

Chapter 9

Geriatric Trauma Care



Jeffrey J. Skubic and Zara Cooper

Introduction

Between 2012 and 2050, the US population of adults aged >65 years is expected to nearly double to 83 million. In 2015, in the USA, medical costs attributable to falls in the elderly were estimated at \$50 billion (Florence et al., 2018). Rates of hospitalizations related to traumatic brain injury (TBI) increased by more than 50% from 2001–2002 to 2009–2010 (from 191.5 to 294 per 100,000) (CDC, 2018). Compared with younger patients, patients aged 75 years and older have the highest rates of TBI-related hospitalizations and mortality (CDC, 2018). Health-care utilization remains elevated for at least 2 years post injury in elderly patients (Carter & Porell, 2011). In 2013, 14.1% of the US population was older than age 65 (OECD, 2019). The same year, 37.9% of personal health-care spending was for elderly patients; at the rate our geriatric population is growing, caring for these patients is expected to become an increasingly larger segment of US health-care spending (Dieleman et al., 2016).

Older patients have worse in-hospital mortality after trauma than younger patients (Taylor, Tracy, & Napolitano, 2002). Mortality associated with geriatric trauma has been estimated to be as high as 15%; however, many who survive fail to return to independent living (Hashmi et al., 2014). For those who do, many experience functional declines that negatively impact their quality of life. Older,

J. J. Skubic · Z. Cooper (✉)

Division of Trauma, Burn and Surgical Critical Care, Brigham and Women's Hospital,
Boston, MA, USA

e-mail: zcooper@bwh.harvard.edu

seriously ill patients tend to prioritize physical and cognitive function over life prolongation, so it is important to keep the individual patient's goals of care in mind when formulating a treatment plan.

Frailty

Frailty is defined as a syndrome of accelerated aging resulting in decreased physiological reserve and decreased resilience to stressors (McDonald et al., 2016). Surgery and trauma lead to major physiological changes, including fluid losses, hemorrhage, cardiovascular stress, respiratory impairments, and mental status changes. These effects are exacerbated in elderly trauma patients, who frequently have many comorbidities in addition to being frail. Although distinct from physiological aging, the incidence of frailty increases with age. Whereas 10–20% of adults aged 65 are frail, that number increases to 26–40% among patients aged 85 and older (American Medical Association, 1991; Collard, Boter, Schoevers, & Oude Voshaar, 2012). As patients age, they use more of their physiological reserves to maintain homeostasis. Therefore, they have fewer reserves to meet challenges introduced by trauma. Numerous studies have demonstrated that frailty is associated with worse outcomes after injury. Joseph et al. (2014) developed the Trauma-Specific Frailty Index, which is based on 15 variables available from the medical record. A score of 0.25 or higher has been shown to be an independent risk factor for in-hospital morbidity and mortality, as well as adverse discharge disposition (Joseph et al., 2014). In a prospective study of 188 patients, Maxwell et al. (2016) were able to show that the pre-injury scores on the Vulnerable Elders Survey-13 (VES-13, a tool that predicts functional decline and mortality) and Barthel Index (an assessment of functional independence) correlated to worse outcomes after injury.

Futility

The word “futility” comes from the Latin word *futilis*, which means worthless. The simplest definition of medical futility is “a clinical action serving no useful purpose in attaining a specified goal for a given patient” (Kasman, 2004). Aghabarary and Dehghan-Nayeri (2016, p. 6) proposed that the definition of futility consists of six elements:

1. The probability of achieving the physiological effects which have been supposed for a medical treatment
2. The probability of achieving the defined goals of a treatment
3. The amount of benefit and utility which the intended treatment has for the intended patient
4. The survival rate of the intended treatment
5. Post-treatment quality of life
6. The cost-effectiveness of the treatment

Determining futility in severely injured, older patients can be highly challenging. Conflicts within the care team (families, patients, and physicians) as to whether futility exists and as to the best treatment approach are not infrequent. During discussions with patients or their surrogates, attention should be focused on whether specific medical treatments may be futile under these specific circumstances. Treatment decisions must be made in the context of understanding a patient's overall health goals and willingness to make the trade-offs necessary to achieve an acceptable outcome. Clinicians are not ethically obligated to provide treatment that they believe is futile and misaligned with the patient's goals and values. The American Medical Association (AMA) has stated that physicians are not ethically obligated to deliver care that, in their best professional judgment, will not have a reasonable chance of benefiting the patient. A *reasonable chance* is very hard to define. In light of that, the AMA goes on to say, "Denial of treatment should be justified by reliance on openly stated ethical principles and acceptable standards of care...not on the concept of 'futility', which cannot be meaningfully defined" (American Medical Association, 2008). Later in their revised guidelines, the AMA has tried to expand upon that statement, saying, "Physicians must remember that it is not possible to offer a single, universal definition of futility. The meaning of the term 'futile' depends on the values and goals of a particular patient in specific clinical circumstances" (American Medical Association, 2016).

The four tenets of medical ethics are autonomy, beneficence, non-maleficence, and justice. Below, we present four clinical vignettes that illustrate how these principles relate to the care of older trauma patients.

Autonomy

Charlie is an 80-year-old retired attorney with five children and a wife of 57 years. His medical history includes diabetes, coronary artery disease, congestive heart failure, and a transient ischemic attack. Charlie was driving back from an appointment with his primary care physician when he lost consciousness behind the wheel, headed the wrong way into traffic and ended up in a head-on collision. Unresponsive at the scene, he was intubated and flown to the nearest level I trauma center. When evaluated in the trauma bay, he was found to be in shock, with a blood pressure reading of 70/40 mm/Hg, a heart rate of 65 beats per minute, a respiratory rate of 20, and an oxygen saturation of 93% on room air. His focused assessment with sonography for trauma (FAST) exam, a study which rapidly uses ultrasound in the trauma bay to look for free fluid in the abdomen, presumed to be blood, was negative. He received fluid resuscitation and was started on vasopressor therapy. He remained unresponsive and was transferred to the intensive care unit (ICU). Twelve hours later, he was finally stable enough to travel to the computed tomography scanner. The imaging demonstrated a large stroke. He remains in critical condition.

Ethical Questions

Who is his health-care agent?

How should the surrogates be coached?

The principle of autonomy states that individuals have the right to self-determination. The current legality of this principle in the USA dates back to the American Hospital Association's 1972 "Statement on a Patient's Bill of Rights" (American Hospital Association, 1973). This statement declares that patients have the right to receive considerate and respectful care and the information necessary to give informed consent for any treatment or procedure and to refuse any treatment offered. Notably, the right to demand a particular treatment is not included. Therefore, physicians must be very cautious which treatments they offer and must simultaneously ensure that they preserve patient autonomy. In a study in which 179 surrogates for 142 incapacitated, critically ill patients were interviewed, only 2% of the surrogates based their beliefs exclusively on the prognostic information given to them by the physician. Instead, 98% of surrogates relied on other factors, such as their own observations of the patient, their belief that their presence at the bedside improved the patient's prognosis, and their optimism, faith, and intuition (Boyd et al., 2010).

If patients are competent and able to participate in treatment decisions, physicians must respect their decision to accept or refuse treatment. Geriatric patients are more likely than younger patients to lack capacity because they are more likely to have cognitive impairment or dementia. When a patient does not have the capacity to make decisions, a health-care proxy or a living will may be used. A health-care proxy is a document that designates a person (health-care agent) to make decisions if a patient is unable to do so for themselves. A living will, on the other hand, is a document that outlines the patient's wishes (advance directives). The living will can be used by the health-care agent and physician to help guide decision-making. Several different approaches exist to help surrogates make decisions, especially when no living will exists. The preferred approach is substituted judgment, i.e., surrogates state what patients would have wanted if they were able to speak for themselves. If the patients' wishes are not known, surrogates should use the best-interest standard, i.e., benefits to the patient should be maximized and harmful risks minimized. Using a narrative approach, surrogates and clinicians can examine a patient's life story to make decisions that seem consistent with previous choices the patient has made for themselves (Torke, Alexander, & Lantos, 2008). In a case that received national media attention in 1976, the supreme court of New Jersey ruled that mechanical ventilation could be removed from Karen Ann Quinlan if she was deemed by her physician and a hospital panel to have no reasonable chance for recovery. This decision fell to her father because Quinlan was not able to express her wishes at that time. It was a direct threat to

her life and was made without her knowledge or consent because she was in a persistent vegetative state (Halper, 1996).

If there is a high degree of certainty that a certain treatment will benefit a patient, the physician should discuss with the surrogate the rationale for offering this treatment and the risks associated with it. If, however, there is uncertainty regarding which treatment would be best aligned with the patient's goals, the physician and surrogate should decide together. Informed consent is the legal process of offering a treatment to a patient and discussing its risks and benefits, whereas shared decision-making is the process by which the physician exchanges information with the patient to allow them to decide between multiple options of treatment, including proceeding without treatment. If the patient cannot participate in the decision-making process, that authority is passed on to the surrogate decision-maker (Whitney, McGuire, & McCullough, 2004).

In our example case, if the patient can be stabilized, with his large stroke, the medical team should first elicit goals of care and then give their prognosis and treatment recommendations in the context of the patient's elicited goals. First, the team should decide whether the patient has the capacity to make health-care decisions. If not, his health-care proxy and/or living will document should be identified. Once a health-care agent is identified, the medical team should meet with the agent and the patient's family to determine the optimal treatment plan. If a living will is available, the care team and surrogate should use this document to help them make decisions, but ultimately, the decisions will be made by the surrogate.

Non-maleficence

Francis is an 82-year-old male who was found unconscious at the bottom of a stairwell by his wife. Emergency medical services were contacted, and they transported the patient to a nearby trauma center. Upon arrival at the trauma bay, he was still unconscious and was intubated. A computed tomography scan of his head showed large bilateral subdural hemorrhages with no shift. He was taken to the trauma ICU, where his intracranial pressure was closely monitored. By hospital day 2, the surgery team was starting to plan a family meeting to suggest limiting aggressive interventions because of his poor prognosis (his Glasgow Coma Scale [GCS] was 3T). Initially, the medical team did not expect the patient to ever regain consciousness or to perform any purposeful movement, let alone return to his prior functional state at home. On hospital day 4, however, the patient started to localize painful stimuli, which improved his GCS. Consequently, the surgery team decided to cancel the planned family meeting and instead to call the patient's wife to obtain consent for a tracheostomy and feeding tube, with plans to discharge him to a long-term care facility soon.

Ethical Questions

Is this an appropriate change in plan by the medical team?

How do we apply the ethical tenet of non-maleficence to aggressive treatments that may be offered to elderly trauma patients?

How should a patient's prognosis influence treatment recommendations?

"Primum non nocere." First, do no harm. Its origins coincide with the beginnings of medicine. On a daily basis, physicians weigh risks and benefits. In trauma patients, physicians need to decide quickly how they will avoid harm because many of these patients need immediate stabilization. Tools to assess outcomes after traumatic injuries in frail patients have been developed, as mentioned above in the section "Frailty" (Joseph et al., 2014; Maxwell et al., 2016).

In our example case, we describe an older patient who has sustained a significant traumatic brain injury (TBI). To decide which treatments are suitable for this patient, we need to first look not only at his chances of survival after a TBI but also at his risk of disability and dependence and his personal priorities and goals for treatment.

The Eastern Association for the Surgery of Trauma (EAST) geriatric trauma guidelines recommend an initially aggressive approach for elderly patients, unless an experienced trauma surgeon determines that the patient's injuries are not survivable (Calland et al., 2012). They also recommend limiting aggressive care in patients older than 65 years with TBI and an admission GCS ≤ 8 if there is no neurological improvement within 72 hours. However, a study from our group suggests that these parameters are not a reliable marker for long-term outcomes. Lilley et al. (2016) used data from a single level I trauma center to examine outcomes among older patients admitted with a GCS ≤ 8 . Patients were divided into "responders" and "non-responders," depending on whether their GCS improved within 72 hours. Responders had little improvement in the rate of independence at discharge. Although the mortality rate in the first 30 days was higher in "non-responders" than in "responders," when those who died in hospital were excluded, the mortality rate at 1 year was roughly the same in both groups. Monitoring progression of TBI patients for 72 hours is an example of a time-limited trial; such a trial is a communication and decision-making strategy that identifies objective markers for deterioration and defines potential actions that can be performed in a stepwise fashion if clinical deterioration occurs. It allows the family time to see how the patient is responding and to better understand the overall prognosis. Quill and Holloway (2011) defined the steps involved in a time-limited trial as follows:

1. Define the clinical problem and prognosis.
2. Clarify the patient's goals and priorities.
3. Identify objective markers of improvement or deterioration.
4. Suggest a time frame for re-evaluation.
5. Define potential actions to take at the end of the time-limited trial.

What does this information mean for Francis in the above scenario? Because he has been in the hospital for 4 days and his GCS had not improved by the 72-hour mark, he has already failed his time-limited trial. He had a slight response in his neurological exam, but only after the time-limited trial of 72 hours. Aggressive treatment beyond this is highly unlikely to help him return to a state of independence. The patient's health-care providers need to discuss his goals of care with his surrogate decision-maker to decide whether to offer further aggressive treatments, such as a feeding tube or tracheostomy. The tenet of non-maleficence must be adhered to while attempting to give care that is in accordance with the patient's goals.

Beneficence

Miriam is an 83-year-old female who fell in her kitchen while cooking dinner for her boyfriend. She had known pre-existing cervical stenosis and a known fear of surgery. At the tertiary trauma center, she was evaluated and noted to have a C5 fracture and to now be quadriplegic. In the trauma bay, she was intubated for dyspnea. She was immediately evaluated by the spine surgery service and admitted to the surgical ICU with a cervical collar in place. She was started on standard preventions, such as chemical deep venous thrombosis prophylaxis and a ventilator bundle. The trauma surgery team contacted her children but were unable to identify a health-care proxy agent. There was no documentation of advance directives. The patient was extubated on hospital day 3. She was evaluated by a physiatrist, with plans for discharge to a nursing facility. She underwent a swallowing evaluation by the speech and swallow service for dysphagia, which determined that she was aspirating and therefore could not be fed by mouth. A small-bore feeding tube was inserted for nutritional support, and she was started on chest physiotherapy and aggressive pulmonary toilet. Despite these measures, she developed pneumonia on hospital day 6 and required intermittent positive pressure respiratory support. On hospital day 8, a family meeting was conducted via telephone. This meeting focused on interventions that would be offered for Miriam, specifically a tracheostomy and percutaneous endoscopic gastrostomy (PEG). The only goals discussed at this family meeting were survival and hospital discharge. The family's understanding of Miriam's prognosis was not assessed nor were her goals of care or alternatives to surgery explored. By hospital day 10, Miriam was refusing both the tracheostomy and PEG and wanted her code status changed to "do not resuscitate." The following day, she was transferred back to the ICU with dyspnea and hypoxia. She expired in the ICU with her boyfriend at her side; her children were not present. When the hospital's "trauma performance improvement and patient safety meeting" reviewed this case, they determined that Miriam's death was not unexpected and that she was not likely to improve with treatment; however, several team members present felt

that Miriam was not cared for optimally in accordance with her goals. Specifically, they thought Miriam was overtreated and that her goals were more aligned with comfort measures rather than transferring her to the ICU for more aggressive care.

Ethical Questions

Was autonomy for the patient preserved?

Were proper goals of care addressed according to the tenet of beneficence?

What quality measures should be used in a case such as Miriam's?

Non-maleficence and beneficence must both be considered in the care of the trauma patient and weighed against each other. Beneficence requires that any treatment or procedure be done with the intent to do good for the patient and to promote their overall well-being and also to respect their values and preferences. The benefits of any procedure must be weighed against the risks. This calls to mind the principle of the double effect: a treatment may be offered to benefit a patient but may unintentionally also cause harm to the patient. This is where clinicians need to think long and hard to decide not only whether this is normally the right treatment to offer but also whether it is the right treatment for this older patient in this specific instance. In older adults, providing care with the intent of "doing good" for the patient must take into account the patient's comorbidities, frailty, level of functional independence, and quality of life before the trauma occurred, as well as the patient's understanding of each of these and their individual goals after hospitalization. In Miriam's case, state-of-the-art trauma care was provided, but was it the right treatment for her?

Current quality measures focus on 30-day in-hospital mortality and complications. However, even though Miriam died, she received goal-concordant treatment—she would not have wanted to survive in her paralyzed, debilitated state. In the care of the older trauma patient, outcomes such as comfort, dignity, long-term survival, functional independence, time with loved ones, and time spent at home rather than in a hospital or nursing facility may be more relevant than the 30-day in-hospital mortality and complication measure. As care of the older trauma patient improves, so must the metrics used to measure the quality of care delivery.

Justice

Harold is an 84-year-old male patient who was brought to the nearest level III trauma center by emergency medical services after slipping on the ice at home. At the hospital, his vital signs were normal, and his GCS was 14 because he was slightly confused. On imaging, he was found to have a femoral neck fracture and a small subdural hemorrhage. Because of the TBI, the emergency room physician decided to transfer him to a level I trauma center, about 45 minutes away.

Ethical Questions

Is it just for Harold to be transferred to a level I trauma center for a higher level of care?

The principle of justice concerns the equal distribution of scarce resources and protection of vulnerable populations. Rationing of resources should not be based on age alone but must take into account the individual patient's preferences and goals and the potential benefit of the procedure being offered. Utilitarianism is defined by the Oxford Living Dictionaries (2018) as the doctrine that actions are right if they are useful or for the benefit of the majority. Although utilitarianism dictates that we must consider the effects on a whole society when treating the individual patient, one must be careful not to undertriage (i.e., assign an inadequately low triage level) or undertreat older trauma patients. Physicians must consider the effect on society but also protect each older trauma patient in their care. However, geriatric trauma patients are consistently undertriaged in the field. A retrospective study from Maryland that evaluated 25,565 trauma activations found a 32% higher rate of undertriage in patients older than 65 (Chang, Bass, & Cornwell, 2008). This may be due in part to the fact that older patients are more likely than younger patients to sustain severe injuries from a low-energy mechanism; in addition, the severity of injury may be underappreciated by those triaging on the basis of mechanism alone (Sterling, O'Connor, & Bonadies, 2001). The Centers for Disease Control and Prevention (CDC) has recommended that advanced age (55) should prompt transfer to a trauma center. Recommendations such as this would support early aggressive resuscitation of the geriatric trauma patient and transfer to a trauma center. However, controversy remains as to whether higher-level trauma centers provide the best care to older injured patients. Goodmanson et al. (2012) retrospectively examined 104,015 patients in the Pennsylvania statewide trauma database and showed a significantly increased mortality risk starting at age 57 and an overall lower mortality risk for trauma care than for non-trauma care for all ages. Using the same database, another study in 39,000 patients found lower rates of geriatric mortality, complications, and failure to rescue at centers with a higher geriatric volume (Matsushima et al., 2014). Barmparas et al. (2016) examined geriatric patients with cervical spine fractures and showed no improved survival after transfer to a higher-level trauma center. Olufajo, Metcalfe, et al. (2016) hypothesized that the geriatric trauma proportion (GTP) cared for was a stronger determinant of outcomes than geriatric trauma volume (GTV). Using the California State Inpatient Database, the research group demonstrated that, compared with centers with the lowest GVP, trauma centers with the highest GVP had lower mortality, failure to rescue, and complications, whereas there was no association between higher GTV and lower mortality (Olufajo, Metcalfe, et al., 2016). These findings suggest that even some smaller, lower-level trauma centers have developed processes of care to address the unique needs of geriatric trauma patients and improve their outcomes.

One way for hospitals to improve trauma care of geriatric patients is to create a dedicated geriatric service for trauma patients. A study at a German trauma center compared data in patients >75 years old treated before ($n = 169$) and after ($n = 216$) introduction of a co-management model in which patients were co-managed by a trauma surgeon and a geriatrician: mean ICU length of stay decreased from 53 to 48 hours and mortality decreased from 9.5% to 6.5% (Grund, Roos, Duchene, & Schuler, 2015). Our hospital added a dedicated trauma geriatrician in 2013. In-hospital mortality was lower in the preintervention ($n = 215$) than in the postintervention ($n = 191$) group (9.30% vs 5.24%, $p = 0.12$), as was 30-day mortality (11.63% vs 6.81%, $p = 0.10$); however, the differences did not reach statistical significance because of the small sample size (Olufajo, Tulebaev, et al., 2016). Treatment by a trauma geriatrician is in alignment with the tenet of justice for this population, which is unique and deserves specialized care.

In our clinical scenario, the correct course of action is for the transferring physician to evaluate the extent of Harold's injuries and involve him in the decision regarding his potential transfer to a higher level of care. At this point in time, it is not clear which trauma centers have the best outcomes for older patients on the basis of the severity of their injuries. More studies are needed to help guide clinicians and patients on the type of hospitals that will provide the best care if they are in a situation similar to the one described in this vignette.

Clinical Pearls

- Geriatric trauma patients are not just older adult trauma patients. Older adults have unique physiological and psychosocial needs, which require that trauma care be tailored to their needs. It is estimated that over 50% of trauma patients are frail. Frail injured patients have particularly bad outcomes and high mortality in the year after injury (Joseph et al., 2014).
- The ethical tenets of autonomy, beneficence, non-maleficence, and justice should be used when making treatment decisions regarding geriatric trauma patients.
- Communication between the physician, patient, and family is crucial. Among older adults in an ICU, 71% have a surrogate involved in decision-making and 43% rely solely on a surrogate (Torke et al., 2014). Surrogates are frequently poorly prepared for this role and do not understand the patient's treatment goals (Lilley et al., 2017). Treatment decisions are especially difficult when changes in health status are dramatic and unexpected. Surrogates require guidance from the surgical team.
- Age should never be the sole determinant of care provided. Patients should be evaluated on an individual basis; their personal goals and values should be at the forefront of decision-making.

References

- Aghabary, M., & Dehghan-Nayeri, N. (2016). Medical futility and its challenges: A review study. *Journal of Medical Ethics and History of Medicine*, 9, 1–13.
- American Hospital Association. (1973). Statement of a patient's bill of rights. *Hospitals*, 47(4), 41.
- American Medical Association. (1991). American Medical Association white paper on elderly health. Report of the Council on Scientific Affairs. *Archives of Internal Medicine*, 151(2), 265.
- American Medical Association. (2008). Code of medical ethics. Opinion 2.035 – Futile care.
- American Medical Association. (2016). Code of medical ethics. Opinion 5.4 – Care for patients at end of life.
- Barmparas, G., Cooper, Z., Haider, A. H., Havens, J. M., Askari, R., & Salim, A. (2016). The elderly patient with spinal injury: Treat or transfer? *The Journal of Surgical Research*, 202(1), 58–65. <https://doi.org/10.1016/j.jss.2015.12.032>
- Boyd, E. A., Lo, B., Evans, L. R., Malvar, G., Apatira, L., Luce, J. M., et al. (2010). It's not just what the doctor tells me: Factors that influence surrogate decision-makers' perceptions of prognosis. *Critical Care Medicine*, 38(5), 1270–1275. <https://doi.org/10.1097/CCM.0b013e3181d8a217>
- Calland, J. F., Ingraham, A. M., Martin, N., Marshall, G. T., Schulman, C. I., Stapleton, T., et al. (2012). Evaluation and management of geriatric trauma: An eastern association for the surgery of trauma practice management guideline. *Journal of Trauma and Acute Care Surgery*, 73(5), D345–S350. <https://doi.org/10.1097/TA.0b013e318270191f>
- Carter, M. W., & Porell, F. W. (2011). The effect of sentinel injury on medicare expenditures over time. *Journal of the American Geriatrics Society*, 59(3), 406–416. <https://doi.org/10.1111/j.1532-5415.2010.03283.x>
- CDC. (2018). *TBI: Get the facts*. https://www.cdc.gov/traumaticbraininjury/get_the_facts.html. Accessed 18 Apr 2018.
- Chang, D. C., Bass, R. R., & Cornwell, E. E. (2008). Undertriage of elderly trauma patients to state-designated trauma center. *Archives of Surgery*, 143(8), 776–781. <https://doi.org/10.1001/archsurg.143.8.776>
- Collard, R. M., Boter, H., Schoevers, R. A., & Oude Voshaar, R. C. (2012). Prevalence of frailty in community-dwelling older persons: A systematic review. *Journal of the American Geriatrics Society*, 60(8), 1487–1492. <https://doi.org/10.1111/j.1532-5415.2012.04054.x>
- Dieleman, J. L., Baral, R., Birger, M., Bui, A. L., Bulchis, A., Chapin, A., et al. (2016). US spending on personal health care and public health, 1996–2013. *JAMA*, 316(24), 2627. <https://doi.org/10.1001/jama.2016.16885>
- Florence, C. S., Bergen, G., Atherly, A., Burns, E., Stevens, J., & Drake, C. (2018). Medical costs of fatal and nonfatal falls in older adults: Medical costs of falls. *Journal of the American Geriatrics Society*, 66(4), 693–698. <https://doi.org/10.1111/jgs.15304>
- Goodmanson, N. W., Rosengart, M. R., Barnato, A. E., Sperry, J. L., Peitzman, A. B., & Marshall, G. T. (2012). Defining geriatric trauma: When does age make a difference? *Surgery*, 152(4), 668–675. <https://doi.org/10.1016/j.surg.2012.08.017>
- Grund, S., Roos, M., Duchene, W., & Schuler, M. (2015). Treatment in a center for geriatric traumatology: Evaluation of length of hospital stay and in-hospital mortality in a prospective case series with historical controls. *Deutsches Ärzteblatt International*, 112(7), 113–119. <https://doi.org/10.3238/arztebl.2015.0113>
- Halper, T. (1996). Privacy and autonomy: From Warren and Brandeis to Roe and Cruzan. *The Journal of Medicine and Philosophy*, 21(2), 121–135.
- Hashmi, A., Ibrahim-Zada, I., Rhee, P., Aziz, H., Fain, M. J., Friese, R. S., et al. (2014). Predictors of mortality in geriatric trauma patients: A systematic review and meta-analysis. *Journal of Trauma and Acute Care Surgery*, 76(3), 894–901. <https://doi.org/10.1097/TA.0b013e3182ab0763>

- Joseph, B., Pandit, V., Zangbar, B., Kulvatunyou, N., Hashmi, A., Green, D. J., et al. (2014). Superiority of frailty over age in predicting outcomes among geriatric trauma patients: A prospective analysis. *JAMA Surgery*, *149*(8), 766. <https://doi.org/10.1001/jamasurg.2014.296>
- Kasman, D. L. (2004). When is medical treatment futile? *Journal of General Internal Medicine*, *19*(10), 1053–1056.
- Lilley, E. J., Morris, M. A., Sadovnikoff, N., Luxford, J. M., Changoor, N. R., Bystricky, A., et al. (2017). “Taking over somebody’s life”: Experiences of surrogate decision-makers in the surgical intensive care unit. *Surgery*, *162*(2), 453–460. <https://doi.org/10.1016/j.surg.2017.03.011>
- Lilley, E. J., Williams, K. J., Schneider, E. B., Hammouda, K., Salim, A., Haider, A. H., et al. (2016). Intensity of treatment, end-of-life care, and mortality for older patients with severe traumatic brain injury. *Journal of Trauma and Acute Care Surgery*, *80*(6), 998–1004. <https://doi.org/10.1097/TA.0000000000001028s>
- Matsushima, K., Schaefer, E. W., Won, E. J., Armen, S. B., Indeck, M. C., & Soybel, D. I. (2014). Positive and negative volume-outcome relationships in the geriatric trauma population. *JAMA Surgery*, *149*(4), 319–326.
- Maxwell, C. A., Mion, L. C., Mukherjee, K., Dietrich, M. S., Minnick, A., May, A., et al. (2016). Preinjury physical frailty and cognitive impairment among geriatric trauma patients determine postinjury functional recovery and survival. *Journal of Trauma and Acute Care Surgery*, *80*(2), 195–203. <https://doi.org/10.1097/TA.0000000000000929>
- McDonald, V. S., Thompson, K. A., Lewis, P. R., Sise, C. B., Sise, M. J., & Shackford, S. R. (2016). Frailty in trauma: A systematic review of the surgical literature for clinical assessment tools. *Journal of Trauma and Acute Care Surgery*, *80*(5), 824–834. <https://doi.org/10.1097/TA.0000000000000981>
- OECD. (2019). *Elderly population (indicator)*. <https://doi.org/10.1787/8d805ea1-en>. Accessed on 03 Apr 2019.
- Olufajo, O. A., Metcalfe, D., Rios-Diaz, A., Lilley, E., Havens, J. M., Kelly, E., et al. (2016). Does hospital experience rather than volume improve outcomes in geriatric trauma patients? *Journal of the American College of Surgeons*, *223*(1), 32–40.e1. <https://doi.org/10.1016/j.jamcollsurg.2016.02.002>
- Olufajo, O. A., Tulebaev, S., Javedan, H., Gates, J., Wang, J., Duarte, M., et al. (2016). Integrating geriatric consults into routine care of older trauma patients: One-year experience of a level I trauma center. *Journal of the American College of Surgeons*, *222*(6), 1029–1035. <https://doi.org/10.1016/j.jamcollsurg.2015.12.058>
- Oxford Living Dictionaries – English. (2018). <https://en.oxforddictionaries.com>. Accessed 29 Apr 2018.
- Quill, T. E., & Holloway, R. (2011). Time-limited trials near the end of life. *JAMA*, *306*(13), 1483. <https://doi.org/10.1001/jama.2011.1413>
- Sterling, D. A., O’Connor, J. A., & Bonadies, J. (2001). Geriatric falls: Injury severity is high and disproportionate to mechanism. *The Journal of Trauma*, *50*, 116–119.
- Taylor, M. D., Tracy, J. K., & Napolitano, L. M. (2002). Trauma in the elderly: Intensive care unit resource use and outcome. *The Journal of Trauma*, *53*(3), 407–414.
- Torke, A. M., Alexander, G. C., & Lantos, J. (2008). Substituted judgment: The limitations of autonomy in surrogate decision making. *Journal of General Internal Medicine*, *23*(9), 1514–1517. <https://doi.org/10.1007/s11606-008-0688-8>
- Torke, A. M., Sachs, G. A., Helft, P. R., Montz, K., Hui, S. L., Slaven, J. E., et al. (2014). Scope and outcomes of surrogate decision making among hospitalized older adults. *JAMA Internal Medicine*, *174*(3), 370. <https://doi.org/10.1001/jamainternmed.2013.13315>
- Whitney, S. N., McGuire, A. L., & McCullough, L. B. (2004). A typology of shared decision making, informed consent, and simple consent. *Annals of Internal Medicine*, *140*(1), 54. <https://doi.org/10.7326/0003-4819-140-1-200401060-00012>