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Low-Energy Pelvic Ring Fractures: A Care Conundrum

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Abstract

Introduction: A need exists for improved care pathways for patients experiencing low-energy pelvic ring fractures. A review of the current literature was performed to understand the typical patient care and post-acute rehabilitation pathway within the US healthcare system. We also sought to summarize reported clinical outcomes worldwide. **Significance:** Low-energy pelvic ring fracture patients usually do not qualify for inpatient admission, yet they often require post-acute rehabilitative care. The Center for Medicare and Medicaid Services' (CMS) 3-day rule is a barrier to obtaining financial coverage of this rehabilitative care. **Results:** Direct admission of some patients to post-acute care facilities has shown promise with decreased cost, improved patient outcomes, and increased patient satisfaction. Secondary fracture prevention programs may also improve outcomes for this patient population. **Conclusions:** Post-acute care innovation and secondary fracture prevention should be prioritized in the low-energy pelvic fragility fracture patient population. To demonstrate the effect and feasibility of these improved care pathways, further studies are necessary.

Keywords

osteoporosis, systems of care, fragility fractures, nonoperative management, low-energy fracture, pelvic ring fracture, geriatric orthopedic trauma

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Introduction

The total number of low-energy pelvic ring fractures is on the rise.[1-4] These injuries have a high morbidity and mortality burden[5,6] and are challenging not only for patients and their families but also for providers and the healthcare systems in which they operate. Given their diminished physiologic reserve, the increasing incidence of low-energy pelvic ring fractures is particularly concerning in the older, frailer population.[7,8]

In the United States, adults 65 years and older account for more than 4 million injury-related emergency room visits each year.[9] Ground-level falls are the most frequent mechanism of injury in this age group. In 2014, reports from the U.S. Center for Disease Control showed that 28.6% of this population experience a fall every year.[10] Up to 5.4% of low-energy falls result in a fracture due to osteoporotic bone.[11] In addition, it is estimated that up to two-thirds of osteoporotic posterior pelvic ring fractures (sacral fractures) occur without a known traumatic incident.[12]

Although there are several reports from the international community on the topic of low-energy pelvic ring fractures, there are very few reports regarding patient outcomes from the US, and no reports detailing the post-acute clinical course and challenges to receiving appropriate rehabilitative care. To identify systemic challenges affecting patient outcomes and propose possible opportunities for change, we summarize the literature on the topic of low-energy pelvic ring fractures and describe the acute and post-acute clinical care pathway of these patients in a US healthcare setting.

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Prevalence

Low-energy pelvic ring fractures, which include anterior ring fractures, such as those of the superior and inferior rami and symphysis, and posterior ring injuries, such as those of the iliosacral region and sacrum, account for 7% of all low-energy fractures in the United States.[13] The prevalence of these fractures is increasing.[1] A report of the incidence of pelvic ring fracture between the years 1990 and 2007 demonstrated a population-adjusted increase from 27.24 to 34.30 per 100,000 capita.[14] The increase in incidence is reported to be steeper than can be explained by purely demographic changes.[3] Further research is needed to identify reasons behind the increased incidence. Risk factors associated with these fractures include female gender, age greater than 65, fall tendency, and decreased bone density. Other pelvic ring fracture risk factors include previous internal fixation of the proximal femur or hip arthroplasty.[13]

While there has been an increase in the percentage of patients who are successfully treated operatively, at least 60% of these fractures worldwide are treated nonoperatively (Tables 1 and 2). Within the United States, operative management of these injuries is quite rare.[29,31] This preponderance of non-surgical management is primarily due to the minimally displaced and stable character of these fractures. The osteoporotic nature of most of these fractures, as well as the increased risk of surgical complications in the older patient population, also favor nonoperative treatment.[33]

Relevance

Low-energy pelvic ring fractures have a high physical and financial burden. Authors Soles and Ferguson reported that, in patients over the age of 50, these fractures account for 5% of the total cost burden of low-energy fractures in the U.S.[13] Other reports have estimated the actual cost burden of all osteoporosis related fractures to be approximately $17.9 billion annually.[34]

For millions of Americans over the age of 65, Medicare is the predominant healthcare coverage plan. This federally funded plan is offered through the Center for Medicare and Medicaid.

Post-Acute Rehabilitation Conundrum

In the US, there is an effort to minimize hospitalization, while maximizing rehabilitation and recovery from low-energy pelvic ring fractures. However, the current CMS 3-day rule makes it challenging for most patients with pelvic ring fractures treated nonoperatively to receive appropriate rehabilitative care. In order to be eligible for Medicare coverage of a post-acute rehabilitation or skilled nursing facility stay, this rule requires that a patient must spend 72 consecutive hours admitted to one or more hospitals, and, specifically, not admitted under "observation status."[35] (Admission under "observation status" is defined by CMS as outpatient services provided within the hospital while healthcare providers decide whether to admit the patient as an inpatient or discharge the patient.) This 3-day rule, first established in 1967, was put into effect when the overall average hospital admission lasted 2 weeks, and the minimum time for appropriate evaluation and planning for discharge was deemed to be approximately 3 days.[36]This time frame is no longer the standard of care; in fact, the overall average length of stay in a hospital, for all diagnoses, in 2016 was 4.6 days.[37]

Although nonoperative low-energy pelvic ring fracture patients generally do not require the full resources of a hospital, they do require some medical/therapeutic services. Many complications occur as a result of the pain and immobility caused by the injury. Given this, priorities in the care of patients with low-energy pelvic ring injury include adequate pain control and early mobilization.[38] Therefore, focused and frequent physical and occupational therapy rendered at post-acute or skilled nursing care facilities is often medically necessary.[1,39,40]

A common scenario is as follows: a patient falls and presents to the Emergency Department. Radiographs and, possibly, a CT scan or MRI are obtained to assess for fracture.[33,38,39] The patient cannot comfortably or well ambulate secondary to this fracture and cannot safely be discharged back to home. On the other hand, the patient does not require the care and interventions that warrant full in-patient admission to the hospital. The patient is held at the hospital under "observation status," As stated above, post-acute or skilled nursing care provided following a hospital stay under "observation status" is not covered by Medicare. In this increasingly common situation, the patient and their family must agree to and arrange for self-pay prior to discharge to a post-acute care facility. Thus, creating a post-acute rehabilitation conundrum.

Non-orthopaedic and geriatric literature reports a broad range of hospital admission rates for low-energy pelvic ring fractures from 4.1%[17] to 67.4%.[24] Purely outpatient care occurs in 2.2%[24] to 32%[19] of patients. This suggests that most patients require at least some stay in the hospital during the first days following this injury (Tables 1 and 2). In-patient hospitalization length-of-stay for these patients also varies widely (range 4.6 days[29] to 39 days[24]) and is likely related to country-specific healthcare settings. Following ED presentation, or subsequent to a short in-patient or "observation status" admission, many patients are admitted to a post-acute facility (range 24.2%[24] to 89.5%[17]).

Patient Outcomes

Low-energy pelvic ring fractures are associated with substantial morbidity and mortality. Complications such as deep vein thrombosis, decreased cardiac function, bedsores, urinary retention, pneumonia and worsening osteoporosis are reported.[13] It has been estimated that as many as 58% of patients will experience at least one of these complications.[20,23,26] There may also be a mental health toll associated with these fractures, including depression and anxiety related to the significant decline in self-sufficiency.[13]

Table 1. International Reports: Low-Energy Pelvic Ring Fracture Patient Outcomes.

	Number of patients	Patient population		Disposition			Length of hospital inpatient stay (Days)	Mortality (%) (non-op only)		
Citation	Non-op (% total)	Age	Fracture type	Hospital admission (%)	Rehabilitation facility (%)	Home (%)		In-patient	1 year	2+ years
Sng et al., 2020 (Australia)[15]	82 (100%)	≥ 65 yo	low energy pelvic fracture	100.0%	81.6%	16.0%	6.0	2.4%	26.0%	
Hamilton et al., 2019 (Canada)[16]	43 (100%)	> 60 yo	low energy pelvic rami fractures	100%	20.0%		31.8	9.0%	16.3%	58.1% (5 years)
Reito., 2019 (Finland)[17]	219 (100%)	≥ 70 yo	low energy pelvic or acetabular fracture	4.1%	89.5%	6.4%	20.0	10.0%	20.9%	
Schmitz et al., 2018 (Germany)[18]	65 (62%)	> 60 yo	pelvic ring fractures				12.7	15.0%		35%
Loggers, 2018 (The Netherlands)[19]	110 (94%)	≥ 65 yo	low energy pubic rami fractures, with or without pelvic ring involvement	67.0%	34.0% (after IP admit)	32.0%	5.5	5.0%	23.0%	
Höch, 2017 (Germany)[20]	63 (61%)	≥ 65 yo	lateral compression fracture of the pelvis	100%			9.2	4.0%		41.0%
Na et al., 2017 (Korea)[21]	14 (93%)	> 65 yo	low energy pelvic insufficiency fractures	33.3%		66.7%	35.0			
Kanakaris, 2017 (UK)[22]	132 (68%)	≥ 65 yo	fragility fracture	100%			21.0	9.0%	27.3%	
Maier, 2016 (Germany)[23]	93 (100%)	Mean age 76.8 yo	pelvic insufficiency fracture	100%	75.0%	25.0%	15.2		20.0%	
Studer et al., 2013 (Switzerland)[24]	127 (96%)	≥ 65 yo	low energy pelvic fracture	67.4%	24.2%	2.2%	39.0		18.5%	
Van Dijk et al., 2010 (The Netherlands)[25]	98 (99%)	> 60 yo	low energy pubic rami fracture	100%	33.3%	63.6%	10.0	3.0%	24.7%	64.4% (5 years)
Krappinger et al., 2009 (Austria)[6]	383 (100%)	Mean age 82.3 yo	pubic rami fractures	100%	46.5%	50.4%	7.8	1.8%	14.9%	
Breuil et.al, 2008 (France)[26]	60 (100%)	Mean age 79 yo	low energy pelvic fracture	100%	69.0%	31.0%	13.9			18.3%
Hill et al, 2001 (Scotland)[1]	286 (100%)	Mean age 74.7 yo	pubic rami fractures	100%	48.6%	44.4%	9.3	7.0%	13.3%	54.4% (5 years)
Leung et al., 2001 (China)[27]	51 (100%)	≥ 60 yo	acute pelvic fracture	100%			20.8	3.0%	12.0%	19.6%
Morris et al., 2000 (UK)[28]	148 (100%)	≥ 65 yo	low energy pelvic fracture	100%	33.1%	56.1%	21.3	7.6%	27.0%	50.0% (3 years)

Table 2. United States Reports: Low-Energy Pelvic Ring Fracture Patient Outcomes.

	Number of patients	Patient population		Disposition			Length of hospital inpatient stay (Days)	Mortality (%) (non-op only)	
Citation	Non-op (% total)	Age	Fracture type	Hospital admission (%)	Rehabilitation facility (%)	Home (%)		In-patient	1 year
Ghassibi et al., 2019[29]	165 (100%)	≥ 65 yo	low energy pelvic fracture	100%	73.3%	26.1%	4.6	0.6%	23%
Bible et al., 2013[30]	16 (100%)	≥ 60 yo	posterior pelvic ring fracture	100%			4.1	6.5%	15.2%
Mears and Berry, 2011[31]	181 (100%)	≥ 65 yo	low energy pelvic fracture	60.8%		39.2%	5.9		22.7%
Koval et al., 1997[32]	63 (100%)	> 55 yo	low energy pubic rami fracture	95.0%	5.0% (After IP)	95.0% (After IP)	14.0	0%	9.5%

*Non-op, nonoperative; yo, years old; IP, in-patient.

In a study of 93 patients who suffered a low-energy pelvic ring fracture, 77% were autonomous prior to the injury, but patient phone interviews conducted 16-36 months following the injury demonstrated 49 patients (53%) required assistance with at least one activity of daily living.[23] Results from Breuil et al. support this finding with 60% of their 51 cases requiring assistance 29 months after injury.[26] Mobility is also decreased after these injuries with as few as 51% of patients successfully returning to their pre-fracture mobility status. [1,19,22]

In-patient mortality following a low-energy pelvic ring fracture is reportedly as high as 10%.[17,29] One-year mortality ranges from 9.5%[32] to as high as 27%[22,28] (Tables 1 and 2). Patients who do survive and recover are also at significant risk for future low-energy fractures. In fact, the major risk factor for an osteoporotic fracture is a history of a prior low-energy fracture, and 10% of patients will experience a second fracture within 1 year of their first injury.[41,42] This risk of a second low-energy fracture increases to 17-21% within 2 years of the initial injury.[42] Studies demonstrate strong evidence supporting the effectiveness of bisphosphonates and parathyroid hormone as the most effective in preventing non-vertebral fractures.[43] Despite this knowledge, Bessette et al. found that 79% of women, aged 50 years and older, had neither undergone testing for osteoporosis nor were they prescribed anti-fracture therapy 6 to 8 months after sustaining a low-energy fracture.[44] The failure to treat osteoporosis places these patients at significant risk for future low-energy fractures.

Satisfaction

In the current model, patients experiencing low-energy pelvic ring fractures and their physicians are left frustrated and dissatisfied with the healthcare system. A 2017 physician survey performed by the Society of Hospital Medicine investigated the effects of notifying patients of their "observation status" and the resulting financial obligations.[45] While 60% of hospitalists say that this process informs the patient, 68% believe it increases conflict between the physician and patient.[45] This conflict stems from the request of patients to change their admission from "observation status" to inpatient in order to be eligible for coverage of the costs associated with the stay. There is an inability, under CMS guidelines, for physicians to make the request change.

Halpert et al. compared the length of stay, charges accrued per patient, satisfaction with the process, and discharge disposition of patients who were admitted from an emergency department directly to an extended care facility.[46] Only 6% required readmittance to the hospital. The mean length of stay in the care facility was 11 days with an average savings of $11,780 per patient. The patients who were discharged from the emergency department to the nursing care facilities fared well after treatment. Seventy-five percent went on to be discharged to their home. At the end of this care process, patients were asked if they would prefer a direct admission to the facility over a hospital admission and 71% responded positively.[46]

International healthcare systems provide a mid-level service to patients such as those who sustain a low-energy pelvic ring fracture. In Norway, for example, hospital-based rehabilitation programs provide transitional care for elderly patients who have been discharged from the full-service hospital care. Orvik et al. showed that patients are more likely to be discharged home with a higher level of functionality and with lower costs when intermediate services were provided.[47]

Opportunities

Post-Acute Care Innovation

Opportunities exist to optimize post-acute care for nonoperative pelvic ring fractures. Direct admission to skilled nursing facilities and rehabilitation centers could result in substantial cost savings. The average U.S. hospital admission is charged at just over $2,000 per day, while charges for skilled nursing facilities are $140-771 per day.[48] A direct admission care pathway was tested within the Cleveland Clinic healthcare system. Over the course of 3 months, a savings of $115,128 was realized. Importantly, no patient was readmitted to the hospital in the 30 days following their skilled nursing facility stay.[49]

Determining which patients qualify for direct admission to post-acute care is crucial to success. Recently, a waiver from the CMS 3-day rule for accountable care organizations (ACOs) has been granted allowing direct admission to nursing and rehabilitation facilities. These waivers generally have the following requirements for patient qualification: 1) the patient must be medically stable, 2) the patient must have a confirmed diagnosis and does not require further testing, 3) the patient does not require inpatient hospital evaluation or treatment, and 4) the patient has an identified need for skilled nursing or rehabilitation that cannot be provided through an outpatient setting or through home health services.[38] These requirements could be met by patients with a low-energy pelvic ring fracture treated nonoperatively. They also are met by patients with a wide range of diagnoses including but not limited to any elderly patient after a nonoperative lower extremity fracture that leaves them unable to bear weight, or an upper extremity fracture that renders them unable to use a gait assistive device or independently perform activities of daily living.

The COVID-19 pandemic prompted CMS to allow hospitals to offer long-term care services such as "swing beds" for patients who meet skilled nursing requirements, but appropriate post-acute facilities in the area were unable to accept patients secondary to the virus.[50] Providing these long-term care services within hospitals, a model that is similar to the international services previously mentioned, may offer another solution to the current post-acute rehabilitation conundrum seen within the US healthcare system.

Secondary Fracture Prevention

Significant improvement is also needed for secondary fracture prevention in patients who have sustained a low-energy pelvic ring fracture. Many reports in the literature include a "call to action" for the medical community to better identify and treat osteoporosis in low-energy fracture patients, yet osteoporosis treatment rates have failed to improve.[51] Presently, 63% of women and 83% of men receive suboptimal bone care following a fracture.[52]

Programs across the country have been implemented and have demonstrated better outcomes with regard to osteoporosis education and care. The New York University (NYU) Langone Osteoporosis Model of Care was developed to proactively identify women at increased risk for recurrent fractures and to reduce the rates of subsequent fracture through patient and physician education.[53] Another program at UCLA was trialed to assist patients in scheduling appointments for osteoporosis care and showed an increased rate of successful follow-up appointments from 54% to 71%.[54] The American Orthopaedic Association's program, Own the Bone, provides a model for a multidisciplinary approach to treating and preventing subsequent low-energy fractures. The program includes 10 measures to address patient nutrition, physical activity, lifestyle counseling, pharmacotherapy, testing, and communication with other healthcare providers.[55] Implementation of a secondary fracture prevention program such as these may reduce the incidence of subsequent fractures. Nevertheless, these resources are under-utilized.

Conclusion

A need exists for improved care pathways for patients experiencing low-energy pelvic ring fractures. Post-acute care innovation and secondary fracture prevention should be prioritized. The current US healthcare system can leave low-energy pelvic fracture patients in a post-acute rehabilitation conundrum. This is particularly true for those with lower physiologic reserve and higher frailty upon presentation. These patients often do not qualify for inpatient admission, yet they cannot safely go home without significant assistance. Direct admission of these patients to post-acute care facilities has shown promise with decreased cost, improved patient outcomes and increased patient satisfaction. Secondary fracture prevention programs may also improve outcomes for this patient population. To demonstrate the effect and feasibility of these care pathways, further studies are necessary.

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References

1. Hill RM, Robinson CM, Keating JF. Fractures of the pubic rami. Epidemiology and five-year survival. *J Bone Joint Surg Br*. 2001; 83(8):1141-1144. doi:10.1302/0301-620x.83b8.11709
2. Clement ND, Court-Brown CM. Elderly pelvic fractures: the incidence is increasing and patient demographics can be used to predict the outcome. *Eur J Orthop Surg Traumatol*. 2014;24(8): 1431-1437. doi:10.1007/s00590-014-1439-7
3. Kannus P, Parkkari J, Niemi S, Sievänen H. Low-trauma pelvic fractures in elderly Finns in 1970-2013. *Calcif Tissue Int*. 2015; 97(6):577-580. doi:10.1007/s00223-015-0056-8
4. Boufous S, Finch C, Lord S, Close J.The increasing burden of pelvic fractures in older people, New South Wales, Australia. *Injury*. 2005;36(11):1323-1329. doi:10.1016/j.injury.2005.02.008
5. Koval KJ, Aharonoff GB, Schwartz MC, et al. Pubic rami fracture: a benign pelvic injury? *J Orthop Trauma*. 1997;11(1):7-9.
6. Krappinger D, Kammerlander C, Hak DJ, Blauth M. Low-energy osteoporotic pelvic fractures. *Arch Orthop Trauma Surg*. 2010; 130(9):1167-1175. doi:10.1007/s00402-010-1108-1
7. Court-Brown CM, Clement ND, Duckworth AD, Biant LC, McQueen MM. The changing epidemiology of fall-related fractures in adults. *Injury*. 2017;48(4):819-824. doi:10.1016/j.injury.2017.02.021
8. Oberkircher L, Ruchholtz S, Maria Rommens P, Hofmann A, Bücking B, Krüger A. Osteoporotic pelvic fractures. *Dtsch Ärztebl Int*. 2018;115(5):70-80. doi:10.3238/arztebl.2018.0070
9. Platts-Mills TF, Owens ST, McBride JM. A modern-day purgatory: older adults in the emergency department with nonoperative injuries. *J Am Geriatr Soc*. 2014;62(3):525-528. doi:10.1111/jgs.12699
10. Bergen G, Stevens MR, Burns ER. Falls and fall injuries among adults aged ≥65 years—United States, 2014. *MMWR Morb Mortal Wkly Rep*. 2016;65(37):993-998. doi:10.15585/mmwr.mm6537a2
11. Morrison A, Fan T, Sen SS, Weisenfluh L. Epidemiology of falls and osteoporotic fractures: a systematic review. *Clin Outcomes Res CEOR*. 2013;5:9-18. doi:10.2147/CEOR.S38721
12. Tsiridis E, Upadhyay N, Giannoudis PV. Sacral insufficiency fractures: current concepts of management. *Osteoporos Int*. 2006;17(12):1716-1725. doi:10.1007/s00198-006-0175-1
13. Soles GLS, Ferguson TA. Fragility fractures of the pelvis. *Curr Rev Musculoskelet Med*. 2012;5(3):222-228. doi:10.1007/s12178-012-9128-9
14. Buller LT, Best MJ, Quinnan SM. A nationwide analysis of pelvic ring fractures: incidence and trends in treatment, length of stay, and mortality. *Geriatr Orthop Surg Rehabil*. 2016;7(1):9-17. doi: 10.1177/2151458515616250
15. Sng M, Gentle J, Asadollahi S. Bleeding risk associated with hemodynamically stable low-energy pelvic fracture. *Geriatr Orthop Surg Rehabil*. 2020;11:215145932091186. doi:10.1177/2151459320911868
16. Hamilton CB, Harnett JD, Stone NC, Furey AJ. Morbidity and mortality following pelvic ramus fractures in an older Atlantic Canadian cohort. *Can J Surg J Can Chir*. 2019;62(4):270-274. doi:10.1503/cjs.011518
17. Reito A, Kuoppala M, Pajulammi H, Hokkinen L, Kyrölä K, Paloneva J. Mortality and comorbidity after non-operatively managed, low-energy pelvic fracture in patients over age 70: a comparison with an age-matched femoral neck fracture cohort and general population. *BMC Geriatr*. 2019;19(1):315. doi:10.1186/s12877-019-1320-y
18. Schmitz P, Lüdeck S, Baumann F, Kretschmer R, Nerlich M, Kerschbaum M. Patient-related quality of life after pelvic ring fractures in elderly. *Int Orthop*. 2019;43(2):261-267. doi:10.1007/s00264-018-4030-8
19. Loggers SAI, Joosse P, Jan Ponsen K. Outcome of pubic rami fractures with or without concomitant involvement of the posterior ring in elderly patients. *Eur J Trauma Emerg Surg*. 2019; 45(6):1021-1029. doi:10.1007/s00068-018-0971-2
20. Höch A, Özkurtul O, Pieroh P, Josten C, Böhme J. Outcome and 2-year survival rate in elderly patients with lateral compression fractures of the pelvis. *Geriatr Orthop Surg Rehabil*. 2017;8(1): 3-9. doi:10.1177/2151458516681142
21. Na WC, Lee SH, Jung S, Jang HW, Jo S. Pelvic insufficiency fracture in severe osteoporosis patient. *Hip Pelvis*. 2017;29(2): 120-126. doi:10.5371/hp.2017.29.2.120
22. Kanakaris NK, Greven T, West RM, Van Vugt AB, Giannoudis PV. Implementation of a standardized protocol to manage elderly patients with low energy pelvic fractures: can service improvement be expected? *Int Orthop*. 2017;41(9):1813-1824. doi:10.1007/s00264-017-3567-2
23. Maier GS, Kolbow K, Lazovic D, et al. Risk factors for pelvic insufficiency fractures and outcome after conservative therapy. *Arch Gerontol Geriatr*. 2016;67:80-85. doi:10.1016/j.archger.2016.06.020
24. Studer P, Suhm N, Zappe B, Bless N, Jakob M. Pubic rami fractures in the elderly—a neglected injury? *Swiss Med Wkly*. 2013; 143:w13859. doi:10.4414/smw.2013.13859
25. van Dijk WA, Poeze M, van Helden SH, Brink PRG, Verbruggen JPAM. Ten-year mortality among hospitalised patients with fractures of the pubic rami. *Injury*. 2010;41(4):411-414. doi:10.1016/j.injury.2009.12.014
26. Breuil V, Roux CH, Testa J, et al. Outcome of osteoporotic pelvic fractures: an underestimated severity. Survey of 60 cases. *Joint Bone Spine*. 2008;75(5):585-588. doi:10.1016/j.jbspin.2008.01.024
27. Leung W, Ban C, Lam J, Ip F, Ko P. Prognosis of acute pelvic fractures in elderly patients: retrospective study. *Hong Kong Med J*. 2001;7(2):139-145.
28. Morris RO, Sonibare A, Green DJ, Masud T. Closed pelvic fractures: characteristics and outcomes in older patients admitted to medical and geriatric wards. *Postgrad Med J*. 2000;76(900): 646-650. doi:10.1136/pmj.76.900.646
29. Ghassibi M, Boyalakuntla DS, Gentile J.Low-energy pelvic ring fractures in the elderly population: expected outcomes and associated mortality rates. *J Clin Med Res*. 2019;11(11):725-728. doi: 10.14740/jocmr3891
30. Bible JE, Kadakia RJ, Wegner A, Richards JE, Mir HR. One-year mortality after isolated pelvic fractures with posterior ring involvement in elderly patients. *Orthopedics*. 2013;36(6):760-764. doi: 10.3928/01477447-20130523-21

31. Mears SC, Berry DJ. Outcomes of displaced and nondisplaced pelvic and sacral fractures in elderly adults: pelvic and sacral fractures in elderly adults. *J Am Geriatr Soc*. 2011;59(7): 1309-1312. doi:10.1111/j.1532-5415.2011.03455.x
32. Koval KJ, Chen AL, Aharonoff GB, Egol KA, Zuckerman JD. Clinical pathway for hip fractures in the elderly: the hospital for joint diseases experience. *Clin Orthop*. 2004;(425):72-81. doi:10.1097/01.blo.0000132266.59787.d2
33. Rommens PM, Wagner D, Hofmann A. Fragility fractures of the pelvis. *JBJS Rev*. 2017;5(3). doi:10.2106/JBJS.RVW.16.00057
34. Curtis EM, Moon RJ, Harvey NC, Cooper C.Reprint of: the impact of fragility fracture and approaches to osteoporosis risk assessment worldwide. *Int J Orthop Trauma Nurs*. 2017;26:7-17. doi:10.1016/j.ijotn.2017.04.004
35. Stefanacci RG. Direct admissions to skilled nursing facilities—are you ready? *Popul Health Learn Netw*. 2018;26(7):10-11. doi: 10.25270/altc.2018.12.00049
36. Grebla RC, Keohane L, Lee Y, Lipsitz LA, Rahman M, Trivedi AN. Waiving the three-day rule: admissions and length-of-stay at hospitals and skilled nursing facilities did not increase. *Health Aff Proj Hope*. 2015;34(8):1324-1330. doi:10.1377/hlthaff.2015.0054
37. Freeman WJ, Weiss AJ, Heslin KC. Overview of U.S. hospital stays in 2016: variation by geographic region:15. In: *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs [Internet]*. Agency for Healthcare Research and Quality (US); 2006.
38. Rommens PM, Arand C, Hofmann A, Wagner D. When and how to operate fragility fractures of the pelvis? *Indian J Orthop*. 2019; 53(1):128-137. doi:10.4103/ortho.IJOrtho_631_17
39. O'Connor TJ, Cole PA. Pelvic insufficiency fractures. *Geriatr Orthop Surg Rehabil*. 2014;5(4):178-190. doi:10.1177/2151458514548895
40. Popejoy LL, Dorman Marek K, Scott-Cawiezell J. Patterns and problems associated with transitions after hip fracture in older adults. *J Gerontol Nurs*. 2013;39(9):43-52. doi:10.3928/00989134-20130620-01
41. Balasubramanian A, Zhang J, Chen L, et al. Risk of subsequent fracture after prior fracture among older women. *Osteoporos Int*. 2019;30(1):79-92. doi:10.1007/s00198-018-4732-1
42. Bukata SV, Digiovanni BF, Friedman SM, et al. A guide to improving the care of patients with fragility fractures. *Geriatr Orthop Surg Rehabil*. 2011;2(1):5-37. doi:10.1177/2151458510397504
43. Saito T, Sterbenz JM, Malay S, Zhong L, MacEachern MP, Chung KC. Effectiveness of anti-osteoporotic drugs to prevent secondary fragility fractures: systematic review and meta-analysis. *Osteoporos Int*. 2017;28(12):3289-3300. doi:10.1007/s00198-017-4175-0
44. Bessette L, Ste-Marie L-G, Jean S, et al. The care gap in diagnosis and treatment of women with a fragility fracture. *Osteoporos Int*. 2008;19(1):79-86. doi:10.1007/s00198-007-0426-9
45. Society of Hospital Medicine Public Policy Committee. The Hospital Observation Care Problem. https://www.hospitalmedicine.org/globalassets/policy-and-advocacy/advocacy-pdf/shms-observation-white-paper-2017. Published September 2017. Accessed June 25, 2020.
46. Halpert AP, Pearson SD, Reina T. Direct admission to an extended-care facility from the emergency department. *Eff Clin Pract ECP*. 1999;2(3):114-119.
47. Orvik A, Nordhus GEM, Axelsson SB, Axelsson R. Interorganizational collaboration in transitional care—a study of a post-discharge programme for elderly patients. *Int J Integr Care*. 2016;16(2):11. doi:10.5334/ijic.2226
48. Ellison A. Average hospital expenses per inpatient day across 50 states. https://www.beckershospitalreview.com/finance/average-hospital-expenses-per-inpatient-day-across-50-states.html. Published January 4, 2019. Accessed February 2, 2020.
49. Phelan MP, Meldon S, Brenner R, et al. 120 Skilled nursing facility 3-day waiver pilot: direct admission to skilled nursing facilities from the emergency department avoids hospital admissions and decreases costs. *Ann Emerg Med*. 2018;72(4): S51. doi: 10.1016/j.annemergmed.2018.08.125
50. Centers for Medicare & Medicaid Services. Hospitals: CMS Flexibilities to Fight COVID-19. Published June 12, 2020. Accessed June 26, 2020.
51. Leslie WD, Giangregorio LM, Yogendran M, et al. A population-based analysis of the post-fracture care gap 1996–2008: the situation is not improving. *Osteoporos Int*. 2012;23(5):1623-1629. doi:10.1007/s00198-011-1630-1
52. Giammattei F, Giammattei J, Howland V. Physician follow-up care for osteoporosis after fragility fractures. *Phys Sportsmed*. 2009;37(4):62-67. doi:10.3810/psm.2009.12.1743
53. Saxena A, Honig S, Rivera S, Pean CA, Egol KA. The NYU osteoporosis model of care experience. *Geriatr Orthop Surg Rehabil*. 2015;6(4):276-281. doi:10.1177/2151458515604358
54. Sugi MT, Sheridan K, Lewis L, et al. Active referral intervention following fragility fractures leads to enhanced osteoporosis follow-up care. *J Osteoporos*. 2012;2012:1-6. doi:10.1155/2012/234381
55. American Orthopaedic Association. What is Own the Bone? Own the Bone. https://www.ownthebone.org/what-is-otb/. Accessed January 4, 2021.