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RESEARCH ARTICLE

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MULTIDISCIPLINARY CARE IN THE TREATMENT OF THE ELDERLY WITH FRACTURES: AN INTEGRATIVE REVIEW

Cavamura M.I. Erika¹, Zwierzikoski A. Jaqueline², Sokoloski N. Christina²
and Lavrador M. José³

¹Department of Medicine at Faculdades Pequeno Príncipe, ²Department of Medicine of Federal University of Paraná; ³Department of Orthopedics of Hospital do Trabalhador do Paraná

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*Corresponding author: Cavamura M.I. Erika,

ABSTRACT

Introduction: Injuries involving hip and femur are one of the main causes of morbidity and mortality in the elderly, affecting both physical and functional capacity. The introduction of multidisciplinary programs in fracture management is being used more and more and has shown a positive outcome in senile fractures. **Objective:** To assess the impact of multidisciplinary care in elderly patients with fractures in terms of mortality, time elapsed until surgery, length of hospital stays, quality of life, ability to walk in the postoperative period and prevention of falls. **Methods:** Integrative literature review based on the bibliography of two search platforms - PUBMED and VHL - regarding the influence of multidisciplinary action in the treatment of elderly people with orthopedic fractures. **Discussion and Results:** The presence of the multidisciplinary team in the hospital context showed a reduction in the waiting time until surgery and hospital stay, generating financial benefits for the service. It also decreased in-hospital mortality within 30 days and within one year. In addition, it significantly improved the quality of life. In the long term, the role of fall prevention played by the multidisciplinary team generated a reduction in the recurrence of falls and fractures, improving physical and mental conditioning.

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INTRODUCTION

Global healthcare is challenged by an aging population. The number of people over the age of 60 is expected to rise from 900 million in 2015 to two billion in 2050 worldwide, respectively 12 and 22% of the population. For the elderly over the age of 80 years, the calculated trend is an increase from 120 million people in 2015 to 434 million in 2050^{1,2}. Fall-related injuries, especially hip fractures, which threaten both the physical and functional capacity of these patients, have thus become a growing problem³⁻⁵. Annually, 1.6 million elderly people worldwide suffer a hip fracture and this number is expected to reach 4.5 million in 2050⁴. A hip fracture in people over 65 years of age is associated with a poor functional outcome, with a mortality rate in a year of approximately 30%^{3,4}. Despite surgery and subsequent rehabilitation programs, many elderly hip-injured patients suffer permanent functional disability as a result of the trauma, with only 40-60% recovering from the pre-fracture level of mobility within a year of the injury. Six months after a fracture, about 42-71% have regained their pre-fracture level of functioning in basic activities of daily living (ADL)³⁻⁵. Approximately 10 to 20% are unable to return to their previous residence⁵.

The degree of disability can be even greater for frail elderly people who need extensive rehabilitation in a hospital setting. Thus, multidisciplinary interventions aimed at optimizing the functional recovery of elderly patients with fractures and reducing the risk of future falls are a promising alternative in the management of these conditions. Given the importance of the topic and the possible impacts that the multidisciplinary approach can offer the patient and the health system, this work seeks to present the main factors influenced by the multidisciplinary approach, as well as demonstrate its potential to change the patient's outcome.

MATERIALS AND METHODS

This research consists of an integrative review carried out from a bibliographic survey in the PUBMED and Virtual Health Library (VHL) search platforms. For the search, the terms "older" or "elderly" or "geriatric", "multidisciplinary" or "multi-professional", "healthcare" or "care" and "fracture" were used. As a result, 619 publications were obtained in PUBMED and 426 in the VHL. The following inclusion criteria were established: time of publication in the last five years, English language, primary studies, elderly population and presence of a multidisciplinary team for treatment or

prevention. The exclusion criteria used were: studies outside the inclusion criteria, presence of non-elderly patients in the research, studies on non-fracture-related injuries, studies not available in full for free, and studies that did not assess the influence of multidisciplinary care on the outcome. The reading of titles and abstracts and the selection of articles for full reading was performed by four researchers independently, two in each tool. After selection, the results were compared, the differences in choice were discussed and the works for reading were selected. With this first analysis, the PUBMED platform returned a total of 58 results and the VHL returned 154 articles. Those that did not meet the criteria of this study were eliminated and ten articles from PUBMED and 17 articles from the VHL were selected for full reading by the four researchers. After reading the full 27 articles in total, an overlap of four articles present in the two searches was observed, thus resulting in a total of 23 articles included in this review.

RESULTS

Mortality: Mortality in the geriatric population after hip fracture still reaches high rates. Mortality within the first year after fracture, compared to control groups, ranges from 8.4% to 36%⁶. The presence of complications is reported in 20% of cases⁷. The implementation of a multidisciplinary team has been developed as a way to optimize care, having proven to be more effective than traditional care, with a reduction in postoperative complication rates and 30-day mortality rates⁵. An original study published by Leung et al. (2018) report the establishment of a multidisciplinary hip fracture management group. The proposed model addresses all management phases: preoperative, perioperative, postoperative and rehabilitation and encompasses nursing professionals, general surgeons, anesthesiologists, physiotherapists, occupational therapists, social workers and the leadership of an orthopedic surgeon. The clinical results were a reduction in short- and long-term mortality, in addition to a lower incidence of complications. After the study intervention, with multidisciplinary care, in-hospital mortality decreased from 2.86% to 0.95%, 30-day mortality reduced from 5.36% to 1.67% and one-year mortality from 23.93% to 13.81%⁸. A program that developed protocols to standardize hip fracture patient care from emergency room assessment to discharge and rehabilitation was developed at Yale New Heaven Hospital. The team included orthopedic surgeons, general practitioners, geriatricians, emergency physicians and anesthesiologists, as well as representatives from the rehabilitation, nursing, pharmacy and quality control services. Teamwork, information control, feedback and a sense of responsibility resulted in a statistically significant decrease in 30-day mortality rates from 8% to 2.8% ($p=0.001$)².

Shenouda et al. (2017) analyze the establishment of a multidisciplinary care program for geriatric hip fractures involving emergency physicians, general practitioners, orthogeriatricians, anesthesiologists, orthopedic surgeons and nursing staff. In this program, all patients with fractures of the proximal femur were admitted by a clinical physician, submitted to a pre-anesthetic evaluation within 12 hours and an orthopedic and orthogeriatric consultation within a maximum of 24 hours with surgery time of up to 36 hours. There was a significant reduction in mortality of 10% (14% before vs 4% after, with $p=0.0336$)⁹. One of the forms of multidisciplinary care is orthogeriatric co-management, with the participation of the geriatrician in the multidisciplinary team. Kristensen et al. (2016) compared a group of patients over 65 years of age with hip fractures admitted to an orthogeriatric unit with a group admitted to an orthopedic unit, in which geriatricians and other specialties are available only on request. Patients admitted to an orthogeriatric unit had a lower 30-day mortality (aOR = 0.69; 95% CI 0.54-0.88)¹⁰. This was also analyzed by a retrospective cohort conducted by Neuerburg et al. (2019), which evaluated mortality over the period of one year in patients of hip fractures over 70 years of age, undergoing integrated orthogeriatric care and conventional orthopedic care. One-year mortality rates were 22.8% for the first group and 28.1% for the second ($p=0.029$)¹¹.

The shift in the flow of care for hip fracture patients from a geriatric consultation service to an integrated orthogeriatric service was analyzed by Middleton, Wan; da Assunção et al. (2016). The change in flow promoted the admission of the patient by the orthopedic trauma team on duty with admission to a unit for the geriatric population under orthogeriatric care. A statistically significant reduction in 302-day mortality was found from 13.2% to 10.3% ($p=0.04$)¹². In another observational study, 58000 patients over 80 years of age admitted to 828 hospitals with hip fractures were analyzed, comparing hospitals with and without orthogeriatric co-management. The 30-day mortality rate found was 10.3% for patients in the first group and 13.4% for the second. The adjusted 30-day mortality was 22% lower for patients under orthogeriatric care (OR 0.78 p 0.05 CI 0.74-0.82)⁹. These data demonstrate the importance not only of a management that encompasses different professionals, but also the relevance of the geriatrician, specialist in the elderly, as manager and integrator of this integrated care.

Time elapsed until surgery: The time elapsed between admission and surgery of elderly trauma victims is appointed as one of the predictors of 30-day mortality and risk of complications¹³. It is recommended that surgery take place as soon as possible, considering the patient's conditions. The Clinical Protocol and Therapeutic Guidelines for femoral neck fractures in the elderly, from the Ministry of Health, following the recommendation of the AAOS (American Academy of Orthopedic Surgeons), guide that, preferably, the time until surgery is less than 48 hours^{14,15}. Several evidences suggest that the multidisciplinary care of the fractured elderly, associating the role of orthopedics with geriatrics, can reduce the time until surgery and, therefore, change the treatment outcome. Leung et al. compared the influence of implementing a multidisciplinary approach in the preoperative, perioperative, postoperative and rehabilitation periods in a Hong Kong hospital in 2007. Data from 2006, before the implementation of the new approach, and from 2008 to 2011, with the new system, were evaluated. The length of stay in the hospital until surgery decreased significantly from 5.76 days in 2006 to 1.9 days in 2008. The curve continued to decrease until reaching 1.32 days in 2011⁸. A similar impact was described in a hospital in the United Kingdom, where the two years before and after the intervention were analyzed, with the implementation of a multidisciplinary model of care, in which the time until surgery was reduced from 41.8 to 27, 2 hours¹². In Italy, an experience with the introduction of a multidisciplinary group aimed at the treatment of elderly people with hip fractures also managed to significantly increase the rate of surgeries performed in the first 24 hours after admission, from 26% to 54%¹⁶.

Improvements in an existing multidisciplinary approach, seeking to correct flaws and optimize patient treatment and follow-up, can also impact the time to operation. The use of Lean Six Sigma (LSS) methodology, which seeks to improve systems and correct defects, requiring mutual collaboration of the process participants, increased the rate of patients operated on in 48 hours from 55% to 85% in six months of implementation, without increased costs for the hospital¹⁷. Furthermore, Werner et al. demonstrate that major changes in the care system for elderly people with fractures are not necessary to achieve significant changes. The implementation of just two changes to usual care in a German hospital was able to generate a drop in the time taken to the operating room. A weekly multidisciplinary visit to the patient and a room reserved daily for corrective surgery for fractures of the proximal femur resulted in a reduction in the meantime to surgery from 35.8 hours to 25.4 hours, in addition to reducing the rate of dissatisfaction with the treatment¹. Studies that analyzed the cost-benefit of multidisciplinary care also suggest that the reduction in time until surgery was linked to saving resources for the hospital^{8,18}. The benefits demonstrated go beyond caring for the elderly's life; they are also of economic interest to health systems.

Length of Stay in Hospital: Due to the patient's clinical profile, often presenting multiple comorbidities and cognitive decline, the length of stay in the hospital after admission can be prolonged. Reducing the length of stay is one of the goals in elderly care, aiming,

in addition to reducing costs, to improve the patient's quality of life. It is suggested in the literature that the multidisciplinary approach to treatment can optimize the time that the patient remains hospitalized, being advantageous for him and for the hospital. The implementation of a multidisciplinary follow-up for elderly patients admitted with a hip fracture in a London hospital reduced the length of stay in the hospital from 24.8 days to 19.5 days, after six months with the new system, in addition to having increased the preoperative care rate from 19% to 85%⁹. A similar percentage reduction was found in another hospital in the UK, with a reduction from 27.5 days to an average of 21 days, with the integration of the geriatric team into patient care¹². In addition, the same study that analyzed the implication of only two new variables in the care of the fractured elderly, in addition to showing a reduction in the time until surgery, also showed a reduction in the length of hospital stay, from 9.1 days to 7, 8 days¹. Thus, the reduction in time until surgery, combined with the reduced length of stay in the hospital, was an important resource-saving factor for hospitals⁸.

Quality of life and ability to walk postoperatively: A large portion of the elderly population that suffers from hip fractures may never regain their mobility and activity levels and may even become more dependent on daily activities. Fractures in the elderly population can result in important changes with long-term consequences in the personal and social aspects of the patient's life, influencing their quality of life from the in-hospital moment^{19,22}. In an evaluation of a Danish database, 11,461 patients over 65 years of age, admitted for hip fracture, were identified. The group admitted to an orthogeriatric unit was compared with the group under traditional orthopedic care. Admission to an orthogeriatric unit was associated with a 1.3-fold (95% CI 1.10–1.16) greater chance of receiving systemic clinical management for pain control and 1.04 times (95% CI 1.02–1.06) greater odds. of assistance for early mobilization, plus a relative risk of 1.07 (95% CI 1.05–1.09), 1.04 (95% CI 1.02–1.06) and 1.15 (95% CI 1.12–1.18) for post-discharge rehabilitation, prescription of medication. anti-osteoporotic and prevention of further falls¹⁰. Another factor related to quality of life and care assessed was the quality of medication prescription for geriatric trauma patients. Gleich et al. (2019) evaluated victims of hip or proximal humerus fractures admitted to a conventional trauma care unit and an orthogeriatric unit. The first group had a rate of 85.4% of prescription of one or more inappropriate medications, while in the second group the occurrence was 22.2% ($p < 0.001$). In addition, the exchange of medications was performed in 48.1% of patients hospitalized under orthogeriatric management, providing a more efficient assessment of the patient's clinic²³. Baroni et al. (2015), in a study that presents a hospital care model focused on multidisciplinary for the elderly population with fragility fractures, identified greater efficiency after the implementation of this model in identifying elderly people at higher risk of low-energy fractures, better and more complete clinical management and increased adherence to medical prescriptions²⁴. The incidence of delirium after surgical intervention was evaluated by Chuan et al. (2020). The care group of a multidisciplinary team consisting of emergency physicians, orthopedic surgeons, geriatricians and anesthesiologists had lower rates of delirium on the third postoperative day compared to patients in the conventional management group (22% vs. 33%, respectively; $p = 0.04$) resulting in the patient's well-being during hospitalization³.

The study published by Cheung et al. (2018) brought about the installation of a rehabilitation program for elderly people with hip fractures. The intervention group, patients over 65 years of age diagnosed with hip fracture, underwent preoperative and postoperative geriatric care, in addition to a rehabilitation process of up to one year. The study reported the efficiency of multidisciplinary care in reducing the length of hospital stay, with early discharge, and a decrease in re-fracture rates²⁵. The impact of the multidisciplinary team on the quality of life of the elderly population after hip fracture was evaluated by Gomez et al. (2019) from an intervention with a multidisciplinary care model focused on preventing osteoporosis and new falls. After six months of follow-up, there was an 80% and 50% reduction in falls in re-fractures, in addition to 65% of patients having

reduced their result in the risk predictor test for falls and a 57% reduction in the probability fracture in ten years⁴. Werner et al. (2020) also prove that orthogeriatric care, when compared to conventional care, reduces patient dissatisfaction rates by more than half (12.9% vs 32.4%; $p = 0.008$)¹. The study developed by Neuerburg et al. demonstrated that a multidisciplinary method of defining behaviors for geriatric patients with hip fractures and the implementation of integrative protocols were effective in reducing the excessive use of blood transfusions (46.6% to 28.1%; $P < .001$), adverse drug effects (4.0 % to 0%; $P < .001$), length of stay (5.12 to 4.47 days; $P = .004$) and unexpected return to the operating room (5.1% to 0%; $P < .001$)¹¹. Another prospective, randomized and controlled study also showed positive effects on mobility, increased performance in daily activities and improved cognition after orthogeriatric care²⁶. Early mobilization is a key component of the treatment of patients with hip fractures, and this intervention should be started soon after surgery²⁷. Most multidisciplinary management protocols include early mobilization as a baseline intervention in the health of geriatric fracture victims, being approached not as a separate intervention to be analyzed individually, but as one of several interventions that result in positive data resulting from the management multidisciplinary. The studies by Morris et al. (2020), Neuerburg et al. (2019), Rapp et al. (2020) and Werner et al. (2020), are some of the studies that bring multidisciplinary interventions that include in their protocols the early mobilization of the patient and obtain positive results in outcome^{1,2,11,27}. The importance of multidisciplinary and its impact on the health of the elderly is clear.

DISCUSSION

Multidisciplinary care in preventing falls: Multifactorial intervention strategies, based on clinically determined individual needs, can reduce the risk of falls in the general population and falls in the elderly⁴. The traditional geriatrician-run falls clinic model for the elderly is highly multifactorial in providing assessment and management of patients with falls, mobility and balance issues, time-limited intervention, counseling and referral to conventional services, and education and training for caregivers and Health professionals. In a study carried out with older adults over 65, at Nepean Hospital, Penrith, Australia, from January 2013 to December 2014, an assessment of the pre-post effects of a new combined model of multidisciplinary care in reducing the incidence of falls and fractures. Thus, interventions such as supervised group exercise (97.2%), combined vitamin D and calcium supplementation (96.2%), osteoporosis treatment (67.0%) and medication adjustment (66.0%) were performed^{4,28}. In this study, the multidisciplinary approach substantially reduced the risk of falls and fractures in elderly people at high risk of these adverse events, even during a relatively short period of six months.

The current model of service delivery through fall clinics can be significantly improved by encompassing fracture prevention within a multifactorial approach to interventions. This new model of care appears to be the ideal setting for evaluating and treating elderly patients with osteosarcopenia at very high risk for falls and fractures. Directed efforts to improve patient compliance increase the benefit gained, especially if adherence to a combination of interventions is achieved. Falls are common events in the elderly, causing considerable morbidity and mortality. In addition to injuries, an accident can also induce fear of falling, which leads to more falls, preventing or restricting daily activities, losing autonomy, decreasing social activity, depression and deteriorating quality of life²⁸. Non-pharmacological interventions are an important approach to preventing falls. Risk factors for these events include a history of falls, gait problems, use of walking aids, vertigo, muscle weakness, a variety of drugs, particularly psychotropic drugs and polypharmacy^{28,29}. As part of the ONTOP project (Optimal Evidence-Based Non-drug Therapies in Older People), research funded by the European Union, the SENATOR work included systematic reviews and meta-analyses of any non-pharmacological intervention to prevent falls among the elderly, published from 2009 to 2015. Fall

prevention measures were identified highlighting the intervention of multiple professionals with exercise, vitamin D administration, vision correction, medication evaluation, risk modification at home and behavioral counseling as fall prevention measures in the elderly in the community, generating a 45% reduction in falls. Among these interventions, group and individual exercise at home, often incorporating balance and strength training, was the main factor capable of reducing falls in elderly people in the community. Favorable effects were also seen for a single preventive home visit by a trained professional, provided to community-dwelling older adults. In this case, the intervention resulted in delaying the progression of the physical impairment to develop daily activities for up to one year. Cognitive training designed to stimulate short-term memory and improve attention, information processing skills, and reasoning and problem-solving skills reduced frailty scores under analysis at 12 months, six months after the intervention³⁰. This project definitively establishes the role of comprehensive care for the individual as a major change in the quality of life of those over 65 years of age.

Final considerations: The aim of this literature review was to address the role of multidisciplinary care in building the health of the geriatric population victim of fractures. After reviewing the evidence presented, it is clear that a service involving orthopedic surgeons, anesthesiologists, general practitioners and, especially, geriatricians, in addition to other health professionals such as occupational therapists, speech therapists, social workers and nurses, positively influences the process of health construction of this group of patients. The studies presented show that the presence of a multidisciplinary team reduces the time until surgery, increases the number of patients operated, so as to reduce in-hospital mortality within 30 days and within one year^{1,2,8,12,16,17}. Even studies that did not show a reduction in mortality showed a reduction in postoperative complications, a reduction in risk factors for falls and a reduction in surgery time^{1,5,16}. Other aspects positively influenced by the presence of the multidisciplinary team are the reduction in hospital stay, increased preoperative care and being a resource-saving strategy for the health institution^{1,8,9,12}. The evaluation of an integrated team increases the quality of life of the patient, provides early ambulation, reduces the incidence of delirium, reduces postoperative complications, in addition to improving long-term outcome as it reduces recurrence of falls and fractures, improves physical and mental conditioning and reduces frailty^{1,5,10,23,25}. The theoretical value of multidisciplinary care in caring for the elderly population, as presented, is proven by several scientifically valid studies. Despite the results in other countries, in the Brazilian reality it still presents itself as a possibility of innovation that, despite the difficulties and resistance, may come to break with the more traditional structures and propose itself as a more effective way to build health.

REFERENCES

Abraha I, Trotta F, Rimland JM, Cruz-Jentoft A, Lozano-Montoya I, Soiza RL, et al. Efficacy of Non-Pharmacological Interventions to Prevent and Treat Delirium in Older Patients: A Systematic Overview. The SENATOR project ONTOP Series. Salluh JI, editor. PLoS One [Internet]. 2015 Jun 10;10(6):e0123090. Available online: <https://dx.plos.org/10.1371/journal.pone.0123090>

Abrahamsen B, van Staa T, Ariely R, Olson M, Cooper C. Excess mortality following hip fracture: a systematic epidemiological review. *OsteoporosInt* [Internet]. 2009 Oct 7;20(10):1633–50. Available online: <http://link.springer.com/10.1007/s00198-009-0920-3>

American Academy of Orthopaedic Surgeons. Management of Hip Fractures in the Elderly – Evidence-Based Clinical Practice Guideline. 1st ed. Rosemont, IL; 2014.

Baroni M, Zampi E, Rinonapoli G, Serra R, Zengarini E, Duranti G, et al. Fracture prevention service to bridge the osteoporosis care gap. *ClinInterv Aging* [Internet]. 2015 Jun;10:1035. Available online: <http://www.dovepress.com/fracture-prevention-service-to-bridge-the-osteoporosis-care-gap-peer-reviewed-article-CIA>

Brasil. Protocolo Clínico e Diretrizes Terapêuticas para Fratura de Colo de Fêmur em Idosos. Brasília: Ministério da Saúde; 2007.

Cheung W, Shen W, Dai D, Lee K, Zhu T, Wong R, et al. Evaluation of a multidisciplinary rehabilitation programme for elderly patients with hip fracture: A prospective cohort study. *J Rehabil Med* [Internet]. 2018;50(3):285–91. Available online: <https://www.medicaljournals.se/jrm/content/abstract/10.2340/16501977-2310>

Chuan A, Zhao L, Tillekeratne N, Alani S, Middleton PM, Harris IA, et al. The effect of a multidisciplinary care bundle on the incidence of delirium after hip fracture surgery: a quality improvement study. *Anaesthesia* [Internet]. 2020 Jan 23;75(1):63–71. Available online: <https://onlinelibrary.wiley.com/doi/abs/10.1111/anae.14840>

de Vos A, Cramm J-M, van Wijngaarden JDH, Bakker TJEM, Mackenbach JP, Nieboer AP. Understanding implementation of comprehensive geriatric care programs: a multiple perspective approach is preferred. *Int J Health Plann Manage* [Internet]. 2017 Oct;32(4):608–36. Available online: <http://doi.wiley.com/10.1002/hpm.2383>

Gleich J, Pfeufer D, Zeckey C, Böcker W, Gosch M, Kammerlander C, et al. Orthogeriatric treatment reduces potential inappropriate medication in older trauma patients: a retrospective, dual-center study comparing conventional trauma care and co-managed treatment. *Eur J Med Res* [Internet]. 2019 Dec 22;24(1):4. Available online: <https://eurjmedres.biomedcentral.com/articles/10.1186/s40001-019-0362-0>

Gomez F, Curcio CL, Brennan-Olsen SL, Boersma D, Phu S, Vogrin S, et al. Effects of the falls and fractures clinic as an integrated multidisciplinary model of care in Australia: a pre-post study. *BMJ Open* [Internet]. 2019 Jul 29;9(7):e027013. Available online: <http://bmjopen.bmj.com/lookup/doi/10.1136/bmjopen-2018-027013>

Kalmet PHS, de Joode SGJ, Fiddelaers AAA, ten Broeke RHM, Poeze M, Blokhuis T. Long-term Patient-reported Quality of Life and Pain After a Multidisciplinary Clinical Pathway for Elderly Patients With Hip Fracture: A Retrospective Comparative Cohort Study. *GeriatrOrthopSurgRehabil* [Internet]. 2019 Jan 6;10:215145931984174. Available online: <http://journals.sagepub.com/doi/10.1177/2151459319841743>

Kristensen PK, Thillemann TM, Søballe K, Johnsen SP. Can improved quality of care explain the success of orthogeriatric units? A population-based cohort study. *Age Ageing* [Internet]. 2016 Jan; 45(1):66–71. Available online: <https://academic.oup.com/ageing/article-lookup/doi/10.1093/ageing/afv155>

Leung FK, Lau TW, Yuen GW, Chan EM, Chan P, Lam RY. Effectiveness of a multidisciplinary approach to geriatric hip fractures in improving clinical outcomes and cost of care. *Hong Kong Med J = Xianggangyixuezhazhi* [Internet]. 2018;24 Suppl 2(1):45–7. Available online: <http://www.ncbi.nlm.nih.gov/pubmed/29938659>

Magaziner J, Hawkes W, Hebel JR, Zimmerman SI, Fox KM, Dolan M, et al. Recovery From Hip Fracture in Eight Areas of Function. *Journals Gerontol Ser ABiol Sci Med Sci* [Internet]. 2000 Sep 1;55(9):M498–507. Available online: <https://academic.oup.com/biomedgerontology/article-lookup/doi/10.1093/gerona/55.9.M498>

Middleton M, Wan B, da Assunção R. Improving hip fracture outcomes with integrated orthogeriatric care: a comparison between two accepted orthogeriatric models. *Age Ageing* [Internet]. 2016 Dec 14; Available online: <https://academic.oup.com/ageing/article-lookup/doi/10.1093/ageing/afw232>

Morris JC, Moore A, Kahan J, Shapiro M, Li J, Spadaccino B, et al. Integrated Fragility Hip Fracture Program: A Model for High Quality Care. *J Hosp Med* [Internet]. 2020 Aug 1;15(8):461–7. Available online: <https://www.journalofhospitalmedicine.com/jhospmed/article/217198/hospital-medicine/integrated-fragility-hip-fracture-program-model-high>

Mow TC, Lukeis J, Sutherland AG. The Benefits of Streamlined Hip Fracture Management in a Regional Hospital. *Geriatr Orthop Surg Rehabil* [Internet]. 2017 Jun 15;8(2):99–103. Available

- online:<http://journals.sagepub.com/doi/10.1177/2151458516689284>
- Murphy C, Mullen E, Hogan K, O'toole R, Teeling SP. Streamlining an existing hip fracture patient pathway in an acute tertiary adult Irish hospital to improve patient experience and outcomes. *Int J Qual Heal Care* [Internet]. 2019 Dec 22;31(Supplement_1):45–51. Available online: https://academic.oup.com/intqhc/article/31/Supplement_1/45/5684861
- Neuerburg C, Förch S, Gleich J, Böcker W, Gosch M, Kammerlander C, et al. Improved outcome in hip fracture patients in the aging population following co-managed care compared to conventional surgical treatment: a retrospective, dual-center cohort study. *BMC Geriatr* [Internet]. 2019 Dec 27;19(1):330. Available online: <https://bmgeriatr.biomedcentral.com/articles/10.1186/s12877-019-1289-6>
- Pincus D, Ravi B, Wasserstein D, Huang A, Paterson JM, Nathens AB, et al. Association Between Wait Time and 30-Day Mortality in Adults Undergoing Hip Fracture Surgery. *JAMA* [Internet]. 2017 Nov 28; 318(20):1994. Available online: <http://jama.jamanetwork.com/article.aspx?doi=10.1001/jama.2017.17606>
- Prestmo A, Hagen G, Sletvold O, Helbostad JL, Thingstad P, Taraldsen K, et al. Comprehensive geriatric care for patients with hip fractures: a prospective, randomised, controlled trial. *Lancet* [Internet]. 2015 Apr;385(9978):1623–33. Available online: <https://linkinghub.elsevier.com/retrieve/pii/S0140673614624090>
- Rapp K, Becker C, Todd C, Rothenbacher D, Schulz C, König H-H, et al. The association between orthogeriatric co-management and mortality following hip fracture. *DtschArzteblatt Online* [Internet]. 2020 Jan 24; Available online: <https://www.aerzteblatt.de/10.3238/arztebl.2020.0053>
- Rimland JM, Abraha I, Dell'Aquila G, Cruz-Jentoft A, Soiza R, Gudmusson A, et al. Effectiveness of Non-Pharmacological Interventions to Prevent Falls in Older People: A Systematic Overview. The SENATOR Project ONTOP Series. Laks J, editor. *PLoS One* [Internet]. 2016 Aug 25;11(8):e0161579. Available online: <https://dx.plos.org/10.1371/journal.pone.0161579>
- Roche JJW, Wenn RT, Sahota O, Moran CG. Effect of comorbidities and postoperative complications on mortality after hip fracture in elderly people: prospective observational cohort study. *BMJ* [Internet]. 2005 Dec 10;331(7529):1374. Available online: <http://www.bmj.com/lookup/doi/10.1136/bmj.38643.663843.55>
- Rosell PA., Parker M. Functional outcome after hip fracture. *Injury* [Internet]. 2003 Jul;34(7):529–32. Available online: <https://linkinghub.elsevier.com/retrieve/pii/S002013830200414X>
- Rostagno C, Buzzi R, Campanacci D, Boccacini A, Cartei A, Virgili G, et al. In Hospital and 3-Month Mortality and Functional Recovery Rate in Patients Treated for Hip Fracture by a Multidisciplinary Team. Abete P, editor. *PLoS One* [Internet]. 2016 Jul 7;11(7):e0158607. Available online: <https://dx.plos.org/10.1371/journal.pone.0158607>
- Shenouda M, Silk Z, Radha S, Bouanem E, Radford W. The Introduction of a Multidisciplinary Hip Fracture Pathway to Optimise Patient Care and Reduce Mortality: A Prospective Audit of 161 Patients. *Open Orthop J* [Internet]. 2017 Apr 20;11(1):309–15. Available online: <https://openorthopaedicsjournal.com/VOLUME/11/PAGE/309/>
- Stenvall M, Elinge E, von HeidekenWågert P, Lundström M, Gustafson Y, Nyberg L. Having had a hip fracture—association with dependency among the oldest old. *Age Ageing* [Internet]. 2005 May 1;34(3):294–7. Available online: <http://academic.oup.com/ageing/article/34/3/294/40089/Having-had-a-hip-fractureassociation-with>
- Werner M, Krause O, Macke C, Herold L, Ranker A, Krettek C, et al. Orthogeriatric co-management for proximal femoral fractures. Can two additions make a big difference? *BMC MusculoskeletDisord* [Internet]. 2020 Dec 11;21(1):371. Available online: <https://bmcmusculoskeletdisord.biomedcentral.com/articles/10.1186/s12891-020-03392-1>
- Zidén L, Kreuter M, Frändin 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. *DisabilRehabil* [Internet]. 2010 Jan 19;32(1):18–32. Available online: <http://www.tandfonline.com/doi/full/10.3109/09638280902980910>
