Prevalence of the Inability to Give Informed Consent in the Elderly Orthopaedic Trauma Population

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Title: Prevalence of the Inability to Give Informed Consent in the Elderly Orthopaedic Trauma Population

Purpose: Despite the fact that fractures are a leading cause of morbidity in the elderly, a study of the prevalence of the inability to give informed consent in the elderly orthopaedic trauma population has, to the best of our knowledge, not been performed. In addition, the condition of mild cognitive impairment (MCI) has become increasingly recognized since the introduction of the Montreal Cognitive Assessment (MoCA). By simultaneously determining capacity for consent (by clinician gestalt – the gold standard) and degree of cognitive impairment (by utilizing the MoCA), we hope to better understand the relationship between the ability to consent and MCI as well as the specific components of cognition that may allow for decision-making capacity (DMC).

Methods: This prospective study was carried out at Brigham and Women's Hospital (BWH). English and Spanish speaking patients older than 65 who were admitted for orthopaedic injury requiring surgical management were included in the study. Those who had previously known dementia and delirium were excluded from the study, as well as those who were unable to communicate. (NB: A recent IRB amendment has now allowed us going forward to approach certain patients with known dementia and delirium). Attending physicians determined whether or not a patient had DMC. Independently, a research staff member administered the confusion assessment method (CAM) short form to screen for delirium and the MoCA to screen for cognitive impairment. Various other background data were obtained retrospectively.

Results: While the prevalence of the inability to give informed consent cannot be determined since the project is still actively recruiting patients, we hypothesize that this prevalence is at least 15.6%. While patients with DMC had various demographic data characteristic of the elderly orthopaedic trauma population, 81.8% had an abnormal total MoCA score. Participants generally scored worse on tasks assessing for certain cognitive domains, such as visuospatial/executive function tasks (mean score: 46.7%) and the delayed recall task (mean score: 40%). The vast majority of participants (90.5%) who struggled with the delayed recall task were, however, able to remember additional words with category and/or multiple choice clues. None of the participants had a positive screen for delirium.

Conclusions: Mild cognitive impairment at the time of consent appears not to preclude a patient from having DMC. Although the relationship between cognitive ability and DMC remains not well understood, further conclusions regarding early cases of dementia should be studied going forward. Deficits in certain domains of cognitive thinking may be correlated with an inability to give informed consent, although a comparison of testing results between patients with versus without DMC will be required to further understand this idea.

Table of Contents

Glossary

BWH = Brigham and Women's Hospital
CAM = Confusion Assessment Method
DMC = decision-making capacity
HMS = Harvard Medical School
MCI = mild cognitive impairment
MIS = memory index score
MoCA = Montreal Cognitive Assessment

Section 1: Introduction

Geriatric orthopaedic trauma

For patients of any age group, traumatic orthopaedic injuries can have significant long-term consequences. In addition to physical recovery, patients often suffer from substantial psychological and financial barriers after their traumatic injuries.[1] For elderly patients, underlying poor bone health and limited social supports add to the burden of disease, which lead to decreased quality of life and increased risk of mortality. In fact, in patients aged 65 or older, the one-year post-operative mortality rate for hip fractures, a common geriatric orthopaedic injury, has been described in the literature as 27.3%.[2]

Informed Consent

Informed consent is inextricably linked to each medical decision made by a patient and lies at the heart of a shared decision making model.[3] In order to provide informed consent, a patient – for his/her own safety and the safety of the patient's medical team – should have decision-making capacity (DMC), defined legally by 4 criteria: communication, understanding, appreciation, and reasoning.[4]

DMC has historically been assessed informally by clinician judgment, either by clinical gestalt and/or by asking the patient to repeat risks and benefits.[5] But some cases are more challenging than others, and providers are not always certain patients have the capacity to make and express an informed decision about their medical care. Previous research has shown that physicians often over-estimate patients' understanding and that patients tend to recall the benefits better than the risks.[6,7]

While clinician gestalt remains the gold standard for determining capacity to consent, the prevalence of the inability to give informed consent in elderly orthopaedic patients is not known.

Cognitive Impairment

Certain cognitive changes are associated with normal aging. However, increasing age also increases the risk of developing significant, irreversible cognitive changes such as dementia. One study found that approximately 13.9% of individuals 71 years of age or older suffer from dementia.[8] As more is learned about cognitive thinking and cognitive impairment, a new model of cognitive decline has been reported. Instead of a binary of normal cognition to dementia, there is now recognition that a transition state of mild cognitive impairment (MCI) exists between normal cognition and dementia, which has been underreported since it is not always screened for or recognized.[9]

The role of screening tools

Medical personnel have sometimes looked to validated screening tools to help them determine DMC. One such tool, the MacArthur Competence Assessment Tool for Treatment (MacCAT-T), for example, explicitly tests the four domains that make up DMC.[10] However, due to this assessment's long length and its difficulty of use, this tool and others have not been widely adopted.

Other medical personnel have used screening tools validated to assess for cognitive ability (e.g. dementia, MCI, etc.) to help them decide whether or not a patient is capable of giving informed consent.

While many of these tools are easy to administer, they are not proven to explicitly determine DMC and their scoring rubrics do not include specifics about how to determine whether or not a patient is able to give consent. The Montreal Cognitive Assessment (MoCA), for example, is now regarded as the gold-standard screening tool for MCI. In the literature, the MoCA has been shown to have a sensitivity of 90% for MCI and 100% for mild Alzheimer's Disease.[11]

What is unclear, however, is to what extent the MoCA accurately predicts DMC and, more broadly, whether or not MCI precludes the ability to consent for treatment.

Standard of care at BWH

At Brigham and Women's Hospital (BWH), patients admitted to the hospital for a traumatic orthopaedic injury are admitted to the Orthopaedic Trauma Service. One of the leaders in geriatric co-management of orthopaedic conditions, the Orthopaedic Trauma Service has recruited a dedicated team of geriatricians to assist with the medical management of geriatric patients admitted to the service. The importance of co-management of geriatric orthopaedic patients has been well documented, with evidence that co-management may be associated with a lower mortality rate and increased patient mobility.[12,13]

Currently, all patients older than 70 years of age admitted to the Orthopaedic Trauma Service are evaluated at some point during their hospitalization by a geriatrician. At the time of evaluation, the geriatrician administers the Mini-Cog, a commonly used screening test for dementia, and the Confusion Assessment Method (CAM), a screening tool for delirium. The service has previously studied and demonstrated that an abnormal Mini-Cog is associated in elderly orthopaedic trauma patients with increased rates of in-hospital complications.[14] Therefore, this study builds upon the efforts that are already in place to respect and protect the rights of patients by better understanding patients' cognitive abilities during the stressful time when they are in the hospital and facing difficult decisions with long-term implications. It also expands these efforts to include patients over the age of 65.

Purpose of the study

Despite the fact that fractures are a leading cause of morbidity in the elderly, a study of the prevalence of the inability to give informed consent in the elderly orthopaedic trauma surgery population has, to the best of our knowledge, not been performed. In addition, the condition of MCI has become increasingly recognized since the introduction of the MoCA. By simultaneously determining capacity for consent (by clinician gestalt – the gold standard) and degree of cognitive impairment (by utilizing the MoCA), we hope to better understand the relationship between the ability to consent and MCI. While a diagnosis of advanced dementia

precludes an ability to consent, the correlation between MCI and the ability to consent is not known. In addition, the MoCA breaks down cognitive ability into various sub-sections (e.g. memory, attention, abstraction, etc.). With the use of this tool at the time of consent, our hope is to better understand the specific components of cognition that permit decision-making capacity in the geriatric orthopaedic trauma population and the extent to which MCI may impair DMC. Specifically, our study has the following aims:

Aim 1: Determine the prevalence of the inability to give informed consent in the elderly orthopaedic trauma population

Our hypothesis is that approximately 1 in 3 patients above 65 years of age will not be able to consent given the literature values for dementia and/or delirium as enumerated in the below "Statistical considerations" section.

Aim 2: Investigate which specific components of cognitive thinking are needed in order for a patient to be able to give informed consent

The MoCA, a validated and widely used screening tool for cognitive impairment that is easy and quick to administer, has multiple sub-sections (e.g. memory, attention, abstraction) that represent various aspects of cognitive thinking. It is our hypothesis that some of these components (specifically memory and attention) will track more closely with the ability to consent than others (such as visuospatial thinking and abstraction).

Aim 3: Determine whether mild cognitive impairment (MCI) precludes the ability to give informed consent

The MoCA is scored out of 30 points and patients with a score less than 26 are deemed to have some degree of cognitive impairment. While patients who have dementia and/or delirium often have MoCA scores substantially below 26, those who have scores closer to the normal range are often determined to have MCI. It is

our hypothesis that these patients with MCI, who are right on the cusp of a normal MoCA score, do in fact have the ability to give informed consent as defined by the four legal criteria that comprise DMC (communication, understanding, appreciation, and reasoning).

Our hope is that the findings of this study will make a real contribution to the quality and safety of patient care, not only in the elderly orthopaedic trauma population but also for elderly patients more generally.

Section 2: Student role

I first proposed this project at a Harvard Medical School (HMS) Orthopaedic Trauma Initiative meeting in September 2017. After critique from surgeons at all three major HMS academic medical institutions, I helped design the methods for this project under the guidance of Dr. Michael J. Weaver, which were submitted to the Partners IRB on June 27th, 2019. After multiple rounds of revisions by the IRB, approval was initially obtained September 25th, 2019. Since that time I have been directly involved with patient recruitment for this study as well as with data interpretation and analysis. I was directly involved with efforts to obtain an amendment to the IRB, which was eventually granted on December 11th, 2019. Although for the purposes of the scholarly project I have written this report using the data we have to date, I intend to continue my involvement with the project until its completion, including data analysis and manuscript preparation.

Section 3: Methods

This prospective study was carried out at BWH. The medical staff in the Orthopaedic Trauma Service at the hospital agreed to participate in this study.

Statistical considerations

A prospective cohort study studying the prevalence of cognitive disorders in patients greater than age 65 admitted to a single hospital in Scotland determined that the prevalence of dementia and/or delirium in patients 65 years of age or older

is 34%.[15] Assuming that the prevalence of dementia and delirium should be approximately the same for our patient population and the fact that dementia and delirium will make up the vast majority of patients who are not able to consent, Harvard Catalyst statistician Dr. Wei Wang was able to determine that we will need to enroll 151 patients for our study:

$$ss = \frac{Z^2 p(1-p)}{c^2}$$

$ss = sample\ size$
$Z = Z\ value$
$p = known\ prevalance$
$c = confidence\ interval$

Setting the Z value at 1.96 (for a confidence level of 95%), the known prevalence at 34%, and the confidence interval at 15% (7.5% from each side):

$$ss = \frac{1.96^2(.34)(1-.34)}{.075^2}$$
$$ss = 153$$

Using the correction for finite population formula:

$$new\ ss = \frac{ss}{1 + \frac{ss-1}{pop}}$$

$new\ ss = corrected\ sample\ size$
$ss = sample\ size\ (as\ above)$
$pop = population$

Using the calculated sample size from above of 153 patients and a population of 10000:

$$new\ ss = \frac{153}{1 + \frac{153-1}{10000}}$$
$$new\ ss = 151$$

Inclusion criteria

Study subjects are patients 65 years of age or older presenting with a traumatic orthopaedic injury requiring an acute surgical procedure; English or Spanish speaking patients who can provide informed consent or for whom consent can be obtained via proxy.

Exclusion criteria

All patients younger than 65 years of age, patients who do not speak English or Spanish, patients who present with severe dementia, delirium, or those who are unable to communicate.

Note on inclusion/exclusion criteria

When the IRB initially approved our study on September 25th, 2019, any patient with prior documentation of dementia or delirium was to be excluded from the study. However, after thorough discussion with the IRB including a conversation about the importance of understanding the cognitive abilities of those patients with, for example, mild dementia at the time of consent, the IRB protocol was updated to reflect the above, less restrictive criteria. This modification was put in place on December 11th, 2019. Therefore, prior to December 11th, 2019, all patients with documented dementia or delirium were automatically deemed ineligible to participate because they were automatically thought to not possess DMC. Since December 11th, 2019, and going forward, only patients with advanced dementia or substantial delirium will be automatically excluded. Also of note, due to research staffing difficulties there was an inclusion gap for this study from mid-December to mid-January. As discussed in the limitations sections, plans are now in place to prevent this from happening going forward.

All patients were evaluated in the inpatient setting at Brigham and Women's Hospital while awaiting an acute surgical procedure with the Orthopaedic Trauma service. The responsible investigator described the study and its goals. Any subject choosing against participation was excluded.

Study protocol

After verbal consent to participate in this study, a member of the study staff met with the subject to administer:

- The MoCA to screen for cognitive impairment
    - As per new MoCA guidelines instituted on September 1st, 2019, the MoCA may only be administered to subjects by those who are trained and certified. Therefore, all research assistants involved in this study have been trained and certified.
- The CAM short form to screen for delirium

Since clinician gestalt remains the "gold standard" with respect to decisions regarding DMC, the attending surgeon met with the patient to discuss the proposed surgery and assess for DMC. For the purposes of the study, the determination of DMC by the attending (as opposed to by the resident or other member of the care team) was utilized for all subjects.

The following additional data was collected about each subject:

- Medical Record Number
- Date of surgery
- Age
- Gender
- Education: number of years, and: less than High School Grad/GED, HS graduate/GED, some college, college degree, advanced degree
- Marital status: single, living with partner, married, separated/divorced, widowed
- Basal location: living alone, living with spouse, living with family, living with roommate, living with private caregiver, temporarily institutionalized, definitely institutionalized
- Charlson Age-Comorbidity Index (CACI)
- FRAIL scale

- Ambulatory aid at home (most frequently used): none, 1 cane, 2 canes, 1 crutch, 2 crutches, walker, wheelchair, scooter
- Ambulatory aid in the street (most frequently used): patient does not go out of home, none, 1 cane, 2 canes, 1 crutch, 2 crutches, walker, wheelchair, scooter
- Type of injury/condition: hip fracture, periprosthetic hip fracture, fracture of the ankle, acetabular fracture, fracture of the tibia, osteoarthritis, fractures of the humerus, fracture of the pelvis, fracture of the distal radius, fracture of the foot, fracture of the elbow, fracture of the clavicle, fracture of the calcaneus, fracture of the patella, fracture of distal femur, other, describe other.
- Date of the injury

Section 4: Results

As can be seen in Figure 1, of the 64 patients who met inclusion criteria and who were able to communicate, 10 were noted to have dementia and delirium prior to being approached. All 10 of these patients were therefore noted to be ineligible for the study using the original IRB exclusion criteria, which excluded patients with known dementia or delirium.

Since these patients were not enrolled in the study, we are unable to definitively conclude that these patients do not have DMC. However, for the purposes of this preliminary analysis, we infer that patients with evidence in their medical record of a cognitively-limiting condition would not have been deemed to possess DMC had they been approached.

Therefore, for our preliminary analysis, we believe that at least 15.6% (10/64) of orthopaedic trauma patients greater than 65 do not possess DMC. This number is likely higher since of the 54 patients eligible for the study, 28 of them were not approached (for reasons described in Figure 1).

Of the 26 patients who agreed to participate in the study, all were deemed to have DMC. Of the 26, however, four did not complete the full MoCA (two subjects

because they became too fatigued after completing the first part of the MoCA and two subjects because they had upper extremity injuries and did not wish to complete the drawing tasks). Therefore, for the purposes of data interpretation, these patients have been excluded from further analysis. If a substantial amount of patients going forward continue to not participate in all aspects of the MoCA, further understanding of participants' reasons for not doing so may be valuable.

Study participant demographics, as seen in Figure 2, are representative of elderly patients traditionally seen on the Orthopaedic Trauma Service. Participants were generally in their mid-70s and had a wide range of education levels and other medical co-morbidities as determined by the Charlson Comorbidity Index.

Of all the participants included in the study, none had delirium as screened for by the CAM (Figure 3). However, almost all the participants had difficulty with some or all parts of the MoCA (Figure 3). As can be seen in Figures 3 and 4, participants on average struggled with certain sections of the MoCA more than others. Namely, participants struggled with the visuospatial/executive function tasks (mean score: 46.7%) and delayed recall (mean score: 40%) tasks. Figure 3 also reveals a calculation of participants' average Memory Index Score (MIS). MIS has been incorporated as an additional metric for the MoCA. While traditional Delayed Recall assesses recall of five words unprompted, the MIS assigns patients additional points if participants are able to remember words with category and/or multiple choice clues. The score is calculated by assigning three points for each word a participant can remember unprompted, two points if the word can be remembered after a category clue, and one point if the word can be remembered after a multiple choice clue. The maximum possible score is 15. Of the 22 participants, only one was able to remember all words unpromoted and receive this maximum score. Of the remaining 21 participants, 19 (90.5%) were able to recall additional words after they were provided with category and/or multiple choice clues.

A positive linear correlation (r^2=0.78916) between MIS and Delayed Recall exists (Figure 5). However, no meaningful correlation exists between the MoCA score and FRAIL score, Charlson Comorbidity Index, or Age, which may imply that a

patient's cognitive ability at the time of consent may be independent from his/her baseline characteristics.

Of note, as an external control for the attending surgeon's determination of DMC, each participant's anesthesia consent form from the same surgery was examined to determine if the anesthesia team, which operates completely independently from the surgical team, had the participant (versus participant's health care proxy) sign the anesthesia consent form. For 20/22 (90.9%) of participants, the anesthesia team agreed with the attending orthopaedic surgeon determination about DMC.

Section 5: Discussion, Limitations, Conclusions, and Suggestions for Future Work

Discussion and Suggestions for Future Work

Aim 1: Determine the prevalence of the inability to give informed consent in the elderly orthopaedic trauma population

While this study is still ongoing, the preliminary data show that there are patients admitted to the Orthopaedic Trauma service who have documented diagnoses that traditionally prevent patients from giving informed consent. Given our initial limitation from the IRB of excluding patients with known dementia and delirium, we are unable to quantify the prevalence of the inability to give informed consent at this time, however we believe that most if not all of the 10 patients who were excluded because of these known diagnoses were not able to consent. Of the 54 patients who were eligible for the study (and who did not have previously-documented dementia or delirium), 28 were not included in the study. We believe that some of these patients too may not have had DMC. Therefore, to our best approximation, we believe that the prevalence of the inability to give informed consent in the elderly orthopaedic trauma population is at least 15.6%. Fortunately, the IRB has granted our amendment to the protocol, which allows us to approach certain patients with known cognitive impairment for the study (including known dementia), provided that the study would not cause participants discomfort. We

believe that this amendment will allow us to understand more fully the prevalence of the inability to give informed consent, since we believe that some patients with documented dementia may still have DMC.

Aim 2: Investigate which specific components of cognitive thinking are needed in order for a patient to be able to give informed consent

The MoCA is a screening tool for cognitive impairment. While its utility has been most widely studied in the outpatient setting to screen for cognitive impairment, it is also a reliable test to better understand the different domains of cognitive thinking. From our preliminary data, it is clear that participants on average tended to do worse on certain subsections of the MoCA (namely the visuospatial/executive functioning and delayed recall sections) than others.

Since our patient cohort at this time is made up entirely of participants with DMC, the fact that participants scored worse on these domains may imply one of two things: 1) that these domains may not be critical for having DMC or 2) that the testing in the MoCA is far too sensitive for patients in an acute setting. Our belief is that the latter may more likely be true, since the ability of patients to "understand," "appreciate," and "reason" (three of the four domains that make up DMC) likely require these domains of thinking. In order to better study this hypothesis, analysis of additional patient data – and specifically a comparison of MoCA data from patients who do versus those do not have DMC – will be helpful. With the new IRB amendment, we will have the ability to do so.

In addition, with regard to delayed recall, the fact that participants improved their recall with category and/or multiple choice clues, as evidenced by their improved MIS, implies that the deficit seen on the MoCA may be an issue with memory retrieval and not memory encoding. This has direct clinical relevance, since in assessing for patients DMC clinicians want to ensure that patients have internalized the information they have just been told. If patients need a reminder, especially in the acute setting where patients are often anxious, sleep-deprived, or in pain, that likely may be sufficient. Going forward, however, a calculation of MIS by clinicians may not be necessary since the positive correlation between delayed

recall and MIS may imply that as long as patients are able to remember some of the asked words he/she may be able to recall more if prompted.

Since the MoCA is a screening test with extremely high sensitivity, it will be extremely valuable to administer the MoCA going forward to patients who do not have DMC, as we are now allowed to do with our new IRB amendment. By comparing MoCA subsection scores in these patients compared to patients who do have DMC by utilizing a two-tailed t test, we may be able to make more nuanced conclusions about the domains that may be required for DMC.

Aim 3: Determine whether mild cognitive impairment (MCI) precludes the ability to give informed consent

In the outpatient setting, patients administered the MoCA who score less than 26 out of 30 are deemed to have some degree of cognitive impairment, the extent of which is often assessed by additional lengthier and more comprehensive cognitive testing.

Our study design of assessing cognitive ability right at the time of consent – as opposed to in the outpatient setting – gives us valuable information about participants' cognitive function in the acute setting when they are faced with complex medical decisions about the implications of undergoing surgery. As can be seen from the data, on average our patients had notable cognitive deficits on the MoCA and 18/22 (81.8%) of them scored below the threshold score of 26/30. This would imply that at the moment of consent, these patients had some degree of cognitive impairment. While some of this cognitive impairment may be attributed to the stresses of having an acute injury and being in the hospital, it is clear that MCI does not preclude the ability to give informed consent. In a future study, it might be valuable to re-administer the MoCA to patients at a follow-up outpatient visit to see which, if any, of their cognitive deficits identified on the original MoCA were temporary and, ultimately, reversible.

Study Limitations

Our ongoing study has a number of important limitations. With regard to study design, the fact that we were not able to initially enroll patients who already had a diagnosis of dementia or delirium, regardless of potential DMC, precludes us from achieving our goal of assessing for the prevalence of the inability to give informed consent in the elderly orthopaedic trauma population. In addition, we were stymied early on in the study by not being able to recruit patients who were the first surgical case of the day because of research and surgical staff logistical hurdles. We are actively addressing these limitations going forward by educating all members of the Orthopaedic Trauma Service about the study and having someone from the research team either attend daily morning rounds or actively screen the operating room schedule early each morning. While this should allow for more patients to be approached, we are aware that in certain instances patients in the pre-operative area will still not be able to be approached prior to surgery. In these cases, a research staff member going forward will approach patients within 24 hours of the attending making an assessment of DMC, which always occurs prior to surgery. While this will inevitably limit our ability to make conclusions about a patient's cognitive ability at the exact moment of assessment for DMC, it should allow us to obtain additional patients that to date we have not been able to include. From a staffing perspective, another clear limitation was our inability to start the study right when we received initial IRB approval in September because of the new MoCA requirement that all research staff members be trained and certified. In addition, we had a gap in staffing between mid-December and mid-January. Going forward, we have processes in place to train and certify new research staff members as soon as possible after onboarding at BWH as well as to minimize any potential future inclusion gaps.

Conclusions

Overall, we are now at a point where we believe the study can finally proceed. We are quite excited about the potential for this ongoing study to highlight not only the prevalence of the inability to give informed consent in the elderly

orthopaedic trauma population, but also to help elucidate the relationship between cognitive decline and DMC. For too long, cognitive ability and DMC have been assessed in parallel but without much attention paid to any potential connection between them.

We hope that the results of our study may shed some light on the relationship between the variances and vagaries of cognitive ability and DMC in the geriatric population. In this way, we believe that the results of our study, once finalized, will allow for additional patient autonomy by not precluding an assessment of DMC just because of a patient's known cognitive impairment, while also allowing for added patient safety by highlighting the fact that there may be a certain subgroup of patients who may not be able to give informed consent.

Section 6: Acknowledgements

I am extremely grateful to Dr. Michael J. Weaver, who has generously encouraged, mentored, and guided me through the entire process of designing and, now, executing this project. I am also thankful for Michael McTague, Karen Bernstein, Elizabeth Allen, and Mira Bansal of the Harvard Medical School Orthopaedic Trauma Initiative for their support, research fellow Dr. Henk Jan Schuijt and Ashlyn Morris for their day-to-day assistance with the project, Harvard Catalyst statistician Wei Wang for her assistance with the power calculation, Drs. Houman Javedan, Julia Lowenthal, and Jennifer Moye for their early guidance, and the numerous other colleagues who were so generous with their time and expertise.

Figure 1. Study flow diagram

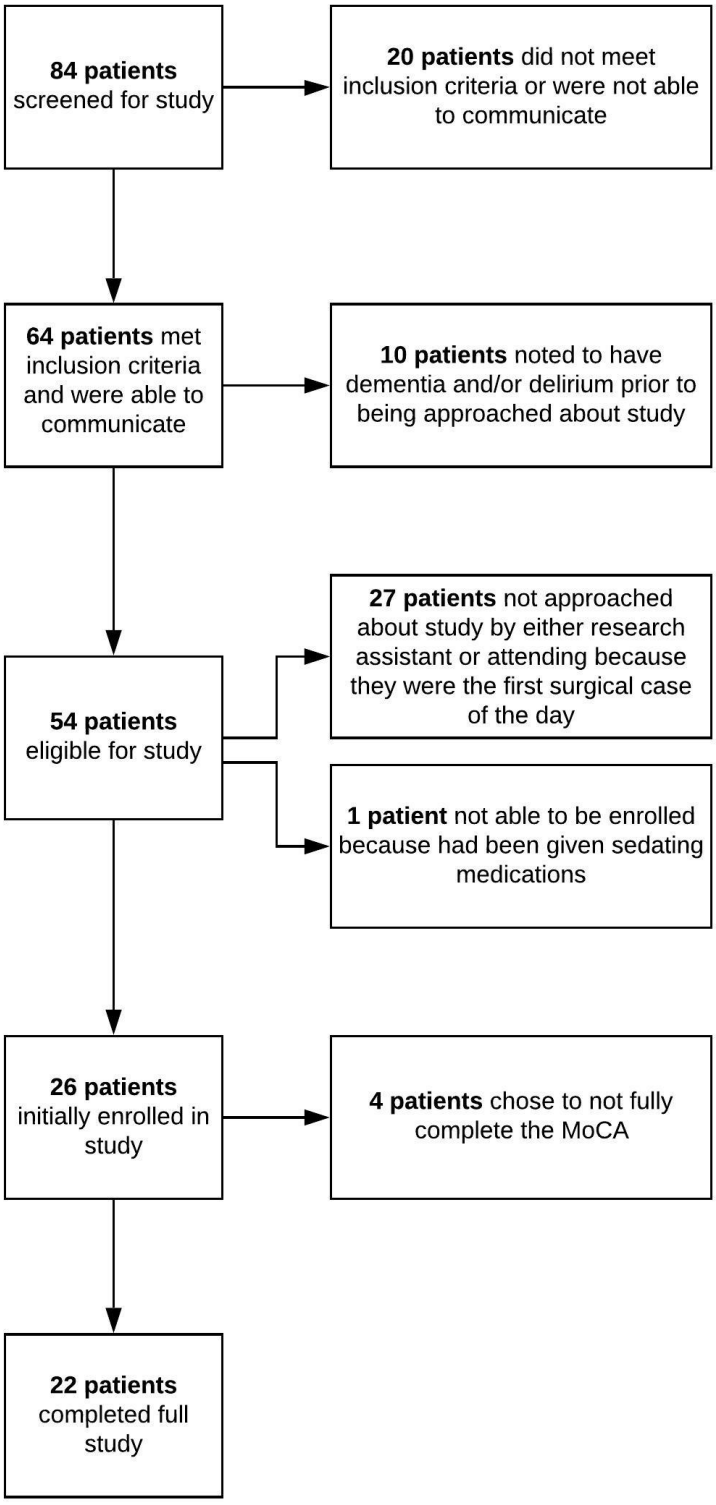


Figure 2. Study participant demographic data

Age	
Mean	74.5
Median (25 – 75th percentiles)	74 (70 – 77.8)
Sex	
Male (%)	11 (50%)
Female (%)	11 (50%)
Education (%)	
Less than high school	3 (13.6%)
High School graduate/GED	6 (27.3%)
Associate degree/Trade school	3 (13.6%)
Some college	3 (13.6%)
Completed college	4 (18.2%)
Advanced degree	3 (13.6%)
Marital status (%)	
Single	3 (13.6%)
Live with partner	1 (4.5%)
Married	13 (59.1%)
Separated	2 (9.1%)
Widowed	3 (13.6%)
Type of injury (%)	
Hip fracture, total	12 (54.5%)
Periprosthetic hip fracture	2 (9.1%)
Non-periprosthetic hip fracture	10 (45.5%)
Proximal femur fracture	1 (4.5%)
Distal femur fracture	1 (4.5%)
Tibia fracture	3 (13.6%)
Ankle fracture	3 (13.6%)
Upper extremity fracture	2 (9.1%)
Baseline ambulatory status, home (%)	
Ambulate independently	12 (54.5%)
Ambulate with mobility aid	9 (40.9%)
Wheelchair dependent	1 (4.5%)
Baseline ambulatory status, outside home (%)	
Ambulate independently	10 (45.5%)
Ambulate with mobility aid	11 (50%)
Wheelchair dependent	1 (4.5%)
FRAIL Score	
Mean	1.9
Median (25 – 75th percentiles)	2 (1 – 3)
Charlson Comorbidity Index	
Mean	5
Median (25 – 75th percentiles)	4.5 (3 – 6)

Figure 3. Confusion Assessment Method (CAM) and Montreal Cognitive Assessment (MoCA) Data

CAM (%)	
Positive screen for delirium	0 (0)
Negative screen for delirium	22 (100%)
MoCA, total score	
Mean (%)	20.7 (69%)
Median (25 – 75th percentiles)	21.5 (15.5 – 25)
MoCA, visuospatial/executive function subsections	
Mean (%)	2.8 (46.7%)
Median (25 – 75th percentiles)	4.5 (3 – 6)
MoCA, naming subsection	
Mean (%)	2.6 (86.7%)
Median (25 – 75th percentiles)	3 (2.25 – 3)
MoCA, attention subsection	
Mean (%)	4.4 (73.3%)
Median (25 – 75th percentiles)	5 (3 – 6)
MoCA, language subsection	
Mean (%)	2 (66.7%)
Median (25 – 75th percentiles)	2 (1.25 – 3)
MoCA, abstraction subsection	
Mean (%)	1.2 (60%)
Median (25 – 75th percentiles)	1 (1 – 2)
MoCA, delayed recall subsection	
Mean (%)	2.0 (40%)
Median (25 – 75th percentiles)	2 (0.3 – 3)
MoCA, orientation subsection	
Mean (%)	5.4 (90%)
Median (25 – 75th percentiles)	6 (5 – 6)
Memory Index Score	
Mean (%)	9.3 (62%)
Median (25 – 75th percentiles)	10.5 (7 – 12)

Figure 4. Graphical representation of Average and Median MoCA Subsection Scores

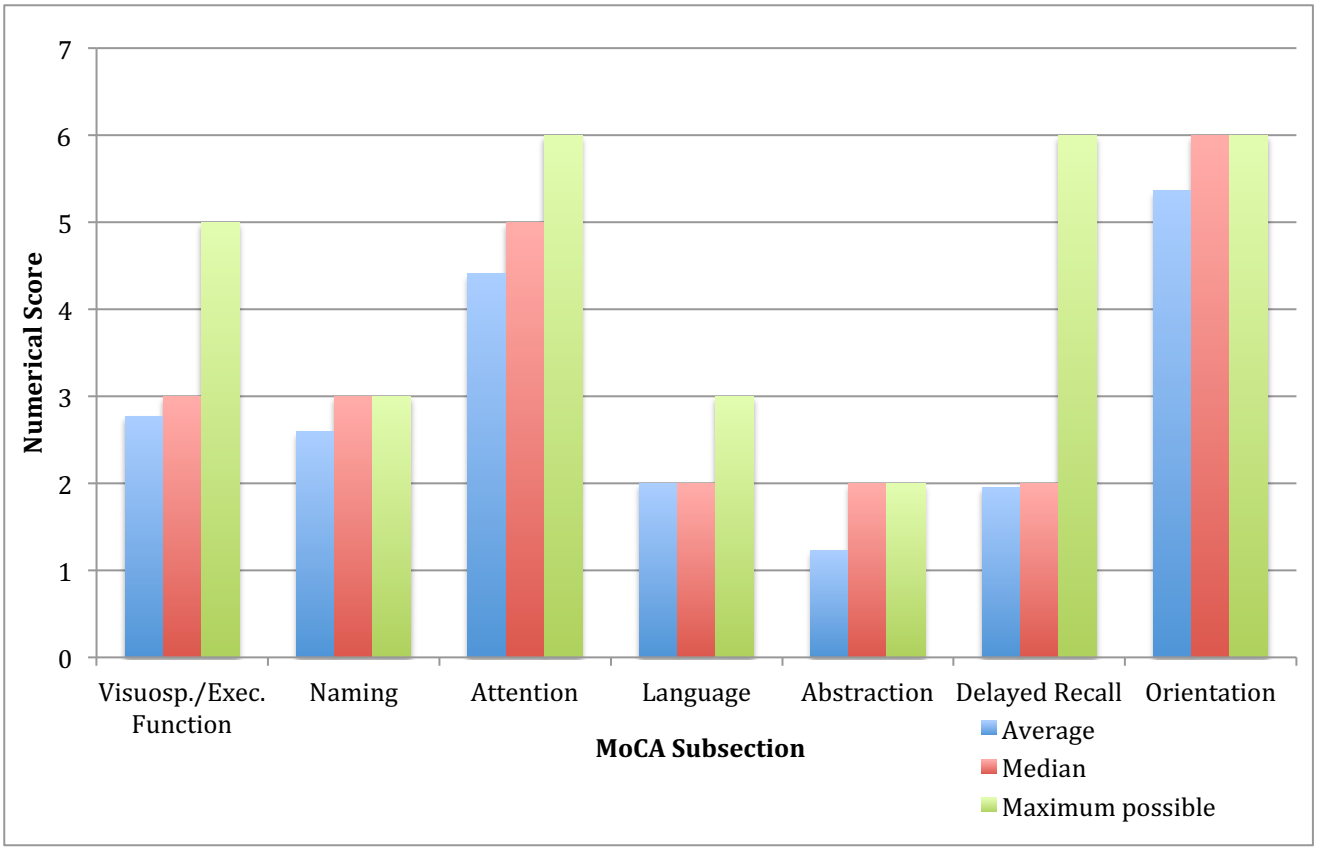


Figure 5. Memory Index Score versus Delayed Recall with superimposed linear regression

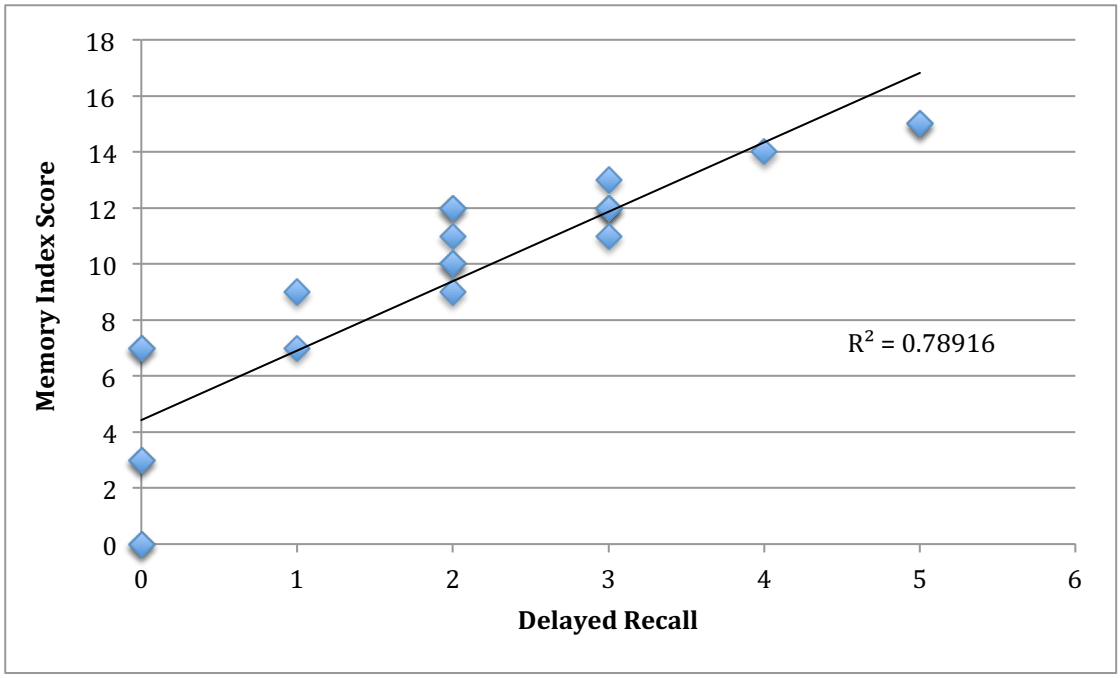
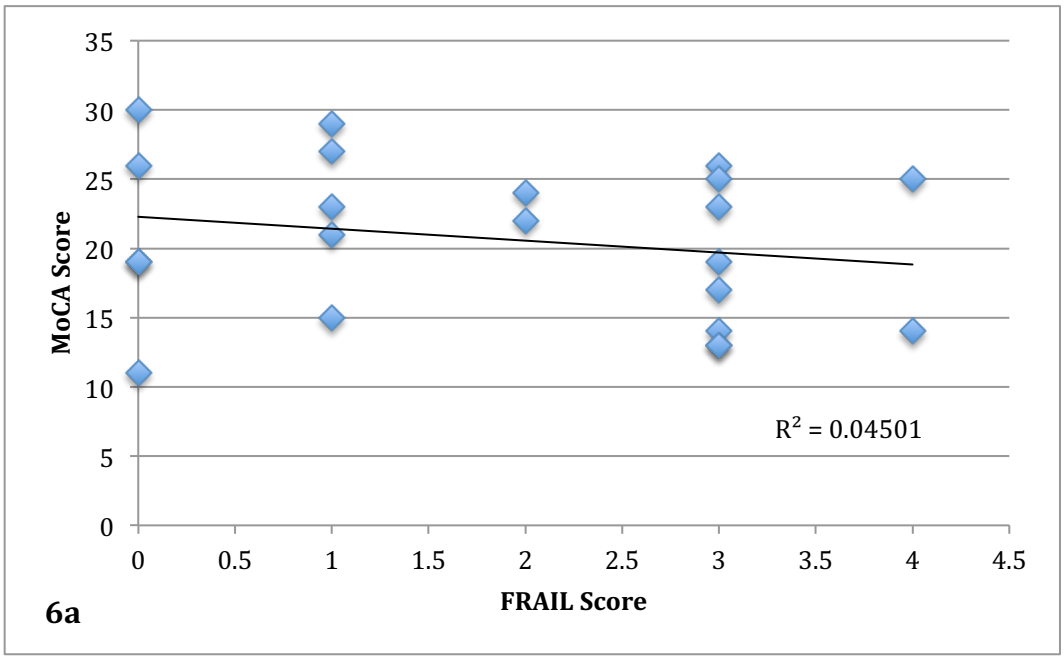
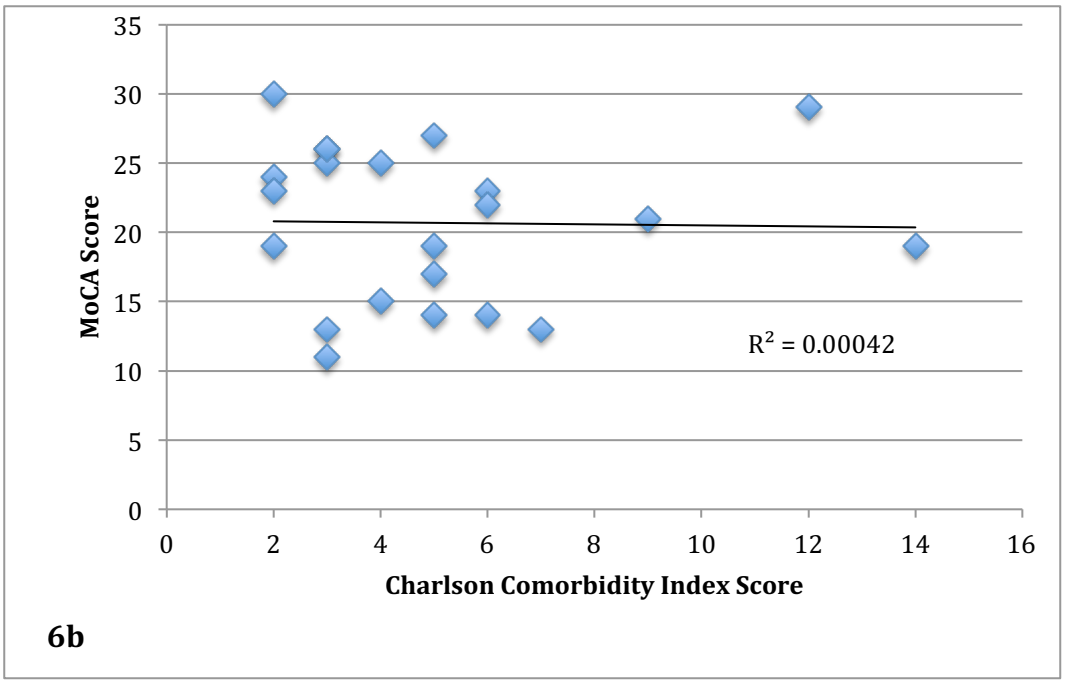
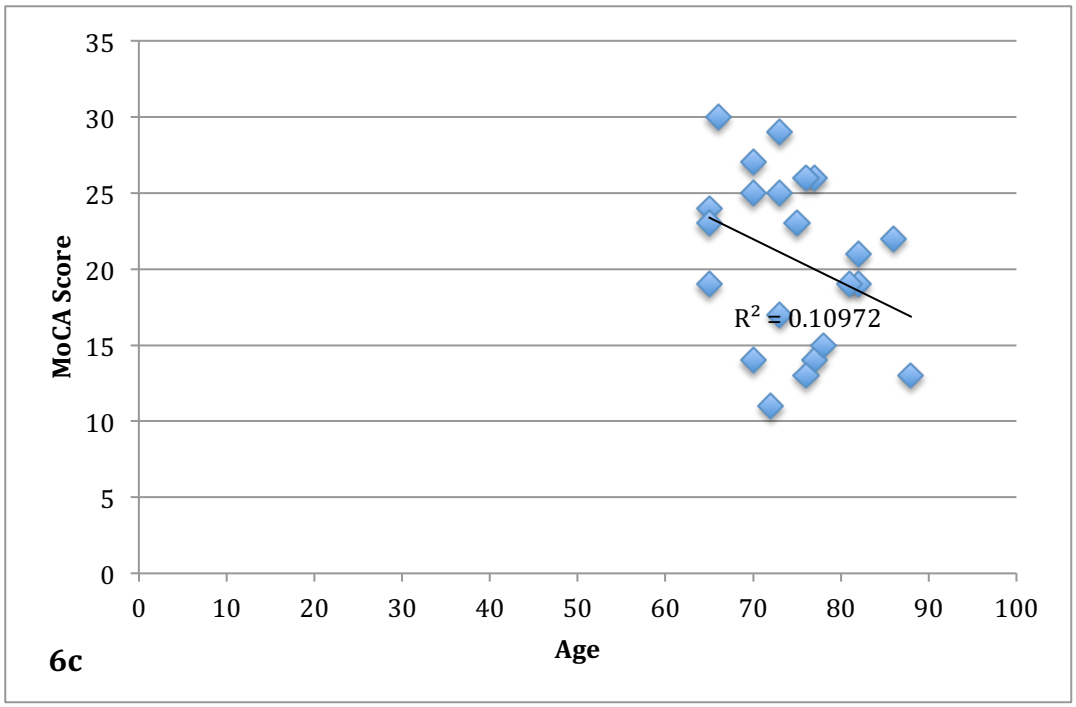


Figure 6. Correlation of MoCA Score versus **(a)** FRAIL Score, **(b)** Charlson Comorbidity Index, and **(c)** Age with superimposed linear regressions






35
30
25
20
15
10
5
0
MoCA Score
0
10
20
30
40
50
60
70
80
90
100
Age
R² = 0.10972

6c

[1] Singaram S,Naidoo M. The physical, psychological and social impact of long bone fractures on adults: A review. Afr J Prim Health Care Fam Med. 2019 May 30;11(1):e1-e9.
[2] Panula J, Pihlajamäki H, Mattila VM, Jaatinen P, Vahlberg T, Aarnio P, et al. Mortality and cause of death in hip fracture patients aged 65 or older - a population-based study. BMC Musculoskelet Disord. 2011 May 20;12:105.
[3] Elwyn G, Frosch D, Thomson R, Joseph-Williams N, Lloyd A, Kinnersley P, et al. Shared Decision Making: A Model for Clinical Practice. J Gen Intern Med. 2012 Oct;27(10):1361-7.
[4] Appelbaum PS. Assessment of Patients' Competence to Consent to Treatment. N Engl J Med. 2007 Nov 1;357(18):1834-40.
[5] Wong AL, Martin J, Tang D, LeBlanc M, Morris SF, Paletz J. The Effect of Written Information on Recall of Surgical Risks of Carpal Tunnel Release Surgery: A Randomized Controlled Study. Plast Reconstr Surg 2016 Dec;138(6):1011e-1018e.
[6] Giudici K, Gillois P, Coudane H, Claudot F. Oral information in orthopaedics: How should the patient's understanding be assessed? Orthop Traumatol Surg Res. 2015 Apr;101(2):133-5.
[7] Porcellini G, Campi F, Paladini P, Rossi P, Lollino N. Informed consent in shoulder surgery. Chir Organi Mov. 2008 Feb;91(2):103-7.
[8] Plassman BL, Langa KM, Fisher GG, Heeringa SG, Weir DR, Ofstedal MB, et al. Prevalence of dementia in the United States: the aging, demographics, and memory study. Neuroepidemiology. 2007;29(1-2):125-32.
[9] Sanford AM. Mild Cognitive Impairment. Clin Geriatr Med. 2017 Aug;33(3):325-37.
[10] Grisso T, Appelbaum PS, Hill-Fotouhi C. The MacCAT-T: a clinical tool to assess patients' capacities to make treatment decisions. Psychiatr Serv. 1997 Nov;48(11):1415-9.
[11] Nasreddine ZS, Phillips NA, Bédirian V, Charbonneau S, Whitehead V, Collin I, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. J Am Geriatr Soc. 2005 Apr;53(4):695-9.
[12] Rapp K, Becker C, Todd C, Rothenbacher D, Schulz C, König HH, et al. The Association Between Orthogeriatric Co-Management and Mortality Following Hip Fracture. Dtsch Arztebl Int. 2020 Jan 24;117(4):53-9.
[13] 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. 2015 Apr 25;385(9978):1623-33.
[14] Heng M, Eagen CE, Javedan H, Kodela J, Weaver MJ, Harris MB. Abnormal Mini-Cog Is Associated with Higher Risk of Complications and Delirium in Geriatric Patients with Fracture. J Bone Joint Surg Am. 2016 May 4;98(9):742-50.
[15] Reynish EL, Hapca SM, De Souza N, Cvoro V, Donnan PT, Guthrie B. Epidemiology and outcomes of people with dementia, delirium, and unspecified cognitive impairment in the general hospital: prospective cohort study of 10,014 admissions. BMC Med. 2017 Jul 27;15(1):140.