekdays of admission (Friday/Saturday vs. Sunday-Thursday).

Conclusions

Patients with LBP are hospitalized significantly longer if they have to wait more than two days for interdisciplinary LBP management. This particularly affects patients reporting high distress. Our study provides a platform to further explore whether interdisciplinary LBP management addressing patients' multidimensional needs reduces LoS in primary care hospitals.

Introduction

Low back pain (LBP) is worldwide a highly prevalent and costly health problem [1, 2]. To reduce the global burden, there is an urgent need for effective and cost-efficient strategies aiming to manage LBP at all levels of health care [3]. Most patients with LBP have a favourable prognosis regarding disability and pain [4–6], and can mostly be treated in outpatient settings. However, occasionally patients with LBP are

hospitalised in primary or acute care hospitals. In Switzerland, about 6% of all people with LBP are admitted to inpatient care in hospitals [2]. This relatively small group accounts however for about 12% of the total direct costs for LBP in Switzerland, which are estimated at € 2.6 billion annually [2].

Despite the relevant healthcare burden caused by hospitalisation, inpatient care for patients with LBP remains largely unstudied. In Australia, it has been shown that patients with concurrent LBP admitted to a specialised hospital had longer LoS than those without LBP [7]. Another study from Australia investigated inpatient LBP management in different general hospitals. Results indicate that patients with LBP admitted to general medicine units stayed longer in hospital than those admitted to specialized rheumatology units [8]. Furthermore, Kyi et al. (2019) found that being a woman, aged ≥ 60 years, presence of comorbidities and a diagnosis of canal stenosis or a disc-related diagnosis were significantly associated with prolonged LoS (>4 days) [8]. To date, it is unclear to what extent psychological factors associated with LBP have an impact on LoS.

LBP is often multidimensional in nature, due to a complex interrelationships of physical, psychological, and social factors [9]. In outpatient settings, psychological factors were identified as significant predictors of poor treatment outcomes [10–12]. Therefore, it is likely that psychological factors complicate inpatient management in general hospitals. Patients with LBP wish clear, consistent and personalised information on prognosis, treatment options and self-management strategies [13]. Unclear information or inconsistent treatment strategies on the part of different healthcare professions may increase patient distress, fears and suffering. Therefore, patient-centred LBP management at primary care hospitals is a complex challenge.

Generally, patients admitted to acute care hospitals on weekends are at risk of delayed clinical management resulting in increased LoS [14]. Associations between weekdays of admission and LoS in acute care hospitals have never been explored in patients with LBP. The influence of delayed clinical management on LoS might be strongest in patients with LBP and high psychological distress. They may respond more negatively to delays and potential uncertainties regarding diagnosis and treatment options than those with lower levels of distress.

Against this background, this study aims (1) to investigate LoS in terms of weekday of admission in patients with LBP admitted to medical units at a primary care hospital in Switzerland; and (2) to explore whether the effect of the weekday of admission on LoS was moderated by patient-reported distress. We hypothesized that patients with LBP having to wait more than two days for patient-centred LBP management (due to admissions on Friday/Saturday) stay longer in hospital than those receiving multidimensional LBP management within the first two days of hospitalisation (admissions on Sunday-Thursday). Furthermore, we hypothesized that patient-reported distress moderates the effect of the weekday of admission (Friday/Saturday vs. Sunday-Thursday) on LoS.

Materials And Methods

Data collection and clinical setting

We included all patients with LBP admitted to a medical unit at the Winterthur Cantonal Hospital during a 12-month period (February 1st, 2019 until January 31st, 2020). Winterthur Cantonal Hospital is a public acute care hospital with over 28000 inpatient visits a year. In 2019, medical units had 8216 inpatients [15].

We identified patients with LBP admitted to medical units on the screening list. All patients received paper-pencil questionnaires for assessing health-related personal data at the initial physiotherapy consultation. We asked patients to complete the questionnaire and to sign the informed consent document concerning the use of health-related personal data for research purposes. Patients returned the completed questionnaires to the physiotherapist.

We used two patient samples in this study (see Figure 1). To analyse the effect of the weekday of admission on LoS (Part 1), we extracted data from the hospital electronic medical records by using patient identification numbers. To record diagnoses related to specific causes of LBP ('red flags' pathologies), we investigated medical records as well. As specific causes of LBP we coded cancer, infection, trauma or inflammatory disease such as spondylarthritis [16]. To analyse the influence of the weekday of admission and patient-reported distress on LoS (Part 2), we only used data of patients having signed the consent document. We did not include patients hospitalized more than one month. In these cases, we assumed that significant complications occurred for reasons that cannot be explained by the initial LBP problem. The further use of routine health-related person data for this study was approved by the Kantonale Ethikkommission Zürich (KEK ZH: 2020-01465). All analyses were performed in accordance with guidelines and regulations from this regional ethics committee.

Low back pain management at general medicine units

Patients with LBP admitted to medical units at Winterthur Cantonal Hospital receive care according to the clinical LBP pathway aiming to facilitate a patient-centred interdisciplinary approach (medicine, physiotherapy and nursing). The pathway requires that a specialised physiotherapist assesses all patients. Physiotherapy is scheduled on the second day of hospitalisation. Immediately after the first physiotherapy session, a consultation between the physiotherapist and the physician in charge should take place. This formal meeting focuses on the diagnosis, further inpatient procedure, and discharge management.

The general aim of the interdisciplinary approach is to achieve a mutual understanding of the pain problem and to set common goals together with the patient. This interdisciplinary procedure cannot be provided during the weekend. For admissions on Friday afternoon, Saturday and Sunday, the physiotherapy assessment and the interdisciplinary meeting are postponed to Monday. On weekends, specialised physiotherapy assessments are not provided.

The physiotherapy assessment (60 minutes) is focused on hearing the full patient story regarding the cognitive and emotional experience of the pain problem. Physiotherapists aim to explore patients' beliefs, emotions, and stress responses associated with their current pain problem as well as their strategies for

coping with pain and stress. Furthermore, the assessment addresses fear-related movements or avoidance behaviour. This functional analysis aims to identify maladaptive movements or postures including extensive protective muscle activation or dysfunctional pain behaviour. In a collaborative process with the patient, physiotherapists explore patients' ability to relax trunk muscles and to normalise pain provocative postural and movement behaviours. Physiotherapists and physicians screen for specific causes of LBP ('red flags' pathologies).

Physicians are responsible for inpatient management, clinical diagnosis, diagnostic imaging, pharmacological treatment or interventional measures (e.g. surgical procedures). Attending physicians and nurses see patients daily during medical rounds focussing on diagnosis, therapeutic procedures, and discharge management. Physiotherapists do not routinely take part in these rounds. However, information from the physiotherapy assessment is incorporated into the communication between the patient and health care professionals.

Health-related personal data

We used the numeric rating scale (NRS, scale: 0-10) to measure average pain intensity over the last week. By means of the German version of the Roland Morris Disability Questionnaire (scale: 0-24), we measured back-specific function [17]. To evaluate patient-reported psychological distress, we used the distress scale of the German Four-Dimensional Symptom Questionnaire (4DSQ). The 4DSQ proved to be a valid self-report questionnaire to measure distress, depression, anxiety and somatisation in patients treated in primary care [18]. The German version of the 4DSQ has previously been validated in a sample of multimorbid elderly people [19]. The questionnaire addresses the presence of symptoms during the last two weeks. Psychological distress was conceptualized as direct manifestation of the effort people must exert to maintain their psychosocial homeostasis and social functioning when confronted with taxing life stress [18, 20]. In the four-dimensional model of the 4DSQ, distress is conceptualized as the most basic, most general or "normal" expression of psychological problems [18]. Higher scores on 4DSQ scales represent higher symptom severity.

Statistical analysis

To compare overall mean LoS in patients with and without LBP, we performed an independent t-test. For the analysis in Part 1, we used a linear model for LoS (dependent variable) with weekday of admission as predictor. If there was evidence against model assumptions after residual analysis, we conducted a Box-Cox power transformation. Based on the ANOVA, we used planned contrast to test the hypothesized difference in mean effects of the weekday of admission dichotomy (Friday/Saturday versus Sunday-Thursday) on LoS. For Part 2, a linear model was fitted for LoS (dependent variable) with continuous patient-reported distress (4DSQ distress scale), categorical weekday of admission (Friday/Saturday vs. Sunday-Thursday), and their interactions as covariates. From the fitted model coefficients, we constructed the planned contrast of interest, the difference in mean distress trend (slope) for Friday/Saturday versus mean distress trend for Sunday-Thursday. This contrast represents the modification of distress effect on LoS by day dichotomy (Friday/Saturday versus Sunday-Thursday). The

level of statistical significance was set at 0.05. We performed all analyses by using R statistical software [21].

Results

Part 1: Length of stay in patients admitted to general medical units

During the 1-year period, 177 patients were screened. Four patients were hospitalised more than one month (extreme cases: range = 31 to 54 days). We excluded four patients with LoS \geq 30 days. The mean age of the total study sample (Part 1: N=173) was 66.10 years (standard deviation, SD=16.21). Out of 173 patients, 103 were female (59.5%). In 20.8% of patients (N=36), specific causes for LBP were diagnosed, most frequently fractures (N=15), followed by cancer (N=9), infection (N=6), spondylarthritis (N=4), and cauda equina (N=2).

The overall mean LoS of all patients with LBP (N=173) hospitalised at general medical units was 7.83 days (SD=5.59). The overall mean LoS in patient without LBP (N=8072) was 6.09 days (SD=5.42). The difference in overall mean LoS between patients with LBP and patients without LBP was statistically significant ($t[df, 8244]=-4.14, p<0.001$). Figure 2 illustrates differences in mean LoS between weekdays of admission in patients with and without LBP. Table 1 provides descriptive statistics on LoS by weekday of admission in patients with LBP.

Weekday of admission	N	Mean	SD	Min	Max
Monday	32	7.28	4.59	3.00	24.00
Tuesday	28	5.89	3.98	2.00	17.00
Wednesday	21	7.05	3.71	1.00	15.00
Thursday	26	7.23	4.16	2.00	20.00
Friday	27	10.33	7.64	3.00	27.00
Saturday	19	10.58	7.24	4.00	27.00
Sunday	20	7.05	5.92	1.00	25.00

N = number of cases, SD = standard deviation; min = minimum; max = maximum.

There was a difference in patients with LBP concerning mean LoS between admissions on Friday and Saturday compared with other weekdays. The difference in mean LoS between Saturday and Sunday was 3.5 days. In patients without LBP admitted to the same medical units, mean LoS in patients ranged from 5.62 days (Monday) to 6.69 days (Saturday).

The distribution of the LoS variable in patients with LBP was right-skewed (skewness=2.14), indicating asymmetry of sample distribution. We conducted further analyses on the log transferred LoS scale. ANOVA revealed that there was a significant effect of the day of admission on LoS, $F(6, 166) = 2.53$, $p=0.023$. Planned contrasts showed that being admitted to hospital with LBP on Friday or Saturday was associated with a significant increase in LoS compared with being admitted on other days (Sunday-Thursday; estimated contrast=0.39, $t[df, 166]=3.43$, $p=<0.001$).

Part 2: Influence of weekday of admission and level of distress on length of hospitalisation

Of the total study sample, 113 (65%) patients returned the questionnaire and 101 patients (57%) signed the consent document. A complete set of data on patient-reported psychological distress (4DSQ distress scale) was available from 86 patient. This sample represents 48.9% of the total study sample (N=173).

Based on the linear model for log LoS, planned contrast revealed that the effect of distress on the log LoS was significantly modified by dichotomic day of admission (Friday/Saturday vs. Sunday-Thursday; estimated contrast=0.09, $t[df, 72]=2.51$, $p=0.014$). Figure 3 illustrates how the effect of distress on log LoS is influenced by day of admission (moderation effect). The graph revealed that patient-reported distress has no or minimal influence on LoS when patients were admitted between Sunday and Thursday. Patients with LBP with high levels of self-reported distress admitted on Friday or Saturday, however, stayed longer in hospital than those reporting lower levels of distress.

Discussion

To the best of our knowledge, this study is the first to investigate the effect of weekday of admission and patient-reported level of distress on LoS in patients with LBP in a primary care hospital. Results show that patients with LBP hospitalised on Friday or Saturday stayed more than three days longer in hospital than those admitted on other weekdays. Although further research is necessary to explore this in more detail, it might be hypothesized that LoS could be prolonged on Fridays and Saturdays as patients have to wait over the weekend for interdisciplinary LBP management to start. Furthermore, based on the observation that the effect of dichotomic weekdays of admission (Friday/Saturday vs. Sunday-Thursday) on LoS was moderated by patient level of distress it might be hypothesized that the effect of delays in interdisciplinary LBP management on LoS is stronger in patients reporting high levels of distress.

We found significant differences in LoS in terms of the weekday of admission in patients with LBP but not in patients without LBP hospitalised at the same general medical units. The potential 'weekend effect' on LoS has been shown in primary care hospitals. A meta-analysis based on 68 studies covering 640 million admissions disclosed that patients admitted during weekends stayed approximately one day longer than those admitted on other weekdays [14]. Delayed clinical management due to the weekend may have an impact on LoS in patients with LBP. However, we found a large difference in mean LoS between Saturday and Sunday admissions (10.58 vs. 7.05 days) and not the known effect due to delayed management at weekends, and LoS was also prolonged in patients admitted on Friday. This may indicate

that patients' waiting time for individualized care has a stronger impact on clinical management in patients with LBP than in patients without LBP.

So far, effects of distress and weekday of admission on LoS of inpatients with LBP have not been explored. An effect of distress on LoS has been found previously in patients undergoing elective joint replacement or joint arthroplasty. In this cohort, higher distress was associated with longer LoS [22, 23]. Findings from these previous studies highlight the importance of addressing psychological factors before surgery and during hospitalisation. Preceding studies on elective surgical procedures did not consider the influence of the weekday of admission on LoS. The reason might be that elective procedures are mainly conducted between Monday and Friday and the hospitalisations can be well planned. In patients with LBP and high levels of distress, prolonged waiting time throughout the weekend could have a negative impact on the individual suffering with pain and thus complicate inpatient management, including planning of the discharge management.

Our results further show that the effect of contrast in weekday of admission (Friday/Saturday vs. Sunday-Thursday) on LoS was moderated by patient-reported distress. This interaction effect means that higher distress is associated with longer LoS if patients are hospitalised on Friday or Saturday. However, patient distress did not influence LoS in patients admitted between Sunday and Thursday. It might be hypothesized that interdisciplinary LBP management was sufficient in managing LBP-related psychological distress under the condition that interdisciplinary multidimensional care started on the second day of hospitalisation. This leads further to the hypothesis of patient trust as an important aspect of therapy outcome [24]. For patients with high levels of distress entering on Friday or Saturday waiting for longer time to get comprehensive and convincing care might lead to less trust in the LBP management and worse treatment outcomes expressed in longer LoS.

Implications

Although real world-interventions are necessary before we can derive clinical recommendations, the current study provides preliminary evidence for the importance of immediate patient-centred LBP management. Providing multidimensional and interdisciplinary LBP management might be easier in specialised units. However, not all hospitals have a specialised inpatient unit for patients with musculoskeletal pain. Our study offers preliminary evidence that even with an interdisciplinary team including medical doctors, physiotherapists, and nurses, LoS can likely be shortened if the interdisciplinary approach is provided within the first days of hospitalisation. However, in general medicine units at primary care hospitals diagnostic and therapeutic services are usually reduced on weekends. Although organizational changes are difficult to implement, strategies to strengthen interdisciplinary LBP management during the weekend should be explored in order to reduce LoS in patients with LBP. Shortened LoS might offer the potential of reducing direct and indirect healthcare costs associated with LBP.

Limitations

Some limitations concerning our study design should be considered. First, we used a retrospective rather than a prospective design. To investigate the value of a multidimensional physiotherapy assessment in inpatient care for patients with LBP, a prospective, controlled design would be required. Second, the study was conducted at only one specific clinical setting, limiting the external validity of our results. Third, patient data were not measured immediately at the time of patient entry but after the first physiotherapy session. The patient questionnaire used for measuring distress aims to capture patient symptoms of the last two weeks. This should describe the distress level at entry into the hospital, but nevertheless the delayed distribution of patient questionnaires could have distorted measures of psychological factors. Last, it should be taken into account that the linear model on LoS was based on the data of 86 patients having completed the 4DSQ. Nevertheless, we consider the estimations derived from this model for LoS with interactions as covariates as robust estimates of effects in the total study sample. Despite these limitations, it can be concluded that LoS in patients with LBP is significantly prolonged if it is necessary to wait more than two days for the beginning of interdisciplinary and multidimensional LBP management. The influence of prolonged waiting time at the weekend might be strongest in patients reporting high levels of psychological distress.

Future research

Inpatient care for patients with LBP remains a scarcely researched area. Our results suggest that the level of patient-reported distress influences the inpatient management of patients with LBP. Future research should further explore how patients' psychological distress relates to therapeutic processes and treatment outcomes. Objective measures of individual suffering could help to systematically capture patients' cognitive and emotional experience of pain and to develop strategies for patient-centred LBP management in primary care hospitals. For this purpose, the Pictorial Representation of Illness and Self Measure (PRISM) could be useful to measure patients' individual experience of the relationship between their pain problem and their personhood [25–27]. The tool was used in patients with rheumatoid arthritis for measuring patients' salient aspects of their personhood which have been affected by the illness and estimating how this experience contributes to their suffering [28]. A systematic assessment of patient's individual suffering would be helpful to evaluate LBP management and to develop patient-centred interventions. Furthermore, for future research should investigate why patients with LBP are hospitalized in primary care hospitals. In our study, only about 20% had specific LBP with diagnosed serious spinal pathologies such as fractures, infections, cauda equina or cancer. For the other subgroup of patients with non-specific LBP, it remains unclear why they were hospitalised and not treated in outpatient care settings. More knowledge about their characteristics and needs could help to improve inpatient care and to clarify possible care gaps in outpatient settings for this patient group.

Conclusions

Patients with LBP are hospitalized significantly longer if they have to wait more than two days for interdisciplinary LBP management. This particularly affects patients reporting high distress. Our study

provides a platform to further explore whether interdisciplinary LBP management addressing patients' multidimensional needs reduces LoS in primary care hospitals.

Abbreviations

4DSQ Four-Dimensional Symptom Questionnaire

LBP Low back pain

LoS Length of hospital stay

Declarations

Ethics approval and consent to participate:

This study was approved by the Kantonale Ethikkommission Zürich (KEK ZH: 2020-01465). Written informed consent was obtained from all patients who provided health-related personal data.

Consent for publication:

Not applicable.

Availability of data and materials:

To protect confidentiality, no raw data have been made available in any public repository. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests:

The authors declare that they have no competing interests

Funding:

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Authors' contribution:

E.B., R.I., D.G., and C.S. contributed to the study conception; E.B., A.M., R.I., D.V., W.D. A.G., D.S., S.R., L.W., S.B. and C.S. contributed to the study planning and design and interpretation of the data. E.B. and D.G. had full access to the data. E.B. and A.M. performed statistical analyses. E.B. wrote the first draft of the report. All authors reviewed the manuscript.

Acknowledgments:

We wish to thank Chantal Studer, Daniela Gomez, and Dominik Gross for their support for data collection.

References

1. Hoy D, March L, Brooks P, Woolf A, Blyth F, Vos T, Buchbinder R. Measuring the global burden of low back pain. *Best Pract Res Clin Rheumatol*. 2010;24:155–65. doi:10.1016/j.berh.2009.11.002.
2. Wieser S, Horisberger B, Schmidhauser S, Eisenring C, Brügger U, Ruckstuhl A, et al. Cost of low back pain in Switzerland in 2005. *Eur J Health Econ*. 2011;12:455–67. doi:10.1007/s10198-010-0258-y.
3. Needs C, Laurent R. Hospital admissions for acute low back pain. *Intern Med J*. 2019;49:294–6. doi:10.1111/imj.14227.
4. Artus M, van der Windt D, Jordan KP, Croft PR. The clinical course of low back pain: a meta-analysis comparing outcomes in randomised clinical trials (RCTs) and observational studies. *BMC Musculoskelet Disord*. 2014;15:68. doi:10.1186/1471-2474-15-68.
5. van den Hoogen HJ, Koes BW, van Eijk JT, Bouter LM, Devillé W. On the course of low back pain in general practice: a one year follow up study. *Ann Rheum Dis*. 1998;57:13–9. doi:10.1136/ard.57.1.13.
6. Dunn KM, Campbell P, Jordan KP. Long-term trajectories of back pain: cohort study with 7-year follow-up. *BMJ Open*. 2013;3:e003838. doi:10.1136/bmjopen-2013-003838.
7. Dennis D, Tampin B, Jacques A, Hebden-Todd T, Carter V, McLintock M, et al. The prevalence of back pain in patients in one Australian tertiary hospital population. *Musculoskeletal Care*. 2018;16:112–7. doi:10.1002/msc.1219.
8. Kyi L, Kandane-Rathnayake R, Morand E, Roberts LJ. Outcomes of patients admitted to hospital medical units with back pain. *Intern Med J*. 2019;49:316–22. doi:10.1111/imj.14075.
9. O'Sullivan PB, Caneiro JP, O'Keefe M, Smith A, Dankaerts W, Fersum K, O'Sullivan K. Cognitive Functional Therapy: An Integrated Behavioral Approach for the Targeted Management of Disabling Low Back Pain. *Phys Ther*. 2018;98:408–23. doi:10.1093/ptj/pzy022.
10. Chou R, Shekelle P. Will this patient develop persistent disabling low back pain? *JAMA*. 2010;303:1295–302. doi:10.1001/jama.2010.344.
11. Foster NE, Thomas E, Bishop A, Dunn KM, Main CJ. Distinctiveness of psychological obstacles to recovery in low back pain patients in primary care. *Pain*. 2010;148:398–406. doi:10.1016/j.pain.2009.11.002.
12. Hill JC, Dunn KM, Lewis M, Mullis R, Main CJ, Foster NE, Hay EM. A primary care back pain screening tool: identifying patient subgroups for initial treatment. *Arthritis Rheum*. 2008;59:632–41. doi:10.1002/art.23563.
13. Lim YZ, Chou L, Au RT, Seneviwickrama KMD, Cicuttini FM, Briggs AM, et al. People with low back pain want clear, consistent and personalised information on prognosis, treatment options and self-management strategies: a systematic review. *J Physiother*. 2019;65:124–35. doi:10.1016/j.jphys.2019.05.010.

14. Chen Y-F, Armoiry X, Higenbottam C, Cowley N, Basra R, Watson SI, et al. Magnitude and modifiers of the weekend effect in hospital admissions: a systematic review and meta-analysis. *BMJ Open*. 2019;9:e025764. doi:10.1136/bmjopen-2018-025764.
15. Kantonsspital Winterthur. KSW Jahresbericht 2019. 2020. https://jahresbericht.ksw.ch/app/uploads/2020/05/KSW_Jahresbericht_2019-21-WEB.pdf. Accessed 23 Jul 2020.
16. NICE. Low Back Pain and Sciatica in Over 16s: Assessment and Management. 2020.
17. Wiesinger GF, Nuhr M, Quittan M, Ebenbichler G, Wöfl G, Fialka-Moser V. Cross-cultural adaptation of the Roland-Morris questionnaire for German-speaking patients with low back pain. *Spine*. 1999;24:1099–103. doi:10.1097/00007632-199906010-00009.
18. Terluin B, van Marwijk HWJ, Adèr HJ, Vet HCW de, Penninx BWJH, Hermens MLM, et al. The Four-Dimensional Symptom Questionnaire (4DSQ): a validation study of a multidimensional self-report questionnaire to assess distress, depression, anxiety and somatization. *BMC Psychiatry*. 2006;6:34. doi:10.1186/1471-244X-6-34.
19. Exner A, Kleinstäuber M, Maier W, Fuchs A, Petersen JJ, Schäfer I, et al. Cross-cultural validation of the German version of the Four-Dimensional Symptom Questionnaire (4DSQ) in multimorbid elderly people. *Qual Life Res*. 2018;27:2691–7. doi:10.1007/s11136-018-1924-2.
20. Terluin B, Brouwers EPM, van Marwijk HWJ, Verhaak PFM, van der Horst HE. Detecting depressive and anxiety disorders in distressed patients in primary care; comparative diagnostic accuracy of the Four-Dimensional Symptom Questionnaire (4DSQ) and the Hospital Anxiety and Depression Scale (HADS). *BMC Fam Pract*. 2009;10:58. doi:10.1186/1471-2296-10-58.
21. R: A language and environment for statistical computing : reference index. [Vienna]: R Foundation for Statistical Computing; 2010.
22. Zeppieri KE, Butera KA, Iams D, Parvataneni HK, George SZ. The Role of Social Support and Psychological Distress in Predicting Discharge: A Pilot Study for Hip and Knee Arthroplasty Patients. *J Arthroplasty*. 2019;34:2555–60. doi:10.1016/j.arth.2019.06.033.
23. Halawi MJ, Chiu D, Gronbeck C, Savoy L, Williams VJ, Cote MP. Psychological Distress Independently Predicts Prolonged Hospitalization After Primary Total Hip and Knee Arthroplasty. *J Arthroplasty*. 2019;34:1598–601. doi:10.1016/j.arth.2019.03.063.
24. Birkhäuser J, Gaab J, Kossowsky J, Hasler S, Krummenacher P, Werner C, Gerger H. Trust in the health care professional and health outcome: A meta-analysis. *PLoS ONE*. 2017;12:e0170988. doi:10.1371/journal.pone.0170988.
25. Sensky T, Büchi S. PRISM, a Novel Visual Metaphor Measuring Personally Salient Appraisals, Attitudes and Decision-Making: Qualitative Evidence Synthesis. *PLoS ONE*. 2016;11:e0156284. doi:10.1371/journal.pone.0156284.
26. Büchi S, Sensky T. PRISM: Pictorial Representation of Illness and Self Measure. *Psychosomatics*. 1999;40:314–20. doi:10.1016/S0033-3182(99)71225-9.

27. Büchi S, Buddeberg C, Klaghofer R, Russi EW, Brändli O, Schlösser C, et al. Preliminary validation of PRISM (Pictorial Representation of Illness and Self Measure) - a brief method to assess suffering. *Psychother Psychosom.* 2002;71:333–41. doi:10.1159/000065994.
28. Taylor PC, Alten R, Haraoui B, Amess B, Macdonald J, Truchon M, et al. Prism – pictorial representation of illness and self measure: the use of a simple non-verbal tool as a patient-centred outcome measure in early rheumatoid arthritis cohorts. In: *Poster Presentations 2017.* 529.2-529. doi:10.1136/annrheumdis-2017-eular.4450.

Figures

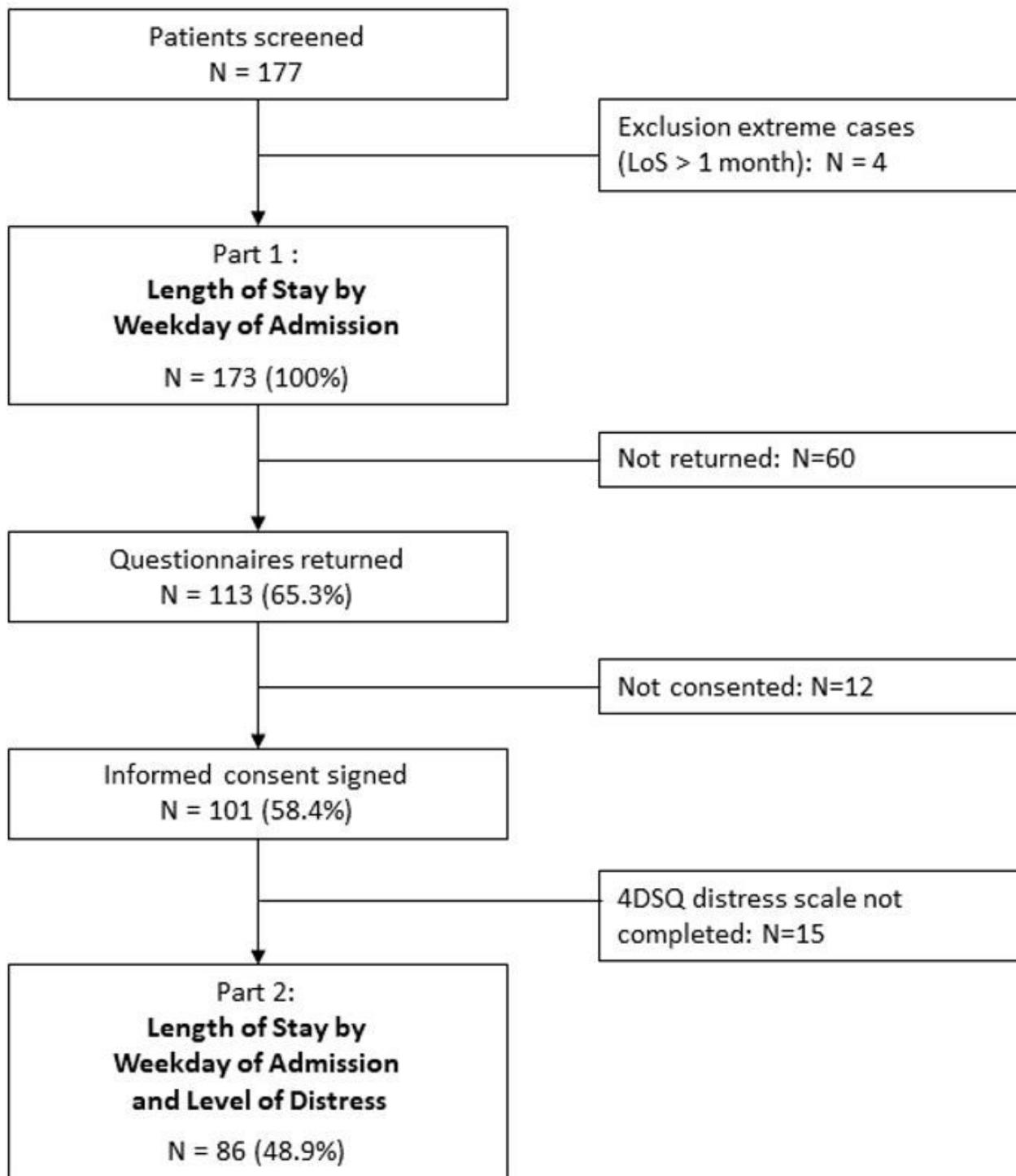


Figure 1

Study flow chart. N, number of cases; LoS, length of stay in hospital; 4DSQ, 4Dimensional Symptom Questionnaire.

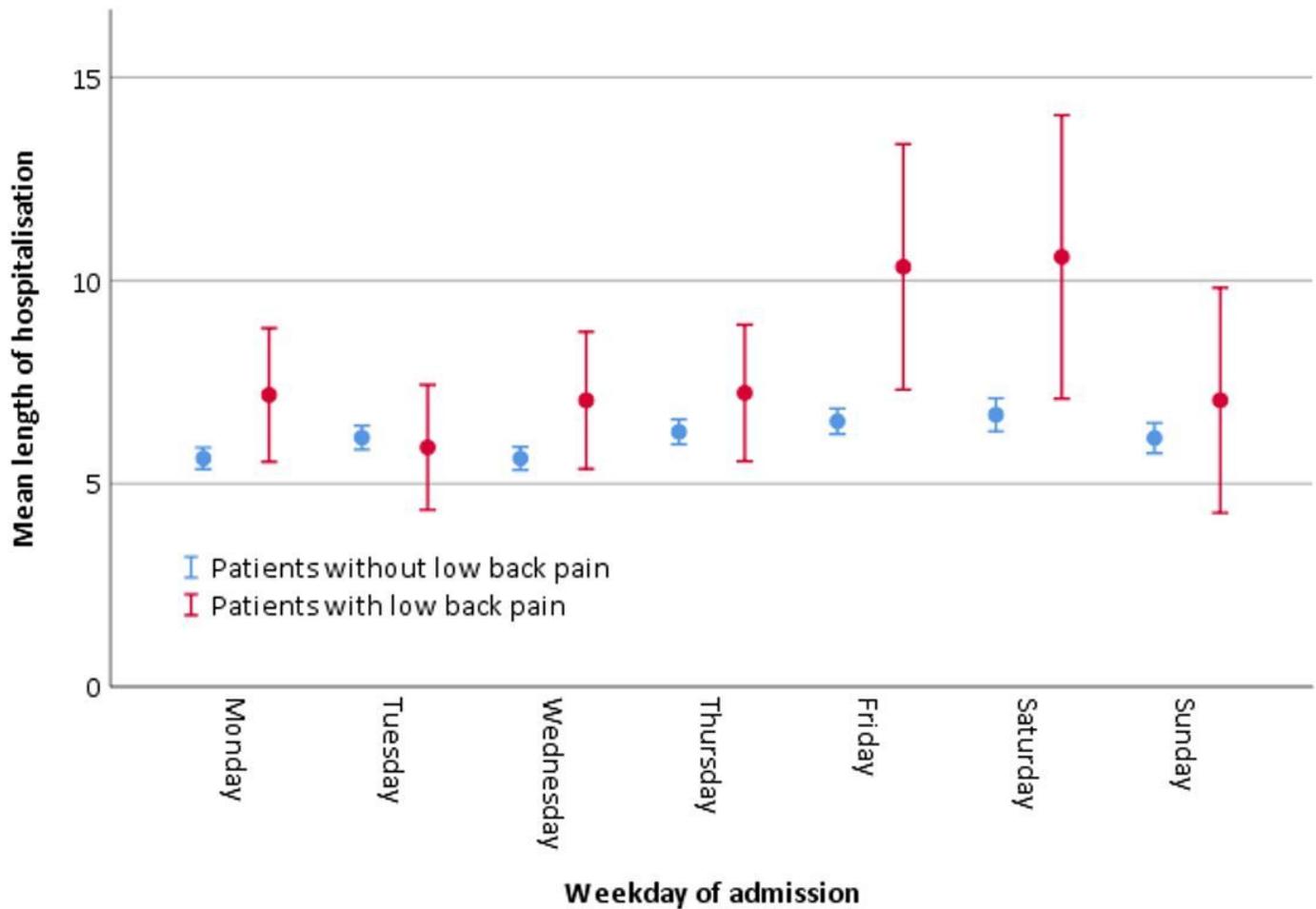


Figure 2

Mean of length of stay on general medicine units by weekday of admission in patients with LBP (N=173) and patients without LBP (N=8072). Error bars indicate 95% confidence intervals of mean values. In both samples, extreme cases with length of hospitalisation of longer than 1 month were excluded. LBP, low back pain.

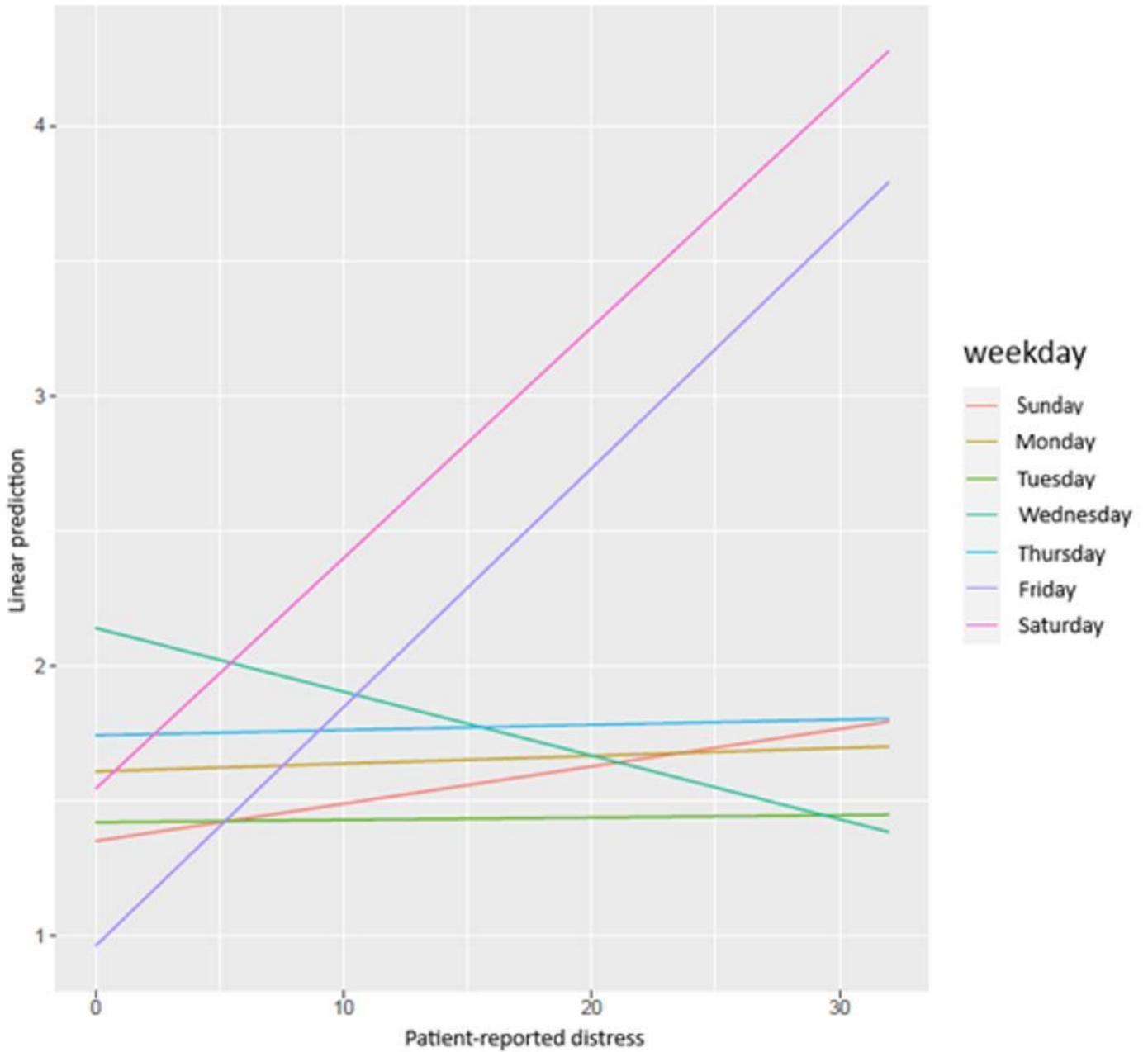


Figure 3

Illustration of the moderation effect of weekday of admission on length of stay by patient-reported distress. Linear prediction refers to prediction of log-transformed length of stay. Planned contrast between weekdays dichotomy (Friday/Saturday versus Sunday-Thursday) is based on mean slopes of patient-reported level of distress. The contrast is a linear parameter of the seven estimated slopes (contrast: -0.2 -0.2 -0.2 -0.2 -0.2 0.5 0.5).