**Comparison of patient-reported outcome measures between home and hospital rehabilitation of patients following a hip fracture**

Abstract

Background

The anticipated increase in hip fractures (HF) due to the aging of the population and the rise in patronization of healthcare services provided at home, following the COVID-19 pandemic, emphasize the pressing need to compare outcomes between home and hospital HF rehabilitation. Research that compares the two settings has focused primarily on clinical outcomes but not on patient-reported outcomes (PROs). This study sought to evaluate PROs of patients with HF in the two rehabilitation settings.

Methods

This study was a longitudinal observational multi-center trial among patients with HF. PROs were measured using the SF36 questionnaire that evaluates eight themes: physical functioning, physical role-limitation, bodily pain, general health, vitality, social functioning, emotional role-limitation, and mental health. Patients were assessed at three points in time: 24–48 hours, 2 weeks, and 3 months after surgery. The first assessment was retrospective and reflected pre-fracture health quality and functionality. Descriptive statistics and mixed effect logistic regression were used to compare the two settings.

Results

 A total of 86 patients with HF participated in the study; they included two groups, 45 and 41 patients in the hospital and home rehabilitation groups, respectively. With the exception of bodily pain, the measures of the SF36 were not significantly (P <0.05) different in improvement from the pre-fracture status to recovery, 3 months post-facture, between the two groups. In both groups, the physical and mental scores decreased 2 weeks after the HF, in comparison to the pre-fracture status. The patients' health statuses improved somewhat 3 months after the fracture but did not return to the pre-fracture score.

Conclusion

PROs of home and hospital rehabilitation were similar, suggesting that for suitable patients, rehabilitation at home can be as effective as hospital rehabilitation. PROs enable a richer and more comprehensive understanding of the health outcomes of patients with HF in different rehabilitation settings. This process of patient-centered care can improve quality healthcare in a growing population of patients.

**What is already known on this topic?** Following the COVID-19 pandemic, the number of patients with hip fractures discharged to continue rehabilitation at home has increased. Studies comparing home-based and hospital-based rehabilitation have focused primally on clinical outcomes but not on patient-reported outcomes (PROs). PROs can broaden our understanding of patients’ experiences and outcomes throughout the recovery process.

**What does this study add?** PROs of home and hospital-based rehabilitation were similar, suggesting that home rehabilitation is as effective as hospital-based rehabilitation.

**How this study might affect research, practice, or policy**? Findings from this study can help medical staff in deciding rehabilitation plans for patients with hip fractures and support the planning of policies on our preparedness for the growing need for rehabilitation units.

Introduction

Hospital admission rates of patients with hip fractures (HF) have increased substantially in the past decade (1) In older adults, HF is associated with poor outcomes, high costs, and a long rehabilitation process (2,3) Post-HF rehabilitation has been designed to reduce the effect of fractures on long-term disability (4), decrease the risk of mortality (5), and improve patients' quality of life (6).

Rehabilitation following an acute HF hospitalization can be performed in a hospital or at home (7). The decision to rehabilitate at home or hospital is dependent on social, medical, and cognitive determinants. Patients are referred for home rehabilitation, if they have a caregiver at home, do not require close medical attention, and/or are permitted to ambulate (8).

Multidisciplinary rehabilitative care has been reported to have a positive outcome in patients recovering from a HF (9,10). This treatment includes healthcare delivery by multiple health professionals, such as nurses, physicians, physiotherapists, occupational therapists, social workers, and dietitians. In Israel, post-HF rehabilitation is multidisciplinary and cost-free in both settings (8).

Rehabilitation in both settings has its objective advantages and disadvantages. Hospitalization of older adults with HF has been associated with an increased risk of infections (11) and cognitive and functional deterioration (12,13). In contrast, home care has been designed to reduce iatrogenic complications and hospitalization-related expenses and honor patients' wishes to stay at home (14). However, rehabilitation at home may lead to less medical attention and a burden on family caregivers (15–17).

Due to the aging of the population, the need for rehabilitation, in general, and home-based rehabilitation has increased in recent years (18). This change became increasingly evident when the advent of the COVID-19 pandemic made older adults afraid to leave their homes for treatment in medical facilities due to the risk of infection (19). Outcome comparisons of the two settings can help healthcare professionals recommend the best-suited rehabilitation setting for patients with HF and support policy planning by improving the preparedness for the growing need for rehabilitation units (14).

Previous studies on the comparison of both settings primarily focused on clinical and functional outcomes (20,21) but not on outcomes that are meaningful to the patient. In recent years, the use of patient-reported outcomes (PROs) in healthcare has increased (22,23). PROs are measured using validated questionnaires that assess the symptoms, function, and quality of life from the patient’s perspective. Therefore, the need to measure patient-valued outcomes is warranted (24). The aging global population and predictable increase in the incidence of HFs emphasize the need to establish outcome sets that would be most meaningful to patients. This study sought to evaluate PROs of patients with HF in home-based and hospital-based rehabilitation settings.

**Methods**

*Study design*

This study was a longitudinal observational multi-center trial among patients with HF. The study was designed based on the Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) statement (25).

*Study-Setting*

Study participants were recruited from the two largest tertiary medical centers in the Middle East, the Sheba Medical Center, and Hadassah Medical Center, during the period from December 2021 to November 2022.

*Participants*

The inclusion criteria included (a) age of ≥60 years; (b) history of femoral neck fracture stabilization; (c) ability to understand and sign the informed consent form; and (d) ability to understand Hebrew. The exclusion criteria included (a) diagnosis of pathological fractures and (b) presence of a severe hearing disability.

Participants were recruited from two groups. Group 1 included patients who were discharged from the orthopedic department to their homes and received a visit from a member of the rehabilitation at-home team within 24–48 hours. Group 2 included patients who were admitted to the rehabilitation department directly from the orthopedic or emergency department. Patients were allocated to a specific group at the discretion of the medical team but not for the purpose of research. The setting was decided based on meetings between the clinical team, including the social worker, nurse, and medical team, and the patient with his/her family. The plan of discharge was decided by the medical team based on clinical and social criteria, such as patients' comorbidities, cognitive status, and social support. Group 2 participated as a control group in a different study.

Rehabilitation therapies in both settings were similar and included an integrative treatment approach by a multidisciplinary staff of geriatricians; orthopedic and rehabilitation specialists; nurses; dietitians; physiotherapists; and occupational, emotional, and speech therapists.

*Data collection*

At baseline, demographic and clinical data, including co-morbidities, functional status prior to fracture, and social support, were collected from patients' hospital and community medical files.

*Outcome Measurements*

PROs were measured using the short form (SF)-36 questionnaire. Although the SF36 is a general questionnaire that addresses specific conditions (28,29), it has been found to be suitable for measuring PROs in patients with HF (26) and evaluating recovery after lower extremity trauma (27). It consists of 36 questions that address eight themes: physical functioning, physical role limitation, bodily pain, general health, vitality, social functioning, emotional role limitation, and mental health. Results are interpreted by calculating scores for each topic and summarizing scores of several topics to generate a physical component score (PCS) and mental component score (MCS) (30,31).

Measurements were performed three times: 24–48 hours after surgery while hospitalized (T1), 2 weeks post-surgery (T2) while hospitalized or by phone, and 3 months later by phone (T3) (See Figure 1 for timeline). The first time point involved a retrospective assessment and reflected health quality and functionality before the fracture (32).

*Statistical measures*

Descriptive statistics were used to outline the patient's demographics and medical history. T-test and Chi-Square were used to detect differences in the characteristics of the groups. SF36 data were scaled; therefore, possible scores ranged from 0 (poor health) to 100 (excellent health) for the eight domains. Additionally, PCS and MCS that have been reported to be responsive in orthopedic conditions (35) were calculated. The calculations were performed according to the RAND Corporation website ([36-Item Short Form Survey (SF-36) | RAND](https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form.html)) and the oblique (correlated) factor solution that is recommended for orthopedic patients (36).

Mixed effect logistic regression was used to compare PROs. The mean scores were adjusted for age, sex, and Charlson co-morbidity index (CCI) (37), which is a predictive score of health outcomes in patients with HF (3,38). The PROs were not adjusted for fracture and surgery type, as others have reported no association between health-related quality of life and surgical approach (39–41). The minimal important difference (MCID) was calculated, assuming that changes of 9 points in one of the subscale scores and 2 points in the PCS and MCS of the SF36 are considered as the MCID (42,43). MCID was compared between the two groups and among assessment time points (pre-fracture and 2 weeks after (T1-T2), 2 weeks and 3 months after fracture (T2-T3), and pre-fracture status and 3 months post-fracture (T1-T3)).

The data were managed with Excel 2016 and analyzed using IBM SPSS Statistics for Windows Version 27 and Stata version 15.0.

*Sample size*

 The sample size was determined using Winpepi 11.65. We considered a change of 9 points in one of the subscales of the SF36 to be the MCID (42). To detect a difference of 9 points on the subscale, assuming a standard deviation of 10 points and a power of 80% and P <0.05, a sample size of 20 participants in each group was required. Accounting for possible attrition due to the unfortunate increased risk for deterioration and mortality following a HF (44), we set a goal to increase the sample size of each group by at least 50%, totaling a minimum of 30 participants in each subgroup.

*Ethics approval and consent of participation*

The study was approved by the ethics committees of Sheba (#SMC-7933-20) and Hadassah Medical Centers (#HMO-0691-21). All participants provided written informed consent before enrolling in the study.

Results

*Characteristics of participants*

 Eighty-six patients with HF participated in the study; 45 and 41 patients underwent rehabilitation in the hospital and at home, respectively (see Figure 2 for the description of study participants’ groups and follow-up at 2 weeks and 3 months later). With the exception of age and CCI, all other characteristics were similar between both groups (P >0.05) (see Table 1). No differences in demographic, clinical, and social characteristics were found between study participants and patients excluded from the study (n=141) for self-reported reasons, such as health issues, hearing difficulties, and language barriers (P >0.05).

Table 1: Comparison of characteristics between inpatient and home groups

|  |  |  |  |
| --- | --- | --- | --- |
|  | Inpatient rehabilitation | Home rehabilitation | P-Value |
| Age, Mean (SD) | 82.4 (7.6) | 77.24 (7.7) | 0.02 |
| Woman, n (%) | 33 (73) | 25 (61) | 0.183 |
| Charlson co-morbidity score, Mean (SD) | 5.3 (1.6) | 4.5 (1.8) | 0.023 |
| Days from hospitalization to surgery, Mean (SD) | 1.4 (1.2) | 1.16 (0.9) | 0.96 |
| Days from hospitalization to rehabilitation, Mean (SD) | 7.02 (4.2) | 8.3 (4.4) | 0.12 |
| Extracapsular fracture, n (%)  | 33 (73) | 29 (71) | 0.81 |
| PFNA (or other nailing) n (%) | 33 (73) | 31 (75) | 0.21 |

*PROs*

Response rates were 100%, 98%, and 91% at T1, T2, and T3, respectively. Figure 3 presents the physical and mental summary scores, adjusted for age, sex, and CCI, of the participants in the home and hospital groups. No significant differences in the scores (P <0.05) were observed when comparing the PROs scores between both groups at T1, T2, and T3. In both groups, the physical and mental scores plummeted 2 weeks after the HF (T2), in comparison to the pre-fracture status (T1). As presented in Table 2, this deterioration was MCID in all health domains and the two summary domains, PCS and MCS. The patients' health statuses improved somewhat 3 months after the fracture (T3). This difference was MCID primarily for the physical health domains (PCS, physical function, and pain) and MCS.

With the exception of physical function, in all of the SF36 health scores, the home and inpatient groups had similar declines 2 weeks after their fractures in comparison to their pre-fracture status. With the exception of bodily pain, no significant (P <0.05) differences in improvement from T1 and T3 were observed between both groups.

Table 2: Comparison of the difference in PRO scores among time points (T1-T2, T2-T3, T1-T3) in the inpatient and home groups adjusted for sex, age, and CCI

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Delta between times | PF, Mean (SE)  | RL, Mean (SE) | BP, Mean (SE) | GH, Mean (SE) | V, Mean (SE) | SF Mean (SE)  | EL Mean (SE) | MH Mean (SE) | PCS Mean (SD) | MCS Mean (SD) |
| Home | T1- T2 | 61.34\* | 73.65 | 38.14 | 12.39 | 21.76 | 31.34 | 19.89 | 15.4 | 34.86 | 16.35 |
| T2 -T3 | -34.38 | -38.16 | -8.34 | 0.27 | -7.27 | -3.18 | 0.17 | -2.41 | -14.99 | -2.49 |
| T1- T3 | 26.92 | 35.47 | 29.8\* | 7.84 | 15.01 | 28.16 | 20.06 | 12.98 | 20.45 | 13.87 |
| Hospital | T1- T2 | 46.38\* | 56.85 | 25.41 | 14.77 | 16.09 | 24.26 | 16.11 | 9.31 | 27.38 | 12.15 |
| T2 -T3 | -30.13 | -24.96 | -17.31 | -9.1 | -8.42 | -12.18 | -13.81 | -4.07 | -14.67 | -6.19 |
| T1- T3 | 16.25 | 31.89 | 8.1\* | 5.67 | 7.67 | 18.08 | 2.3 | 5.24 | 12.71 | 5.96 |

\*Values in a row that differ statically (P <0.05) when compared between groups, home, and hospital groups, at the 5% probability level according to the multi-analysis regression. PF- physical functioning, RL- physical role limitation, BP- bodily pain, GH-general health, V- vitality, SF social functioning, EL-emotional role limitation, MH- mental health. PCS- physical component score, MCS-mental component score.

Discussion

The findings suggest that the rehabilitation setting did not influence PROs. Therefore, the choice of rehabilitation setting should be based on other factors, such as the patient and family/caregiver’s preference and ability to provide homecare and the patients' medical condition. For the pre-fracture evaluation, the hospital group had a lower SF36 score than the home group. Expectedly, patients with more co-morbidities are often referred for inpatient rehabilitation, as opposed to home rehabilitation (45,46). For a more balanced comparison of both groups, the outcomes were controlled for age, sex, and CCI. However, although the preliminary SF36 score of the home rehabilitation group was higher than that of the inpatient population, the outcomes were mostly similar (P >0.05).

The findings from this study are consistent with findings from previous studies that compared clinical outcomes, such as 30-day readmission rates, mortality rates during or 90 days after rehabilitation, and functional improvement. No significant difference in these outcomes were observed between home-based rehabilitation and hospital care (20,47–50). In fact, patients undergoing home rehabilitation have been reported to experience fewer adverse events (51), such as infections (52). Additionally, home rehabilitation has been found to have a positive effect, in the early stages of rehabilitation, on patients’ balance confidence (17), self-efficacy (53), functionality (54), time-space orientation, collaboration (50), and even caregivers’ burden (55). These findings are consistent with findings from studies that compare PROs of acute patients undergoing rehabilitation at home and hospital (16). They suggest that patients with HF can be managed at home while achieving equivalent outcomes and using lesser resources than those being managed in inpatient settings (56,57). This information is especially valuable due to the shortage of rehabilitation beds in long-term facilities (58).

PRO data provided a richer understanding of the outcomes, functionality, and well-being of patients with HF throughout time. As expected, patients' physical and functional statuses were altered by the fracture. However, our findings suggest that a HF affects general, emotional, and mental health and social functioning. A sharp decline in SF36 scores post-HF and only a partial recovery after rehabilitation have been reported previously (40,41). Jaglala (59) reported that the same trend continues 6 months post-fracture.

*Strengths and limitations*

The study demonstrated several strengths that were not reported previously. Others (14) have stressed the importance of conducting studies that compare the outcomes of home-based and hospital-based care. This study examined the PROs of patients with HF undergoing home and hospital rehabilitation. In contrast to previous studies, which compared quality of life between patients with HF undergoing home rehabilitation and those undergoing no treatment (17,51,55,60–63) or had small sample sizes (50,64), our study measured the PROs of inpatient and home rehabilitation. As such, we performed a more balanced comparison between the two rehabilitation settings. This study had relatively higher response rates in all age groups than other HF PRO studies (54–15%), which reported a lack of representation of older adults (65–67). The high response rates could be due to the use of a single questionnaire that reduced survey fatigue (68) and the use of sequential methods, in-person and phone-based assessment, which has been associated with higher survey response rates (69). Unlike other studies (70), we collected patient pre-fracture PROs and evaluated the effect of HF on patients. To our knowledge, this study is the first PRO study in Israel to focus on the context of real-practice rehabilitation settings of patients with HF. The study was conducted in two large tertiary hospitals, and the results can serve as a benchmark for the comparison of future PROs in patients with HF.

A possible limitation is that naturally, this study cannot evaluate if patients who received rehabilitative care in the hospital would have had similar improvements if they were cared for at home and vice versa. Additionally, factors, such as socioeconomic status, may have influenced the referral of patients for home or hospital rehabilitation. Assessment at 3 months and aspects of the assessment at 2 weeks were performed by telephone interviews. Previous studies have reported that telephone-administered questionnaires usually result in a more optimistic health-related quality of life (71–73), suggesting that the recovery of patients with HF may be worse than the reported outcomes described in the study.

The COVID-19 pandemic has had an effect on rehabilitation services. Increased use of home-based rehabilitation and telerehabilitation was designed to ensure the safety of patients and their staff (74). In keeping with this new reality, the study of the outcomes and effectiveness of HF rehabilitation in different settings is needed. Findings from this study can help with decisions on where to discharge the patient and support policy planning regarding the development of future rehabilitation services.

*Conclusion*

Patient-reported outcomes of home rehabilitation and inpatient rehabilitation are similar, suggesting that both settings are similarly effective. PROs ensure a richer and more comprehensive understanding of the healthcare outcomes of patients with HF in different rehabilitation settings. This process of patient-centered care can improve quality healthcare in a growing population of patients.

1. The Israeli Ministry of Health. The national program for quality indicator: For general and geriatric hospital, psychiatric hospitals, mother and baby centers and emergency medical services (ambulances). . Jerusalem; 2022.

2. Barnea R, Weiss Y, Abadi-Korek I, Shemer J. The epidemiology and economic burden of hip fractures in Israel. Isr J Health Policy Res. 2018 Dec 2;7(1):38.

3. Kirkland LL, Kashiwagi DT, Burton MC, Cha S, Varkey P. The Charlson Comorbidity Index Score as a Predictor of 30-Day Mortality After Hip Fracture Surgery. American Journal of Medical Quality. 2011 Nov 30;26(6):461–7.

4. Handoll HH, Sherrington C, Mak JC. Interventions for improving mobility after hip fracture surgery in adults. Cochrane Database of Systematic Reviews. 2011 Mar 16;

5. Tedesco D, Gibertoni D, Rucci P, Hernandez-Boussard T, Rosa S, Bianciardi L, et al. Impact of rehabilitation on mortality and readmissions after surgery for hip fracture. BMC Health Serv Res. 2018 Dec 10;18(1):701.

6. Crotty M, Unroe K, Cameron ID, Miller M, Ramirez G, Couzner L. Rehabilitation interventions for improving physical and psychosocial functioning after hip fracture in older people. Cochrane Database of Systematic Reviews. 2010 Jan 20;

7. Kuisma R. A randomized, controlled comparison of home versus institutional rehabilitation of patients with hip fracture. Clin Rehabil. 2002 Aug 1;16(5):553–61.

8. Levi H. Measures for the provision of care and rehabilitation for the elderly. Jerusalem; 2009 Jan.

9. Handoll HH, Cameron ID, Mak JC, Finnegan TP. Multidisciplinary rehabilitation for older people with hip fractures. Cochrane Database of Systematic Reviews. 2009 Oct 7;

10. Momsen A, Rasmussen J, Nielsen C, Iversen M, Lund H. Multidisciplinary team care in rehabilitation: An overview of reviews. J Rehabil Med. 2012;44(11):901–12.

11. Deng Y, Zheng Z, Cheng S, Lin Y, Wang D, Yin P, et al. The factors associated with nosocomial infection in elderly hip fracture patients: gender, age, and comorbidity. Int Orthop. 2021 Dec 5;45(12):3201–9.

12. Zisberg A, Shadmi E, Gur-Yaish N, Tonkikh O, Sinoff G. Hospital-Associated Functional Decline: The Role of Hospitalization Processes Beyond Individual Risk Factors. J Am Geriatr Soc. 2015 Jan 1;63(1):55–62.

13. Folbert EC, Hegeman JH, Gierveld R, van Netten JJ, Velde D van der, ten Duis HJ, et al. Complications during hospitalization and risk factors in elderly patients with hip fracture following integrated orthogeriatric treatment. Arch Orthop Trauma Surg. 2017 Apr 23;137(4):507–15.

14. Leff B, Montalto M. Home hospital-toward a tighter definition. Vol. 52, Journal of the American Geriatrics Society. 2004. p. 2141.

15. Arsenault-Lapierre G, Henein M, Gaid D, le Berre M, Gore G, Vedel I. Hospital-at-Home Interventions vs In-Hospital Stay for Patients with Chronic Disease Who Present to the Emergency Department: A Systematic Review and Meta-analysis. JAMA Netw Open. 2021;

16. Mendoza H, Martín MJ, García A, Arós F, Aizpuru F, Regalado De Los Cobos J, et al. “Hospital at home” care model as an effective alternative in the management of decompensated chronic heart failure. Eur J Heart Fail. 2009 Dec;11(12):1208–13.

17. Crotty M, Whitehead CH, Gray S, Finucane PM. Early discharge and home rehabilitation after hip fracture achieves functional improvements: A randomized controlled trial. Clin Rehabil. 2002;16(4):406–13.

18. Mnistry of Health. Home rehabiliation. Unpublished data.

19. Mantica G, Riccardi N, Terrone C, Gratarola A. Non-COVID-19 visits to emergency departments during the pandemic: the impact of fear. Public Health. 2020 Jun;183:40–1.

20. Levi Y, Punchik B, Zikrin E, Shacham D, Katz D, Makulin E, et al. Intensive Inpatient vs. Home-Based Rehabilitation After Hip Fracture in the Elderly Population. Front Med (Lausanne). 2020 Oct 9;7.

21. Karlsson Å, Berggren M, Gustafson Y, Olofsson B, Lindelöf N, Stenvall M. Effects of Geriatric Interdisciplinary Home Rehabilitation on Walking Ability and Length of Hospital Stay After Hip Fracture: A Randomized Controlled Trial. J Am Med Dir Assoc. 2016 May 1;17(5):464.e9-464.e15.

22. Clapham S, Daveson BA, Allingham SF, Morris D, Blackburn P, Johnson CE, et al. Patient-reported outcome measurement of symptom distress is feasible in most clinical scenarios in palliative care: an observational study involving routinely collected data. International Journal for Quality in Health Care. 2021 May 19;33(2).

23. Øvretveit J, Zubkoff L, Nelson EC, Frampton S, Knudsen JL, Zimlichman E. Using patient-reported outcome measurement to improve patient care. International Journal for Quality in Health Care. 2017 Oct 1;29(6):874–9.

24. Porter ME. What Is Value in Health Care? New England Journal of Medicine. 2010 Dec 23;363(26):2477–81.

25. Vandenbroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and Elaboration. PLoS Med. 2007 Oct 16;4(10):e297.

26. Schroeder H, Israeli A, Liebergall I, Or O, Andrews C, Justo D, et al. Patient reported outcome measures in patients after a hip fracture: Promoting quality and patient centered care. In Ashkelon: Israeli Association of Public Health conference; 2022.

27. Pan SL, Liang HW, Hou WH, Yeh TS. Responsiveness of SF-36 and Lower Extremity Functional Scale for assessing outcomes in traumatic injuries of lower extremities. Injury. 2014 Nov;45(11):1759–63.

28. Browning RB, Alter TD, Clapp IM, Mehta N, Nho SJ. Patients Require Less Time to Complete Preoperative Patient-Reported Outcomes Measurement Information System (PROMIS) Than Legacy Patient-Reported Outcome Measures. Arthrosc Sports Med Rehabil. 2021 Oct;3(5):e1413–9.

29. Randell AG, Nguyen T v., Bhalerao N, Silverman SL, Sambrook PN, Eisman JA. Deterioration in Quality of Life Following Hip Fracture: A Prospective Study. Osteoporosis International. 2000 May 1;11(5):460–6.

30. McHorney CA, Ware JE, Rogers W, Raczek AE, Lu JFR. The Validity and Relative Precision of MOS Short-, and Long- Form Health Status Scales and Dartmouth COOP Charts. Med Care. 1992 May;30(Supplement):MS253–65.

31. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care. 1992 Jun;30(6):473–83.

32. Tidermark J, Bergström G, Svensson O, Törnkvist H, Ponzer S. Responsiveness of the EuroQol (EQ 5-D) and the SF-36 in elderly patients with displaced femoral neck fractures. Quality of Life Research. 2003;12(8):1069–79.

33. Scholten AC, Haagsma JA, Steyerberg EW, van Beeck EF, Polinder S. Assessment of pre-injury health-related quality of life: A systematic review. Vol. 15, Population Health Metrics. BioMed Central Ltd.; 2017.

34. van Beeck EF, Larsen CF, Lyons RA, Meerding WJ, Mulder S, Essink-Bot ML. Guidelines for the Conduction of Follow-up Studies Measuring Injury-Related Disability. Journal of Trauma: Injury, Infection & Critical Care. 2007 Feb;62(2):534–50.

35. Marx RG, Jones EC, Allen AA, Altchek DW, OʼBrien SJ, Rodeo SA, et al. Reliability, Validity, and Responsiveness of Four Knee Outcome Scales for Athletic Patients. The Journal of Bone and Joint Surgery-American Volume. 2001 Oct;83(10):1459–69.

36. Laucis NC, Hays RD, Bhattacharyya T. Scoring the SF-36 in orthopaedics: A brief guide. Journal of Bone and Joint Surgery - American Volume. 2014 Sep 2;97(19):1628–34.

37. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. J Chronic Dis. 1987 Jan;40(5):373–83.

38. Hasan O, Barkat R, Rabbani A, Rabbani U, Mahmood F, Noordin S. Charlson comorbidity index predicts postoperative complications in surgically treated hip fracture patients in a tertiary care hospital: Retrospective cohort of 1045 patients. International Journal of Surgery. 2020 Oct 1;82:116–20.

39. Leonardsson O, Rolfson O, Rogmark C. The surgical approach for hemiarthroplasty does not influence patient-reported outcome. Bone Joint J. 2016 Apr;98-B(4):542–7.

40. da Silva Mendonça TM, da Silva CHM, de Tavares Canto RS, de Macedo Oliveira Morales N, de Melo Costa Pinto R, de Rizo Morales R. Evaluation of the Health-Related Quality of Life in Elderly Patients According to the Type of Hip Fracture: Femoral Neck or Trochanteric. Clinics. 2008 Oct;63(5):607–12.

41. Tidermark J, Bergström G, Svensson O, Törnkvist H, Ponzer S. Responsiveness of the EuroQol (EQ 5-D) and the SF-36 in elderly patients with displaced femoral neck fractures. Quality of Life Research. 2003;12(8):1069–79.

42. Ware J. SF-36 health survey: manual and interpretation guide . 1993.

43. Angst F, Aeschlimann A, Stucki G. Smallest detectable and minimal clinically important differences of rehabilitation intervention with their implications for required sample sizes using WOMAC and SF-36 quality of life measurement instruments in patients with osteoarthritis of the lower extremities. Arthritis Rheum. 2001 Aug;45(4):384–91.

44. McIsaac DI, Talarico R, Jerath A, Wijeysundera DN. Days alive and at home after hip fracture: a cross-sectional validation of a patient-centred outcome measure using routinely collected data. BMJ Qual Saf. 2021 Jul 30;bmjqs-2021-013150.

45. Cecchi F, Pancani S, Antonioli D, Avila L, Barilli M, Gambini M, et al. Predictors of recovering ambulation after hip fracture inpatient rehabilitation. BMC Geriatr. 2018 Dec 31;18(1):201.

46. Levy C, Ocampo-Chan S, Huestis L, Renzetti D. Early Rehabilitation for Patients with Hip Fractures: Spreading Change Across the System. Healthcare Quarterly. 2017 Apr 13;20(1):29–33.

47. Helal A, Botros D, Qureshi F, Alhreish K, Dutcher L, Teel J, et al. Effects of the COVID-19 pandemic on hip fracture volume, disposition, and readmission rates. Baylor University Medical Center Proceedings. 2022 Jul 4;35(4):444–6.

48. Karlsson Å, Berggren M, Olofsson B, Stenvall M, Gustafson Y, Nordström P, et al. <p>Geriatric Interdisciplinary Home Rehabilitation After Hip Fracture in People with Dementia – A Subgroup Analysis of a Randomized Controlled Trial</p>. Clin Interv Aging. 2020 Sep;Volume 15:1575–86.

49. Closa C, Mas MÀ, Santaeugènia SJ, Inzitari M, Ribera A, Gallofré M. Hospital-at-home Integrated Care Program for Older Patients With Orthopedic Processes: An Efficient Alternative to Usual Hospital-Based Care. J Am Med Dir Assoc. 2017 Sep;18(9):780–4.

50. Freitas MM, Antunes S, Ascenso D, Silveira A. Outpatient and home-based treatment: Effective settings for hip fracture rehabilitation in elderly patients. Geriatrics (Switzerland). 2021;6(3).

51. Donohue K, Hoevenaars R, McEachern J, Zeman E, Mehta S. Home-Based Multidisciplinary Rehabilitation following Hip Fracture Surgery: What Is the Evidence? Rehabil Res Pract. 2013;2013:1–10.

52. Mahomed NN, Davis AM, Hawker G, Badley E, Davey JR, Syed KA, et al. Inpatient compared with home-based rehabilitation following primary unilateral total hip or knee replacement: A randomized controlled trial. Journal of Bone and Joint Surgery. 2008 Aug 1;90(8):1673–80.

53. Zidén L, Frandin K, Kreuter M. Home rehabilitation after hip fracture. A randomized controlled study on balance confidence, physical function and everyday activities. Clin Rehabil. 2008;22(12):1019–33.

54. Stolee P, Lim SN, Wilson L, Glenny C. Inpatient versus home-based rehabilitation for older adults with musculoskeletal disorders: a systematic review. Clin Rehabil. 2012 May 4;26(5):387–402.

55. Crotty M, Whitehead C, Miller M, Gray S. Patient and caregiver outcomes 12 months after home-based therapy for hip fracture: A randomized controlled trial. Arch Phys Med Rehabil. 2003 Aug 1;84(8):1237–9.

56. Dai K, Zhang Q, Fan T, Sen SS. Estimation of resource utilization associated with osteoporotic hip fracture and level of post-acute care in China. Curr Med Res Opin. 2007 Jan 1;23(12):2937–43.

57. Hollingworth W, Todd C, Parker M, Roberts JA, Williams R. Cost analysis of early discharge after hip fracture. BMJ. 1993 Oct 9;307(6909):903–6.

58. Zucker I, Laxer I, Rasooli I, Han S, Cohen A, Shohat T. Regional gaps in the provision of inpatient rehabilitation services for the elderly in Israel: Results of a national survey. Isr J Health Policy Res. 2013 Dec 23;2(1):27.

59. Jaglal S, Lakhani Z, Scharzker J. Reliability, Validity, and Responsiveness of the Lower Extremity Measure for Patients with a Hip Fracture\*. The Journal of Bone and Joint Surgery-American Volume. 2000 Jul;82(7):955–62.

60. Zidén L, Kreuter M, Fränndin K. Long-term effects of home rehabilitation after hip fracture - 1-year follow-up of functioning, balance confidence, and health-related quality of life in elderly people. Disabil Rehabil. 2010;32(1):18–32.

61. Zidén L, Frandin K, Kreuter M. Home rehabilitation after hip fracture. A randomized controlled study on balance confidence, physical function and everyday activities. Clin Rehabil. 2008;22(12):1019–33.

62. Mehta S, Roy J. Systematic review of home physiotherapy after hip fracture surgery. J Rehabil Med. 2011;43(6):477–80.

63. Latham NK, Harris BA, Bean JF, Heeren T, Goodyear C, Zawacki S, et al. Effect of a Home-Based Exercise Program on Functional Recovery Following Rehabilitation After Hip Fracture. JAMA. 2014 Feb 19;311(7):700.

64. Tsauo JY, Leu WS, Chen YT, Yang RS. Effects on Function and Quality of Life of Postoperative Home-Based Physical Therapy for Patients With Hip Fracture. Arch Phys Med Rehabil. 2005 Oct;86(10):1953–7.

65. Kristoffersen MH, Dybvik EH, Steihaug OM, Kristensen TB, Engesæter LB, Ranhoff AH, et al. Patient-reported outcome measures after hip fracture in patients with chronic cognitive impairment. Bone Jt Open. 2021 Jul 1;2(7):454–65.

66. Möller M, Wolf O, Bergdahl C, Mukka S, Rydberg EM, Hailer NP, et al. The Swedish Fracture Register – ten years of experience and 600,000 fractures collected in a National Quality Register. BMC Musculoskelet Disord. 2022 Dec 1;23(1).

67. Kristensen TB, Vinje T, Havelin LI, Engesæter LB, Gjertsen JE. Posterior approach compared to direct lateral approach resulted in better patient-reported outcome after hemiarthroplasty for femoral neck fracture: 20,908 patients from the Norwegian Hip Fracture Register. Acta Orthop. 2017 Jan 2;88(1):29–34.

68. Philpot LM, Barnes SA, Brown RM, Austin JA, James CS, Stanford RH, et al. Barriers and Benefits to the Use of Patient-Reported Outcome Measures in Routine Clinical Care: A Qualitative Study. American Journal of Medical Quality. 2018 Jul 19;33(4):359–64.

69. Pit SW, Vo T, Pyakurel S. The effectiveness of recruitment strategies on general practitioner’s survey response rates – a systematic review. BMC Med Res Methodol. 2014 Dec 6;14(1):76.

70. Leonardsson O, Rolfson O, Rogmark C. The surgical approach for hemiarthroplasty does not influence patient-reported outcome. Bone Joint J. 2016 Apr;98-B(4):542–7.

71. Hays RD, Kim S, Spritzer KL, Kaplan RM, Tally S, Feeny D, et al. Effects of Mode and Order of Administration on Generic Health-Related Quality of Life Scores. Value in Health. 2009 Sep;12(6):1035–9.

72. Hanmer J, Hays RD, Fryback DG. Mode of Administration Is Important in US National Estimates of Health-Related Quality of Life. Med Care. 2007 Dec;45(12):1171–9.

73. Maglinte GA, Hays RD, Kaplan RM. US general population norms for telephone administration of the SF-36v2. J Clin Epidemiol. 2012 May;65(5):497–502.

74. Chatterji G, Patel Y, Jain V, Geevarughese NM, Haq RU. Impact of COVID-19 on Orthopaedic Care and Practice: A Rapid Review. Vol. 55, Indian Journal of Orthopaedics. Springer; 2021. p. 839–52.