THE ASSESSMENT OF FRAILTY IN COMMUNITY-DWELLING OLDER ADULTS: A FEASIBILITY AND VALIDATION STUDY

by

Judah Goldstein

Submitted in partial fulfilment of the requirements
for the degree of Doctor of Philosophy

at

Dalhousie University
Halifax, Nova Scotia
March 2013

DALHOUSIE UNIVERSITY

INTERDISCIPLINARY PhD PROGRAM

The undersigned hereby certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled "The Assessment of Frailty in Community-Dwelling Older Adults: A Feasibility and Validation Study" by Judah Goldstein in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Dated: March 25, 2013

External Examiner: _____

Research Supervisor: _____

Examining Committee _____

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_____

Departmental Representative: _____

DALHOUSIE UNIVERSITY

DATE: March 25, 2013

AUTHOR: Judah Goldstein

TITLE: THE ASSESSMENT OF FRAILTY IN COMMUNITY-DWELLING OLDER ADULTS: A FEASIBILITY AND VALIDATION STUDY

DEPARTMENT OR SCHOOL: Interdisciplinary PhD Program

DEGREE: PhD CONVOCATION: May YEAR: 2013

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Signature of Author

DEDICATION PAGE

This thesis is dedicated to my grandmother Pearl “Jo” Ambrosone who always showed me the joys of growing older.

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ABSTRACT

The assessment of frailty is challenging in the presence of diverging views on its clinical measurement. Frailty is a state of vulnerability, multidimensional, and dynamic. Frail older adults have a diminished physiological reserve and ability to respond to stress (environmental or pathophysiological) making them susceptible to adverse health outcomes. Even so, there is the potential for frailty prevention, treatment and improvement in health status. A valid and feasible measure of frailty is necessary for advancing knowledge. The frailty index (FI) incorporates many of the agreed upon properties of frailty (e.g., multifactorial, diminished reserves, can be graded). Its main detractor in the clinical setting is the need for at least 30-40 items. Many frailty assessment tools aim to reduce the instrument to a few criteria, and this can be problematic for accurately grading fitness/ frailty. The objective of this thesis was to evaluate frailty assessment in the emergency medical services (EMS) setting. A series of studies were conducted in order to 1) evaluate how frailty is currently assessed by EMS, 2) to describe EMS use by older adults and, 3) to evaluate the feasibility and validity of a FI based upon the view of a carer. In the first study, it was determined that no frailty measures are currently being used by EMS, however, risk-screening tools were evident and these may identify frail older adults. The second study confirmed that older adults were high users of EMS in a Canadian provincial EMS system. In the final study, a survey completed by care partners and based upon comprehensive geriatric assessment [Care Partner – Comprehensive Geriatric Assessment (CP-CGA)] was developed and subsequently assessed as a means to construct a FI. The CP-CGA was deemed feasible in the EMS and geriatric outpatient setting. The FI based upon the CP-CGA demonstrated properties similar to other FIs and was predictive of adverse outcomes. Older adults are frequent users of EMS so it is imperative that EMS providers have the knowledge and tools to care for this demographic appropriately. The CP-CGA may be a useful assessment tool and method for identifying and managing frailty in older EMS patients.

LIST OF ABBREVIATIONS USED

EMS	Emergency Medical Services
CGA	Comprehensive Geriatric Assessment
CP-CGA	Care Partner – Comprehensive Geriatric Assessment
FI	Frailty Index
EHS	Emergency Health Services
GAC	Geriatric Ambulatory Care
CSHA-CFS	Canadian Study of Health and Aging – Clinical Frailty Scale
MPI	Multidimensional Prognostic Index
PAC	Paramedic Association of Canada
NOCP	National Occupational Competency Profile
EMR	Emergency Medical Responder
PCP	Primary Care Paramedic
ACP	Advanced Care Paramedic
CCP	Critical Care Paramedic
ICP	Intermediate Care Paramedic
EMD	Emergency Medical Dispatcher
GERD	Gastro Esophageal Reflux Disease
CTAS	Canadian Triage and Acuity Scale
ED	Emergency Department
TRST	Triage Risk Screening Tool
ISAR	Identification of Seniors at Risk

ACKNOWLEDGEMENTS

I would first like to thank my supervisor, Dr. Kenneth Rockwood, for his support, encouragement, patience and occasional push that enabled me to get to this point.

I would like to acknowledge the support of my committee members. Dr. Arnold Mitnitski's ability to provide practical insight and perspective were valued. I would like to thank Dr. Joseph Byrne for his thoughtful comments and support. To Dr. Andrew Travers, I value your commitment to paramedicine and understanding of the unique challenges faced in this environment. Completing this project would not have been possible without your support, advice and insight.

I would like to express my gratitude to the Nova Scotia Health Research Foundation (Student Research Award) and the Atlantic Regional Training Center. I would also like to thank the nurses (Capital Health) and paramedics (and "B platoon"co-workers specifically) (EHS) that were involved with enrolling patients in this study.

Finally, I would especially like to thank my family for their support. I would like to thank my wife (Andrea) and my two daughters (Anna and Madeleine) for their patience, love and support. To Andrea, thank you for the many hours you spent reading my work and providing feedback. You provided motivation when I lacked it, encouragement, and understanding. To Anna – I will not be going to "play at school" anymore. However, I hope to have fun doing more research in the future.

CHAPTER 1 INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

To meet the needs of an aging population, novel approaches directed towards caring for the frail older adult in the community are required. Emergency Medical Services (EMS) is well situated to play a large role in their care. Initially designed as a transport system, EMS now bridges the gap between acute care, primary care and chronic disease management in the out-of-hospital setting (Shah 2006, Hoyle et al. 2012). It is important that we begin to tailor EMS systems for older adults with unique health care needs. To do this, paramedics require appropriate tools to assess health status and care for the frail older patient in an effective manner. Our current health care system is equipped to address issues one at a time, resulting in ever-increasing specialization. While this has had many beneficial results, the approach can be detrimental for someone who is frail. In short, a more comprehensive approach to assessment, treatment and care may be required.

Frailty is a state of increased vulnerability that has gained much attention recently. Its measurement is controversial and challenging to integrate into clinical care. A frailty measure has yet to be used in the pre-hospital setting and frailty in general has not been addressed in the EMS literature. A standardized approach for collecting information from patients' care partners (e.g., chiefly family members, usually a spouse or adult daughter) may improve our ability to operationalize a definition of frailty. Factors that enable clinicians to distinguish between the fit and frail older adult will be identified. It is expected that the results of this research will help to create better tools for use by frontline health care providers so that they may be able to assess, treat and care for the frail patient in a more appropriate manner, including in pre-hospital care.

The primary objective of this research is to examine the feasibility of measuring frailty in EMS patients and to determine whether its measurement will lead to an improved prediction as to who is at risk for adverse outcomes and health deterioration. More specifically, this study will examine whether clinical information (i.e., cognition, mobility/ balance, function, medical problems, social factors) (Sternberg et al., 2011) considered important in assessing frailty, - can be collected from a care partner in a standardized format. This information will be used in calculating a frailty index. The care partner derived frailty index (CP-FI-CGA) will be compared to specialist completed comprehensive geriatric assessments (FI-CGA). The relationship between the care partner derived frailty index and adverse outcomes (hospitalization, institutionalization, mortality) will be evaluated to assess its predictive validity. These results should expand our understanding of frailty in the clinical setting.

1.2 OBJECTIVES

With reference to the aforementioned, the study will address several specific research questions:

i) To what extent are geriatric health assessment (frailty screening) measures reflected in current pre-hospital clinical practice?

ii) What is the emergency medical services usage profile of older adults in Nova Scotia?

iii) Is it feasible to collect health information in a standardized format from a care partner in the pre-hospital setting and ambulatory care clinics?

iv) Would a care partner-derived frailty index be a valid measure of frailty in the pre-hospital setting?

Study 1: A review of published literature was conducted in order to describe the use of frailty assessments or risk stratification tools within EMS clinical practice (question i)

Student Contribution: JG was responsible for developing the protocol, conducting the search strategy, reviewing abstracts and full articles, data analysis and interpretation and writing the manuscript.

Study 2: A secondary analysis of Emergency Health Services (EHS) Nova Scotia central database for all emergent responses for older adults in Nova Scotia was conducted in order to quantify EMS use (question ii).

Student Contribution: JG was responsible for developing the protocol, ethics submission, data analysis/interpretation and writing the manuscript.

Study 3: Prospective analysis evaluating the use of a care partner completed comprehensive geriatric assessment. Subjects included older patients (≥70 years of age) transported to the emergency department by ambulance or assessed, but not transported to hospital, or attending the Geriatric Ambulatory Care (GAC) clinic (question iii to iv).

Student Contribution: JG was responsible for contributing to the development of the CP-CGA and worked with a graphic designer to develop the layout of the survey. JG developed the study protocol for the EMS component of the study. JG was responsible for operationalizing the study in the EMS setting. JG was responsible for data collection, chart abstractions, collecting follow-up data, data analysis and interpretation and writing manuscripts.

1.3 CURRENT STATE OF KNOWLEDGE

Current pre-hospital EMS care is sometimes not congruent with the care that older people want or require. EMS is tightly bound to timelines, clinical guidelines and immediate intervention (need to correct problems). For an older adult that calls 911 with multiple co-morbidities, complex family dynamics, and issues surrounding decision-making capacity a seemingly straightforward call can become difficult. Paramedics must quickly ascertain the care goals of the patient, whether problems require immediate attention, and whether they should intervene.

One of the primary problems is that little time or emphasis is placed on the geriatric assessment during paramedic training. In addition, there is a lack of research on geriatric medicine in the pre-hospital setting and only sporadic translation of research results from that literature to the pre-hospital field. For these reasons, it is likely that when paramedics attend emergencies that involve older adults, important information is missed that would help to identify an accurate acuity level and effective care plan. In addition, there may be system level factors that are lacking which may prevent older adults from receiving the care that they want or require. The pre-hospital assessment, identification of the acuity level and chief problems often determines the path of care for the patient. Getting this right is vital for establishing appropriate care plans and effective treatments during this node of care.

Through an interdisciplinary (and applied health services research) framework, the objective of the present inquiry is to examine frailty measurement and its potential value-added clinical use in the provision of EMS services. Frailty as a concept stretches the limits of defined disciplines and may be better understood through the integration of theoretical perspectives (Hogan, MacKnight & Bergman, 2003). Frailty measurement has

drawn on expertise from epidemiology, mathematics, social sciences, natural science (biology) and medical sciences among others. The last twenty years of research on frailty have led to the development of a number of approaches for frailty quantification (DeVries et al., 2011). Some have merit and require evaluation in the clinical setting. The goal of the present series of studies is to advance our current knowledge on frailty from the population-based or theoretical analysis to applied research in clinical care. The research reported here will be rooted in a health services evaluation approach. Health services research is the study of how to make healthcare more effective, equitable and efficient (Phillips, 2006). Intuitively, it would seem that frailty identification could potentially provide insight into these domains (effectiveness of care and efficiency of services, and equitable care).

1.3.1 DEFINING FRAILTY

Frailty is recognized as an important concept and as a clinically important entity. Early definitions originating in the 1980's linked frailty with functional dependence, physical weakness and need for more supportive care (Hogan, MacKnight & Bergman, 2003). Buchner and Wagner (1992) defined frailty as a loss of physiologic reserve that increases the risk of disability. It is generally understood that frailty is a state of vulnerability due to multi-system impairment that leads to a loss of physiological reserves and susceptibility to adverse outcomes (Hogan, MacKnight & Bergman, 2003; Rodriguez-Manas et al., 2012).

However, there is no universally accepted operational definition of frailty (Rodriguez-Manas et al., 2012). A recent systematic review identified 20 approaches for frailty evaluation (De Vries et al., 2011). Candidate definitions of frailty should account for core features that are agreed upon components of frailty (extreme vulnerability) (e.g.

minimal stress causes functional impairment), multi-system impairment, and loss of physiological reserve. Definitions should reflect problems in multiple domains (e.g. physical function, cognition, mental health), be simple to use and predict adverse outcomes (Rockwood, 2005). To identify a consensus operational definition of frailty suitable for use in clinical practice, more research is required to improve our understanding of the relationship between co-morbidity, frailty and the combination of key components that will be vital for its diagnosis (Rodriguez-Manas et al., 2012).

Caring for frail older adults is a core component of geriatric medicine and perhaps its most important mandate (Rockwood & Hubbard, 2004). Some see frailty as a unique entity, joining other "geriatric giants (confusion, falls, immobility, incontinence)" (Crome & Lally, 2011), while others view frailty as a state close to whole system failure where people experience delirium, falls and other conditions that are reflective of multisystem impairment. Research on frailty and the pathways by which people become frail is necessary in order to develop evidence informed guidelines for assessment and treatment (Crome & Lally, 2011). To do this, frailty measures must be operationalized, so a priority must be to evaluate these tools in the clinical setting. The EMS setting is of particular interest due to the nature of the environment given it typically represents the first contact with the patient and given there is afforded limited time to provide health services in a high stress environment, with high volume of responses for older adults. Translating research from geriatric medicine on frailty to EMS could prove useful in terms of developing a feasible approach to frailty measurement.

Although frailty identification has merit, there are negative connotations associated with the term. Frailty is a real medical condition that requires careful consideration in the clinical setting. Being able to operationalize a definition of frailty

may help to legitimize the problems that people who are frail have and allow for more evidence informed treatment plans to be implemented. With the ability to measure frailty, comes the added benefit of developing ways to prevent or treat it. Improvements in health states are possible (Mitnitski, Song & Rockwood, 2007) so evaluating transitions between health states should be a research priority. A useful measure of frailty should be able to capture this change. Frailty has implications to care requirements, treatment regimes and a person's ability to recover from illness or injury. Ignoring the existence of frailty or allowing our understanding of this concept to remain a subjective notion that most health care providers believe exists, yet cannot quantify, could be detrimental to their care. Frailty should become an important part of the medical decision making process for older adults (Lacas & Rockwood, 2012)

Evaluation of frailty measures must seek to describe the feasibility, reliability and validity of potential measures in multiple settings. A definition of frailty should possess a number of key features: 1) face validity – it must be comprehensive and make sense to clinicians (e.g. increase with age, be higher in women than men) 2) criterion validity – it must predict relevant and non arbitrary outcomes (death, use of acute care, institutionalization), and correlate with other related constructs in a predictable manner (function, mobility, self-rated health) and 3) construct validity – correlation with other frailty measures (Streiner & Norman, 2003; Rockwood, 2005). Finally, (and maybe most importantly) a useful measure of frailty must be feasible in the clinical setting, as this will determine whether it is used.

1.3.2 PREVALENCE OF FRAILTY

However defined, frailty is common. A recent review of prevalence data found that when the phenotype of frailty was considered the pooled prevalence was 14% for those 65 years

and older, while it increased to 24% when deficit accumulation was considered (Shamliyan et al., 2012). For those 85 years and older, the prevalence of frailty in community-dwelling people was 44% in a national population based survey (Rockwood, Song & Mitnitski, 2011). Close to 1 in 5 adults over the age of 80 could be considered frail by any definition used. Gender differences are also observed with prevalence estimates higher in women regardless of the definition (Shamliyan et al., 2012).

Frailty is common in the clinical setting and is an important contributor to outcomes (Partridge, Harari & Dhesi, 2012). In cardiac care, (post-cardiac catheterization group), using the phenotype of frailty, prevalence of frailty was estimated to be 27% (70 years and older) (Purser et al., 2006). In patients with non-ST elevation myocardial infarction, it was found that 24.1% of older adults (>75years) could be considered moderately to severely frail (Ekerstad et al., 2011). Frailty has been demonstrated to be an important risk factor for severe adverse events (death, hospitalization and institutionalization) in patients discharged from the emergency department (ED) (Hastings et al., 2008). Makary et al. (2010) observed that over 40% of older adults assessed for elective surgery could be considered frail or intermediately frail. The incidence of postoperative complications increased in frail patients and frailty independently predicted admission to long term care (OR 3.16 (1.00-9.99) intermediate, 20.48 (5.54-75.68) (Makary et al., 2010). In addition to being a strong predictor of outcomes, frailty defined by deficit accumulation has an impact on balance and mobility and the recovery potential in the acute care setting (Hubbard et al., 2011). In a longitudinal analysis, frailty was found to be the most common condition leading to death in older adults (Gill et al., 2010).

1.3.3 CONTROVERSIES IN FRAILTY MEASURMENT

Three approaches have merit and have been extensively investigated: a phenotype of frailty, frailty scales, and indexes or indicators. Each has certain attributes and problems that can be context dependent (Sternberg et al., 2011). The phenotype of frailty (Fried et al., 2001) seeks to describe frailty as a clinical syndrome (rules-based) and identify pathophysiological causal pathways to frailty. The Canadian Study of Health and Aging Clinical Frailty Scale (Rockwood et al., 2005) ranks relative fitness/ frailty by clinically discernable categories. Finally, indexes consider a set of factors and present a summation score for frailty (Mitnitski, Mogilner & Rockwood, 2001). The three approaches to frailty measurement will be discussed in terms of how well they conceptualize vulnerability, multi-system impairment, and loss of physiological reserve. Properties of the measures are described (e.g. face validity, criterion validity, construct validity, ease of animal modeling, and physiological exploration).

1.3.3.1 THE PHENOTYPE OF FRAILTY

The frailty phenotype is a rules-based approach that is measured by performance on five variables: weight loss (> 10 lbs in prior year), weakness (grip strength lowest 20%), exhaustion (self report), slowness (walking time slowest 20%), and low activity (Kcals/week; lowest 20%). Using this approach, a person can be graded as "robust" (no problems in the five domains), "pre-frail" with one or two problems and "frail" with three or more problems (Fried et al., 2001). Subjects unable to complete the performance based measures or with cognitive impairment were excluded from the initial analysis, however, others have evaluated whether including cognition improves the predictive validity of this approach (Avila-Funes et al., 2009). Although the original phenotype of frailty included a mixture of performance based measures and self-reported questions, it has been operationalized using variations of the original definition with similar results,

raising questions about the specific value of each particular component (Rockwood, Andrew & Mitnitski, 2007).

Using the phenotype definition (from the Cardiovascular Health Study), frailty was associated with age and was more common in women (Fried et al., 2001). The prevalence of frailty was 7% in this group (Fried et al., 2001). The phenotype of frailty was predictive of adverse events (adjusted model) including falls, hospitalizations, disability and death (7 year HR 1.23 – 1.79) and was associated with disability, cognitive impairment and self-rated health (Fried et al., 2001). In hospitalized older adults with coronary artery disease, the prevalence of frailty by the phenotypic definition was 27% (Purser et al., 2006). Frailty was demonstrated to be predictive of adverse outcomes post surgery (Makary et al., 2010) indicating that it is an important clinical entity in this setting.

Fried et al. (2001) contend that frailty is a physiological syndrome that is clinically distinct from disability and co-morbidity. Physiological mechanisms have been investigated in relation to the phenotype of frailty (Chaves et al., 2008). The phenotype of frailty has good construct validity correlating moderately (R = 0.65) with other frailty measures (frailty index) (Rockwood, Andrew & Mitnitski, 2007).

Criticisms of the phenotype of frailty are that it primarily evaluates physical attributes and their performance based measurements exclude certain groups of patients, such as those who could not complete performance measures, or who have Parkinson's disease or cancer. The phenotypic definition may not overlap completely with the clinical notion of frailty (Whitson, Purser, & Cohen, 2007). For the critically ill patient it would be necessary to collect information from family or friends as the patient may not be able to provide the information or follow commands making capturing items from the

phenotypic definition problematic (McDermid, Stelfox & Bagshaw, 2011). In terms of feasibility, it contains relatively few variables, typically requires performance based measures and self reported data, and has been studied in multiple settings.

1.3.3.2 THE CANADIAN STUDY OF HEALTH AND AGING-CLINICAL FRAILTY SCALE

The Canadian Study of Health and Aging – Clinical Frailty Scale (CSHA-CFS) is a scales-based approach to frailty measurement. The CSHA-CFS was originally developed to stratify patients based upon their relative degree of vulnerability and is closely linked to function (Rockwood et al., 2005). The current version of the scale includes nine clinical descriptors ranging from very fit to very severely frail/ terminally ill. The scale aims to stratify patients based upon their level of fitness/frailty. Those with higher scores are at greater risk for death or institutionalization (Rockwood et al., 2005). The CFS takes into account the presence of co-morbidities, mobility, cognition and physical function so it does have multidimensional underpinning. The clinical frailty scale has been used in a variety of medical settings, including with burn patients (Masud et al., in press), and post non-ST elevation myocardial infarction patients (Ekerstad et al., 2011) and institutionalized individuals (Matusik et al., in press; Rockwood, Abeysundera & Mitnitski, 2007). Frailty was a strong and independent predictor of in-hospital mortality for NSTEMI patients (OR 2.2; 95%CI 1.3-3.7) (Ekerstad et al., 2011).

The CFS may be criticized for its subjective nature, although this can be a strength. Clinicians may be able to readily recognize frailty, but unable to describe it. The CFS brings a level of objectivity and uniformity to the process of describing frailty. The CFS is limited in its ability to investigate physiological mechanisms of frailty. It also can be insensitive to people who are frail without disability or cognitive impairment

(Rockwood, Abeysundera and Mitnitski 2007). It has moderate construct validity demonstrating a high correlation (0.71-0.8) with the frailty index (Rockwood, Abeysundera & Mitnitski, 2007; Rockwood et al., 2005) and good criterion validity in terms of predicting adverse outcomes (HR for time to death: 1.25 (CI 1.16-1.36) (Rockwood, Abeysundera and Mitnitski 2007). To those in critical care or in other settings where time may play a role in data collection; the CSHA-CFS has certain appeal (McDermid, Stelfox & Bagshaw, 2011). It would be feasible to collect this information based upon a clinical assessment of the patient and in conjunction with a discussion with family in order to get a pre-morbid health status.

1.3.3.3 THE FRAILTY INDEX (FI)

The final approach to frailty measurement is through the use of indexes or indicators. These are calculated by counting the number of problems that a person has and then providing a summation value or score that reflects the person's current state of fitness/ frailty. A number of approaches can be identified in the medical literature, starting with, the frailty index (deficit accumulation index) (Mitnitski, Mogilner & Rockwood, 2001) and the Groningen Frailty Indicator (Steverink et al., 2001). More recent variants include the Tilburg frailty indicator (Gobbens et al., 2012), and the Multidimensional Prognostic Index (MPI) (Pilotto et al., 2007). The most studied is the Frailty Index (FI) that describes the age-associated accumulation of deficits (Mitnitski, Mogilner & Rockwood, 2001). In 1994, frailty was conceptualized as a condition where an individual has certain assets or deficits (medical and social) that help maintain independence (Rockwood et al., 1994). If this balance between assets and deficits is tipped too far towards the deficits the individual is frail. This idea has pragmatic value with real world implications. This

dynamic model of frailty has been extensively explored and has certain reproducible mathematical properties (Rockwood & Mitnitski, 2011).

The frailty index (FI) can be constructed using data that is readily available in the clinical setting. It is calculated as a proportion of deficits (signs, symptoms, diseases) present in an individual (Mitnitski, Mogilner & Rockwood, 2001). The more problems that accumulate in a person, the greater chance that they will be frail (Rockwood & Mitnitski, 2007). The FI can be derived from a standard CGA (Rockwood & Mitnitski, 2008, 2011 (Figure 1); Jones, Song & Rockwood, 2004). For a person with 10 problems out of a possible 40 considered deficits, their FI would be 0.25. Searle et al. (2008) provide a detailed description of the FI calculation. The FI-CGA can be completed by the clinical nurse and attending physician and has similar properties to other versions of the FI (Jones et al., 2005; Rockwood & Mitnitski, 2007, 2008). The scale can contain 30 - 70 items that can be scored as 0 (no problem) or 1 (problem present). Where there are intermediary values, these can be given an appropriate score (e.g. standby assistance = 0.5). The FI increases with age at a characteristic rate and is closely correlated with mortality (Mitnitski et al., 2002; Goggins et al., 2005; Kulminski et al., 2007). Women on average have higher deficit counts then men, however, have lower mortality rates at any given level of deficits (Rockwood & Mitnitski, 2011). Of note, even though an individual could potentially accumulate all the problems in a particular data set, it appears that there is an upper limit to deficit accumulation at 0.67 (Rockwood & Mitnitski, 2006). The FI correlates well with adverse outcomes (institutionalization and death) (Kulminski et al., 2008; Rockwood, Song & Mitnitski, 2011) demonstrating good criterion validity. The FI also correlates moderately well with other frailty measures (Rockwood, Andrew & Mitnitski, 2007) demonstrating good construct validity.

A criticism of this approach is that it is cumbersome in clinical practice to engage in a detailed assessment that requires 30 to 70 items. One benefit is that the FI is susceptible to animal modeling (Parks et al., 2012) allowing for physiological mechanisms to be more extensively evaluated. It can be graded and allows for transitions between health states to be studied with high precision (Fallah et al., 2011). The criticisms are less a concern in established databases, where the FI can readily be calculated, and likewise may be a lesser concern in the era of the electronic medical record. Any health deficit can be included in the frailty index assuming five certain conditions are met: 1) variables must be associated with health status, 2) a deficit's prevalence should increase with age, 3) a deficit must not saturate too early, 4) the deficits as a group must cover a range of systems, 5) if the goal is to use the FI in longitudinal analysis on the same people, the items that comprise the FI should be the same (Searle et al., 2008). One of the highest forms of validation is the presence of reproducible results. The mathematical properties of the FI have been studied in different countries, and different data sets by different research groups with the properties remaining consistent in terms of how deficits accumulate, gender difference and an upper limit to deficit accumulation (Rockwood & Mitnitski 2008). The FI is flexible in terms of the number (between 30 and 70) and types of deficits that can be considered. If criticisms regarding its feasibility can be overcome, the FI could prove useful in the clinical setting.

Summing across these studies, it is clear that differences exist in terms of the prevalence of frailty, risk prediction and properties depending on how frailty is conceptualized. Recently, some have criticized the properties of frailty assessments with a call for more evaluation and transparency (Drame et al., 2011; DeVries et al., 2011).

De Vries et al. (2011) indicate the FI may be a good candidate measure primary outcome measure for effect studies if further evaluation of the index is performed.

1.3.4 OPERATIONALIZATION OF FRAILTY: COMPREHENSIVE GERIATRIC ASSESSMENT

Each approach to frailty measurement has certain challenges in terms of its operationalization. The frailty phenotype is performance based although self reported data has been used in some studies. The frailty scale may be quite feasible in the clinical setting. The FI has been operationalized through a standard comprehensive geriatric assessment (FI-CGA); however, it is potentially daunting for those unfamiliar with its calculation. Efforts have been made to develop criteria for screening (includes the CGA) older adults for interventions such as surgery (Seymour, 2008) and there have been efforts made towards assessing the use of the CGA in a variety of medical settings (Klepin et al., 2011; Rodin & Mohile, 2007). A FI can be calculated easily with a completed CGA so as CGA becomes more common in standard care, gaining insights into frailty by deficit accumulation will be possible.

The Comprehensive Geriatric Assessment is an essential tool for geriatricians when managing complex patients. It is used to capture relevant information about the health status and function of an older person. This tool helps to inform the diagnosis and management of patients through the development of an individualized care plan. It has been defined as a multidimensional interdisciplinary diagnostic process that enables the clinician to determine the medical and social issues that may be having an affect on an older adult so that an integrated plan for treatment and follow-up can be developed (Rubenstein et al., 1991). The Division of Geriatric Medicine at Dalhousie University has developed a single page assessment form that can be used to construct a Frailty Index (FI-

CGA) (Fig 1) (Rockwood & Mitnitski, 2011; Jones, Song & Rockwood, 2004; Jones et al., 2005). The FI is calculated by determining the number of deficits that a person has accumulated divided by the total number of items considered. When deficits accumulate, it may be the quantity that is most significant rather than each specific problem in the clinical setting (Rockwood & Mitnitski, 2011).

Another index approach that is based on comprehensive geriatric assessment is the Multidimensional Prognostic Index (MPI). The MPI is constructed from routine CGA and is designed to improve prognostication (e.g. mortality) in older adults (Pilotto et al., 2007). Like other frailty measures that aim to reduce a tool to the most substantial contributors, Pilotto et al. (2007) performed a cluster analysis to identify the most important domains and assess the independence of variables. The final version of the MPI included 8 domains (63 items) from the CGA. The absolute scores of the MPI were then reduced to an ordinal scale of: low, medium and severe risk. The MPI was able to stratify groups of patients based on 1-year mortality (Pilotto et al., 2007). The MPI is comparable to the FI in terms of its predictive power for all cause mortality in hospitalized patients (Area Under Curve MPI=0.75 vs. FI=0.73) (Pilotto et al., 2012). Both the FI and MPI allow clinicians to aggregate data from the comprehensive geriatric assessment in order to gain insight into the overall health status of a patient.

1.3.5 EMERGENCY MEDICAL SERVICES: THE RESEARCH SETTING

The world of EMS is unlike most other health care settings. The approach to clinical care in EMS has for the most part been translated from emergency medicine or other disciplines. Emergency medical services have their origins rooted in the military with the development of specialized transport units that served to get injured soldiers back to field hospitals in a timely manner while attempting to reduce injury severity and

mortality (Shah 2006). Modern EMS in North America developed in the 1960's following the publication of a white paper on accidental death and disability (National Academy of Science 1966; Accidental death and disability). The authors called for improved standards of care, equipment and training of personnel. Since its publication, EMS systems in North America have developed following two paradigms, either as a health service, public safety agency or mixture of the two. In its earliest days, EMS had been defined as strictly a transport service focusing on the safe, timely transport and treatment of the ill or injured. Paramedics are traditionally certified through skills based diploma programs. Paramedics typically practice under the license of a physician and are guided by protocols or clinical guidelines that are often condition specific. More recently, there has been a trend towards providing case based care where interventions with robust research evidence support are implemented in the field with patients then transported to the most appropriate facility, not necessarily the closest (Cheskes et al., 2011).

A well-developed EMS system has a number of key components including a communications center (paramedic call takers/ dispatchers), ground ambulance service, air medical transport, trauma program (data collection), training and simulation center, medical first response, and medical oversight (EHS, 2003). Services are often evaluated on response times and outcomes such as cardiac arrest survival to discharge (Myers et al., 2008). These outcome measures may not reflect quality of care for older adults.

1.3.6 NOVA SCOTIA EMS

In the mid 1990's, the Government of Nova Scotia assumed control of emergency services (Murphy, 1994). Since 1995, Emergency Health Services (EHS) Nova Scotia has provided oversight in implementing, monitoring and evaluating pre-hospital

emergency care (EHS, 2005). Emergency Medical Care Inc. is the private organization that is contracted out to provide emergency health care in Nova Scotia by the government regulatory body (EHS). Prior to 1995, over 50 private and public ambulance operators provided care to the citizens of Nova Scotia (EHS, 2005). The previous system resulted in inconsistencies in medical care, levels of staff qualification and the type and condition of ambulances (EHS, 2005).

In the present system, high quality pre-hospital care can be provided to all individuals in Nova Scotia, regardless of where they live, and with improved accountability compared with the previous system. Since the development of EHS, there has been improved credentialing of personnel, standards for education, continuing education, single access to the EHS system, computer aided dispatch, standards for response times, performance based contracts, medical oversight, improved research capacity and cost/benefit analysis. Ultimately, the transition to EHS meant a change from a patient transport system to a patient care system (Murphy, 1994).

In Nova Scotia, calls for ambulance services are processed through a single dispatch center using the computer aided dispatch system (CAD). CAD data has been used in previous studies to monitor patient contact times (Campbell et al., 1995) and to investigate the relationship between severity of illness and dispatch codes (Michael and Sporer, 2005). In 2008, EHS NS began using an electronic patient care record that has improved the surveillance and auditing process. Both the CAD data and electronic patient care report (ePCR) comprise a central registry of EMS information that has been largely untapped as a research resource.

1.3.7 PARAMEDIC TRAINING

The Paramedic Association of Canada (PAC) has developed the National Occupation Competency Profiles (NOCP) with a detailed list of competencies for all provider levels: emergency medical responders (EMR), primary care paramedic (PCP), advanced care paramedics (ACP) and the critical care paramedic (CCP) (Symons & Shuster, 2004). In Nova Scotia, five paramedic designations are presently listed and include: PCPs, Intermediate Care Paramedics (ICPs), ACPs and CCPs. The emergency medical dispatcher (EMD) is also a trained paramedic.

Paramedics in Nova Scotia can perform certain designated medical procedures under the licensure of the EHS Provincial Medical Director, although there have been discussions regarding the creation of a college of paramedics. The scope of practice of PCPs and ACPs will be outlined briefly as they make up the majority of paramedics in Nova Scotia. PCPs in Nova Scotia provide basic life support care and symptom relief. This includes basic airway management skills and ventilation techniques, IV access and blood glucose monitoring. In terms of medication administration, a variety of drugs may be given following pre-designated algorithms. The primary medications include aspirin, nitroglycerin, ventolin, glucagon, and epinephrine. PCPs are also trained in cardiac monitoring and automated external defibrillation.

The education of ACPs delves into the study of injury and disease processes in more detail. A few of the essential competencies of ACPs include: definitive airway management, 12 lead interpretation, appropriate electrical therapy (defibrillation, cardioversion, pacing), needle decompression, IV and IO drug administration (Symons & Shuster, 2004). The ACP may also administer a wide variety of medications that include antiemetics, bronchodilators, analgesics and adrenergic agonists. EHS NS provides a

complete list of essential competencies for PCPs and ACPs in Nova Scotia. Paramedics undergo an intensive, skills- based training program to obtain these competencies.

As an adjunct to the health care system, EMS is relatively new. Even so, with the changes of the past 15 years, the Nova Scotia system has become an ideal setting to conduct EMS research, and this may be even truer in the context of research on older adults. The system is reasonably controlled in terms having standardized equipment, personnel, and care guidelines. There is a central repository of data that allows for the collection of a wide variety of information from one data source. Further, there has been an emphasis on evidence based practice, research literacy and participation in research for Nova Scotia paramedics. Nova Scotia paramedics have played an important role in a number of randomized controlled trials that have led to a change in practice within the province (e.g. STEMI care, CPAP, C-spine immobilization).

At present, in general there is limited research and training on geriatrics in the EMS setting. Nova Scotia has the highest proportion of older adults in Canada (16%) (Statistics Canada, 2011). For these reasons, Nova Scotia arguably provides an excellent opportunity to study frailty in the EMS setting.

EMS as currently organized is not designed to cope with the full range of needs of older adults who are frail, given the current approach to care. In the past the goal was to arrive quickly, conduct a quick assessment and transport patients to the closest emergency department. Upon arrival, the goal was to clear up from the hospital in 20 minutes in order to be response ready. For paramedics, there is often a mismatch between expectations of what EMS is like and the reality. EMS personnel are trained to deal with major trauma and cardiac arrest, but receive little training in geriatrics even though that is an important part of the duties they are called upon to perform.

A number of challenges can affect the assessment of older adults in the pre-hospital setting. When EMS is called it is often their first patient encounter with that individual. There may be pre-existing communication, cognitive, functional or mobility challenges that make the initial assessment difficult, with potentially limited collateral information. Paramedics often rely on information from care partners (typically close family members), but do not have a standardized approach to collecting this data. Assessments are often performed in the home or potentially public places where there are multiple distractions including bystanders, noise, other public safety providers.

As well, EMS operates under various time constraints where there is often the goal to minimize the scene time. EMS providers must balance the assessment, treatment, transport decisions with the need to extricate the patient from the residence and managing the scene (e.g. interacting with bystanders, family, or other medical personnel). As well, there are often conflicts in terms of the transport decision. Many patients call EMS for assessment but still, for a variety of reasons refuse transport (non-transport). Older adults comprise a large group that make up the non-transport population, however, may be at high risk for adverse events (Rutschmann et al., 2005).

1.3.8 A TYPICAL EMS CASE

To secure a clearer understanding of the unique environment within which EMS operates, there may be value in providing an illustrative example as a typical case. Mr. D is an 83-year-old gentleman who lives with his wife in an apartment. He has some family support to help with driving and he is able to self-manage all of his activities of daily living (e.g., bathing, dressing). Mr. D has a history of hypertension, ischemic heart disease, GERD, high cholesterol, arthritis, and eye problems. He typically walks without assistance and has had limited contact with a primary health care provider over the past few months.

One night, Mrs. D abruptly awoke by her husband thrashing around. Mr. D seemed to be having seizure-like activity and is not responding to her appropriately. Mrs. D called 911.

When paramedics arrived they found Mr. D in bed. He was conscious and oriented to person, place and time. Mr. D stated that he was getting up to move his bowels and fell back into bed. He did not believe that he had any loss of consciousness and had no medical complaints. He still needed to use the bathroom and did not want to go to the hospital. He questioned why the paramedics were called and stated that he felt fine. Mrs. D was visibly upset by the ordeal and adamant that he had a seizure. The paramedics conducted a secondary exam and identified no issues initially. Vital signs were within normal limits and the patient had a normal sinus rhythm on the cardiac monitor. At this point, Mr. D proceeded to use the bathroom. Following a bowel movement, Mr. D became diaphoretic, nauseated and had problems standing. His bowel movement appeared normal and he was assisted out of the bathroom. Sitting and standing blood pressures revealed orthostatic hypotension. The patient's 12-lead electrocardiogram revealed a normal sinus rhythm.

An intravenous was initiated with normal saline. As his nausea and diaphoresis persisted with standing, it was decided that the patient would be transported to the emergency department. Mr. D was noticeably unstable while walking and needed the assistance of a paramedic. Upon arrival at the emergency department the patient was triaged as a Level III (Urgent) on the Canadian Triage Acuity Scale (CTAS). Vital signs and patient condition were monitored while waiting for placement in the emergency department. Following 1.5 h, Mr. D became hypotensive while supine. Mr. D was provided with a bed in the emergency department and ultimately treated for an upper GI bleed.

Would a frailty assessment aid with the decision-making and patient care process in this scenario?

Using the Dalhousie Division of Geriatric Medicine Comprehensive Geriatric Assessment (CGA) form, a person's health status can be ascertained merely by glancing at the pattern of responses (Figure 1). In this case, Mr. D was relatively healthy prior to the event, but showed a variety of acute changes while EMS was on scene. An efficient, time-sensitive mechanism for collecting and summarizing much of the information from the CGA could potentially help to guide care, decision making, and the clinicians ability to predict need for admission.

While much of the literature from specialized geriatric medicine uses the concept of frailty to distinguish between patient populations with unique needs and risks, this terminology is not used in the pre-hospital or emergency medicine setting. For many older adults, paramedics are the first point of contact with the health care system, and so need a better understanding of their patients'needs, and ideally, their treatment preferences, in order to initiate the most appropriate path that is congruent with their desires for medical care.

The challenges facing EMS and the ED are complex. There seems to be a mismatch between the current models of care and public expectations. The widespread problem of ED overcrowding can be attributed to the lack of effective primary care services, growing unmet healthcare needs, and an increased reliance on emergency services by the general public (Rowe et al., 2006). For EMS, ED overcrowding means that paramedics need to provide care for longer periods of time once at the hospital awaiting placement in the ED. These offload delays (time from arrival at hospital to return to service) can have an effect on service delivery to older adults. Initially, EMS

agencies were established to provide care for major trauma and cardiac arrest victims (Shah, 2006). EMS quality was based on how well agencies performed in relation to these conditions. However, responses for these conditions are few. In Nova Scotia, the three most common complaints are breathing problems, falls and sick person complaints (EHS, 2008). For this reason, paramedics require the appropriate knowledge and tools to accurately assess the health status of older adults. The basis of care for older patients is through the systematic assessment of health care needs, effective communication with the patient and caregiver, and the maintenance of continuity of care. A reliable evaluation of the health status of older people in the pre-hospital setting may serve to improve patient care and ultimately outcomes.

In general, older patients can benefit from aggressive treatment in acute illness, such as acute coronary syndromes (Gupta & Kaufman, 2006) and sepsis (Girard & Ely, 2007). However, many older patients (>75 years) often experience significant treatment delays (McLaughlin et al., 1999). A robust indicator of frailty might aid in identifying patients who may benefit from timely, aggressive therapy. Its measurement may also allow us to better predict illness progression in older people. Acute illness in a patient that is frail often manifests itself in "atypical" presentations (falls, confusion, functional problems) possibly leading to treatment delays or inappropriate care. For these patients more comprehensive, yet judicious care is recommended (Rockwood & Kephart, 2008).

Atypical presentations, such as cognitive impairment (Press, Margulin & Grinshpun, 2008; Kakuma et al., 2003), or changes in function (Wilber, Blanda & Gerson, 2006), can go unrecognized in the ED. In the ED, it is most likely that delirium goes unrecognized due to workload pressures and limited training (Press, Margulin & Grinshpun, 2008). No research has looked at this issue in the pre-hospital setting. A

comprehensive measure of frailty could potentially lead to the improved detection of unrecognized geriatric syndromes. It may allow health care practitioners across disciplines and medical settings to communicate more effectively, in terms that are meaningful for the patient. At present we strive to fit the patient into our current model of health care (one thing wrong at a time) instead of embracing the complexity of the frail older patient and striving to meet meaningful outcomes. A new approach to assessment may lead to improvements in care for the frail older person, lessen the stress on carers and improve efficiencies within the health care system.

For some, EMS is the gateway into the medical system. For this reason care must be directed appropriately so as to minimize re-admissions, duplications of care, and to ensure the needs of the patient are met in a timely fashion. Nova Scotia also has a high prevalence of chronic disease, further complicating health care delivery. Older adults account for 12-21% of ED visits (Aminzadeh & Dalziel, 2002). Clinicians are often challenged by the patient's complex history, communication difficulties and their own sometimes limited training with this patient population. A practical working definition of frailty may be helpful for clinicians working in the acute care setting. At present, frailty in ED patients has not been well described. Previous research has demonstrated that if a more comprehensive geriatric assessment is performed initially in the ED, outcomes could improve for certain patients (Kakuma et al., 2003; Caplan et al., 2004). Hastings et al. (2008) demonstrated that in patients discharged from the ED, frailty measured by the FI is able to discern between patients at high risk for serious adverse events (death, institutionalization) further highlighting the usefulness of this concept in population-based analysis.

1.3.9 FRAILTY AND HEALTH POLICY IN NOVA SCOTIA

Older adults are thought to be frequent users of EMS and the emergency department. Compared with younger adults, they are more likely to be admitted, to arrive by ambulance, and are at risk for adverse outcomes following discharge from the emergency department (Salvi et al., 2007). Older adults coming into the emergency department have special needs and increased complexity that typically surpasses their primary medical problems (Bridges et al., 2005). The system level adjustments that are necessary to provide improved care will not take place unless changes are made at the policy level (organizational/ public). Under the auspices of the report on the improvement of emergency services in Nova Scotia (Ross, 2010), it was recommended that every frail older adult (>75years) be assessed using a geriatric assessment tool with the goal to develop a care plan that ensures patients can remain in their homes for as long as possible. Further, paramedics should play a larger role in providing emergency care to patients within their home or long-term care setting (Ross, 2010). Comprehensive geriatric assessment and frailty measures have not been evaluated in the pre-hospital setting but could be helpful for providing care. With this policy piece there is an opportunity to conduct the necessary evaluation of available measures and provide recommendations for practice.

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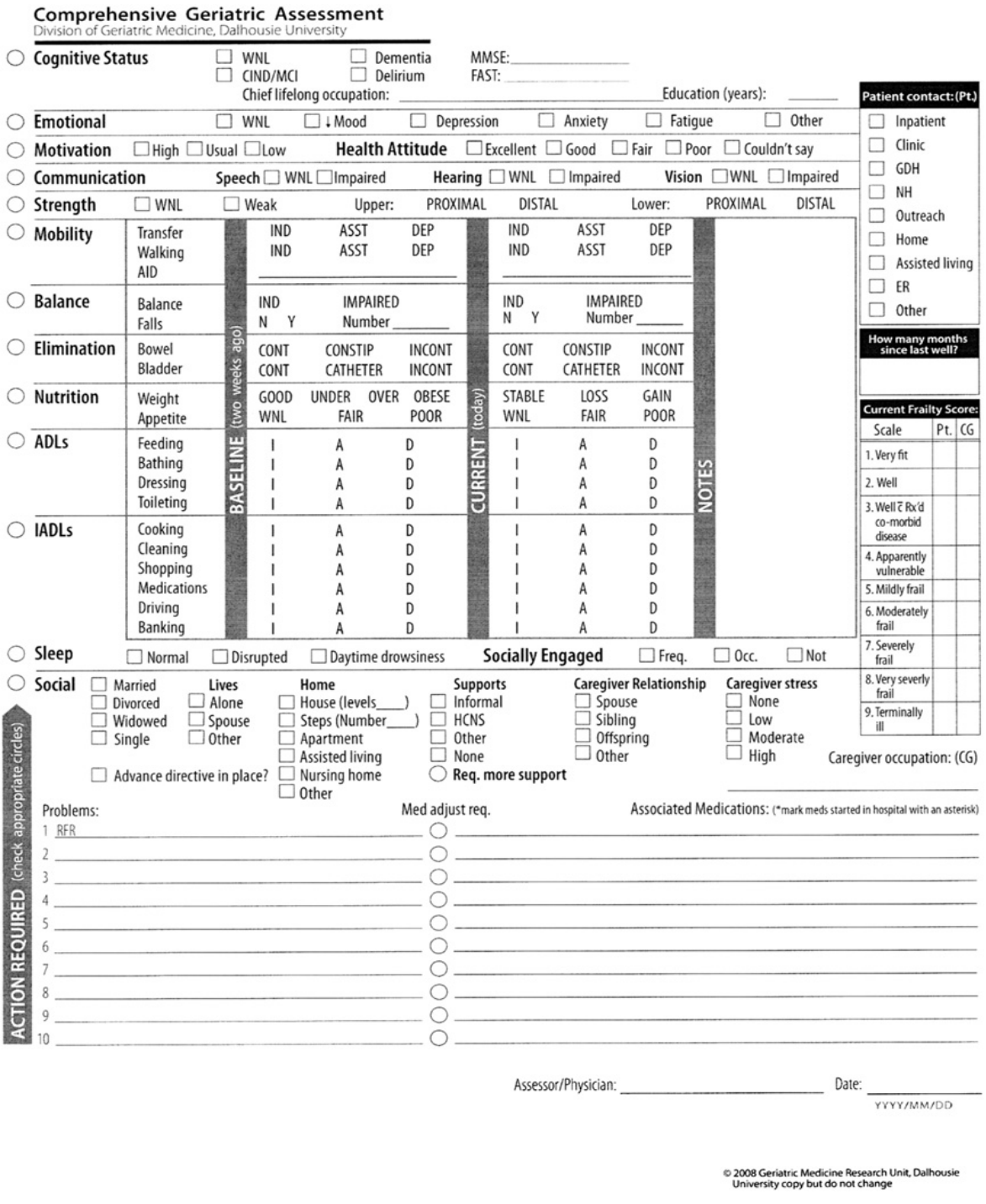
1.5 GRAPHICS

Figure 1. Comprehensive Geriatric Assessment (Copyright of the Dalhousie Geriatric Medicine Research Unit)



Comprehensive Geriatric Assessment
Division of Geriatric Medicine, Dalhousie University

○ **Cognitive Status** ☐ WNL ☐ Dementia MMSE:_____
☐ CIND/MCI ☐ Delirium FAST:_____
Chief lifelong occupation:_____ Education (years):_____

○ **Emotional** ☐ WNL ☐ ↓Mood ☐ Depression ☐ Anxiety ☐ Fatigue ☐ Other

○ **Motivation** ☐ High ☐ Usual ☐ Low **Health Attitude** ☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Couldn't say

○ **Communication** **Speech** ☐ WNL ☐ Impaired **Hearing** ☐ WNL ☐ Impaired **Vision** ☐ WNL ☐ Impaired

○ **Strength** ☐ WNL ☐ Weak Upper: PROXIMAL DISTAL Lower: PROXIMAL DISTAL

		BASELINE (two weeks ago)	CURRENT (today)	NOTES
○ **Mobility**	Transfer	IND ASST DEP	IND ASST DEP	
	Walking	IND ASST DEP	IND ASST DEP	
	AID	_____	_____	
○ **Balance**	Balance	IND IMPAIRED	IND IMPAIRED	
	Falls	N Y Number _____	N Y Number _____	
○ **Elimination**	Bowel	CONT CONSTIP INCONT	CONT CONSTIP INCONT	
	Bladder	CONT CATHETER INCONT	CONT CATHETER INCONT	
○ **Nutrition**	Weight	GOOD UNDER OVER OBESE	STABLE LOSS GAIN	
	Appetite	WNL FAIR POOR	WNL FAIR POOR	
○ **ADLs**	Feeding	I A D	I A D	
	Bathing	I A D	I A D	
	Dressing	I A D	I A D	
	Toileting	I A D	I A D	
○ **IADLs**	Cooking	I A D	I A D	
	Cleaning	I A D	I A D	
	Shopping	I A D	I A D	
	Medications	I A D	I A D	
	Driving	I A D	I A D	
	Banking	I A D	I A D	

○ **Sleep** ☐ Normal ☐ Disrupted ☐ Daytime drowsiness **Socially Engaged** ☐ Freq. ☐ Occ. ☐ Not

○ **Social** ☐ Married ☐ Divorced ☐ Widowed ☐ Single
Lives ☐ Alone ☐ Spouse ☐ Other
☐ Advance directive in place?
Home ☐ House (levels____) ☐ Steps (Number____) ☐ Apartment ☐ Assisted living ☐ Nursing home ☐ Other
Supports ☐ Informal ☐ HCNS ☐ Other ☐ None ○ **Req. more support**
Caregiver Relationship ☐ Spouse ☐ Sibling ☐ Offspring ☐ Other
Caregiver stress ☐ None ☐ Low ☐ Moderate ☐ High
Caregiver occupation: (CG)_____

Patient contact: (Pt.)
☐ Inpatient ☐ Clinic ☐ GDH ☐ NH ☐ Outreach ☐ Home ☐ Assisted living ☐ ER ☐ Other

How many months since last well?

Current Frailty Score:

Scale	Pt.	CG
1. Very fit		
2. Well		
3. Well ∃ Rx'd co-morbid disease		
4. Apparently vulnerable		
5. Mildly frail		
6. Moderately frail		
7. Severely frail		
8. Very severly frail		
9. Terminally ill		

ACTION REQUIRED (check appropriate circles)

Problems: Med adjust req. Associated Medications: (*mark meds started in hospital with an asterisk)
1 RFR ○ _____
2 _____ ○ _____
3 _____ ○ _____
4 _____ ○ _____
5 _____ ○ _____
6 _____ ○ _____
7 _____ ○ _____
8 _____ ○ _____
9 _____ ○ _____
10 _____ ○ _____

Assessor/Physician:_____ Date:_____
YYYY/MM/DD

CHAPTER 2 FRAILTY IN OLDER ADULTS USING PRE-HOSPITAL CARE AND THE EMERGENCY DEPARTMENT: A NARRATIVE REVIEW

2.1 PUBLICATION DETAILS

Goldstein JP, Andrew MK, Travers A. Frailty in older adults using pre-hospital care and the emergency department: A narrative review. *Canadian Geriatrics Journal* (2012);15 (1):16-22 *DOI: http://dx.doi.org/10.5770/cgj.15.27*

2.2 MANUSCRIPT

2.2.1 ABSTRACT

Background: Older adults use more health care services per capita than younger age groups and the older adult population varies greatly in its needs. Evidence suggests that there is a critical distinction between relative frailty and fitness in older adults. Here, we review how frailty is described in the pre-hospital literature and in the broader emergency medicine literature.

Methods: PubMed was used as the primary database but was augmented by searches of CINAHL and EMBASE. Articles were included if they focused on patients 60 years and older and implemented a definition of frailty or risk screening tool in the Emergency Medical Services (EMS) or Emergency Department setting.

Results: In the broad clinical literature, three types of measures can be identified: frailty index measures, frailty scales and a phenotypic definition. Each offers advantages and disadvantages for the EMS stakeholder. We identified no EMS literature on frailty conceptualization or management, although some risk measures from emergency medicine use terms that overlap with the frailty literature.

Conclusions: There is a paucity of research on frailty in the emergency medical services literature. No research was identified that specifically addressed frailty conceptualization or management in EMS patients. There is a compelling need for further research in this area.

Keywords: frailty, Emergency Medical Services, frail elderly, aged

2.2.2 INTRODUCTION

Older adults are the chief users of Emergency Medical Services (EMS) (Shah et al., 2007), but we have paid little heed to understanding their special needs (Bridges et al., 2005). Older patients use emergency services at higher rates, require more resources once in the emergency department (ED) and are more likely to experience adverse health outcomes compared with younger patients (Aminzadeh & Dalziel, 2002). A mechanism to identify those at higher risk for adverse outcomes may lead to improvements in care.

Although older age groups use EMS at disproportionately higher rates (Shah et al., 2007; Canadian Institute for Health Information, 2005), paramedic training has changed little to meet the specific needs of this older demographic. Moreover, there has been very little alteration in how EMS systems are organized, with agencies initially established to provide care for major trauma and cardiac arrest victims (Shah, 2006). The ability of EMS to cope with the influx of frail older patients may be reaching a limit, and unless changes are made in its organization, it seems inevitable that care provided to the older adult will suffer.

Older patients are a heterogeneous group due to multiple medical and social factors. Dichotomizing older patients as fit or frail may serve to optimize pre-hospital care. The term "frailty" is often employed in the medical literature, including emergency medicine, and is widely recognized as a state of vulnerability or decline in physiological

reserve (Hogan, MacKnight & Bergman, 2003). A definition of frailty should integrate biological, clinical, social, psychological, and environmental components, while also reflecting the multi-system impairment that is intrinsic to this concept (Hogan, MacKnight & Bergman, 2003). Frailty is common with prevalence estimates of 40% or more in those aged 80 and older (Fried et al., 2004; Rockwood et al., 2004).

Geriatric interventions provided in the community setting have been shown to reduce ED utilization over relatively short intervals, likely due to improved continuity of care and access (McCusker & Verdon, 2006). The utility of geriatric interventions applied in the ED have demonstrated mixed results (McCusker & Verdon, 2006), however, the evidence suggests benefits may be derived from targeting interventions towards high-risk clients (Caplan et al., 2004). Although a focus on frailty might usefully inform care provision in the pre-hospital and ED settings, the concept has received little attention to date.

Frailty measurement is controversial (Rockwood, Andrew & MItnitski, 2007; Whitson, Purser & Cohen, 2007). Three approaches can be discerned: rules-based approaches such as the frailty phenotype (Fried et al., 2001), clinical frailty scales based on clinical judgment (Rockwood et al., 2005), and the Frailty Index based on deficit count (Mitnitski, Mogilner & Rockwood, 2001; Ensrud et al., 2008; Rolfson et al., 2006; Rockwood & Mitnitski, 2007a,b) (Table 1). Some describe frailty as a medical syndrome (Fried et al., 2001), while others believe that it is derived from the accumulation of age-related changes over time (Mitnitski, Mogilner & Rockwood, 2001). While this will be a particular challenge for defining frailty in emergency services, it is also the case that the special needs in the emergency setting – not just for reliable and valid measures, but for feasible measures that can be used rapidly – usefully will resolve some of the more

esoteric considerations that are often at play in the debate about frailty operationalization. Regardless, adverse outcomes are more common in those who are considered frail (Rockwood, Andrew & Mitnitski, 2007). In fact, data from the Medicare Current Beneficiary Survey confirmed that the Rockwood-Mitnitski frailty index was a robust predictor of serious adverse events (death, nursing home admission, hospital admission) in the first 30 days following an older individual's visit to the emergency department (Hastings et al., 2008).

Objectives

The primary objectives of this review were: 1) to identify measures of frailty used by Emergency Medical Services and; 2) to describe frailty measures used in Emergency Medicine. We limited our discussion to the pre-hospital and ED environments, with their unique time, resource and system constraints. Here, we undertook a narrative review of the EMS and emergency medicine literature to understand how the concept of frailty is being applied, which measures have been validated for use in this population, and what can be recommended.

2.2.3 METHODS

The concept of frailty in the EMS/ED literature was reviewed by identifying primary literature where measures of frailty were implemented or clinically applied. For the purposes of this review databases (PubMed, EmBase, and CINAHL) were screened between the years 1990 and 2009. The search terms (MeSH and text) included aged, geriatric assessment, frail elderly, frail*, health services research, outcome assessment/screening, geriatric combined with either emergency medical services or emergency service. This search strategy was informed by hand searches of bibliographies, review of conference abstracts and contact with colleagues.

English language articles were included in this review if they focused on patients 60 years and older and implemented a definition of frailty or risk-screening tool in the EMS/ED setting. In our desire to be liberal with inclusion criteria, sixty years and older was chosen as this is sometimes used as the population of interest in emergency medicine literature on aging. The risk screening tools may be proxy markers of frailty so were included in this research. Studies were excluded if they were not focused on measuring frailty in the practice setting. The search strategy was considered up to date as of April 2009. A single reviewer (JG) initiated the search strategy, screened the titles and abstracts using the inclusion/ exclusion criteria and reviewed the full text articles.

2.2.4 RESULTS

A single reviewer performed the title and abstract screening on 5568 studies. An additional 412 records would have been located if the search strategy was not restricted by language. A total of 42 full text articles were reviewed. No articles specifically using a measure of frailty in the pre-hospital setting or emergency department were identified. The 6 original studies on risk screening tools used in the pre-hospital setting or emergency department were included in this review.

2.2.4.1 FRAILTY IN EMS PATIENTS

No primary research that implemented a validated measure of frailty in the EMS setting was identified. Because frailty is predictive of the risk for adverse outcomes, a search was also performed to identify tools that may predict risk for health deterioration or decline in functional status among older patients. Although no risk screening tools appear to be used by EMS, one study described how EMS services have attempted to provide more extensive care through screening, education and referral programs for older patients in an attempt to identify unmet health care needs (Table 2) (Shah et al., 2006). EMS-

based public health promotion programs are rare, however, Shah et al. (2006) determined that it is feasible for EMS agencies to take on non-traditional roles in public health. In addition, an EMS specific tool is currently in the derivation phase (PERIL (Paramedics and Elders at Risk of Independence Loss)) (Lee et al., 2007). This risk-screening tool may represent a feasible approach for assessing older people within their own home.

2.2.4.2 FRAILTY IN EMERGENCY DEPARTMENT PATIENTS

No primary research that implemented a validated measure of frailty in the Emergency Department was identified. In the ED setting, efforts have been made to develop tools that identify older patients at risk for functional decline, readmission to the ED or other adverse outcomes. Although these are not conceptualized as measures of frailty, their goal is to capture those patients who might be considered to be frail in their state of vulnerability. The first point of contact in the ED is triage so it would be intuitive that risk assessment scales may be administered at this point. Triage scales are used in emergency departments to aid with assigning acuity levels to patients so priority can be given to those with more urgent medical problems. A suitable risk assessment tool in this context would have to be easily obtained and embedded into the triage process.

Five risk screening tools were identified that specifically targeted older adults in the ED prior to discharge (Table 2) (McCusker et al., 1999; Meldon et al., 2003; Ruciman et al., 1996; Rowland et al., 1990; Boyd et al., 2008). The Triage Risk Screening Tool (TRST), a six item tool comprised of yes/no questions that are completed during the triage process, has been evaluated for use in older patients being discharged from the ED (Meldon et al., 2003; Hustey et al., 2007). It evaluates the presence of cognitive impairment, difficulty walking or transferring, recent falls, living alone with no available caregiver, taking five or more prescription medications, ED use in previous 30 days or

hospitalization in previous 90 days, and registered nurse (assessor) concern. Two or more risk factors or the presence of cognitive impairment leads to a designation of "high risk" (Meldon et al., 2003; Hustey et al., 2007).

The Identification of Seniors at Risk (ISAR) is a self or caregiver-completed, six item measure that is administered during the ED visit either upon early presentation or prior to discharge. It incorporates questions pertaining to pre-morbid and acute functional dependence, recent hospitalization (within 6 months), impaired memory, impaired vision, and polypharmacy (taking more than 3 medications). This tool has been demonstrated to be clinically relevant and to be predicative of adverse outcomes in a high risk group of elderly patients (McCusker et al., 1999, 2001).

The Brief Risk Identification for Geriatric Health Tool (BRIGHT) is a self or caregiver –completed, eleven item measure. It has been designed for use as a postal questionnaire or can be administered within the ED in order to detect older adults that might benefit from comprehensive geriatric assessment (Boyd et al., 2008). The BRIGHT requests the patient or caregiver to think about the previous three months and respond with "yes" or "no" to questions related to functional problems, shortness of breath, mobility problems, cognition, falls, self rated health, and depression (Boyd et al., 2008).

The final two screening tools identified were the seven item questionnaire developed by Rowland et al. (1990) and an eight item questionnaire by Ruciman et al. (1996). The seven item screening primarily assesses function (activities of daily living (ADL) and instrumental activities of daily living (IADLs)) and mobility. A score of four or more would identify an individual at risk for readmission. The Ruciman et al. (1996) tool included questions pertaining to function, use of diuretics, presence of soft tissue

injury, memory problems, difficulties with mobility and problems urinating. The questions were derived from a pilot study evaluating the use of a health visitor intervention post-discharge from the emergency department. The eight variables were identified through logistic regression and formulated based on the opinion of ED staff. A patient was considered at risk if three or more positive responses were present (Ruciman et al., 1996).

2.2.5 DISCUSSION

At present, no measure of frailty is being used by emergency medical services. Further, we found limited reference to mechanisms used to identify high risk older patients. Reasons for this may be a lack of attention paid to research focused on older patients, EMS system design factors, or lack of clear understanding regarding how these tools can be applied. In general, there appears to be a paucity of geriatric presence within the EMS literature and this could be reflected in current protocols and practices. Although an operational definition of frailty has been elusive, those currently available have proven to be useful in predicting adverse outcomes. Older patients cared for by EMS may not present in a typical fashion. For the frail older patient coming into the emergency department, these so called "atypical presentations" are common (Madden et al., 2002). The presence of geriatric syndromes has been shown to be predicative of prolonged hospital stay for patients admitted through the ED to medical units (Lang et al., 2006). Discerning between the fit and frail patient is critical as a first step towards identifying common geriatric problems that may have an impact on care needs and outcomes.

In addition, not all patients attended to by EMS are transported. A measure of frailty may be useful towards identifying vulnerable older adults in the community. Recently released quality indicators for geriatric emergency medicine, identified by

Terrell and colleagues, are intricately connected to frailty (Terrell et al., 2009). Pre-hospital care providers could improve care for older adults, by initiating the screening process and facilitating referral or transport to the most appropriate service.

The utility of defining frailty is clear, however, a practical method of incorporating a measure of frailty into the clinical setting is more difficult. Jones et al. (2004) demonstrated the feasibility of constructing a Frailty Index based on data collected from a Comprehensive Geriatric Assessment. Of note, it is not the nature of the deficits but rather the index value that is most predictive of outcomes (Rockwood & Mitnitski, 2007a). The Rockwood-Mitnitski Frailty Index is relatively simple to calculate and provides a high degree of precision. Due to the broad nature of the deficits that can be included into the FI, it may be possible to create an index based upon routinely collected data from the EMS environment (e.g. patient function). Paramedics are in a unique position to document the living conditions and function of an older person within their own home. A method for capturing this important information and aggregating it in a useful format is required. EMS agencies may want to consider how the measurement of frailty can be included into current clinical practice.

A decision to incorporate a measure of frailty into the clinical assessment should be guided by the purpose (Rockwood, Abeysundera & Mitnitski, 2007). During triage or in the pre-hospital setting, identifying whether a patient is fit or frail may be the primary concern and could lead to directing care. For this, a brief screening process such as a clinical frailty scale (rating system) or rules based approach resembling the risk screening tools outlined in Table 2 may be appropriate and feasible in this setting. These tools are easily applied and may be able to stratify patients by level of frailty. Later during the clinical evaluation, other measures of frailty (e.g. frailty index) may aid with identifying

changes in health status and provide prognostic value (see Table 1). This approach is thought to by more cumbersome, however, can be more precise in its ability to grade levels of frailty. In the prehospital setting, it may be enough to know whether someone is fit or frail, however, later in the care process when intervention options are being considered, a more precise measure may be useful in directing treatment decisions.

No research focused on frailty conceptualization in the ED was identified. A persistent problem is the lack of appropriate tools designed for use or validated in the ED to aid with the assessment of the older patient. Risk-screening tools have been developed to identify patients at risk for readmission to the ED, functional decline or death (McCusker et al., 1999; Meldon et al., 2003; Ruciman et al., 1996; Rowland et al., 1990; Boyd et al., 2008). Although these tools are not attempting to quantify frailty, their components are related to a conceptualization of frailty (e.g. function, mobility, cognitive impairment). For older patients discharged from the emergency department, functional deficits and use of community services were predictive of readmission (Caplan et al., 1998). These authors advocated for the use of a simple screening tool on all people over 75 presenting to the ED (Caplan et al., 1998). The TRST and ISAR screening tools have been the most studied to date. Each brief screening instrument has demonstrated a moderate ability to predict functional decline in older ED patients (Boyd et al., 2008). These tools are not designed to grade frailty and may lack the necessary precision to identify which patients may benefit most from specialized geriatric services.

In older patients presenting to the Emergency Department, functional impairment is common and is a predictor for poor short term outcomes following discharge (Wilber, Blanda & Gerson, 2006). It is often an unrecognized contributing factor to their ED visit (Wilber, Blanda & Gerson, 2006). Attempts have been made to quantify the under-

recognition of cognitive impairment (Hustey & Meldon, 2002; Kakuma et al., 2003), problems with function (Wilber, Blanda & Gerson, 2006) and other geriatric syndromes (Madden et al., 2002). Evaluating frailty, depending on the measure employed, may provide a more robust measure of impairment or general health status. There is evidence that case finding with subsequent intervention can lead to improved outcomes for older people following discharge from the emergency department (McCusker et al., 2001). It may be possible to improve the screening process through the identification and measurement of frailty in older ED patients.

2.2.5.1 LIMITATIONS

Although the search criteria allowed us to conduct a comprehensive review of the literature, we may have missed publications on this subject matter. The primary objective of this review was to identify frailty tools (Table 1) that are currently used in the prehospital and emergency medicine setting. Risk-screening tools were included in this analysis as they may identify frail older adults in the EMS/ED setting; however this linkage has not been studied and should be the focus of further exploration. Differences in terminology between medical settings may have precluded our search criteria from identifying relevant articles in the emergency medicine literature.

2.2.5.2 IMPLICATIONS FOR RESEARCH

It is clear that more geriatric specific research is necessary in the pre-hospital setting. To improve processes of care for older patients using pre-hospital and emergency services, geriatric patients should be tracked through different nodes of care (e.g. pre-hospital, triage, clinical assessment/treatment, and discharge). The implications of frailty on care provision should be evaluated. Older patients are often not included in clinical trials or interventional research. A measure of frailty may mean an improved ability to include

geriatric patients in interventional research as the ability to stratify patients according to their overall health status will be possible. The clinical utility of frailty measurement and screening requires further investigation.

2.2.5.3 IMPLICATIONS FOR PRACTICE

An older person that is fit but acutely unwell can benefit from aggressive, "usual care". For the older person that is frail, with multiple co-morbidities, and acutely unwell; complex care brought by a multidisciplinary team is recommended (Rockwood, MacKnight & Bergman, 2006). For the frail older adult it may be ideal to intervene early through comprehensive assessment and management of issues within the community setting. A common language of frailty is necessary to facilitate communication between healthcare providers and provide a nonarbitrary way to classify relative fitness and frailty. Pre-hospital providers may be able to effectively identify those frail patients that would benefit most from specialized geriatric services. EMS providers have the advantage of interacting with patients within their own home, which provides them with a more in-depth understanding of the patient's environment, social supports and family dynamics. Collating this information with frailty measurement may lead to improvements in processes of care, possibly through early identification and referral to geriatric services.

2.2.6 CONCLUSION

To our knowledge, this is the first comprehensive review that aggregates research pertaining to frailty in the pre-hospital and emergency medicine literature. There is a paucity of geriatric specific research on frailty in the pre-hospital literature. A number of approaches to frailty conceptualization and measurement are evident. Each approach has certain benefits. A standardized approach to frailty assessment is warranted in order to detect and document common geriatric problems (e.g. cognitive impairment, functional

impairment, social vulnerability and mobility impairment) and guide care provision in this setting.

Any measure of frailty used by EMS must be designed to address the challenges of clinical care encountered in this setting and must be rigorously evaluated. It is clear, based upon our review, that little attention has been focused on this construct in the pre-hospital and emergency medicine literature. Efforts should be devoted towards developing tools to aid with discerning between fitness and frailty in older adults requiring emergency services as their care needs will be dependent on this distinction.

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2.2.8 GRAPHICS

Table 1. Common definitions of frailty from the geriatric medicine literature with associated positive and negative attributes that may have an impact on their use in the pre-hospital setting.

Frailty Definition	**Components**	**Grades of Frailty**	**Authors**	**Measurement**	**Pros/ Cons**
Phenotype/ Rules-Based Approach	Performance on five variables	Robust: no problems Pre-frail: one or two problems Frail: three or more problems	Fried et al. 2001	Clinical Performance-based measures	Pros: Performance based, easy to apply Cons: floor effect for some variables (immobile patients)
Frailty Index (e.g. Rockwood-Mitnitski Frailty Index)	Deficit count or proportion of potential deficits that a person has accumulated	Range: 0-1.0 Empirical cut-off: <0.25 (robust/ pre-frail) ≥ 0.25 (frail) 0.67 (99% upper limit of FI)	Mitnitski, Mogilner & Rockwood, 2001	Comprehensive Geriatric Assessment, Population-based data (survey)	Pros: Simple approach, robust indicator of frailty, reproducible mathematical properties, precise grading Cons: Cumbersome in clinical setting

Frailty Definition	Components	Grades of Frailty	Authors	Measurements	Pros/Cons
Frailty Scale (e.g. Canadian Study of Health and Aging – Clinical Frailty Scale)	Single descriptor of a person's state of frailty (fitness)	CSHA- CFS: A 7 point scale ranging from "very fit" to "severely frail"	Rockwood et al. 2005	Clinical Judgment	Pros: Subjective, easy to use/ implement Cons: validated for use by specialists, insensitive in some populations

Table 2. Risk screening tools or programs used by EMS or in the Emergency Department.

Study	Tool/ Program	Setting/Sample Size	Reliability/ Validity	Outcomes
Shah et al. 2006	EMS Screening Program (falls, need for vaccination)	Community-dwelling patients requesting EMS N= 143 control group, 258 intervention group	Feasibility of screening for vaccination status, falls, environmental hazards	Feasibility of screening programs, reduction of risk
McCusker et al. 1999	ISAR (Identification of Seniors at Risk)	Four urban academic ED N=1854	- Test-retest reliability – 0.78 McCusker et al. (1998) - Predictive validity has been assessed independently Salvi et al (2009), Moon et al. (2007)	Adverse Outcomes Sensitivity:72% Specificity:58%
Meldon et al. 2003	TRST (Triage Risk Screening Tool)	Two urban academic ED/ N=647	- Inter-rater reliability – kappa 0.94-1.0 (Meldon et al., 2003); 0.9 (Hustey et al., 2007) -validated by Moon et al. (2007), Lee et al. (2005) (moderate predictive validity)	ED use (30 day) RR =1.7 (95% CI 1.2-2.3), Hospital Admission (30 day) RR=3.3 (95% CI 2.2-5.1) Sensitivity:64% Specificity:63%
Ruciman et al. 1996	VEQ (Vulnerable Elderly Questionnaire)	One urban ED/ N=48/ 75 years and older	- Inter-rater reliability not reported - Validated by Moon et al. (2007)	Risk for readmission Sensitivity:86.4% Specificity:38.5%

Study	Tool/Program	Setting/Sample Size	Reliability/Validity	Outcomes
Rowland et al. 1990	Seven item questionnaire	One urban ED/ N=450/ 75 years and older	- Inter-rater reliability not reported - Validated by Moon et al. (2007)	Risk for readmission Sensitivity: 85% Specificity: 28%
Boyd et al. 2008	BRIGHT (Brief Risk Identification for Geriatric Health Tool)	One urban ED/ N= 139 75 years and older	- Inter-rater reliability – n/a - No Independent validation	Functional Decline Sensitivity: 76% Specificity: 79%

CHAPTER 3 EPIDEMIOLOGY OF NOVA SCOTIA EMS CALLS

3.1 PUBLICATION DETAILS

Goldstein J, Travers A, Jensen JL, Carter A & Rockwood K. Epidemiology of Pre-hospital Emergency Responses for Older Adults in a Provincial Emergency Medical Services System. Preparing to submit

3.2 MANUSCRIPT

3.2.1 ABSTRACT

Introduction: Societal aging is expected to impact the use of Emergency Medical Services (EMS). Older adults are known as high users of EMS. The objective of this study was to quantify the rate of EMS use in a Canadian provincial EMS system. A secondary objective was to compare characteristics of patients transported to hospital to those not transported.

Methods: A secondary data analysis of a provincial EMS database was conducted for emergency responses between January 1 and December 31, 2010. All older adults (aged 65+ years) requesting EMS for an emergent call were considered. EMS use in relation to age, gender and geographical location were described.

Results: During the study period there were 30,653 emergency responses for older adults. The mean age was 79.9 ± 8.5 years, and over half were women (57.3%). The median Canadian Triage and Acuity Scale (CTAS) score was 3 (range 1-5). The overall response rate for older adults in this provincial EMS system was 202.8 responses per 1000 with a transport rate of 174.8 per 1000 and non-transport rate of 24.4 per 1000. Nontransported patients tended to be slightly younger, women, with lower acuity (CTAS 5), co-morbidity and medication counts.

Conclusions: In this provincial EMS system, there was a high rate of EMS use amongst older adults. The rate of EMS use increased with age, was higher for women and in urban regions. The frequency of EMS use suggests the need for training health care providers to meet the needs of older adults in the out-of-hospital setting.

3.2.2 INTRODUCTION

3.2.2.1 POPULATION AGING

In general, populations are aging. In Canada, 14.1% of the population is aged 65 years or older. This is expected to increase, and indeed to accelerate over the next 20 years (Statistics Canada, 2011). The median age of 42.8 years in Nova Scotia is among the highest in Canada, with the proportion of older adults (16%) in Nova Scotia being the highest (Statistics Canada, 2011). This changing demographic profile is expected to challenge future health care delivery; therefore it is important to monitor health care demand and adjust resources accordingly.

3.2.2.2 EFFECTS OF AGING ON EMS

Population aging is of considerable concern for Emergency Medical Services (EMS). Older adults tend to use emergency services at disproportionately higher rates compared with younger age groups (Aminzadeh and Dalziel, 2002; McConnel and Wilson, 1998; Shah et al., 2007). In a nationally representative sample (United States), 38% of older adults arrived in the emergency department by EMS (Shah et al., 2007). Understanding EMS use by older adults is an important step towards developing appropriate services that meet their care needs.

To better understand their effect, EMS utilization rates have been studied in relation to a number of factors including age, socio-demographic characteristics, and insurance status (Meisel et al., 2011) (McConnell and Wilson, 1998). The

disproportionately higher EMS usage rates among older adults are well documented in many countries including the United States, Australia, and Turkey (Shah et al., 2007; Clark and Fitzgerald, 1999; Keskinoglu et al., 2009). EMS transport rates are highest in the oldest old (> 85 years) and are expected to accelerate (Lowthian et al., 2011). In addition to age, other factors contribute to EMS use. Emergency responses for older adults are particularly high in urban centers (McConnel and Wilson, 1998; Lowthian et al., 2011) and amongst the poor (US data) (Svenson, 2000). The relationship between gender and transport rates is mixed, with women having higher rates of transport whereas repeated transports were higher in men (Svenson, 2000; Tangherlini et al., 2010). Although there is a fairly large body of literature on EMS use, there appears to be little research exploring this topic in Canada. As Nova Scotia has both an older population and a provincial EMS system, it can offer useful insights into EMS usage by older adults. An important part of the demand for EMS are those requests not associated with transport to the hospital, which in fact can consume more time than do hospital transports. Non-transport rates are often difficult to quantify due to the limited availability of high quality out-of-hospital data (Shah et al., 2007). Little is known about the factors associated with non-transport in the pre-hospital setting. The non-transport rate in this provincial system will be evaluated. Our objective was to quantify the rate of EMS use, including both transport to the ED and non-transports, by older adults in a provincial EMS system.

3.2.3 METHODS

3.2.3.1 DESIGN

A secondary data analysis of Emergency Health Services (EHS) electronic Patient Care Record (ePCR) database was performed.

3.2.3.2 SETTING

In Nova Scotia, EHS is a provincially organized EMS system and the sole provider of emergency and transfer services. EHS provides oversight for credentialing of personnel, standards for education, and ensures single access to the EMS system, centralized computer aided dispatch, standards for response times, and medical oversight. Ground ambulances are staffed with primary, intermediate and advanced care paramedics. The ground ambulance service receives over 120, 000 requests for service (emergency calls and patient transfers) per year which result in over 100, 000 patient transports (EHS, 2011). This provincial EMS system services an area of 55 000 square kilometers and serves 942 506 people (2010 data) with 457,489 (male) and 485,017 (female) (Estimates of Population, CANSIM 051-0001) (Statistics Canada, 2012). The population of adults 65 years and older was 151 160 representing 16% of the population.

3.2.3.3 SAMPLE

All EMS emergent responses for those 65 years and older over one year (January 1, 2010 until December 31, 2010) were included in the analysis. 'Emergent responses' includes all emergency 911 calls, including those in which paramedics respond with lights-and-sirens ('code 1') and without lights-and-sirens ('code 2'). Both community dwelling older adults and residents of extended care facilities were included. Air ambulance responses, inter-facility transfers or other scheduled responses (e.g. return to residence from the hospital) were excluded from the analysis.

3.2.3.4 DATA COLLECTION

Paramedics are responsible for documenting operational and patient care data on all responses where an incident number is generated. The ePCR (electronic patient care record) data is a reflection of the out-of-hospital course of care. The ePCR data set include all transported and non-transported patients that requested EMS. The ePCR data

includes personal and clinical characteristics including age, residence, chief complaint, symptoms, allergies, medications, past medical history, vital signs, primary assessment, diagnostic tests (e.g. glucose, 12 lead), and treatment (interventions/ medications administered). Operational details of responses are also captured including provider level, scene, transport, and turn-around times. Upon completion of each call, paramedics complete an ePCR that is given a unique identifier from the computerized aided dispatch system. Once the ePCR is finalized and signed by both paramedics, it is uploaded to a central server, and stored in a single administrative database.

Data collected was associated with four domains (dispatch, demographic, clinical, and transport) of the electronic chart. For Dispatch Data, we captured the dispatch problem and response mode (code 1 or code 2). Demographic data included the patient's age, gender and location by postal code or region. The clinical data included the paramedic's clinical impression, first set of vital signs (respiratory rate, heart rate, blood pressure, Glasgow Coma Scale, Blood Glucose, oxygen saturation, pain scale), the pre-hospital Canadian Triage and Acuity Scale (CTAS), co-morbidity count, medication count, therapies provided and transport mode to hospital (code 1 or 2). The CTAS and transport mode to hospital are surrogate markers of illness severity. The decision to transport or not was also captured.

Non-transports occur for a number of reasons and are coded in a different ways. For the purposes of this study, we grouped all non-transports into one category. Obvious deaths and cardiac arrests that were not transported were categorized separately. In Nova Scotia, there are few indications for treat and release conditions and no specific policy on paramedic initiated non-transports. Insulin dependent diabetic patients may be treated

and left at home post-hypoglycemia if they do not wish to be transported (Cain et al. 2003).

3.2.3.5 ANALYSIS

Descriptive statistics were used to describe rates of EMS use by age cohorts, gender, and location (region). The EMS transport rate per 1000 population was determined. Age associated rates of utilization are presented. The chi-square test was used to detect differences in proportions of EMS use by age, gender, and location at the system level. The independent t-test was used to detect differences between continuous variables. As a secondary outcome, patients who were transported to the ED were compared to those who were not transported, in terms of illness severity, age, gender, and location. Data was analyzed using SPSS version 15.0 (Chicago, IL).

3.2.3.6 ETHICS

The study was approved by the Capital District Health Authority research ethics committee (CDHA-RS/2012-248).

3.2.4 RESULTS

In 2010, there were a total of 63 076 requests for emergent service. Of these, there were 32 423 emergency responses for those aged ≥ 16 years but less than 65 resulting in 24 228 transports. There were 30 653 emergency responses for older adults 65 years and older, resulting in 26 420 transports (86.2%; Figure 2). The mean age was 79.9 ± 8.5 years with over half female (57.3%) (Table 3). A bimodal distribution was observed with one peak near 68 years and a second closer to the mean of almost 80 years (Figure 3). Patients typically had multiple problems (median co-morbidity count was 3 (IQR - 3), and median 6 medications (IQR - 6). The most common co-morbidities were hypertension

(44%), cardiac problems (27%), breathing problems (21%), diabetes (25%) and Alzheimer's disease or related dementias (11%). Most were triaged as CTAS 3 (Urgent).

The most common clinical impressions, as documented by paramedics, were trauma, respiratory and cardiovascular conditions. Almost 20% of responses were coded as a nonspecific complaint, wellness check, or no patient complaint. Of these, 31.7% (n=2255) of patients were not transported to the emergency department. Only 12 % of responses were scored with the highest acuity levels (CTAS 1 and 2), indicative of the need for resuscitation or emergent care. This was reflected in a lower proportion of calls (4%) returned to hospital code 1 ('lights and sirens'). The most common treatment interventions were IV access (39%) and oxygen therapy (35%). The most common medications administered were morphine, nitroglycerin and ventolin (Table 3).

The overall response rate for older adults in this provincial EMS system was 202.8 responses per 1000 with a transport rate of 174.8 per 1000 and non-transport rate of 24.4 per 1000 (Table 4). The transport rate increases with age from 76.9 transports per 1000 in the 65-69 age group to more than 500 per 1000 in the > 90 year cohort. 1.8 % of responses were for obvious deaths or cardiac arrest with no return of spontaneous circulation (ROSC) (Table 5). Older women had slightly higher rates of EMS use compared to men. Geographic variations in EMS use were found with slightly higher transport rates in urban regions. The non-transport rate also increases up to 85 years. Non-transports were more likely to be women, triaged less acute (CTAS 5), with lower co-morbidity counts (3.3 ± 2.6; $p<0.05$) and on fewer medications (5.2 ± 3.9; $p<0.05$) (Table 6).

3.2.5 DISCUSSION

The objective of this study was to describe the use of EMS by older adults and to compare patients who were transported with those who weren't. In this Canadian provincial EMS system the transport rate for older adults was found to be high and comparable to other reported transport rates for EMS systems in developed countries. Previously, Svenson (2000) found an overall transport rate in older adults of 178.5 per 1000. In a national population based study, the response rate was found to be 167 responses per 1000, 4 times higher than younger age groups (Shah et al., 2007). In this study, the transport rate was over 4.5 times higher for older adults compared to younger adults. Age has been noted to be the major determinant of EMS use (Svenson, 2000). EMS use is the highest in the oldest old with transport rates greater than 470 uses per 1000 with the expectation that this will continue to grow (Lowthian et al., 2011; Clark and Fitzgerald, 1999).

Health care services should be tailored for older age groups as they can have complex care needs in the presence of frailty, however, this has not always been the case in the setting of emergency medical care. In terms of public health care policy, the first step is to recognize the scope of a problem and call attention to it (Berger, 2008). In NS, provincial policy on emergency care is being targeted towards providing better care for older adults in this context through improved assessment, efficient and timely care that is congruent with the patient's care goals (Ross, 2012).

Factors associated with EMS use include older age, gender, geographical location and poverty (Shah et al., 2007; Lowthian et al., 2011; McConnel and Wilson, 1998; Svenson, 2000). Our findings are consistent with previous research demonstrating that urban residence and being female were associated with a higher transport rate. In this analysis we were unable to look at socioeconomic variables such as poverty, however, it

may be possible to link with other data sets using postal codes to identify the link between these factors and EMS use. Whether poverty is a predictor of EMS use has not been well studied in Canada. The effect of neighborhood poverty can be attenuated by universal access to health care as in Canada, however, the perception of neighborhood disorder has been demonstrated to be associated with health service use (including emergency department) (Martin-Storey et al., 2012). Further research is required to understand this relationship in the context of EMS use.

Our study extends the knowledge of previous work by quantifying the non-transport rate in a provincial EMS system. The under-triage of older adults with non-specific complaints is a problem in the emergency department (Rutschmann et al., 2005). Indeed, one report found that more than half of older adults classified as no specific complaint in the emergency department had an acute medical problem. Here, 20% of chief complaints were classified as nonspecific (e.g. no chief complaint or wellness check). Non-specific complaints can in fact be the most sensitive sign of illness in frail older adults (Jarrett et al., 1995). Further work is necessary to understand the burden of illness in this population and the contributing factors for the non-transport of EMS responses. A major strength of this data set is that it is a summary of the care provided in the out-of-hospital setting. We were able to capture data on non-transports, a group often missed in other analysis (Shah et al., 2007).

3.2.5.1 LIMITATIONS

This was a retrospective study based upon the electronic patient care records so there are associated limitations with this research design. All cases were included in the analysis as there were no missing data for age (mandatory field). There were 25 cases (<0.1%), where gender was not indicated and geographical information (postal code) was missing

for 6903 (22.5%) cases. All cases have longitude and latitude of the call documented so future research may be able to use this data to get a more accurate picture of rural/ urban differences in transport rates. The transport decision was absent for 106 cases (<0.1%). One of the most common fields missing was transport mode (lights and siren versus no lights and siren) with 27% missing data. The ePCR data are not linked to hospital records so patient outcomes were not known. It may be possible to link out-of-hospital data sets to population based survey data through postal codes to explore demographic factors associated with EMS use which is of interest to our research group. For this analysis, we looked at one calendar year of EMS use which may have been affected by certain conditions that were unique to that year, but to our knowledge this was not the case. Longitudinal analyses of EMS based data have demonstrated that there is a trend towards increasing use of services. This should be evaluated further in the Canadian context.

3.2.5.2 IMPLICATIONS FOR PRACTICE

Older adults represent a large patient population attended to by EMS. With age (especially past 80 years), there is a much higher likelihood of frailty and multiple co-morbidities, even amongst community-dwelling older adults (Rockwood et al., 2011). Shah et al. (2007) highlighted the fact that EMS professional provide a high amount of care to older adults and this should be reflected in equipment, training and clinical guidelines for care. In light of our findings, we would suggest that more emphasis be placed on geriatric specific education and training in paramedic programs.

In this study, most patients were classified as 3 or higher on the CTAS. Frail older adults may be at higher risk for misdiagnoses where atypical presentations are common. In some countries, attention has been paid towards initiating alternative care or transportation policies when transport to the emergency department may not be necessary

or wanted by the patient. Other programs seek facilitate transport in a timely manner. In this study, there was a relatively low frequency of interventions, in a population with a high burden of illness. More research is necessary to optimize pre-hospital care for older adults in the context of frailty.

3.2.6 CONCLUSION

Older adults were high users of EMS in this Canadian provincial EMS system. EMS use was associated with age and was the highest in the oldest old. This study extends the field by demonstrating that the non-transport rate also increases with age. Paramedics must have the appropriate knowledge and training to care for older adults in this setting.

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3.2.8 GRAPHICS

Figure 2. Flow of patient enrollment.

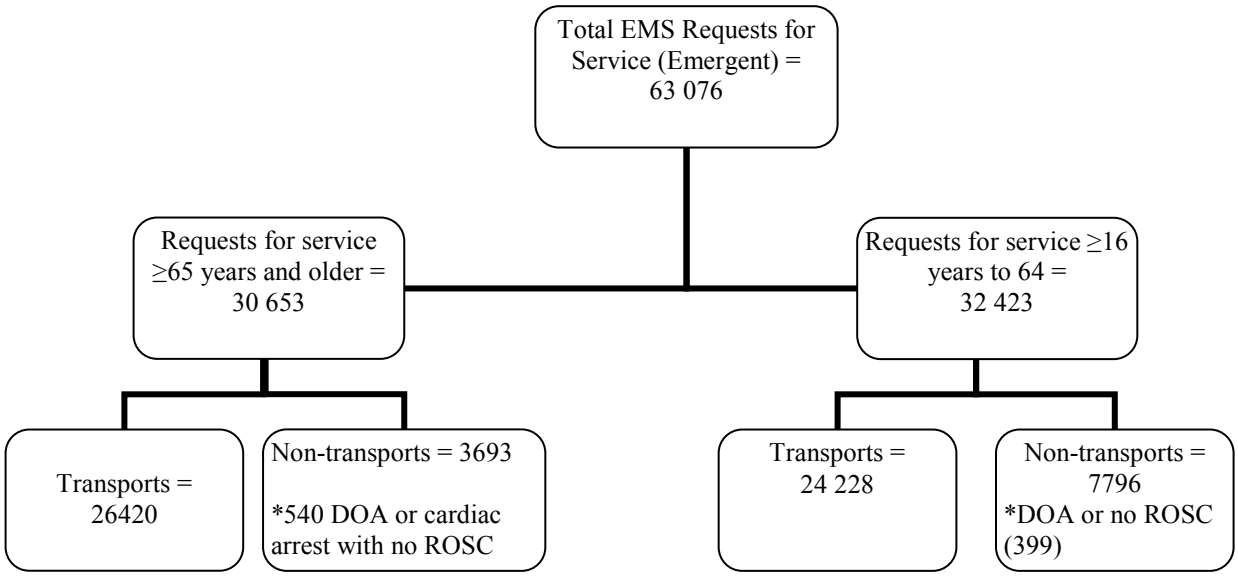

Table 3. Baseline characteristics of patients enrolled (n=30653)

Characteristic	Value
Age, mean (SD)	79.9 (8.5)
Range	65-111 years
Female	17 572 (57.3)
Male	13 056 (42.6)
*Location	
Rural	8193 (29.5)
Urban	13229 (47.9)
Common Co-morbidities	
Stroke or TIA	4252 (13.9)
Hypertension	13586 (44.3)
Cardiac (MI, CHF)	8475 (27.7)
Arthritis	3823 (12.5)
Respiratory (COPD, asthma)	6477 (21.1)
Gastrointestinal (Crohns/ Colitis)	2263 (7.4)
Diabetes	7818 (25.5)
Mental Health (Depression)	2854 (9.4)
Dementia (Parkinson, AD)	4137 (13.5)
Vitals (mean, SD)	
First Heart Rate	82.4 (23.5)
Respiratory Rate	19.02 (5.4)
Blood Pressure (systolic)	131.3 (32.9)
Oxygen (% saturation)	94.2 (11.1)
Glucose (mmol/L)	18.1 (10.6)
Glasgow Coma Scale	14.3 (2.2)
Pain Scale	2.0 (3.2)
Co-morbidities	4.1 (3.1)
Median	3
Medications	6.4 (4.5)
Median	6
CTAS	
1(Resuscitation)	523 (1.7)
2 (Emergent)	3079 (10)
3 (Urgent)	12180 (39.7)
4 or 5 (Less Urgent)	7070 (23.1)
Clinical Impression	
Cardiovascular	3579 (11.7)
Cardiac Arrest	
Obvious Death	368 (1.2)
ROSC	113 (0.4)
No ROSC	180 (0.6)

Characteristic	Value
Clinical Impression	
Cardiac Arrest	4
Traumatic	3718 (12.1)
Respiratory	4436 (14.5)
Trauma	2830 (9.9)
Nonspecific	2836 (9.3)
Neurological	1695 (5.5)
Wellness Check	209 (1.6)
Psychological	1632 (5.3)
No Patient Complaint	4342 (14.2)
Gastrointestinal	
Response Mode	
Code 1	15014 (49.9)
Code 2 (No Lights)	8626 (28.1)
Transport Mode	
Code 1	1211 (4.0)
Code 2 (No Lights)	19130 (62.4)
Interventions, n (%)	
Airway Adjunct/ Suction	448 (1.5)
Bag Valve Mask	328 (1.1)
ASA	1053 (3.4)
Dextrose	243 (0.8)
Diazepam	55 (0.2)
Adenosine	31 (0.1)
Atropine	283 (0.9)
Gravol	945 (3.1)
Benadryl	40 (0.1)
Epinephrine	253 (0.8)
Lasix	81 (0.3)
Lidocaine	58 (0.2)
Versed	99 (0.3)
Morphine	1757 (5.7)
Nitroglycerin	1793 (5.8)
Oral Glucose	162 (0.5)
Ventolin	1980 (6.5)
Electrical Therapy	152 (0.5)
Intubation	300 (1.0)
IV Access	12116 (39.5)
Oxygen Therapy	10811 (35.3)
Spinal Immobilization	519 (1.7)

MI = myocardial infarction, TIA = transient ischemic attack, CHF = congestive heart failure, COPD = chronic obstructive pulmonary disease, AD = Alzheimer's disease, IV = intravenous, ROSC = return of spontaneous circulation, *Missing postal code data for 6903 (22.5%)

Figure 3. Distribution of emergency responses by age.

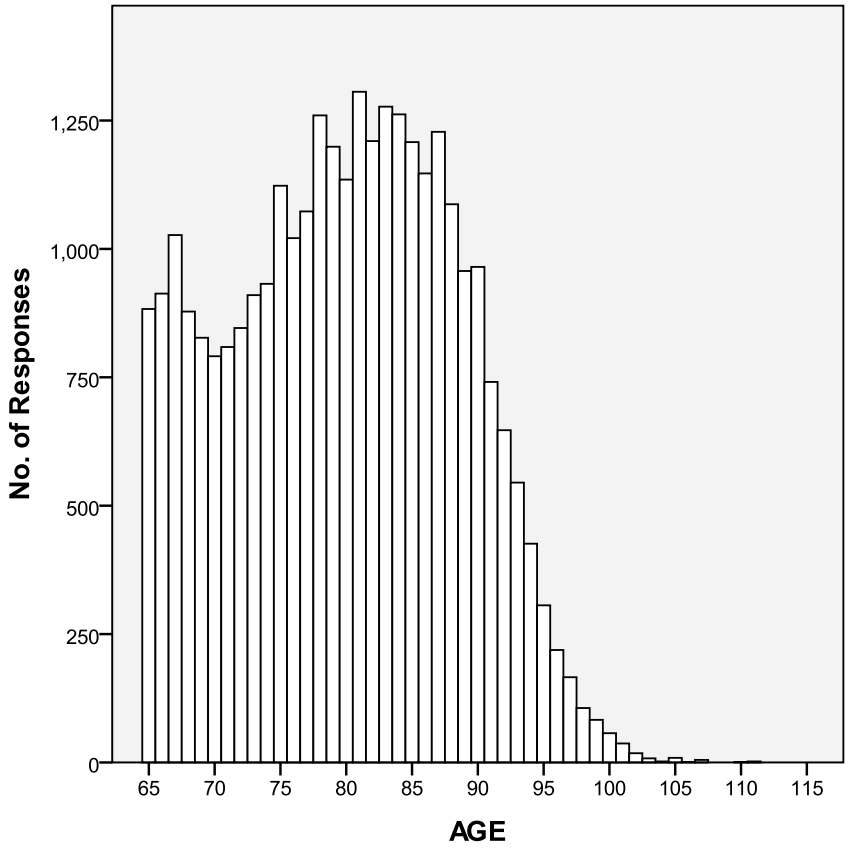

Table 4. Overall response rates by gender and location.

	Responses per 1000	Transports per 1000	Non-transports rate	% Non-transport
Overall				
≥65 years	202.8	174.8	24.4	3693 (12.1)
≥16 to 64 years	49.7	37.2	11.9	7796 (24.0)
Gender				
Male	N/A	196.5	25.0	1658 (12.7)
Female	N/A	207.4	23.9	2027 (11.5)
*Geographical Location				
Rural	N/A	54.2	4.63	701 (7.7)
Urban	N/A	87.5	8.62	1303 (8.9)

*denominator older adults in NS, location data missing for 6903 patients

N/A= not applicable

Table 5. Response rates by age in a provincial EMS system.

	Responses per 1000	Transports per 1000	Non-transport rate	% Non-transport	DOA (or NO ROSC)
16-64	49.77	37.19	11.97	7796 (24.3)	399
65-69	95.0	76.9	16.1	766 (16.9)	99
70-74	121.7	102.5	16.5	579 (13.5)	102
75-79	205.1	177.1	24.5	677 (11.9)	100
80-84	309.6	270.9	34.1	682 (11.0)	92
85-89	432.3	378.8	46.8	609 (10.8)	87
90-94	564.4	507.7	49.4	291 (8.7)	43
≥95	583.5	522.9	50.9	89 (8.7)	17

Table 6. Characteristics of patients by transport decision.

	Transported patients (n=26420)	Non-transported patients (n=3693)
Age*	80.15 (8.42)	78.32 (8.51)
Female, n (%)∞	15545 (57.3)	2027 (54.9)
Rural, n (%)∞	8351 (38.4%)	701 (35%)
CTAS,mode (n)∞	3(12008)	5 (1750)
Co-morbidities*	4.2 (3.2)	3.3 (2.6)
Medications*	6.6 (4.5)	5.2 (3.9)
Pain scale*	2.2 (3.3)	0.3 (1.2)

values indicate mean and standard deviation unless indicated otherwise

* results of t-test ($p<0.05$), ∞ results of χ^2($p<0.05$)

CHAPTER 4 THE ASSESSMENT OF OLDER ADULTS BY EMERGENCY MEDICAL SERVICES: METHODOLOGY AND FEASIBILITY OF A CARE PARTNER – COMPREHENSIVE GERIATRIC ASSESSMENT (CP-CGA)

4.1 PUBLICATION DETAILS

Goldstein JP, Travers A, Hubbard R, Moorhouse P, Andrew M, Rockwood K. The assessment of older adults by emergency medical services: Methodology and feasibility of a care partner – comprehensive geriatric assessment (CP-CGA). *Canadian Journal of Emergency Medicine*. Accepted for publication.

4.2 MANUSCRIPT

4.2.1 ABSTRACT

Objectives: Although older adults represent a significant proportion of Emergency Medical Services (EMS) responses little research has been done to understand their care needs. Comprehensive Geriatric Assessment (CGA) is used in geriatric medicine as a means to manage the health care needs of older adults and grade frailty. Our goal was to modify the CGA so that it could be completed independently by care partners as a means to summarize information necessary for frailty measurement. Here we present a detailed overview of the implementation and feasibility of a care partner completed Comprehensive Geriatric Assessment (CP-CGA) administered by paramedics. The satisfaction of care partners and paramedic practitioners with this approach is also reported.

Methods: A prospective, observational study was conducted with a convenience sample. Participants were 70 years or older and had a knowledgeable care partner with them.

Feasibility was measured by the time-to-complete and the questionnaire's percent completeness of items.

Results: 104 subjects were enrolled by EMS with 3 surveys excluded due to not meeting eligibility criteria. Most participants were women, older and lived in their own home. The mean time-to-complete was 18.7 ± 11.3 minutes (median 15 minutes) with 93.5 percent of the form complete. Most care partners were satisfied with the clarity, depth, and length of the survey. All paramedics that completed the survey (19% completion rate for follow up survey) felt screening for frailty was worthwhile; with the majority (71%) stating the CP-CGA may be useful.

Conclusion: The CP-CGA appears feasible as a mechanism to gather health information about older adults seeking emergency care. Future research will aim to evaluate the validity of this instrument as a mechanism to assess and quantify frailty.

4.2.2 INTRODUCTION

Older adults, particularly the 'oldest old' (aged 85 and over) are the most rapidly growing segment of society (Louria, 2005). Societal aging may be of particular concern for Emergency Medical Services (EMS), as older adults are over-represented among EMS patients (Canadian Institute for Health Information [CIHI], 2008; Shah et al., 2007). Once in the emergency department (ED), older adults often require more resources compared with younger age groups (Aminzadeh & Dalziel, 2002). The presence of frailty (a state of vulnerability arising as a result of multiple, interacting medical and social problems) can further complicate the care process (Rockwood et al. 1994; Hogan, MacKnight & Bergman, 2003). Frailty is common with prevalence estimates of 22-24% or more in subjects 65 years and older (Song, Mitnitski & Rockwood, 2010; Shamliyan et al., 2012) and is a strong predictor of serious adverse events (Schuurmans et al., 2004;

Rockwood et al., 2006). Currently, there is a lack of research on the measurement and impact of frailty in EMS (Goldstein, Andrew & Travers, 2010).

There are a number of approaches to frailty measurement with the deficit accumulation model being one that has a certain appeal in terms of its ability to grade frailty. The frailty index (FI) conceptualizes frailty as a summation of the number of problems that a person has accumulated over time (Mitnitski, Mogilner & Rockwood, 2001). The FI is presented as a proportion of health deficits present and typically considers 30-40 items (symptoms, diseases, or disabilities) (Searle et al., 2008). It has been well studied in population based analysis with reproducible characteristics identified, including an upper limit to deficit accumulation near 0.7 (Rockwood & Mitnitski, 2006, 2012). In emergency department patients, the FI is predictive of severe adverse events (death, hospitalization, and institutionalization) (Hastings et al., 2008). A benefit of the FI is that it can be derived from a standard comprehensive geriatric assessment (Jones, Song & Rockwood, 2004; Rockwood & Mitnitski, 2012).

Comprehensive Geriatric Assessment (CGA) is used in geriatric medicine to capture relevant information about the health status and function of an older person. CGA is an essential tool for geriatricians when managing complex patients. It facilitates accurate diagnosis, holistic management and effective communication within the multi-disciplinary team (Rockwood et al., 2000; Stuck et al., 1993). CGA allows for a greater understanding of one's level of fitness/ frailty and is important towards determining the best course of care (Ellis, Whitehead, Robinson & O'Neill, 2011). It's suggested that all frail older adults admitted through the emergency department should have access to CGA (Ellis et al., 2011), indicating that a frailty assessment in this setting is becoming increasingly more important.

Given the determining importance of frailty in relation to health outcomes, it is desirable that care providers other than geriatricians have some means of assessing frailty. Non-geriatricians, however, report that they find it burdensome to gather such detailed information on their patients (Samaras, Chevalley, Samaras & Gold, 2010). Given that much of what is important in determining an individual's level of frailty is known to others (such as informal care partners) who are familiar with that older person, care partner-completed instruments may provide a reasonable way to get the information in the hands of health care providers while they attend to other tasks. A standardized approach to gathering collateral knowledge in the form of a care partner completed CGA (CP-CGA) may be a feasible, valid and efficient means of capturing this knowledge.

Our objective was to examine the feasibility of a care partner derived CGA administered by EMS as a means to quantify frailty. This knowledge may be important for care provision and towards planning future interventions. As geriatric research in general is lacking in EMS, we will describe the enrollment process for this study; including the facilitators and barriers for conducting geriatric focused research in the field. Our goal was to describe the implementation of a geriatric assessment tool for use with older EMS patients that could improve our ability to quantify the burden of illness or frailty in this population. The satisfaction of care partners and paramedic practitioners with this approach is also reported.

4.2.3 METHODS

4.2.3.1 STUDY DESIGN AND SETTING

We conducted a prospective, observational study in one region (Halifax, Nova Scotia) of a provincial EMS system between February 2009 and March 2010. Paramedics enrolled a convenience sample of patients aged 70 years and older with a target of 100 subjects.

The Nova Scotia Ground Ambulance service covers an area of 55 000 square kilometers and approximately 1 million people. The service receives over 110, 000 requests for service per year which result in over 90, 000 patient transports (Emergency Health Services Nova Scotia, 2008). During the study period, there were 4, 829 eligible patients.

To be eligible, subjects had to have a care partner who was knowledgeable about their medical and social history with them. Both patients transported to the Halifax ED and those who were assessed by EMS but not transported were candidates for enrollment. The survey was presented in English only so language may have prohibited some from participating. Exclusion criteria were age less than 70, no care partner available, inability of care partner to self-complete the CP-CGA form in English, transport to a non-study hospital, or refusal (either patient or care partner) to participate. The Capital District Health Authority research ethics committee approved the study. For patients with cognitive impairment, implied consent (verbal assent) was sought from the substitute decision maker.

4.2.3.2 RECRUITMENT AND DATA COLLECTION: THE CARE PARTNER – COMPREHENSIVE ASSESSMENT

The CP-CGA was based on an in-hospital standard CGA (Jones, Song & Rockwood, 2004; Rockwood & Mitnitski, 2011). Each question on the CP-CGA corresponds to an item on the in-hospital CGA. The initial version of the CP-CGA was pre-screened to assess the interpretability, readability and face validity of the items (Streiner & Norman, 2003). The survey was composed of 62 questions derived from 10 domains including cognition, emotion, communication, mobility, balance, bladder, bowel, nutrition, activities of daily living and social factors (Appendix A). The survey specifically asked

about fourteen co-morbidities and the number of medications. A major difference between the CP-CGA and standard CGA is that the CP-CGA is based upon the opinion of the care partner while in-hospital CGAs often use formal clinical testing for specific items (e.g. cognition, mobility, and mood). Pilot data demonstrated that the survey could be completed in less than 15 minutes when respondents were focused on the task (mean 11.6 ± 4.1 minutes, n=12).

Paramedics applied the inclusion/ exclusion criteria. The care partner was identified as someone who spent enough time with the patient to be knowledgeable about his or her health and social circumstances. Ultimately, recruitment was at the discretion of the attending paramedic. Patients were eligible for enrolment twenty-four hours per day, seven days per week.

The patient and care partner were initially approached by the attending paramedic to introduce the study. Paramedics were aware of the study protocol and related details of the study to patients and care partners. Staff in the central region (n=156) (including management, communication officers and paramedics) were provided with a brief training session on the CP-CGA during mandatory in-services (Fall 2008). The training included information on frailty measurement, atypical disease presentations, the CGA, and details regarding the study logistics.

When paramedics identified an eligible participant, both the patient and care partner were asked whether they would be interested in participating in a study that looks at how we gather information from care partners. For those who agreed, the details of the study were explained and a letter inviting the patient and care partner to participate was provided. The care partner completed the CP-CGA while the patient was assessed and

treated by paramedics. The care partner also recorded the time-to-complete as well as three Likert style questions pertaining to their satisfaction with the tool.

The CP-CGA allows for frailty to be assessed in a couple of different ways. One approach that has pragmatic value is the Canadian Study of Health and Aging -Clinical Frailty Scale (CSHA-CFS). This scale is based upon clinical judgement (history taking and function) and is primarily used by geriatricians. Paramedics and care partners estimated the subject's frailty status using the CSHA-CFS (Fig. 4) (Rockwood et al., 2005). The original version included seven clinical descriptors to stratify patients based on their level of fitness/frailty. The revised scale has additional categories for severe frailty (with death expected within six months) and terminal illness that is non-disabling. The most common categories that we expected to see were the vulnerable or mildly frail categories. Mildly frail is characterized by slow mobility and varying degrees of independent activities of daily living (IADL) dependence.

Following the completion of the study, paramedics were asked to complete a survey either online using the Dalhousie University Opinio survey software (ObjectPlanet Inc., Oslo, Norway) hosted on Dalhousie University Opinio web server or in hardcopy version. This survey captured the paramedic's thoughts on the assessment tool and general care provision for frail older adults. This questionnaire also inquired about the challenges associated with patient enrollment, the perceived value of the tool, and barriers for use.

In-hospital and EMS patient care records were reviewed using a structured data collection form for one year outcomes to identify resource use and adverse events including: hospital admission, return visits to the ED, EMS use, institutionalization and

death. In-hospital CGAs were also obtained if available, though in the course of usual care, only a minority of older adults who come to hospital are seen by a geriatrician.

4.2.3.3 DATA ANALYSIS

Data were analyzed using SPSS version 15.0 (Chicago, IL). The sample size calculation was based on the approach of Kraemer and Thiemann (1987) for correlation analysis with the expected correlation of 0.8 (0.2) (geriatrician derived frailty index and care partner derived frailty index). This will be important for future validation of the tool. Descriptive statistics were used to characterize the sample and to provide details pertaining to the care partner respondent. Feasibility estimates of time-to-complete and percent completeness of items were compiled. Categorical variables were analyzed with the chi square test while continuous variables were compared using the t-test or one way ANOVA as appropriate. Paramedic and care partner acceptability of the tool was determined using a Likert scale. Free text feedback was assessed by thematic analysis. Incomplete questionnaires were included in the final data analysis. As this was a feasibility study, our primary outcome was to monitor percent completeness of items and time-to-complete. Incomplete forms provided valuable information regarding the acceptability of survey items and were therefore included in the final data analysis.

4.2.4 RESULTS

Paramedics enrolled 104 subjects (Figure 5). Three subjects were withdrawn due to not meeting the eligibility criteria leaving 101 subjects. In one case, two family members were provided with the survey so only the first distributed was included.

Participants were mostly female, older and lived in their own home (Table 7). Most participants were classified as Canadian Triage and Acuity Scale (CTAS) 3 (urgent) with the most common presenting complaint being respiratory problems. The median

paramedic-completed Clinical Frailty Scale rating was 5 (Mildly Frail). The survey was typically completed by a relative, usually the spouse or an offspring (Table 8). Many subjects (42%) lived with the care partner and most respondents (73%) stated they provided the majority of care. Many care partners reported a high (20%) or moderate (42%) level of stress and almost half stated that they needed more help with providing care.

The mean time-to-complete was 18.7 ± 11.3 minutes (median 15 minutes) (n=64) (Table 9). The completeness of the questionnaire was greater than 93.5 (10.9) percent. The sample was further explored with respect to the care partner's relationship with the subject. There were no significant differences in terms of the time-to-complete; however, there was a trend towards a shorter completion time if the survey was completed by an offspring. Slightly (but not significantly) higher completeness of questionnaires was also observed when an offspring was the care partner (Table 9).

4.2.4.1 CARE PARTNER SATISFACTION

Care partners (n=101) were asked to evaluate the CP-CGA in terms of the clarity of questions, length, and scope of the survey. The response rate was 95 %. Most care partners (92 %) strongly agreed or agreed that the questions were clear and easy to understand. Most respondents (87%) also felt that the survey was an appropriate length. Some care partners (20%) thought that there were important areas of health not covered. Care partner's comments about the questionnaire can be summarized in four themes: the relationship of the care partner (context), the survey design, health topics not covered within the survey, and reasoning for completing the survey (see Table 10).

4.2.4.2 PARAMEDIC FEEDBACK

Twenty-one respondents (12 primary care and 9 intermediate / advanced care paramedics) completed the paramedic follow-up survey representing a 19% response rate (110 surveys sent via email to field paramedics). Most respondents were male (62%) with 7.2 (4.9) years of experience. Half of the respondents reported enrolling a patient. All of the respondents thought there might be value in screening for frailty with 71% stating that the CP-CGA may be a useful approach.

The major barriers to enrollment were: the lack of a care partner present (71%; n=15), transport to a non-study hospital (52%, n=11), and lack of awareness (38%; n = 8). Paramedics also commented on issues of literacy (and health literacy) of care partners, prioritization of tasks, and the overall stress of the situation and its impact on the enrollment process. Paramedics identified three challenges to providing care for older adults: communication issues, a perceived lack of health literacy, and difficulties ascertaining the baseline state of the patient (which can be captured by the CP-CGA).

4.2.5 DISCUSSION

This is the first study to investigate the implementation of a standardized comprehensive geriatric assessment that would enable frailty measurement in the EMS setting by capturing information from a care partner. The approach appears feasible, both in terms of the time-to-complete and the completeness of the filled-in form. The high percentage of item completeness may be due to most forms being completed prior to care being transferred to the in-hospital staff. For this reason, paramedics were present to answer questions about the survey when necessary.

Whether a 15 minute survey in the out-of-hospital setting is feasible is debatable. In this study, care partners were approached either on scene or en route to the hospital with most forms being completed upon arrival in the Emergency Department. Due to

offload delays, many patients wait for prolonged periods of time, allowing time for collection of detailed information. These delays also mean paramedics need a more detailed awareness of their patients' care needs as they are responsible for their care until the hand over to hospital staff. Our goal was to develop a survey that was based on CGA but remained brief and easy to complete. It may be possible to refine the tool in the future based upon our findings from this study. In Nova Scotia, paramedics aim for a 20 minute scene time and 20 minute turn-around time upon arrival in the ED. A typical call is at least 40 minutes with extended transport times and off-load delays in some regions. The survey should be able to fit within these parameters.

One potential barrier that was identified by paramedics was that the EMS setting is often a place of high stress that could impede care partners from being able to provide this detailed information. Based upon the responses of care partners it seemed that the survey could be done in a timely fashion without disrupting care. Further, care partners were grateful for the task as a way to keep them busy and provide them with a voice in the care process. Future work should look at the integration of the CP-CGA into current paramedic electronic charting procedures and how summary information derived from the survey can inform clinical care.

Frailty is a term used to describe differences in the vulnerability to adverse outcomes for people of the same age. Those who are frail have multi-system impairment making the individual vulnerable to further stressors. There are a number of approaches to frailty measurement including a phenotype of frailty (Fried et al., 2001), scales (Rockwood et al., 2005), indicators (Gobbens et al., 2012; Steverink et al., 2001) and indexes (Mitnitski, Mogilner & Rockwood, 2001). In the out-of-hospital setting, frailty can be manifested as nonspecific presenting complaints with patients potentially triaged

less urgent than their actual health status (Rutschmann et al., 2005). The CP-CGA allows for frailty to be assessed in a number of different ways (deficit accumulation and the CSHA-CFS). Future work will evaluate the reliability and validity of this approach.

4.2.5.1 METHODOLOGICAL CONSIDERATIONS

In general, the EMS literature reports comparatively little geriatric research, despite how commonly older adults are the recipients of EMS care. Important challenges arise when conducting research in the out-of-hospital setting in general, and this is more evident when the population of interest is older. One challenge specific to this research project included the move to a new ED during the study period. Although this was not anticipated to be a barrier, there were difficulties with the availability of resources (study forms), awareness of the study and communication post transition. Another issue that affected the enrollment process (and which is not unique to this study) was staff turnover. As Nova Scotia operates as a province-wide EMS system it is not uncommon to have crews from other regions doing calls in the study region. For this project, only paramedics in the study region were made aware of this research. Also, patients were only enrolled at the Halifax ED site to ensure the potential for a geriatric consult, as this will be important for future criterion validation. This limited the potential for all paramedics in the study region to enroll patients on a regular basis. The major challenges associated with this research were the absence of a suitable care partner in some situations and that the spouse some times had physical or cognitive impairment that made completing the survey difficult.

4.2.5.2 LIMITATIONS

Although the completeness of items on the questionnaire was high, one question often missed was the time- to-complete. Only 64% (n=64) of this data was available. This was

a convenience sample of patients with enrollment at the discretion of the practitioner potentially limiting the generalizability of the results. No patient with a CTAS 1 (emergent requiring immediate care) was enrolled. Future research should look at how this information could be captured for critically ill patients. Many of the surveys were competed on arrival at the hospital during offload delays, which may limit the use of this tool where these conditions do not exist. The response rate for the paramedic survey was low (19%) limiting the generalizability of these findings.

4.2.5.3 IMPLICATIONS FOR RESEARCH

This study highlighted the opportunity to have paramedics participate in geriatric focused research. In this study, paramedics identified potential subjects, screened patients in terms of their capacity to consent, identified the most appropriate substitute decision maker, and evaluated frailty using the Clinical Frailty Scale. To conduct this research, a partnership was established between geriatric and emergency medical services. This partnership enabled EMS to evaluate a novel tool based upon a CGA, while those in geriatric medicine were able to expand their reach into a growing patient population and conduct research on frailty in a setting that has been lacking in geriatric focused research. In order to create the CP-CGA geriatric fellows, geriatricians and a paramedic contributed to the development of the survey. EMS operations managers and emergency physicians provided guidance in terms of operationalizing the study in the EMS setting. There is still work to be done in order for a CP-CGA to be used by EMS. Future research should evaluate its ability to discern between levels of fitness and frailty and determine the implications of frailty on outcomes in this patient population.

4.2.5.4 IMPLICATIONS FOR PRACTICE

The use of emergency services by older adults is increasing (Lowthian et al., 2011) so it is imperative that paramedics have the knowledge and tools to provide effective care. The basis for care in geriatric medicine is the CGA. The CP-CGA may be useful for frailty screening, while also acting as a mechanism to facilitate communication between care providers. The CP-CGA provides information on the subject's baseline status (e.g. cognition and function) and relative fitness/ frailty before the illness or injury. Research suggests that the frail older adult may benefit most from supportive care while the fit older adult from more aggressive "usual" treatment (Rockwood, MacKnight & Bergman, 2006). Early evaluation and identification of frailty are important components to providing care to older adults (Conroy, 2008; Moorhouse & Mallery, 2010). A survey approaching 20 minutes may be too long in an uncomplicated EMS call with short transport times. The CP-CGA may prove most useful on non-transport responses where time should be taken to ensure a thorough assessment is performed, with complex patients with multiple co-morbidities transported to hospital and in regions where off-load delays are prevalent (a situation where EMS provides prolonged periods of patient care). Further evaluation is necessary to understand how it can be incorporated into standard EMS care.

4.2.6 CONCLUSION

We have demonstrated that it is feasible to have care partners complete a survey based on the CGA and administered by EMS. This data can be used to evaluate frailty. As older adults comprise an ever growing demographic using EMS, it will be necessary to understand their care needs.

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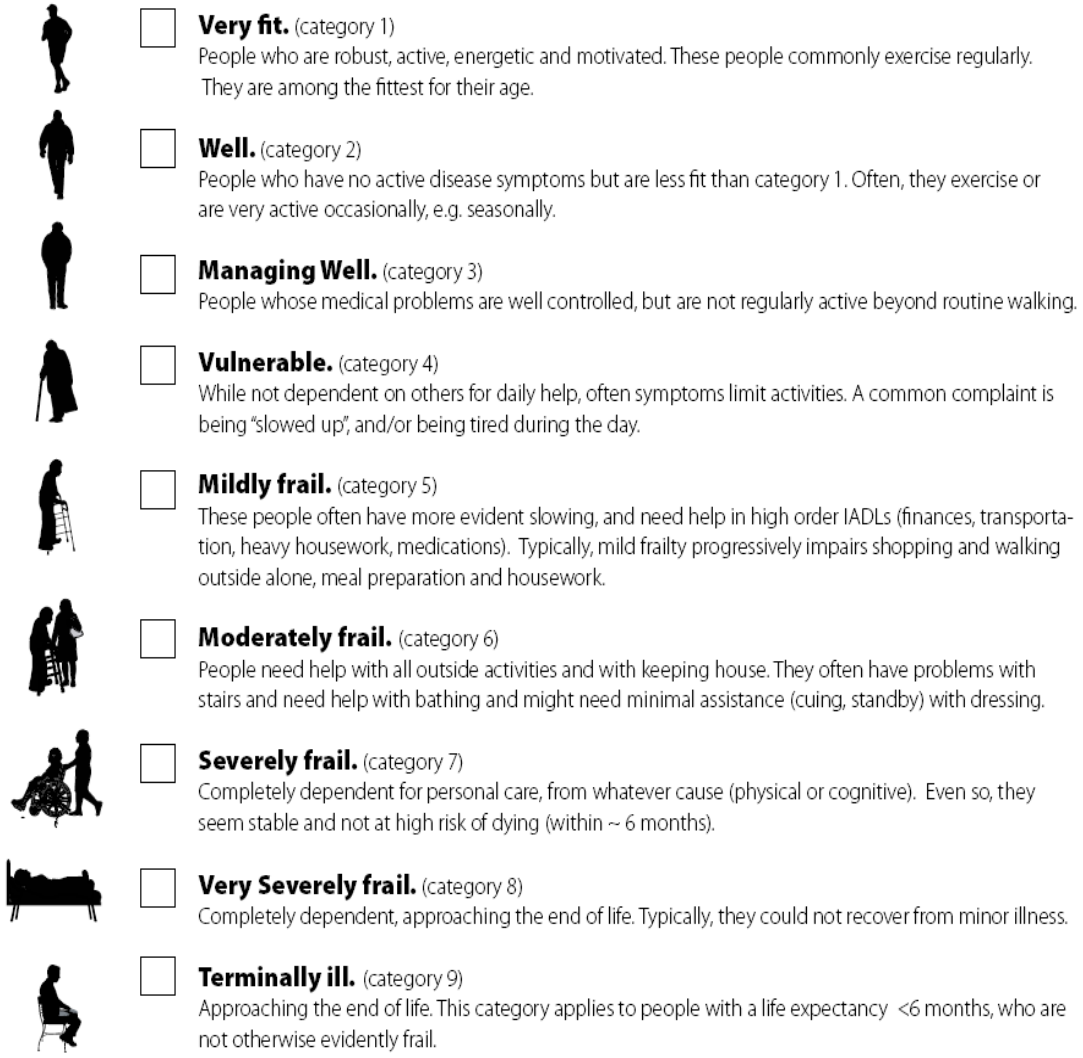
4.2.8 GRAPHICS

Figure 4. Canadian Study of Health and Aging – Clinical Frailty Scale Version 1.2 (Coutesy of Geriatric Medicine Research Unit, Dalhousie University, Halifax, Nova Scotia).



Very fit. (category 1)
People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.

Well. (category 2)
People who have no active disease symptoms but are less fit than category 1. Often, they exercise or are very active occasionally, e.g. seasonally.

Managing Well. (category 3)
People whose medical problems are well controlled, but are not regularly active beyond routine walking.

Vulnerable. (category 4)
While not dependent on others for daily help, often symptoms limit activities. A common complaint is being "slowed up", and/or being tired during the day.

Mildly frail. (category 5)
These people often have more evident slowing, and need help in high order IADLs (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.

Moderately frail. (category 6)
People need help with all outside activities and with keeping house. They often have problems with stairs and need help with bathing and might need minimal assistance (cuing, standby) with dressing.

Severely frail. (category 7)
Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).

Very Severely frail. (category 8)
Completely dependent, approaching the end of life. Typically, they could not recover from minor illness.

Terminally ill. (category 9)
Approaching the end of life. This category applies to people with a life expectancy <6 months, who are not otherwise evidently frail.

Figure 5. Flow diagram of patient enrollment.

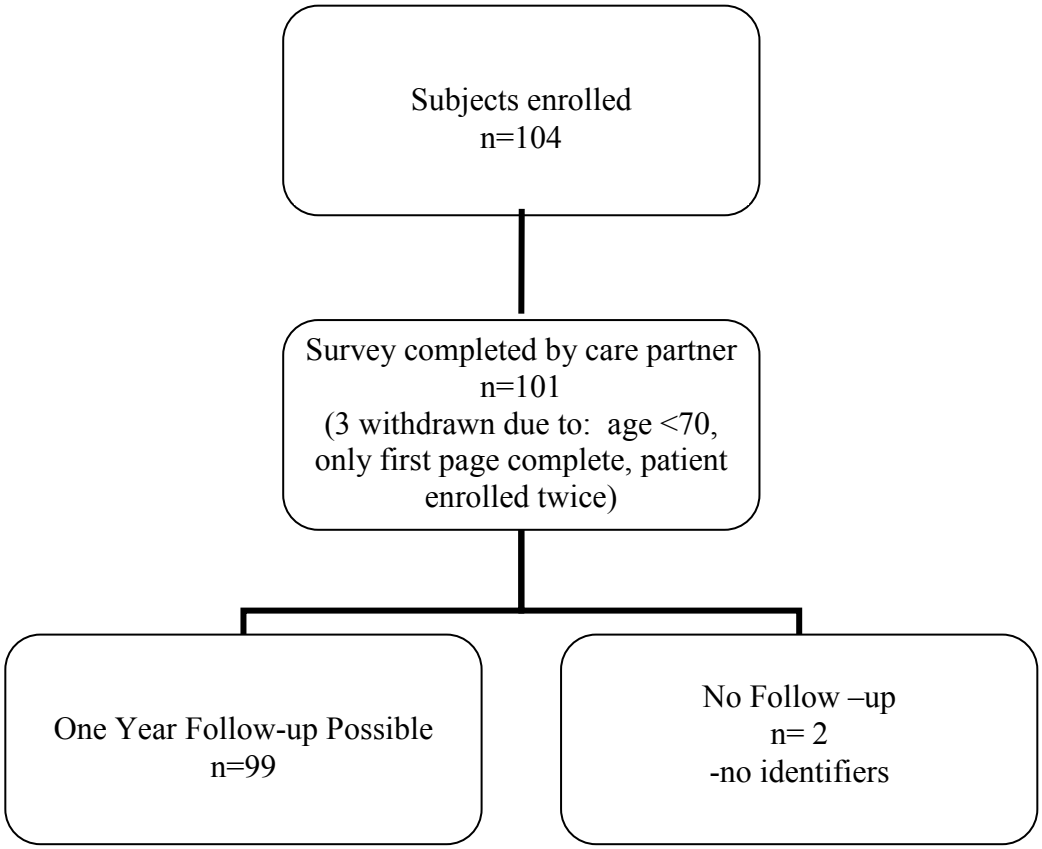


Table 7. Baseline characteristics for subjects (101) enrolled.

Characteristic	N (%)*
Age, mean (SD)	82.93 (6.07)
Female	64 (63)
Marital status	
Married	39 (38)
Widowed	52 (52)
Divorced or Single	10 (10)
Education – years, mean (SD)	10.4 (2.3)
Living Arrangement	
Own Home	49 (49)
Apartment	31 (31)
Other	21 (21)
CTAS	
2 (Emergent)	13 (13)
3 (Urgent)	75 (77)
4 or 5 (Less Urgent)	10 (10)
Chief Complaint	
Respiratory	25 (26)
Trauma (falls)	13 (13)
Nonspecific (e.g. weakness, general malaise)	12 (12)
CSHA-CFS – median	5 (Mildly Frail)

Table 8. Characteristics of the care partner (CP) and current supports.

Characteristic	N (%)
Relationship of CP	
Offspring	48 (48)
Spouse	27 (27)
Sibling	5 (5)
Other	20 (20)
Primary Care Provider –Yes	73 (72)
Living Arrangement	42 (42)
With CP	34 (34)
Alone	23 (23)
With someone else	
Level of Stress (CP)	20 (20)
High	42 (42)
Moderate	27 (27)
Low	11 (11)
No Stress	
Needs More Help – Yes	46 (50)
Additional Supports	
Private Help	22 (22)
Homecare (e.g. Victoria Order of Nurses)	36 (36)
Friends Help	61 (60)

Table 9. Feasibility outcomes for time-to-complete (n=64) and percent completeness of items (n=101) on the care partner CGA.

Characteristic	Mean (SD)
Time to complete (minutes), mean (SD)*	18.71 (11.3) Median – 15 minutes (n=64)
TTC Spouse	20.41 (12.65), (n=17)
TTC Sibling	34.5 (n=2)
TTC Child	15 (7.83), (n=31)
TTC Other	22.5 (12.94), (n=14)
Completeness of items	93.5 (10.9)
Completeness – Spouse	88.1 (14.5)
Completeness – Sibling	98.6 (n=2)
Completeness – Offspring	97.1 (5.8)
Completeness – Other	92.2 (12.5)

* n=64 for time to complete as 37 care partners did not complete this question

Table 10. Thematic analysis of free text feedback as provided by the care partner.

Theme	Responses	Comments
Care partner relationship	2	Context of relationship – non family member, stress, competing priorities (employment)
Survey design	11	More response items were required (too many "yes" or "no" with no room for "maybe") , 2 week period of change not adequate
Health topic not covered	3	Mental health, safety, socialization, activities, stimulation, attitude or family concern
Reasoning for completing survey	4	Survey acted as a distraction – “something to do while I wait”, “tired caregiver”

19 care partners provided written feedback. Care partners were asked if they would like to provide additional comments about the questionnaire.

CHAPTER 5 FEASIBILITY OF USING INFORMATION DERIVED FROM A CARE PARTNER TO DEVELOP A FRAILTY INDEX BASED ON COMPREHENSIVE GERIATRIC ASSESSMENT

5.1 PUBLICATION DETAILS

Goldstein JP, Hubbard RE, Moorhouse P, Andrew MK. (2013). Feasibility of using information derived from a care partner to develop a frailty index based on comprehensive geriatric assessment. *Journal of Frailty and Aging*, 2(1): 15-21.

5.2 MANUSCRIPT

5.2.1 ABSTRACT

Background: Frailty is a state of increasing vulnerability that places an individual at high risk for adverse health outcomes. The best approach for frailty measurement in clinical practice has not been resolved. Frailty can be measured by deficit accumulation and be derived from a comprehensive geriatric assessment (CGA). In busy clinical practice, it may not be feasible to gather this information entirely from patients, particularly from those with cognitive decline.

Objective: We describe the feasibility of a frailty index based upon a care partner derived CGA (CP-CGA). In addition, we sought to establish the acceptability of the questionnaire and explore whether care partners felt that the provided information contribute to patient assessment.

Design and Setting: A cross-sectional data analysis of 99 community dwelling older adults attending geriatric ambulatory care clinics at a single tertiary care center.

Measurements: Care partners completed the CP-CGA and a Clinical Frailty Scale (CFS)

(Range 1 (Very fit) to 9 (Terminally Ill). We evaluated the time to complete and item completeness.

Results: The mean age of patients was 81.3±5.7 years. Most were women (n=54), widowed, lived in their own home, with a median CFS of 5 (Mildly Frail). The care partner respondent was usually an offspring. Item completeness was 95% with a mean time to complete of 15.5±8.6 minutes.

Conclusion: The CP-CGA seems feasible for gathering information that would be integral towards determining frailty by deficit accumulation. Future inquiries will evaluate its feasibility in other settings and validity as a form of frailty assessment.

5.2.2 INTRODUCTION

Comprehensive geriatric assessment has been essential for understanding frailty and determining how best to provide care in older adults (Ellis et al., 2011). In many fields of medicine, frailty is not fully appreciated as an important determining factor for health outcomes, yet it is one of the most common health problems facing older adults, particularly the oldest old (Song, Mitnitski & Rockwood, 2010). By focusing more attention on frailty, it may be possible to better predict health outcomes that are important to this age group (e.g. institutionalization, functional decline) and improve prognostication and care planning (Mallery & Moorhouse, 2011). The lack of a widely accepted, feasible frailty assessment is problematic for clinicians. Two approaches have merit: the phenotype of frailty characterized by impairment in at least one of five clinical features (Fried et al., 2001) and the view of frailty as the accumulation of health deficits (Mitnitski, Mogilner & Rockwood, 2001). Both have certain drawbacks that impede their widespread use in clinical care. More experimental work is necessary to identify an

approach to frailty quantification that is operationally feasible in a variety of settings (Rodriguez-Manas et al., 2012).

The Rockwood-Mitnitski Frailty Index (FI) is appealing in terms of its simplistic approach (count of health problems), reproducible characteristics (e.g. relationship with age, gender, sub-maximal limit) (Rockwood & Mitnitski, 2012), and its amenability for use in a variety of patient populations. It's calculated as the proportion of health deficits (typically 30-40 items - symptoms, diseases, or disabilities) and can be derived from a standard comprehensive geriatric assessment (FI-CGA) (Rockwood & Mitnitski, 2007). In the clinical setting, a strong relationship exists between the frailty index and adverse outcomes (hospitalization, institutionalization and death) (Hastings et al., 2008). One deterrent to its use is that it is thought to be too cumbersome for routine clinical care.

CGA has been used in the geriatric ambulatory care (GAC) setting as a means to manage the care for patients with multiple needs. Collateral information from care partners (typically family) is often essential for determining the health status of the people for whom they care. Much of what needs to be known to feasibly determine frailty status comes from this history. Although CGA is widely used by geriatrics, it is often seen as difficult to implement in other settings (Rodin & Mohile, 2007). Our objective was to determine whether a survey that is based upon CGA could be completed by care partners in GAC clinics so that a frailty index could be calculated based upon the carer's knowledge of the patient. We were interested to know whether care partners felt they had enough information to complete the questionnaire, whether it was acceptable to them and how they saw such information as contributing to the assessment.

5.2.3. METHODS

A cross-sectional study was conducted at a single tertiary care center (Capital Health, Halifax, Nova Scotia) between February 2009 and July 2010. A convenience sample of patients aged 70 years and older was enrolled. The survey was presented in English only. Exclusion criteria included age less than 70 years, no care partner available or refusal (either patient or care partner) to participate. We sought to enroll new clinic referrals as these patients have a higher likelihood of a specialist completed CGA. Ultimately, recruitment was at the discretion of clinic staff. The sample size calculation was based on the approach of Kraemer and Thiemann (1987) for correlation analysis with the expected correlation of 0.8 (0.2) (geriatrician derived frailty index and care partner derived frailty index). This will be important for future criterion validation.

Participants came from the Geriatric Ambulatory Care (GAC) clinics including Memory clinics, Geriatric Day Hospital, and the Palliative and Therapeutic Harmonization clinic (PATH) (Moorhouse & Mallery, 2012). Patients are requested to bring a family member or friend with them to clinic for collateral history regarding cognitive concerns. During the course of a clinic visit, patients undergo a CGA including cognitive testing using validated cognitive scales (Mini-mental Status Exam (Folstein, Folstein & McHugh, 1975), Frontal Assessment Battery (Dubois et al., 2000), Montreal Cognitive Assessment (Nasreddine et al., 2005), Brief Cognitive Rating Scale (Reisberg & Ferris, 1988) and collateral history from a care partner is used to understand the time course, progression and nature of cognitive deficits. All patients undergo a focused physical examination. Most patients receive a diagnosis (including dementia type and stage where applicable) during their first clinic visit. Patients who attend the GAC clinics follow a bimodal distribution of younger patients (age 50-65), who chiefly have frontotemporal dementia, early-onset Alzheimer's disease, or unusual neurodegenerative

disorders and older patients (mean age 78 years; 67% women, who mostly have late onset Alzheimer's disease). Patients attending the PATH clinic have a mean age of 81 years. The Capital Health research ethics committee approved the study (CDHA-RS/2009-138).

5.2.3.1 RECRUITMENT AND DATA COLLECTION: THE CARE PARTNER – COMPREHENSIVE GERIATRIC ASSESSMENT

The care partner – comprehensive geriatric assessment (CP-CGA) was based upon a CGA used by in-hospital staff and described elsewhere (Rockwood & Mitnitski, 2011; Jones, Song & Rockwood, 2004). A team comprised of geriatric fellows, geriatricians, graduate students, and other health professionals contributed to the development of the CP-CGA. Members of the interdisciplinary team evaluated the final iteration of the questionnaire for its readability, interpretability and face validity (Streiner & Norman, 2003). The survey is comprised of 62 questions that address topics such as: the care partner relationship, co-morbidities, history of falls, problems with hearing, memory, sensory function, and functional questions (e.g., toileting, bathing, dressing). The difference between the typical CGA and the CP-CGA is that the latter can be completed by care partners (usually family) and is based upon their opinion rather than formal clinical testing. The CP-CGA contains enough information to construct a frailty index with at least 40 items (Appendix A).

Care partners estimated the subject's frailty status using the Canadian Study of Health and Aging-Clinical Frailty Scale (CSHA-CFS) (Rockwood et al., 2005). The CSHA-CFS was initially developed to stratify patients based upon their relative degree of fitness/frailty (Rockwood et al., 2005). The original version included seven clinical descriptors. The revised scale has additional categories for severe frailty (with death expected within six months) and terminal illness that is non-disabling.

Clinic staff screened patients as they registered. The care partner was identified as someone who spent enough time with the patient to be knowledgeable about their health and social circumstances. Both the patient and care partner were asked whether they would be interested in participating in a study that looks at how we gather information from care partners. For those who agreed, the details of the study were explained and a letter inviting the patient and care partner to participate was provided. The care partner completed the CP-CGA while the patient was assessed.

Health care records were reviewed using a structured data collection form for one year outcomes to identify resource use and adverse events including: hospital admission, institutionalization and death. Specialist completed clinic CGAs were obtained if available. The survey included a qualitative component that allows the carer to describe the health status of the patient (in their words) and to express their thoughts about the questionnaire.

5.2.3.2. DATA ANALYSIS

We used descriptive statistics to characterize the sample and attributes of the care partner respondent. Feasibility estimates of time-to-complete and item completeness are presented. Categorical variables were analyzed with the chi square test while continuous variables were compared using the t-test or one way ANOVA as appropriate. The care partner relationship was coded into a dichotomous variable of non-offspring (1) or offspring (2) in order to identify differences in feasibility estimates. Care partner acceptability of the tool was determined using a Likert scale. Free text feedback was assessed by qualitative thematic analysis. Incomplete questionnaires were included in the final data analysis. As this was a feasibility study, our primary outcome was to monitor the completeness of items and time-to-complete. Incomplete forms provided valuable

information regarding the acceptability of survey items. Data were analyzed using SPSS version 15.0 (Chicago, IL).

5.2.4. RESULTS

Of 99 participants enrolled, two subjects were withdrawn due to age being less than 70 years and in one case only the first page (demographic information) was completed, leaving 97 completed CP-CGAs. Refusals were not tracked, however, anecdotally, most people that were asked were willing to complete the survey. Participants were mostly female, older and lived in their own home (Table 11). The median care partner-completed Clinical Frailty Scale rating was category 5 (mildly frail). The survey was typically completed by a relative, usually the spouse or an adult child (Table 12). Many subjects (42%) lived with the respondent and most respondents (73%) indicated they were the primary care provider. The majority of respondents reported a high (16%) or moderate (48%) level of stress with 57% stating that they needed more help with providing care.

The mean time-to-complete was 15.55 ± 8.56 minutes (median – 14 minutes) (Table 13). The completeness of items on the questionnaire was 95.0 ± 8.8 percent. The sample was further explored with respect to the care partner's relationship with the subject. There were no significant differences in terms of the time-to-complete when analyzed by relationship of respondent; however, there was a trend towards a shorter completion time if the survey was completed by a non-offspring (typically the spouse). Slightly (not statistically significant) higher completion rates for offspring respondents were observed (Table 13). We also evaluated how the care partners' stress or living arrangement may have impacted the completeness of data. No statistically significant

differences were identified. There was a trend towards higher completion rates for those with any level of identifiable stress versus no stress ($p>0.05$).

5.2.4.1 CARE PARTNER SATISFACTION

Care partners evaluated the CP-CGA in terms of the clarity of questions, length, and scope. Most care partners strongly agreed (36%) or agreed (61%) that the questions were clear and easy to understand. They (72%) also felt that the survey was an appropriate length. Some care partners (17%) thought that there were important areas of health not covered (e.g. alcohol consumption, mental health and family health history). Care partners' comments about the survey can be summarized in four themes: the relationship of the care partner (context), the survey design, health topics not covered, and reasoning for completing the survey (Table 14).

5.2.5 DISCUSSION

We aimed to investigate the implementation of a standardized CGA completed by care partners in geriatric ambulatory care. The approach appears feasible, both in terms of the time-to-complete and the completeness of items on the form. In general, care partners felt that the survey was clear, an appropriate length and acceptable in terms of the cross section of questions posed. Care partners commented most on the survey design. Of note, care partners thought that a number of the questions required multiple response categories instead of yes or no. It was also mentioned that the time course for change (two weeks) might be too close. The care partners were not informed about the goal of constructing a frailty index and this ultimately led us to pose the questions as we did. In acute care, a two week time period of change (pre-morbid function) is predictive of poor hospital outcomes (Jarrett et al., 1995) which may not be the case in ambulatory care. Whether a 14 minute survey in this setting is feasible is debatable. In this study,

care partners were approached at a convenient point during the visit. Future work should look at how it could be included as part of the clinical care process (which is the case in the PATH clinic).

Frailty is a term used to describe differences in aging and its associated risks for poor outcomes in people of the same age. The CP-CGA can measure frailty using the CSHA-Clinical Frailty Scale and frailty index. There are sufficient variables to construct a frailty index of over 40 health deficits. Future work will evaluate the validity of measuring frailty based upon the care partner's responses.

5.2.5.1 LIMITATIONS

Although percent complete rates were high, one question often missed was the time-to-complete. Only 48% (n=47) of this data was available. This was a convenience sample of patients with enrollment at the discretion of the practitioner potentially limiting the generalizability of the results. Selection bias could be a concern, as refusals to participate were not tracked. The decision to approach a patient was left to the clinic staff. We advised staff to approach care partners that had enough medical and social knowledge of the patient to be able to complete the form. Clinical discretion was necessary to identify care partners that would be able to provide this detailed information. Staff also considered that care partner's themselves could have cognitive, communication or literacy issues that would prohibit completing the survey. We believe that the CP-CGA may be an adjunct to other methods of frailty assessment especially in high workload areas where this type of assessment is currently not performed. We are currently evaluating this approach in the emergency medical services setting. Participation bias may have existed where those that were too stressed may not have wanted to participate. The majority of respondents (63%) indicated that they experienced moderate to high

stress and half required more help in providing care so it appears that this was not the case. Additional qualitative inquiry should explore how care partners and patients view the role of the carer during clinical assessment.

5.2.5.2 RESEARCH AND CLINICAL IMPACT

Harnessing care partners' knowledge and translating it using a standardized tool such as the CP-CGA allows for reproducible measures such as a frailty index to be determined. Such information could provide valuable information in regards to the health status of the patient and in discussions regarding prognosis and care planning. Of interest to our group is how such a form could be used in the acute care setting (emergency department). We believe this survey will be most beneficial in the very frail where communication and cognitive issues are prevalent, provided that there is a suitable care partner available.

Translating the CGA into one that can be completed by care partners (CP-CGA) may be useful for frailty screening, and risk prediction while also acting as a mechanism to facilitate communication between care partners, health care providers and their patients in different out patient settings. The CP-CGA provides information on the patient's baseline status (e.g. cognition and function) and relative fitness/ frailty before the illness or injury. Research suggests that frail older adults may benefit most from supportive care while the fit older adult from more aggressive "usual" treatment (Rockwood, MacKnight & Bergman, 2006). Early evaluation and identification of frailty are important components to providing appropriate care (Moorhouse & Mallery, 2012; McMillan & Hubbard, 2012; Conroy, 2008). Future research will attempt to validate the CP-CGA for frailty quantification. The additional information it provides, with little direct increase in time spent by health providers, may allow it to address the issue of the apparently time-consuming nature of a CGA, which has been seen as an obstacle. This in turn has led to

very short screening tools, which may be inadequate to get all the information needed to grade frailty (Woo, Leung & Morley, 2012).

5.2.6 CONCLUSION

We have demonstrated that it is feasible to have care partners complete a survey based on the CGA in the outpatient setting. This data can be used to evaluate frailty. The CP-CGA may be beneficial in other medical settings less familiar with geriatric medicine. Future research will evaluate the validity of the CP-CGA in frailty measurement and whether it can be integrated into the care process to aid with decision-making.

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5.2.8 GRAPHICS

Table 11. Baseline characteristics of study population

Characteristic	Value (n=97)
Age, mean (SD)	81.3 ± 5.7
Female, n (%)	54 (56)
Marital status, n (%)	
Married	41 (42)
Widowed	46 (47)
Divorced or Single	10 (10)
Education years, mean (SD)	10.6 ± 2.3
Place of Residence, n (%)	
Own Home	47 (48)
Apartment	28 (29)
Other	19 (20)
Living Arrangement, n (%)	
With CP	42 (43)
Alone	31 (32)
With someone else	23 (24)
CSHA Clinical Frailty Scale – median	5 (Mildly Frail)

Table 12. Characteristics of the care partner respondent

Characteristic	**Value (n=97)**
Relationship of CP, n (%)	
Offspring	53 (55)
Spouse	23 (24)
Sibling	5 (5)
Other	12 (12)
Primary Care Provider –Yes, n (%)	73 (75)
Level of Stress (CP) , n (%)	
High	16 (16)
Moderate	47 (48)
Low	23 (24)
No Stress	6 (6)
Needs More Help – Yes, n (%)	55 (57)
Additional Supports, n (%)	
Private Help	20 (21)
Homecare (e.g. Victoria Order of Nurses)	27 (28)
Friends Help	65 (67)

Table 13. Feasibility estimates and care partner satisfaction with the survey.

Characteristic	Offspring Completed Survey (n=53)	Non-offspring Completed Survey (n=44)	Mean (SD) or n (%) (n=97)
Item completeness, mean (SD)	96.6 (4.1)	93.54 (11.35)	95 (8.8)
Time to complete, mean (SD)	16.97 (10.02)	12.82 (4.98)	15.55 (8.56), median = 14 minutes (n=47)
Clarity n, (%) – strongly agree or agree – survey clear	N/A	N/A	70 (97)
Length n, (%) – strongly agree or agree – appropriate length	N/A	N/A	66 (92)
Acceptability n, (%) – strongly agree or agree that survey had an acceptable range of health topics	N/A	N/A	22 (31)

N/A - the satisfaction survey remained anonymous (completed by 72 participants), time to complete was available for 47 subjects

Table 14. Thematic analysis of free text feedback as provided by the care partner

Theme	**Responses**	**Comments**
Care partner relationship	3	Caregiver as family, patient's perception of caregiver, time and intensity of caregiving
Survey design	12	More response categories, two week period of change not adequate
Health topic not covered	2	Mental health, alcohol consumption, family health history
Reasoning for completing survey	1	Contribute to the research process

16 care partners provided written feedback with some comments reflected in multiple themes. Care partners were asked if they would like to provide additional comments about the questionnaire.

CHAPTER 6 VALIDATION OF A CARE PARTNER DERIVED FRAILTY INDEX BASED UPON COMPREHENSIVE GERIATRIC ASSESSMENT (CP-FI-CGA) FOR COMMUNITY DWELLING OLDER ADULTS

6.1 PUBLICATION DETAILS

Goldstein J, Hubbard R, Moorhouse P, Andrew M, Mitnitski A, Rockwood K. Validation of a care partner derived frailty index based upon comprehensive geriatric assessment (CP-FI-CGA) for community dwelling older adults. Preparing to submit.

6.2 MANUSCRIPT

6.2.1 ABSTRACT

Introduction: The appropriate care of older adults requires a great deal of information for non-arbitrary decision-making. A Comprehensive Geriatric Assessment (CGA) quantifiable in a frailty index (FI) based on deficit accumulation, has been criticized as cumbersome. To improve feasibility, we have developed a questionnaire based on a CGA that can be completed by family members (or other care partners) in busy clinical practice. We assessed the content, construct and criterion validity of a Frailty Index based on the care partner CGA (FI-CP-CGA).

Methods: We enrolled a convenience sample of older adults (n=198) presenting to Emergency Medical Services (EMS) or Geriatric Ambulatory Care (GAC). To test construct validity, we evaluated the shape of the FI-CP-CGA distribution, including its maximum value, relationship with age, gender and other frailty scales. Criterion validity was evaluated by survival analysis and by the correlation between the CP-FI-CGA and specialist completed FI-CGA.

Results: The mean age was 82.2 ± 5.9 years. Most patients were women (62.1%), married (40.1%) and lived in their own home (49.2%). The mean CP-FI-CGA was 0.41 ± 0.15. It was higher in the EMS group (0.45 ± 0.15) compared with GAC patients (0.37± 0.14) ($p<0.001$). There was no relationship with age ($R^2 = 0.041$). Women did not have a significantly higher mean FI (0.42 ± 0.15) than men (0.40 ± 0.15; $p=0.52$). The maximum observed value was 0.73; 99% had a CP-FI-CGA <0.72. The CP-FI-CGA correlated well with the specialist completed FI-CGA (0.7; $p<0.05$). People who died had a higher CP-FI-CGA than did survivors. The frailest people had a greater risk of death (HR 1.04; 95% CI 1.02-1.06).

Conclusion: The CP-FI-CGA has properties that resemble other published FIs. This approach to frailty measurement appears to have good content, construct and criterion validity. The CP-FI-CGA may be useful in a busy clinical practice setting for frailty determination. It efficiently integrates information from care partners into a useful decision making tool.

6.2.2 INTRODUCTION

Frailty is an important clinical concept that is receiving attention broadly across the medical literature (Partridge et al., 2012). Frailty is recognized as a state of vulnerability and susceptibility to adverse health outcomes. Even so, there is disagreement on how best to measure frailty in clinical practice (Sternberg et al., 2011; DeVries et al., 2011). In addition, differing settings will most likely require different approaches for frailty measurement. In emergent care, there is a need for quick, easily applied measures that capture risk and can be interpreted accurately so that those most in need of follow up will not be missed.

Frailty and aging are particular concerns in emergency medicine and emergency medical services (EMS). Older adults are frequent users of EMS and the emergency department (ED) (Aminzadeh and Dalziel, 2002; Bridges et al., 2005). Frailty, in general, is known to contribute to health services use (Rockwood et al., 2011). In the emergent care setting, there is a systematic tendency to miss important clinical changes in cognition and function (Bridges et al., 2005). Clinical leaders and policy makers have called for improvements in care provision for older adults in acute care (Bridges et al., 2005, Ross, 2010). Addressing frailty should be a core component to improving care. Although no consensus definition exists, there are ways to screen for frailty in clinical practice that require further exploration (Rodriguez Manas et al., 2012). Clinicians require a feasible, valid and sensible approach to frailty assessment.

One approach to frailty measurement that has been studied extensively is the frailty index (FI) based on the accumulation of health deficits (Mitnitski et al., 2001). Frailty by deficit accumulation recognizes that as people age they accumulate health problems and it is this accumulation of problems, more than age itself, that gives rise to frailty (Rockwood & Mitnitski, 2007). The FI has characteristic properties including a sub-maximal value at about 0.7 (Rockwood & Mitnitski, 2006), an increase with age, higher mean values in women than in men (Mitnitski et al., 2005; Rockwood & Mitnitski, 2012), high predictive accuracy (Hasting et al., 2008), and responsiveness to change. The FI is multidimensional and typically employs 30 plus health variables (Searle et al., 2008). It is essentially a count of the number of problems (health deficits) that a person has. For example, if 40 variables are considered, a person with 10 health deficits would have a FI score of 10/40 = 0.25. A health deficit can be any sign, symptom or disease provided certain criteria are followed (Searle et al., 2008). The FI has been evaluated in

multiple population based data sets and countries (Australia, Sweden, China, Canada, UK, USA) with reproducible properties observed (Rockwood & Mitnitski, 2012). Even so, the FI is criticized as being too cumbersome for use in clinical care (Salvi et al., 2012).

The EMS setting is a fluid environment that is dynamic, time-dependant, with competing priorities (e.g. assessment, initiating treatment, extrication, transport). Close to 40% of older adults who come into the emergency department will come in by ambulance (Shah et al., 2007). Those who are transported by ambulance are more likely to be admitted. There is a strong interest in developing risk screening tools (e.g. Identification of Seniors at Risk (ISAR) (McCusker et al., 1999) or TRST (Meldon et al., 2003) that would help to identify older adults at risk for functional decline and other serious adverse events (Salvi et al., 2012) so that a more detailed examination and follow up could be provided for those most at risk. Due to workload constraints, frailty measures in this setting must be clinically sensible, feasible and valid. Using data derived from the Medicare Current Beneficiary Survey, the FI has been demonstrated to be predictive of some adverse events over the short-term (30 days) post discharge from the ED (Hastings et al., 2008). Integrating a FI into the clinical care of older adults has yet to be evaluated in this setting.

In geriatric medicine, the CGA is used to capture health and functional information in order to ensure issues are addressed in a systematic manner (Stuck et al., 1993; Ellis et al., 2011). A frailty index can be calculated based upon the results of CGA (FI-CGA) (Jones et al., 2004; Hubbard et al., 2011; Rockwood, Rockwood & Mitnitski, 2010). The FI-CGA is a valid indicator of health status and discriminates between levels of fitness and frailty, thereby offering insights into differences in aging, and health care

needs. The FI-CGA may prove useful in emergency medicine and pre-hospital care where it is often difficult to capture much of this information in an efficient manner. Most of the information that is necessary for frailty determination is known to care partners or family members. Here, we will evaluate the use of care partner derived information to construct a frailty index.

Our objectives were to explore the validity of a care partner derived FI based upon CGA (CP-FI-CGA). We evaluated its validity in two medical settings: the pre-hospital setting where there is typically no prior knowledge of the patient, limited time, high degree of stress. The GAC clinics were included as addressing frailty is a core component of these clinics. Including GAC clinics was important for criterion validation where it is standard practice to assess frailty. Our specific objectives were to test the *content* (face validity), *construct* (relationship with other tools, similarity to other FIs, including a specialist FI-CGA) and *criterion* validity (prediction of outcomes – highest form of validation for frailty screening) of this instrument.

6.2.3 METHODS

6.2.3.1 STUDY DESIGN, SETTING AND POPULATION

We conducted a prospective, observational study in one urban center (Halifax, Nova Scotia) between February 2009 and July 2010. A convenience sample of participants aged 70 years and older was enrolled with a target sample size of 200. Participants were enrolled by Emergency Medical Services (EMS) or in the Geriatric Ambulatory Care (GAC) clinics. The sample size calculation was based on the approach of Kraemer and Thiemann (1987) for correlation analysis with the expected correlation of 0.8 (+/-0.2) between the geriatrician derived frailty index and care partner derived frailty index.

The Nova Scotia Ground Ambulance service covers an area of 55 000 square kilometers and approximately 1 million people. The service receives over 110, 000 requests for service per year which result in over 90, 000 patient transports (EHS, 2008). During the study period, there were 4, 829 eligible older adults in the study region.

To be enrolled, subjects had to have a care partner who was knowledgeable about their medical and social history with them. The care partner would usually be a family member (typically a spouse or offspring), but could also include others that play a large role in providing care. Both patients transported to the ED and those assessed by EMS but not transported were eligible. The survey was presented in English only so language may have prohibited some from participating. Exclusion criteria were age less than 70, no care partner available, inability of care partner to self-complete the CP-CGA form in English, or refusal (either patient or care partner) to participate.

Participants were also enrolled from the Geriatric Ambulatory Care (GAC) clinics including memory clinics, geriatric day hospital, and the Palliative and Therapeutic Harmonization clinic (PATH) (see Moorhouse & Mallery, 2010 for clinic description, Moorhouse & Mallery, 2012). For GAC clinics, patients are requested to bring a family member or friend with them to clinic for collateral history regarding cognitive concerns. During the course of a clinic visit, patients undergo a comprehensive geriatric assessment including cognitive testing using validated cognitive scales (Mini-mental Status Exam (Folstein, Folstein & McHugh, 1975), Frontal Assessment Battery (Dubois et al., 2000), Montreal Cognitive Assessment (Nasreddine et al., 2005), Brief Cognitive Rating Scale (Reisberg & Ferris, 1988) and collateral history from a care partner is used to understand the time course, progression and nature of cognitive deficits. Patients also undergo a focused physical examination. Patients participating in the PATH program return to

clinic for a second visit which is dedicated exclusively to discussion of the implications of their health status (including frailty and dementia where applicable) on health prognosis, and skills transfer to the care partner for decision making. The mean age for older patients attending memory clinics was 78 years (67% women, who mostly have late onset Alzheimer's disease). Patients attending the PATH clinic have a mean age of 81. The study was approved by the Capital Health research ethics committee (CDHA-RS/2009-138).

6.2.3.2 DATA COLLECTION

The CP-CGA was based on an in-hospital standard CGA (Rockwood & Mitnitski, 2011) and was composed of 62 questions that addressed topics such as: the care partner relationship, co-morbidities, falls, problems with hearing, memory, mobility, and functional problems. The care partner was identified as someone who spent enough time with the patient to be knowledgeable about their health and social circumstances. Recruitment was at the discretion of the attending health care provider.

The patient and care partner were initially approached by their health care provider. When an eligible participant was identified, both the patient and care partner were asked whether they would be interested in participating in a study that looks at how we gather information from care partners. For those who agreed, the details of the study were explained and a letter inviting the patient and care partner to participate was provided. The care partner completed the CP-CGA while the patient was assessed and treated through standard care.

6.2.3.3 FRAILTY MEASURES

The CP-CGA incorporates two approaches to frailty quantification. One approach that has pragmatic value is the Canadian Study of Health and Aging -Clinical Frailty Scale

(CSHA-CFS). This scale is based on clinical judgement (history taking and function) and has been primarily used by specialists. Care partners estimated the subject's frailty status using the CSHA-CFS (Rockwood et al., 2005). The original version included seven clinical descriptors to stratify patients based on their level of fitness/frailty. The revised scale has additional categories for severe frailty (with death expected within six months) and terminal illness that is non-disabling.

A care partner derived frailty index (CP-FI-CGA) was constructed based upon methods described elsewhere (Searle et al., 2008). Briefly, the frailty index is the proportion of deficits present in an individual out of a possible 44 items considered (Appendix B). Care providers were asked to identify problems in a number of domains. Deficits were ordinal or binary. The majority of questions were scored as 0= no problem or 1 = problem present. For questions on function, intermediate values (0.5) were possible if the care provider rated the patient as requiring some help with a task. Higher FIs are indicative of a greater level of frailty.

6.2.3.4 ADVERSE OUTCOMES

In-hospital and EMS patient care records were reviewed using a structured data collection form for one year outcomes to identify resource use and adverse events including: hospital admission, return visits to the ED, EMS use, institutionalization and death. Data was abstracted by a single researcher (JG). In-hospital CGAs were also obtained if available, though in the course of usual care, only a minority of older adults who come to hospital through the emergency department are seen by a geriatrician. It was expected that the majority of GAC patients would have the CGA completed.

6.2.3.5 DATA ANALYSIS

Data were analyzed using SPSS version 15.0 (Chicago, IL). Descriptive statistics were used to analyze the baseline characteristics of the sample and care partner respondent. Categorical variables were analyzed with the chi square test while continuous variables were compared using the Student t-test or one way ANOVA as appropriate. Construct validation was performed by comparing frailty measures to each other and measures of relevant patient characteristics (e.g. activities of daily living, age, cognition). The Pearson correlation was calculated for continuous variables while Spearman correlation was used for ordinal level data. The Pearson correlation between the specialist derived FI-CGA and care partner derived FI-CGA was determined. Criterion validity was assessed by evaluating Kaplan-Meier curves to demonstrate how grades of frailty were related to survival and other health outcomes. Predictive validity was further explored through Cox regression analysis. Incomplete questionnaires were included in the final data analysis.

6.2.4 RESULTS

Of 203 subjects enrolled, 5 were withdrawn due to not meeting the eligibility criteria (age less than 70 years, subject completed first page of questionnaire only, enrolled twice) leaving 198 respondents. Patients were older (82.2 ± 5.9 years), mostly women (62.1%), married (40.1%) and lived in their own home (49.2%). There were no significant differences in baseline characteristics for most variables between the EMS and GAC groups (Table 15). Those in the EMS group had more breathing and gastrointestinal problems while GAC patients had more memory problems. The care partner respondent in both settings was typically an offspring. The median CSHA-Clinical Frailty Scale score as indicated by the care partner was 5 for both groups which is indicative of evident slowing and a greater need for help with daily tasks (e.g. heavy housework, medication

management, and walking outside alone). For EMS patients, the most common triage level was 3 (urgent) indicative that there should be a physician consult within 30 minutes 90% of the time following arrival in the emergency department. The most common chief complaints for EMS subjects were breathing problems, recent trauma (fall) or nonspecific complaint. One GAC patient was admitted to hospital at the time of enrolment while 48 EMS patients were admitted.

At baseline (two weeks prior to the visit), the mean care partner FI-CGA was 0.39 ± 0.15 and this increased to 0.41 ± 0.15 at the time of the visit. The mean CP-FI-CGA (current) was highest in the EMS group (0.45 vs. 0.36; $p<0.001$) (Table 16). There was also a greater change in the CP-FI-CGA observed in the EMS group whether it was derived from the care partner or specialist. The CP-FI-CGA was normally distributed around the high mean (Figure 6). The maximum observed value was 0.73 and was observed in the EMS group. The 99th percentile was 0.73 at the time of the index visit and 0.69 at baseline. There was no relationship between age and the FI score; $R^2 = 0.041$; $p>0.05$). Women did not have a significantly higher mean FI than did men (0.42 vs. 0.4; $p=0.52$).

Concerning construct validity, there was a moderate correlation between the CP-FI-CGA and the CSHA- Clinical Frailty scale as completed by a specialist, paramedic or care partner (0.54, 0.54, and 0.68) (Table 17). There was a moderate correlation between the specialist derived FI-CGA and the CP-FI-CGA of 0.7 ($p<0.05$). The specialist and care partner FIs correlated with age (Table 17). The CP-FI-CGA was correlated with worsening disability but not cognition (Table 17). There was no association between the CTAS and frailty, however defined.

Predictive validity was evaluated by survival analyses and Cox regression. One-year mortality, EMS and emergency department use, and hospitalization were highest in the EMS group, while there was a higher percentage of GAC patients institutionalized (12 vs. 21%) (Table 18). The care partner FI-CGA was able to stratify survival over one year period by grades of frailty with worse survival in the highest levels of frailty (Figure 7A). The care partner FI-CGA was also able to discriminate between groups at high risk for any severe adverse event over a one-year period (Fig. 7B). In addition, the CP-FI-CGA was able to discriminate between groups at high risk for future EMS (the most frail) (Fig. 8). Frailty (current CP-FI-CGA) was a strong predictor of survival with a HR of 1.04 (1.02-1.06) adjusting for age (HR 1.02, 95% CI 0.97-1.07) and gender (2.78; 95% CI 1.54-5.02). Hazard ratios represent the risk of death associated with a 1% increment in the FI, one-year increments of age and being male. For example, compared with a 70 year old woman with an FI-CP-CGA score of 0.10, an 80 year old man with an FI-CP-CGA score of 0.50 would have a risk of death of 2.82, with the hazard calculated as follows: age associated risk [ln (1.02)*10] and being male [ln (2.78)], and frailty index-associated relative risk of death [ln (1.04)*40].

6.2.5 DISCUSSION

Frailty is an important clinical characteristic that has an impact on health outcomes. A feasible, clinically sensible approach to frailty assessment is required in order to further understand the ramifications of frailty in a variety of clinical settings. We developed a form (care partner-comprehensive geriatric assessment) that could be used by health care providers to assess frailty in their patients by capturing the knowledge of care partners (family members) in a standardized format. The CP-CGA is feasible in EMS patients

(Goldstein et al., 2013), ambulatory care (Goldstein et al., 2013) and allows for frailty to be quantified using the deficit accumulation method. Care partners are a rich source of information when it comes to caring for older adults. The CP-CGA gathers enough data in multiple domains so that a frailty index can be constructed. We have demonstrated that the FI based upon the CP-CGA is valid in terms of its content, construct and criterion validity. The CP-FI-CGA represents a mechanism to tap into the knowledge of care partners and summarize this data in the form of a FI. Previous FIs have been based upon self-reported data, clinical assessments or performance-based measures so this is the first care partner completed FI that we are aware of.

In this study, the FI increased with age and was generally high at all ages. This is typical of a clinical sample where the FI is normally distributed around a high mean (Hubbard et al., 2011) as opposed to the typical gamma distribution noted in community samples (Searle et al., 2008). A trend for gender differences were observed here with men having a lower mean FI but still having a higher risk for death. In previous studies, men have a higher risk of death compared to women at any given level of deficit accumulation (Mitnitski, Song & Rockwood, 2004).

The CP-CGA is based upon an in-hospital CGA assessment form. The properties of the CP-FI-CGA were similar to other FIs in terms of its distribution in this clinical population, the presence of a sub-maximal upper limit and its relationship with age and gender. A moderate correlation (0.7) was found between the care partner derived FI and specialist completed FI. Although slightly lower than expected, there is still strong agreement between the care partner and specialist. One reason for the observed difference may be that care partners reported deficits that were sub-clinical as determined by the health care provider. Measurement error may have also contributed to this

difference. Only 26 in-hospital CGAs were performed on EMS patients. In these cases the in-hospital CGA was either completed in the emergency department or upon admission. It is possible that some deficits may have changed during the course of care as treatments were initiated which would not have been the case for GAC subjects. The correlation between the FI-CGA and CP-FI-CGA was 0.77 for the GAC group. One of the highest forms of validity for frailty assessment is predictive validity for adverse outcomes. The CP-FI-CGA was highly predictive of severe adverse events including death, institutionalization and hospitalization over a one year time period in this small sample.

We have demonstrated that frailty as measured by deficit accumulation can be assessed in the clinical setting by capturing the knowledge of care partners. Collecting information in this manner is efficient, less time consuming and decreases the workload of the health care practitioner. By collecting data in this way, time is available for practitioners to focus care on the patient while also accessing this valuable information from care partners. The correlation between the CP-FI-CGA and other frailty scales was similar to those reported elsewhere (Rockwood et al., 2005; Rockwood, Abeysundera & Mitnitski, 2007). In other studies involving emergency department patients, there is a strong relationship between the frailty index and serious adverse outcome in older adults discharged from the emergency department over the short term (Hastings et al, 2008). In this study, the CP-FI-CGA was predictive of mortality over a one-year period stratifying patients by level of frailty. Although, there was overlap initially, the CP-FI-CGA is also able to stratify patients at risk for any serious adverse event.

There are a few limitations to our study that should be considered. This was a convenience sample of patients so enrollment was at the discretion of the health care

practitioner. For emergency department patients, enrollment was possible 24 h per day, seven days per week with most patients enrolled during off-load delays or periods where the emergency department was busy and paramedics were required to maintain care until a department bed became available. A second limitation may be the small sample size (n=198). Whether a CGA was performed was also at the discretion of the practitioner. It was our expectation that most ambulatory care patients would have a CGA while the majority of emergency department patients would not which was the case.

The clinical assessment of frailty is of interest. There is no consensus approach to frailty measurement with some attempting to reduce the frailty assessment to a short screening tool. With deficit accumulation it is not the nature of the deficits present but the number that is most important when evaluating the whole person. The main criticism of this approach is that it may be too cumbersome in the clinical setting. We have demonstrated that it is possible to collect the data necessary to calculate a FI in EMS patients and in ambulatory care. Recently, the frailty index has been demonstrated to be an important predictive variable in older emergency general surgery patients (Farhat et al., 2012), and in older adults discharged from the emergency department (Hastings et al., 2008). Although, these studies demonstrate the validity of the frailty index, these results are derived from large clinical data sets and do not provide insight into the integration of frailty assessment into clinical care. This is the first study to assess frailty in the clinical setting using information obtained solely from a care partner during the course of care in order to construct a frailty index. Future work should look at how this data collection could be integrated into the current care process through electronic data collection and real time output of a frailty index and its implications.

The emergency department care of older adults is of particular concern. Frail older adults may be more vulnerable to adverse events in this setting. Emergency department triage scales may not identify high-risk older adults, with non-specific complaints and could lead to their undertriage and delayed treatment in this setting (Rutschmann et al., 2005). Once in the emergency department, older adults with multiple problems are at high risk for health decline. An association between the length of stay in the emergency department and adverse events for admitted patients has been described (Ackroyd-Stolarz et al., 2009). It is likely that frailty is an important factor that to now has not received the attention that it deserves in this setting.

6.2.6 CONCLUSION

The care partner – comprehensive geriatric assessment may represent a means to gather much of the information necessary for frailty measurement from care partners in a busy clinical practice. Frailty/ fitness is a contributing factor to health outcomes and is deserving of attention in clinical practice. An efficient method for frailty quantification in the clinical setting would allow for frailty identification, and management. It would also mean that frailty interventions could be assessed so that care could be improved for this patient population.

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6.2.8 GRAPHICS

Table 15. Baseline characteristics for subjects (198) enrolled in the study.

Characteristic	Emergency Medical Services n=101	Geriatric Ambulatory Care n=97
Age, mean (SD)	82.9 (6.1)	81.3 (5.6)
Age range	70-98	70-93
Female, n (%)	64 (63)	54 (56)
Marital status n (%)		
Married	39 (38)	41 (42)
Widowed	52 (52)	46 (47)
Divorced or Single	10 (10)	10 (10)
Education – years, mean (SD)	10.4 (2.3)	10.6 (2.3)
Living Arrangement, n (%)		
Own Home/ Apartment	80 (80)	75 (77)
Other	21 (20)	19 (20)
Relationship of CP, n (%)		
Offspring	48 (48)	53 (55)
Spouse	27 (27)	23 (24)
Sibling/ Other	25 (25)	17(17)
CTAS, n (%)		
2 (Emergent)	13 (13)	N/A
3 (Urgent)	75 (77)	N/A
4 or 5 (Less Urgent)	10 (10)	N/A
Emergency Department Length of Stay (hours),		
mean (SD)	15.8 ± 14.4	N/A
median	10.7	
Chief Complaint, n (%)		
Respiratory	25 (26)	N/A
Trauma (falls)	13 (13)	N/A
Nonspecific (e.g. weakness)	12 (12)	N/A

Characteristic	EMS	GAC
Common Co-morbidities, n (%)		
Cardio/cerebrovascular	76 (76)	71 (73)
High Blood Pressure	50 (50)	60 (62)
Lung Problems*	45 (45)	31 (32)
Musculoskeletal	85 (84)	64 (66)
Gastrointestinal*	42 (42)	27 (28)
Falls	58 (60)	46 (48)
Memory problems*	48 (50)	85 (90)
Disposition, n (%)		
Home	48 (49)	86 (99)
Internal Medicine/IMCU	32 (32)	1
General Surgery	4 (4)	N/A
Orthopedics	4 (4)	N/A
Neurology	4 (4)	N/A
In-hospital CGA		
Yes, n (%)	26 (26)	76 (78)
CSHA-CFS – median	5 (Mildly Frail)	5 (Mildly Frail)

CTAS = Canadian Triage and Acuity Scale, CSHA-CFS = Canadian Study of Health and Aging Clinical Frailty Scale, N/A = not applicable
*$p<0.05$

Table 16. Baseline and current FI-CGA (care partner or specialist) characteristics of the frailty index by setting and method of assessment.

Characteristic	EMS N= 101	GAC Clinics N=97	Total N= 198
CP-FI-CGA (baseline)	0.41 (0.15) (n=98)	0.37 (0.14) (n=95)	0.39 (0.15) (n=193)
Maximum (observed)	0.69	0.70	
CP-FI-CGA (current)	0.45 (0.15) (n = 99)	0.36 (0.14) (n=95)	0.41 ± 0.15 (n=194)
Maximum (observed)	0.73	0.70	
FI-CGA (baseline)	0.33 (0.12) (n=26)	0.30 (0.12) (n=74)	0.31± 0.12 (n =97)
Maximum (observed)	0.58	0.64	
FI-CGA (current)	0.39 (0.12) (n=22)	0.30 (0.12) (n=59)	0.33± 0.13 (n=81)
Maximum (observed)	0.65	0.63	

CP-FI-CGA = care partner derived frailty index, FI-CGA = specialist completed frailty index

The CP-FI-CGA was not calculated where the completeness of items was less than 60% (n=4 current) and (n=5 baseline)

Figure 6. Distribution of the care partner derived frailty index (current) for both EMS and GAC patients (n=198).

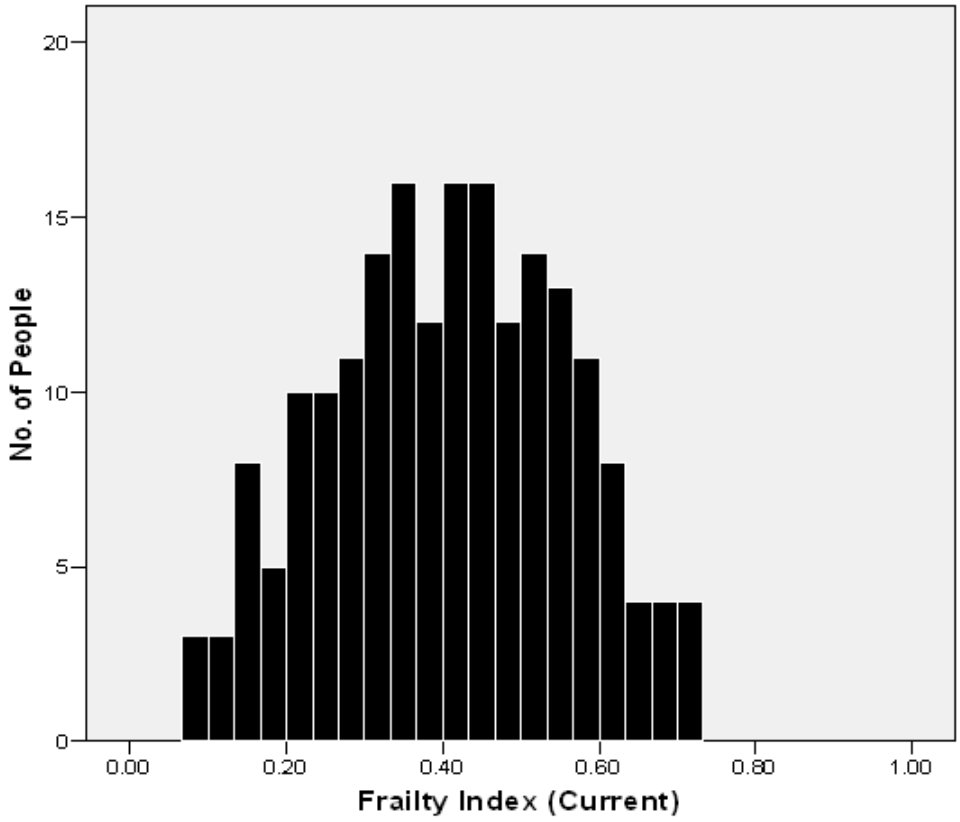


Table 17. Correlations of frailty measures (CSHA-Clinical Frailty Scale, Frailty Index), MMSE score, disability and CTAS.

	CP-FI-CGA (current)	FI-CGA (current)	CP-CFS	Geriatrician-CFS n=42	MMSE	Disability ADLs	Age	CTAS
CP-FI-CGA (current)	1	0.70 (p<0.05)	0.68 (p<0.05)	0.54 (p<0.05)	-0.17	-0.43 (p<0.05)	0.2 (p<0.05	-.001
FI-CGA (current)		1	0.68 (p<0.05)	0.66 (p<0.05)	-0.41 (p<0.05)	-0.45 (p<0.05)	0.22 (p<0.05)	0.02
CP-CFS			1	0.49 (p<0.05)	-0.29 (p<0.05)	-0.38 (p<0.05)	0.15 (p<0.05)	0.1
Geriatrician-CFS				1	-0.65 (p<0.05)	-0.29	0.13	-0.4
MMSE					1	0.35 (p<0.05)	0.02	0.06
Function (ADL)						1	-0.08	0.09
Age							1	-0.02
CTAS								1

MMSE = mini mental status exam, CTAS = Canadian Triage and Acuity Scale

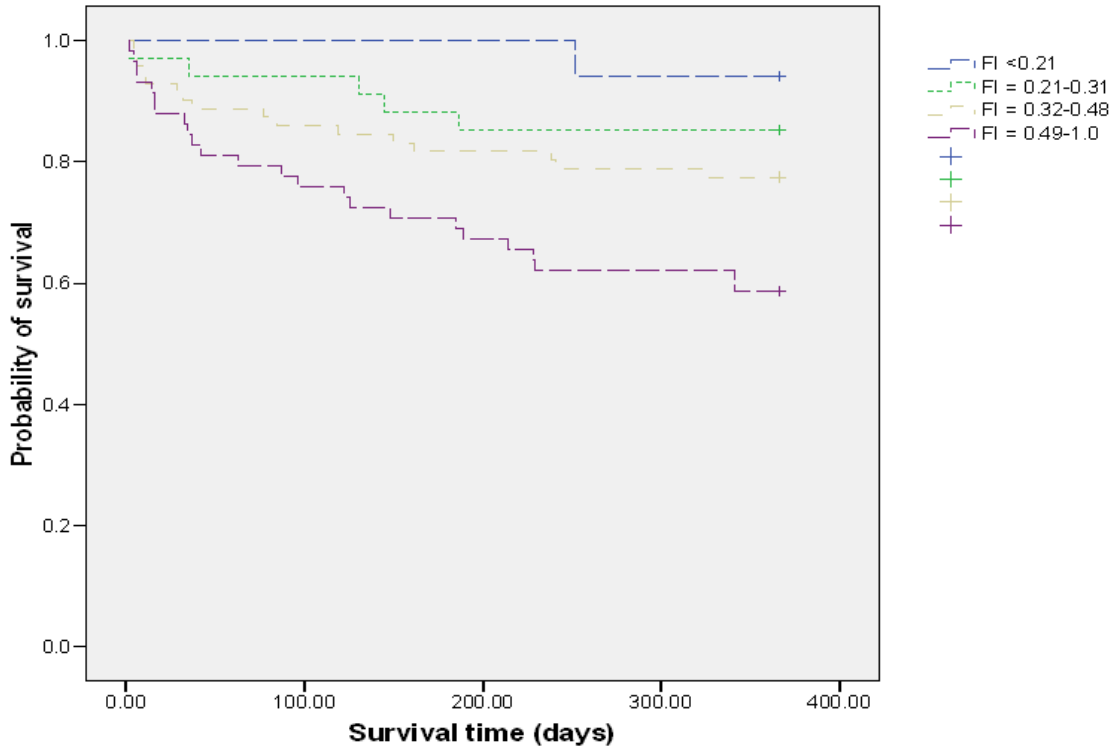
Table 18. Proportion of patients with adverse outcomes within one year of their use of EMS or visit to the GAC clinics (n = 198).

Adverse Outcome	Emergency Medical Services N (%)	Geriatric Ambulatory Care N (%)
Mortality	32 (33)	15 (17)
Hospitalization at time of index visit	48 (49)	1 (1)
Hospital LOS (days) Median	23.4 ± 31.5 10	26
Hospitalization	38 (40)	18 (21)
Institutionalization*	12 (12)	18 (21)
EMS use	51 (52)	26 (30)
ED use	57 (56)	28 (32)

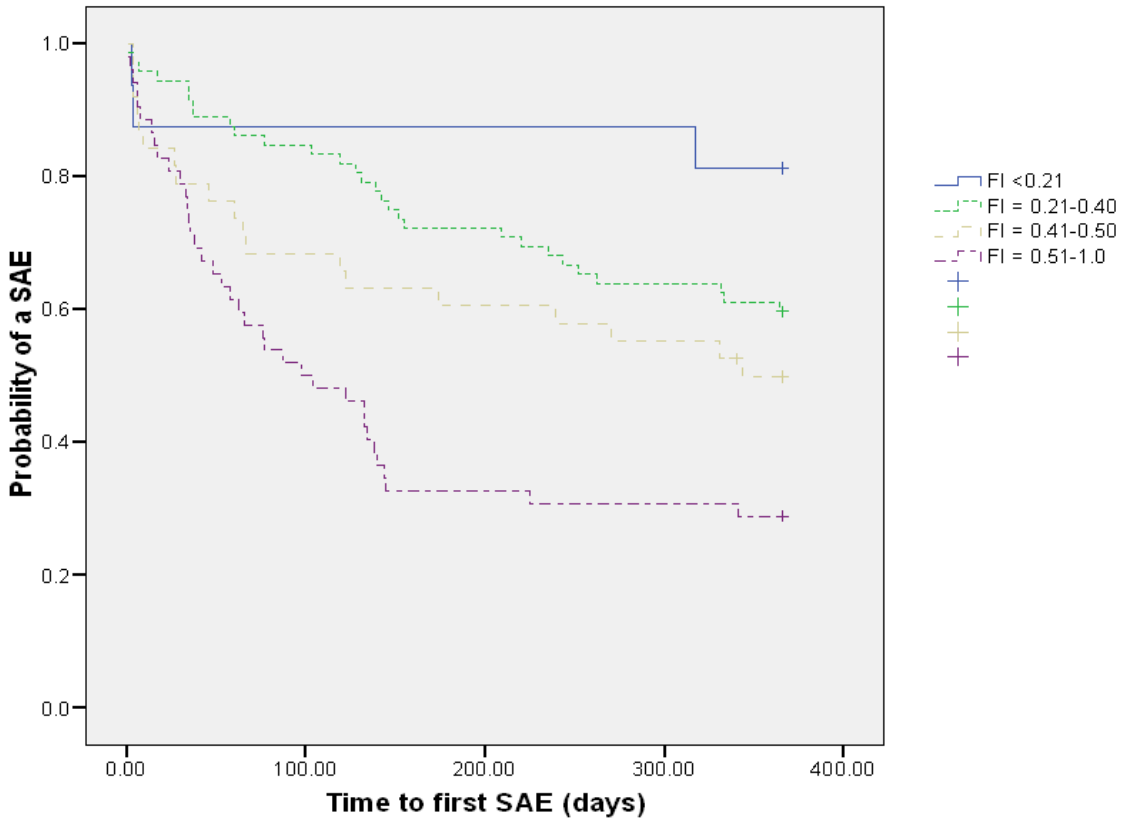
*20 pts already in nursing home or assisted living facility (16 EMS/ 4 GAC)

Figure 7. Survival by grades of fitness/ frailty.

A

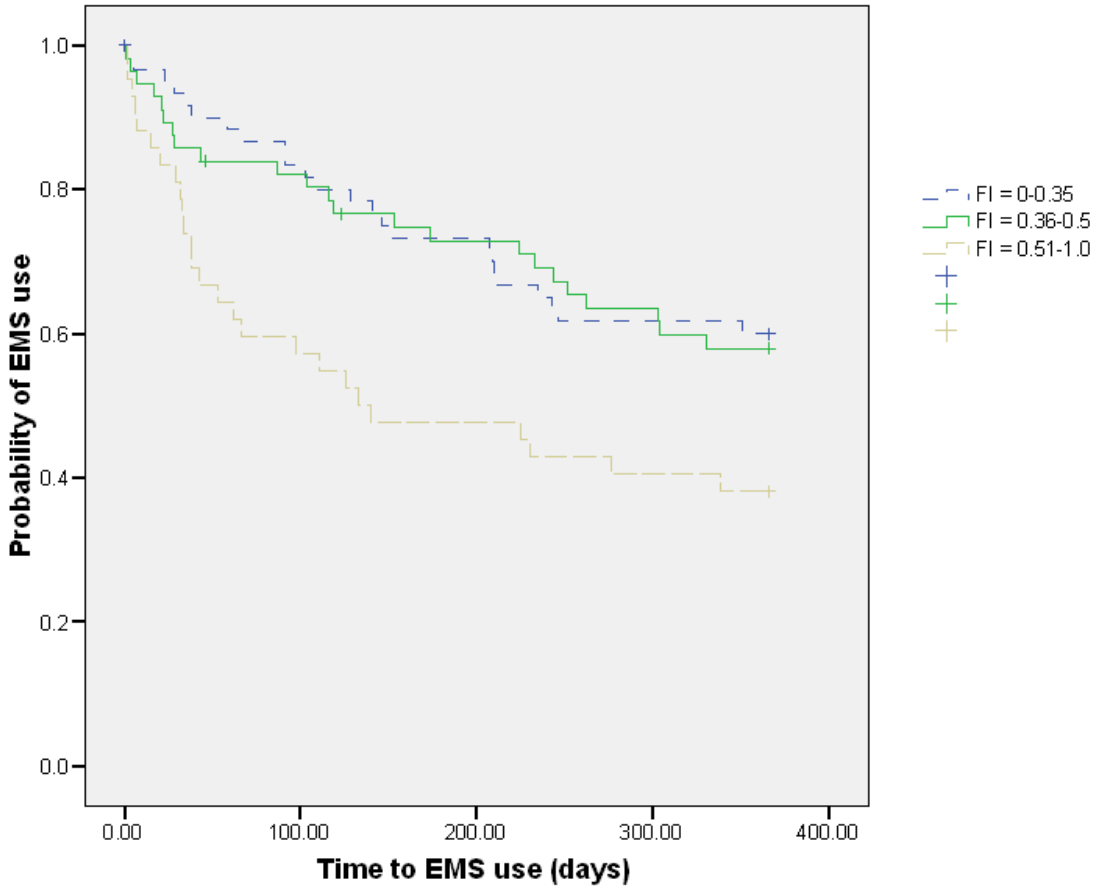


B



A four part stratification of the CP-FI-CGA (current). Panel A. The four lines refer to people with a Frailty Index Score of less than 0.21 (n=17), between 0.21 and 0.31 (n=34), 0.32 and 0.48 (n=71) and 0.49 or greater (n=58). Panel B depicts the probability of a severe adverse event (SAE) within one year of the index visit. A SAE includes death, institutionalization, and hospitalization. The four lines refer to people with a Frailty Index Score of less than 0.21 (n=16), between 0.21 and 0.40 (n=72), between 0.41 and 0.5 (n=38), and 0.51 and greater (n=52).

Figure 8. Time to EMS use by grades of fitness/ frailty.



A three part stratification of the CP-FI-CGA (current) was used. The three lines refer to people with a Frailty Index Score of less than 0.35 (n=61), between 0.36 and 0.5 (n=56), 0.51 or greater (n=42) (p=0.016).

CHAPTER 7: GENERAL CONCLUSIONS

Frailty in the out-of-hospital setting may be the most important predictor of health outcomes (death, institutionalization, hospitalization) for older adults, yet it has received little attention in this environment. Older adults are frequent users of EMS. Their care is often complicated by the presence of multiple co-morbidities, functional impairment, cognitive decline and varying degrees of social vulnerability. Health care providers in this setting require the knowledge and tools to effectively assess and care for older adults appropriately. This should include a method for determining one's level of fitness/ frailty in this context.

As a paramedic, I have seen that the care that we provide sometimes does not match the care that older people want or require. For example, the default decision for paramedics is to transport people to the Emergency Department whenever they access EMS. This does not recognize that often EMS is accessed because it simply is the most accessible health care service. In consequence, it is called on for a wide variety of needs whether for primary, chronic or acute care. In some cases, patients would prefer not to go to the Emergency Department, but would rather have their need addressed at home. In other situations patients require advice on how to navigate health care services. EMS acts as a safety net for some, but without the proper knowledge of the issues common in older adults (e.g. cognitive impairment, frailty, immobility and functional impairment) care may not be optimal. Older adults rely on the judgement of paramedics in making health-care decisions. In short, because of this paramedics need to understand frailty to aid in informed health care decisions. In EMS, we tend to work from protocols or practice guidelines and are challenged when patients do not fit into a certain pathway. Even though older adults comprise a large percentage of EMS call volumes, little training or

research is focused on this population. Through this research I have addressed this gap in knowledge. I hope that this research will lead to further exploration of frailty and its implications in EMS.

The objectives of my research were to: describe current EMS practice as it pertains to frailty quantification and its implications to care provision, to describe the older population that EMS providers attend to, and finally to develop a method for assessing frailty in this setting. Time is often cited as the major factor in preventing a more detailed assessment in this setting (Salvi et al., 2012). For this reason, I developed and evaluated an assessment tool that aimed to minimize the workload of practitioners yet capture all relevant information for determining fitness/ frailty. This tool integrates the knowledge that caregivers (or care partners) have of their loved one. The assessment tool (CP-CGA) is based on a standard comprehensive geriatric assessment and can be completed by care partners with minimal extra work on the part of the health care provider. The CP-CGA was designed so that a frailty index of at least 40 items could be calculated. The properties of this CP-FI-CGA were evaluated in the context of two medical settings.

7.1 STUDY SUMMARIES

Study 1: There is a lack of research on frailty and its implications in the pre-hospital and emergency department setting. No research on frailty conceptualization or management was identified in the EMS literature. Methods for frailty measurement were characterized as either pertaining to the frailty syndrome, index, or scales based approach. Although no specific studies on the implementation of frailty measurement in the clinical setting were identified, risk-screening tools overlap frailty measures in their goal to identify older

adults at risk for health decline and other adverse events. In a recent study, Salvi et al., (2012) compared one version of these risk-screening tools to a brief frailty assessment instrument (Rockwood et al., 1999). Although their choice of frailty screening tool may not have been the most appropriate, this study identified the need to understand the ability of these tools to identify frail older adults in the emergency department setting. In this study of ED patients, frailty was common (58.5%) and was predictive of ED return, hospitalization and 6 month mortality. The ISAR was able to identify frail older adults in the ED (94% sensitivity and 63% specificity). In a secondary analysis, the FI was found to be a strong predictor of short term serious adverse events in the ED (Hastings et al. 2008). It is clear that there is a gap in the EMS literature that should be addressed by EMS researchers and clinicians.

Study 2: Older adults are high users of EMS. Of note, non-transports are also common. In this Canadian provincial EMS system, the transport rate increased with age, was higher for women and in urban locations which is consistent with previous research. More research is required to evaluate the causes and outcomes of non-transports (reasons, safety) in this context and the implications of frailty in this patient population.

A practical implication of this research, demonstrated the potential for using the electronic patient care record as a tool to assess trends in EMS use. This is a largely untapped resource for researchers and policy makers, but one that has the potential to illuminate our understanding of unique EMS patient populations within Nova Scotia. It may be possible to link this data set with other population-based samples to further explore EMS use by older adults in this provincial system.

Study 3: The Care Partner-Comprehensive Geriatric Assessment (CP-CGA) was created by myself, along with other members of the Dalhousie Geriatric Medicine Research Unit. Frailty can be assessed feasibly in the EMS and ambulatory care setting using the CP-CGA. Paramedics and care partners agreed that this approach might be beneficial, although further research is necessary in order to integrate it into clinical practice. The median completion time was 15 minutes in the out-of-hospital setting and 14 minutes in ambulatory care with greater than 90% of the items completed on the survey. Care partners were satisfied with the survey in terms of its length, ease of use and included items. All paramedics that provided feedback on the study felt that screening for frailty may be of value. The survey was most feasible in patients triaged in the intermediate to low risk categories. Future work should look at including those in the most emergent triage categories and the integration of the CP-FI-CGA by electronic data capture so that results could be used in real time. These analyses demonstrate that care partners are able to complete the survey in a timely manner and are a valuable source of information. Capturing their knowledge in a standardized format that can be summarized by a single deficit accumulation value provides clinicians with more objective information that can be used for clinical decision-making. A randomized trial of whether this can improve outcomes would be a logical next step.

The CP-FI-CGA is a valid method for assessing frailty in the out-of-hospital and ambulatory care settings. It displays similar properties to other FIs in terms of its relationship with age, gender, distribution and limits. It had good construct validity with a moderate correlation with other frailty measures, function and age. The CP-FI-CGA was predictive of one-year outcomes, possibly the highest form of validation for frailty measures.

Paramedics provide a substantial amount of care to older adults in the community and long-term care settings. It is imperative that they have the knowledge to contribute to discussions about prognosis, care planning and appropriate treatments in this context. By embracing frailty and striving to understand its implications to care, it may be possible to improve how care is provided.

7.2 INTERPRETATION, REFLECTION, AND CLINICAL IMPLICATIONS: FRAILTY MATTERS

These results have clear implications for practice and research. EMS providers can find providing care to older adults a challenge in the out-of-hospital setting. There is little specific training on issues unique to older adults in paramedic training. In addition, there is a high potential for missing serious issues and for the under-recognition of acute problems. Frailty as a clinical concept is not discussed in the EMS literature and this is reflected in current practice. Even so, some have attempted to address these issues by developing short screening tools to identify high-risk older adults in the emergency department (McCusker et al., 1999). Other clinicians have brought attention to the under recognition of functional impairment, cognitive decline (Shah et al., 2009), delirium, and falls. Novel methods for providing emergency services to older adults are being investigated (Hoyle et al, 2012). Carpenter et al. (2011) identify one of the most important EMS research questions is on how alternative forms of care can be provided such as “care in place”.

The CP-CGA brings attention to certain items in the assessment process that can be missed during usual care. During the course of this research, simple yet important keys to assessing older adults became apparent. The CP-CGA brings a level of

standardization to each assessment. A number of items are particularly important and should be documented on each EMS response, addressed as part of their care and communicated to those health care providers that can ultimately improve their care over the long term.

1) Cognition – EMS providers must have the ability to assess the capacity of older adults to make basic health care decisions in the out-of-hospital setting. This should include a brief cognitive assessment specifically identifying whether the patient has a new problem with memory or thinking or a chronic issue. Is it delirium? Does the patient have the capacity to make specific health care decisions including whether or not they would like to go to the hospital? At this point it also seems reasonable to ask the patient and family about care directives if they exist. The CP-CGA specifically asks about memory problems and whether they are new or old.

2) Medical History – The CP-CGA specifically asks about 14 common co-morbidities. Collateral information from care partners is often vital for understanding the history in the EMS setting.

3) Function – This is a topic that has not been addressed adequately in paramedic training; however, function is an important component to the assessment of older adults and is often one of the main contributing factors to seeking care when there is a decline (Wilber, Blanda, & Gerson, 2006). The CP-CGA specifically addresses the instrumental activities of daily living and activities of daily living.

4) Social – The loss of social supports can often lead to seeking EMS care. Social vulnerability is independently associated with mortality in older adults (Andrew et al., 2008). The CP-CGA asks about current supports, care provider stress and need for more help at home.

5) Changes in Medications – New medications or recent changes in medications are common contributors to EMS use.

6) Mobility/ Falls – A brief history regarding mobility and balance should always be completed in the EMS setting. The CP-CGA inquires about the use of walking aids, transferring, balance problems, gait speed and history of falls. Orthostatic hypotension should be assessed along with a walking/ transferring assessment. The association between falls and delirium should also be evaluated in the EMS setting.

7) Frailty – The CP-CGA assesses frailty in a number of ways. The paramedic completed Clinical Frailty Scale demonstrated a moderate correlation with the CP-FI-CGA and may be sufficient for early screening and identifying those in need of a more detailed assessment. For example, if a patient is deemed to be in categories 1-3 of the CSHA –CFS indicating that they are fit to well with treated co-morbidities it may not be necessary to have care partners complete a CP-CGA. However, the CP-CGA could be completed for those in categories 4-8 (apparently vulnerable to very severely frail).

In this study, frailty was predictive of death, institutionalisation and use of health services. It can be feasibly assessed and is likely a contributing factor for seeking EMS

care. The frailty index does not rely on the measurement of pre-specified variables but is a count of the number of problems that a person has wrong. EMS practitioners should be attentive to this count of problems, the associated risk of poor outcomes, and likelihood that patients may not present in a "typical" fashion especially when they are close to the limit of defit accumulation. The count of problems should consider co-morbidities, memory problems, mobility factors and functional impairment. Paramedics can also document the time course of change, care goals of the patient and desire for interventions. Paramedics should be cognizant of changes in mobility (falls), reasons for such changes, changes in memory and thinking, and environmental changes (e.g. changes to social support system, in-home safety). A thourough assessment and documentation of these issues will enhance our ability to be advocates for our patients. EMS providers need to be able to communicate effectively with other health care providers in a language that is meaningful to the patient. Understanding, caring for and treating frailty will be a large component of EMS care.

Healthcare Policy and Frailty

System level changes in the provision and management of emergency health care services will be necessary in order to improve care provided to frail older adults. These system level changes should be evidence-informed and have a built in methodology for evaluation. Two recommendations for policy can be proposed:

- An annual report on service use by older adults should be published in Nova Soctia. Longitundianl changes in EMS use could be monitored so that when system level changes take place their effects on useage may be better understood.

- Linkages between primary, acute and chronic care are required to improve service provision to older adults in the community. EMS has the potential to fill a gap and provide services more efficiently. An exploration of potential collaborations should be conducted to identify where frailty identification, goal directed care and alternate forms of care can be provided in the out-of-hospital setting.

7.3 RESEARCH

7.3.1 Research Limitations

In this study, a gap in the EMS literature was identified with the lack of research on frailty in EMS patients. The scope of the problem was presented by analyzing call volumes over a one-year period. An assessment tool was created (the Care Partner Comprehensive Geriatric Assessment) that could be used in the out-of-hospital setting and other medical settings where frailty may have important implications to care. Even though much work was completed, more questions arise. There were limitations to this work including a possible selection bias with the enrollment of subjects left to the discretion of practitioners. There were no patients enrolled in the most urgent CTAS category. The CP-CGA may have utility for this group so future research should address how best to capture this group. This study did include a wide variety of patients with differing chief complaints, CTAS levels, and outcomes (33% of EMS patients died, 49% hospitalized) so the sample may closely resemble a typical EMS population. Subjects were eligible for enrollment twenty-four hours per day, seven days per week.

Non-respondent bias may be present as well where those that did not participate may have differed from the group enrolled. Refusals were not tracked in this study. Anecdotally, very few people refused to participate. In cases where someone refused, reasons provided included the CP feeling that they were not the primary care provider or

that they did not have the medical knowledge to complete the survey. Finally, there were very few very fit people enrolled in the study. The goal was to capture a wide range of older adults arriving by EMS, however, there may have been a tendency to enroll patients that were most frail. On occasion, family remarked that the patient does not require any care so there was confusion regarding the purpose of the survey.

Another issue may have involved measurement bias as most patients enrolled in the study did not have a FI-CGA completed in the emergency department. When one was completed, it often occurred on the floor so some problems may have resolved with treatment. Indeed, the correlation between the CP-FI-CGA and FI-CGA was higher for GAC patients.

7.3.2 Future Research

1. Validation of CP-FI-CGA (Multi-site study): In order to address the identified issues, it would seem prudent to initiate a multi-site study to further identify the properties of the CP-FI-CGA. In a larger, multi-site study the goal would be to enroll all older adults over the age of 70 years. Enrollments could be tracked in order to quantify the refusals (reasons), and the rate of lack of appropriate care partner. As CGAs are rarely performed in the ED, it would be most appropriate to evaluate the CP-FI-CGA by short term outcomes (mortality, hospitalization, return visits) and its correlation with other measures (e.g. memory assessments, functional assessments). As part of this study, it would be possible to also assess currently used risk-screening tools such as the ISAR or TRST in order to compare their ability to predict adverse outcomes and to classify frailty in older EMS patients. Finally, with the survey developed and initial validity assessed, it may be possible to develop an electronic version of the survey that can be integrated with current electronic charting. This would enable frailty to be assessed by deficit accumulation in

real time improving the clinical feasibility of this approach. Efforts should be devoted towards developing tools to aid with discerning between fitness and frailty in older adults requiring emergency services, as their care needs will be dependent on this distinction.

2. Evaluation of Dispatch Data (Predictors of Frailty): As EMS services evolve; the goal is to send the most appropriate resource at the most appropriate time. In the past, an ambulance was typically sent when a 911 call was made, however, other methods for providing services are being developed. To tailor services for older adults, it may be possible to predict needs based on information derived from the dispatch data. For the 101 EMS patients enrolled in this research, it may be possible to identify predictors of frailty in the dispatch records. A mixed methods design could be used to identify predictors of frailty. A multivariate analysis of dispatch data, including age, gender, and changes in mobility, function, cognition mentioned by the caller but typically not part of the call taking process will be evaluated. Using a checklist approach, audiotapes will be evaluated qualitatively to assess the presence of additional information that is not typically requested by call takers and used in current dispatch algorithms. In a typical call, the call taker screens for age, level of alertness, breathing, shortness of breath and chest pain. Once a specific chief complaint is selected, additional questions are asked based upon prompts with the answers relayed to the responding paramedics. I would hypothesize that the frailest may present more frequently with vague, atypical complaints and that callers may attempt to provide additional details that are not requested in usual care. The implications are that if there is a high likelihood of frailty the responding paramedics could be prompted to conduct a more comprehensive assessment. In the future, it may also be possible to tailor care. This research could also help to inform the

development of dispatch programs so that the most important questions are asked to ensure the most appropriate resource arrives in a timely fashion. Older adults are already at risk for being under triaged so it is imperative that the right questions are asked so that appropriate care is provided.

3. Paramedic completed Clinical Frailty Scale: Using the data from the CP-FI-CGA study it will be possible to evaluate the validity of the paramedic completed Clinical Frailty Scale. Construct validity can be assessed by evaluating the correlation of the paramedic completed CFS with other frailty scales (care partner and specialist completed CFS and CP-FI-CGA). It will also be possible to evaluate the correlation of the CFS with age, cognition, and function for a subset of patients that had a FI-CGA completed in-hospital. Criterion validity will be assessed by its ability to predict adverse events (mortality, institutionalization, hospitalization and return ED visits).

4. Identification of Predictors of EMS Use: In this study, I demonstrated the feasibility of using the EHS electronic patient care record database to evaluate EMS use in older adults. Future research, will evaluate the potential of linking this data set with other large population based data sets (National Population Health Study) in order to evaluate the impact of socioeconomic factors on EMS use in a Canadian provincial EMS system. In addition, the data can be further explored in terms of how certain populations may require EMS. For example, it will be possible to quantify EMS use for those older adults with Alzheimer's disease or other dementia.

7.4 GENERAL CONCLUSION

A gap in knowledge regarding frailty in older adults in the context of Emergency Medical Services was identified and addressed through this research. This is the first study that I am aware of that has implemented a survey based upon CGA that could be used to construct a frailty index in the pre-hospital setting. Frailty is an important clinical construct in the EMS setting. It can be quantified, is predictive of outcomes and deserves further attention.

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Appendix A. Care partner comprehensive geriatric assessment (CP-CGA). Copyright of the Dalhousie Geriatric Medicine Research Unit, copy but do not change (Version 2, Oct 17, 2008).

Care Partner Comprehensive Geriatric Assessment

Please record the present time (Prior to starting this questionnaire). _____ AM /PM

Please help us by answering these questions about the person you care for. To help us provide the best care we would like to know more about their health. First, please provide us with some background information about this person.

Social

Marital Status

Is the person you care for:

☐ Married (including common-law) ☐ Widowed
☐ Divorced or separated ☐ Single

Living arrangement

Does the person you care for live:

☐ Alone ☐ With spouse ☐ With someone else

Supports

What is your relationship with the patient?

☐ Spouse ☐ Sibling ☐ Child ☐ Other

What help does the person you care for have at home? (Choose all that apply)

☐ Help from friends and family
☐ Help from Home Care, VON, Veterans' Affairs
☐ Privately arranged help (ex. hired help with housekeeping)

Does the person you care for live in their:

☐ Own home/condominium
☐ Rented home/apartment
☐ Other

_____

Does the person you care for need more help at home?

☐ YES
☐ NO

Are there stairs to climb to get into the home?

☐ YES (How many stairs? ____)
☐ NO

Are there stairs they need to climb day-to-day indoors?

☐ YES (How many stairs? ____)
☐ NO

Education

What was the highest grade they completed at school?

_____

Did they take further courses after high school?

☐ YES
☐ NO
Please give detail (e.g. University Degree, Technical School)

_____

What was their main job or occupation?

_____

Care Partner Stress

Are you the person who mostly provides care for this person?

☐ YES
☐ NO
If no, please indicate the primary care person:

_____

How would you describe the level of stress of caring for this person?

☐ No stress
☐ Low level of stress
☐ Moderate level of stress
☐ High level of stress - often overwhelmed

Research and Ethics Board Version #2 - October 17, 2008

Please continue the questionnaire on page 2. Thank you.

Medical Problems

Below is a list of health problems people often have. Does the person you care for have any of the following?

High blood pressure	YES	NO
Heart and circulation problems	YES	NO
Stroke, or effects of stroke	YES	NO
Arthritis or rheumatism	YES	NO
Parkinson's disease	YES	NO
Dental problems	YES	NO
Lung or breathing problems	YES	NO
Troubles with stomach/digestive	YES	NO
Kidney trouble	YES	NO
Diabetes	YES	NO
Trouble with feet or ankles	YES	NO
Skin problems	YES	NO
Recent broken bones	YES	NO
Thyroid problems	YES	NO

Other health problems please specify:

_____

_____

_____

_____

Medications

How many different medications does the person you care for take per day?

- ☐ Five or more medications
- ☐ Between two and four medications
- ☐ One medication
- ☐ No medications

Health Description

How would you describe their health to someone who had not met them before?

_____

_____

_____

_____

Health Attitude

In general, how would the person you care for rate their own health?

- ☐ Excellent
- ☐ Good
- ☐ Fair
- ☐ Poor
- ☐ Couldn't say

Falls

Has the person you care for fallen down in the past year? For example, a fall means a sudden, unexpected drop from a standing, sitting, or laying position (bed) that ended with the person on the floor or ground.

- ☐ YES
- ☐ NO

If yes please tell us how many falls you are aware of in the last year?

_____

Sleep

Does the person you care for have sleep problems?

- ☐ YES, disrupted
- ☐ YES, daytime drowsiness
- ☐ NO, no problems

Please continue the questionnaire on page 3. Thank you.

Care Partner Comprehensive Geriatric Assessment pg.3

These questions also refer to the person you care for. Think of this person when you answer these questions.
We want you to think about two time points – two weeks ago, which is in the left hand column, and today, which is in the right hand column.

		2 weeks ago	Today
General Health In general, would you say their health is:	Excellent	☐	☐
	Very good	☐	☐
	Good	☐	☐
	Fair	☐	☐
	Poor	☐	☐
	Very Poor	☐	☐
Emotional Do you think the person you care for is depressed?	YES, depressed	☐	☐
	NO, but seems to have low mood at times	☐	☐
	NO, not depressed	☐	☐
Do you think the person you care for worries a lot or gets anxious?	YES	☐	☐
	NO	☐	☐
Do you think the person you care for feels exhausted or tired all the time?	YES	☐	☐
	NO	☐	☐
Mental Status Does the person you care for have problems with memory *or* thinking?	YES	☐	☐
	NO	☐	☐
Communication Does the person you care for have any problems speaking to make themselves understood?	YES, some or great difficulty	☐	☐
	NO, no problems	☐	☐
Does the person you care for have difficulty hearing? For example, do they have problems hearing ordinary speaking?	YES	☐	☐
	NO, wears hearing aid	☐	☐
	NO, no problems	☐	☐
Does the person you care for have problems with eyesight? (even when wearing glasses)	YES	☐	☐
	NO	☐	☐
Appetite Has there been a change in their appetite?	YES, they have a bigger appetite	☐	☐
	YES, they have a smaller appetite	☐	☐
	NO, there has been no change	☐	☐
Nutrition Has there been a **change** in their weight in the last six months?	YES, weight loss more than 10lbs	☐	
	YES, weight loss less than 10lbs	☐	
	YES, weight gain	☐	
	NO, weight has stayed the same	☐	

Please continue the questionnaire on page 4. Thank you.

Care Partner Comprehensive Geriatric Assessment pg.4

These questions also refer to the person you care for. Think of this person when you answer these questions.
We want you to think about two time points – two weeks ago, which is in the left hand column, and today, which is in the right hand column.

		2 weeks ago	Today
Balance			
Does the person you care for have problems with balance?	YES	☐	☐
	NO	☐	☐
Do they complain of feeling dizzy or lightheaded?	YES	☐	☐
	NO	☐	☐
Do they require assistance of a person or aid (walker/cane) to prevent falling?	YES	☐	☐
	NO	☐	☐
Do they hold on to furniture to keep from falling?	YES	☐	☐
	NO	☐	☐
Mobility			
Is the person you care for able to get out of a bed or chair by themselves?	YES	☐	☐
	YES, with some help	☐	☐
	NO	☐	☐
Is the person you care for able to walk? (with or without a cane or walker)	YES, able to walk by themselves at their usual speed	☐	☐
	YES, able to walk by themselves but walks slowly	☐	☐
	YES, but needs some help	☐	☐
	NO, needs a lot of help or cannot walk at all	☐	☐
Bowels			
Does the person you care for have problems with control of their bowels?	YES, wears pad or needs full assistance with colostomy bag	☐	☐
	YES, occasional soiling or needs some assistance with bag	☐	☐
	NO, no problems	☐	☐
Bladder			
Does the person you care for have problems with control of their bladder?	YES, wears pad or needs full assistance with catheter	☐	☐
	YES, occasional bladder control loss or needs some assistance with catheter	☐	☐
	NO, no problems	☐	☐

Please continue the questionnaire on page 5. Thank you.

Care Partner Comprehensive Geriatric Assessment pg.5

These questions also refer to the person you care for. Think of this person when you answer these questions.
We want you to think about two time points – two weeks ago, which is in the left hand column, and today, which is in the right hand column.

		2 weeks ago	Today
Function			
Can the person you care for feed themselves?	YES, without help	☐	☐
	YES, some help	☐	☐
	NO, or only with significant help	☐	☐
Can the person you care for take a bath or shower?	YES, without help	☐	☐
	YES, with some help	☐	☐
	Only with great deal of help	☐	☐
Can the person you care for dress themselves?	YES, without help	☐	☐
	YES, some help	☐	☐
	Only with great deal of help	☐	☐
Does the person you care for drive?	YES	☐	☐
	YES, but I am concerned about safety	☐	☐
	NO, has stopped	☐	☐
	NO, never drove	☐	☐
Can the person you care for do day-to-day shopping?	YES, without help	☐	☐
	YES, some help	☐	☐
	NO, not at all	☐	☐
	NO, has never done shopping	☐	☐
Can the person you care for do day-to-day household cleaning?	YES, without help	☐	☐
	YES, some help	☐	☐
	NO, can't do at all	☐	☐
	NO, has never done cleaning	☐	☐
Can the person you care for cook well enough to maintain their nutrition?	YES, without help	☐	☐
	YES, some help	☐	☐
	NO, can't do at all	☐	☐
	NO, has never done cooking	☐	☐
Can the person you care for look after taking their own medications?	YES, without help	☐	☐
	YES, some help	☐	☐
	NO, can't do at all	☐	☐
	NO, doesn't need any medications	☐	☐
Can the person you care for look after their own banking and financial affairs (pay their own bills)?	YES, without help	☐	☐
	YES, some help	☐	☐
	NO, can't do at all	☐	☐
	NO, has never looked after finances	☐	☐
Is the person you care for too weak to carry out some day to day tasks (e.g. open a jar)?	YES	☐	☐
	NO	☐	☐

Please continue the questionnaire on page 6. Thank you.

Frailty Estimation

How would you describe the state of health of the person you care for?

☐ **Very fit.** (category 1)
People who are robust, active, energetic and motivated. These people commonly exercise regularly. They are among the fittest for their age.

☐ **Well.** (category 2)
People who have no active disease symptoms but are less fit than category 1. Often, they exercise or are very active occasionally, e.g. seasonally.

☐ **Managing Well.** (category 3)
People whose medical problems are well controlled, but are not regularly active beyond routine walking.

☐ **Vulnerable.** (category 4)
While not dependent on others for daily help, often symptoms limit activities. A common complaint is being "slowed up", and/or being tired during the day.

☐ **Mildly frail.** (category 5)
These people often have more evident slowing, and need help in high order IADLs (finances, transportation, heavy housework, medications). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation and housework.

☐ **Moderately frail.** (category 6)
People need help with all outside activities and with keeping house. They often have problems with stairs and need help with bathing and might need minimal assistance (cuing, standby) with dressing.

☐ **Severely frail.** (category 7)
Completely dependent for personal care, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~ 6 months).

☐ **Very Severely frail.** (category 8)
Completely dependent, approaching the end of life. Typically, they could not recover from minor illness.

☐ **Terminally ill.** (category 9)
Approaching the end of life. This category applies to people with a life expectancy <6 months, who are not otherwise evidently frail.

Other Information Do you have any other information you think will be helpful for us?

_____

_____

_____

Please record the time (Upon finishing this questionnaire). _____ AM / PM

Research and Ethics Board Version #2 - October 17, 2008

This is the end of the questionnaire. Thank you for your time.

Appendix B. Variables used to contruct a frailty index from the CP-CGA.

Deficit Count	Cut Point	Percent missing (%)	Prevalence (%)
1. Hypertension	Yes=1, No=0	0	56
2. Heart Problems	Yes=1, No=0	0	50
3. Stroke	Yes=1, No=0	0	25
4. Arthritis	Yes=1, No=0	0	58
5. Parkinson's Disease	Yes=1, No=0	0	5
6. Dental Problems	Yes=1, No=0	0	10
7. Lung or Breathing Problems	Yes=1, No=0	0	38
8. Stomach Problems	Yes=1, No=0	0	35
9. Kidney Problems	Yes=1, No=0	0	12
10. Diabetes	Yes=1, No=0	0	20
11. Feet Problems	Yes=1, No=0	0	32
12. Skin Problems	Yes=1, No=0	0	23
13. Recent Broken Bones	Yes=1, No=0	0	18
14. Thyroid Problems	Yes=1, No=0	0	15
15. Falls	Yes=1, No=0	3	54
16. Sleep Problems	Yes=1, No=0	4	60
17. Depression	Yes=1, Low Mood=0.5, No=0	7	21

18. Anxiety	Yes=1, No=0	8	60
19. Exhaustion	Yes=1, No=0	8	60
20. Memory Problems	Yes=1, No=0	8	70
21. Speech Problems	Yes=1, No=0	8	30
22. Hearing Problems	Yes=1, No=0	7	42
23. Eyesight Problems	Yes=1, No=0	8	36
24. Loss of Appetite	Yes=1, No=0	10	38
25. Balance Problems	Yes=1, No=0	6	73
26. Dizzy or Lightheaded	Yes=1, No=0	6	42
27. Assistance with walking (aid, stand by)	Yes=1, No=0	5	59
28. Hold onto furniture to prevent falls	Yes=1, No=0	11	55
29. Difficulties getting out of bed or chair on own	Yes=1, Some Help=0.5, No=0	6	19
30. Difficulties walking	Yes=1, Some Help=0.75, Walks slowly=0.25, No=0	6	19
31. Bowel Problems	Yes=1, Some Help=0.5, No=0	8	8
32. Bladder Problems	Yes=1, Some Help=0.5, No=0	7	16

33. Difficulties with eating	Yes=1, Some Help=0.5, No=0	5	11
34. Difficulties with bathing	Yes=1, Some Help=0.5, No=0	6	25
35. Difficulties with dressing	Yes=1, Some Help=0.5, No=0	6	16
36. Unable to Drive	Yes=1, No=0	6	60
37. Difficulties with shopping	Yes=1, Some Help=0.5, No=0	7	51
38. Difficulties with cleaning	Yes=1, Some Help=0.5, No=0	7	45
39. Difficulties with cooking	Yes=1, Some Help=0.5, No=0	8	46
40. Difficulties managing finances	Yes=1, Some Help=0.5, No=0	6	40
41. Difficulties managing medications	Yes=1, Some Help=0.5, No=0	6	40
42. Health attitude	Excellent=0, Good=0.25, Fair=0.5, Poor=1.0	2	24
43. Weight Loss (more than 10 pounds in six months)	Yes=1, No=0	5	18
44. Weakness	Yes=1, No=0	7	49

APPENDIX C Copyright Permission Letters

January 30, 2013

Canadian Geriatrics Journal
Gordon and Leslie Diamond Health Centre
7th Floor, 2775 Laurel Street
Vancouver, BC, V5Z1M9
Canada

I am preparing my Interdisciplinary PhD thesis for submission to the Faculty of Graduate Studies at Dalhousie University, Halifax, Nova Scotia, Canada. I am seeking your permission to include a manuscript version of the following paper as a chapter in the thesis:

Frailty in older adults using pre-hospital care and the emergency department: A narrative review. Goldstein JP, Andrew MK, Travers A. Canadian Geriatrics Journal, 15(1): 16-22, 2012.

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Yours sincerely,

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Name: Dr. Ken Madden Title: Editor-in-Chief, CGJ

Signature:

Date: March 11, 13

February 25, 2013

JFA: The Journal of Frailty & Aging
54 Route d'Espagne
31100 Toulouse, France

I am preparing my Interdisciplinary PhD thesis for submission to the Faculty of Graduate Studies at Dalhousie University, Halifax, Nova Scotia, Canada. I am seeking your permission to include a manuscript version of the following paper as a chapter in the thesis:

Feasibility of using information derived from a care partner to develop a frailty index based on comprehensive geriatric assessment.Goldstein JP, Hubbard RE, Moorhouse P, Andrew MK. Journal of Frailty and Aging, 2013, 2(1): 15-21.

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Name: Matteo Cesari, MD, PhD Title: Editor-in-Chief

Signature: Date: 2-28-2013