

INVESTIGATING FRAILTY AND THE FEASIBILITY OF USING A FRAILTY
MEASUREMENT TOOL AMONG EGYPTIANS

by

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DEDICATION

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ABSTRACT

Background: Older frail adults experience higher mortality, hospitalization, and morbidity. As a result, researchers have extensively studied frailty in developed nations. However, the same cannot be said for developing countries, especially Arabic-speaking countries (ASCs). Egypt has the largest Arabic-speaking population, which is aging, but frailty has not been well studied in this region. This creates the risk of a health catastrophe when caring for older, frail Egyptians.

Objectives of this thesis are to: 1) examine frailty research in ASCs; 2) understand the reported information on frailty and its related domains (e.g., prevalence, sex, comorbidities, and health and social conditions) among people over 60 who live in ASCs; 3) determine the frailty assessment tools used to identify and/or measure frailty in older adults living in ASCs; 4) assess the suitability of a Canadian frailty tool (PFFS) for identifying frail older adults in Egypt; and 5) evaluate the familiarity of non-geriatric doctors in Egypt with the concept of frailty and their preferred methods for identifying frail older people.

Method: To achieve objectives 1–3, a scoping review based on the Joanna Briggs Institute (JBI) methodology was conducted. For objective 4, a study was conducted to determine whether it was feasible to utilize the Arabic translated version of the Pictorial Fit Frail Scale (PFFS-A) to assess frailty in older Egyptians in diverse settings. A questionnaire was used to determine the perceptions of four non-geriatric specialities on frailty (objective 5).

Result: Only 27 papers matched the search criteria of the scoping review. These papers showed that frailty research was limited in ASCs and what has been done is mainly cross-sectional in nature. The results of the feasibility study showed that the PFFS-A was a valid and reliable tool that could identify frailty among older Egyptians. Finally, the results from the questionnaire indicate that Egyptian non-geriatric clinicians understand the concept of frailty but not its measurement. Non-geriatric clinicians also believe that frailty should be mainly assessed in primary care and geriatric clinics.

Conclusion: In ASCs, frailty, its measurement, and its associated outcomes are not well understood. However, our work has shown that frailty can be easily and accurately measured with a simple frailty tool, the PFFS-A. This study also shows that more work needs to be done to educate non-geriatric specialities about the importance of frailty and how to measure it.

LIST OF ABBREVIATIONS USED

ADL=Activity of Daily Living

ASA-PS=American Society of Anesthesiologists' Physical Status

ASCs= Arabic Speaking Countries

BADL= Basic Activities of Daily Living

BMI= Body Mass Index

GFI= Groningen Frailty Indicator

CFS= Clinical Frailty Scale

CGA= Comprehensive Geriatric Assessment

CHF= Congestive Heart Failure

CHS= Cardiovascular Health Study

CINAHL= Cumulative Index to Nursing and Allied Health Literature

CKD = Chronic Kidney Disease

COVID-19= Coronavirus Disease of 2019

CSHA= Canadian Study of Health and Aging

DM= Diabetes Mellitus

DNA= Deoxyribonucleic Acid

ED = Emergency Department

EGS= Emergency Geriatric Screening

EIMJ= Electronic Interdisciplinary Miscellaneous Journal

EMS= Emergency Medical Services

FI= Frailty Index

FI-CGA= Frailty Index- Comprehensive Geriatric Assessment

FI-CD= Frailty Index- Cumulative Deficits

FP= Frailty Phenotype

HCPs= Healthcare Providers

IADL = Instrumental Activities of Daily Living

ICU= Intensive Care Unite
IGF-I= Insulin Like Growth Factor-1
ISAR= Identification of Seniors at Risk
JBI= Joanna Briggs Institute
LAC=Latin America and Caribbean
LMD= Lebanese Mediterranean Diet
LMICs= Low- and Middle-Income Countries
LTCFs= Long Term Care Facilities
MAC= Mid Arm Circumference
MCC= Mid Calf Circumference
MENA= Middle East and North Africa
MMSE= Mini-Mental State Examination
MRs = Medical Residents
MUC= Mid Upper Arm Circumference
PFFS-A= Pictorial Fit-Frail Scale- Arabic version
PFFS= Pictorial Fit-Frail Scale
PRESS= Peer Review of Electronic Search Strategies
PRISMA-ScR= Preferred Reporting Items for Systematic Reviews and Meta-Analyses
extension for Scoping Reviews
Qol= Quality of Life
SAVR= Surgical Aortic Valve Replacement
SD= Standard Deviation
SEGAm= Short Emergency Geriatric Assessment
SHA mFI=Canadian Study of Health and Aging modified Frailty
SOF=Study of Osteoporotic Fractures
TAVR= Transcatheter Aortic Valve Replacement
TFI= Tilburg Frailty Indicator

TUG= Time Up and Go

UAE= United Arab Emirates

UI= Urinary Incontinence

UK= United Kingdom

USRIJ= University Studies for Inclusive Research

VES-13= Vulnerable Elders Survey

WHO=World Health Organization

WHO/ ECOG= World Health Organization/ Eastern Cooperative Oncology Group

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CHAPTER 1: INTRODUCTION

The average age of the world population has been increasing steadily through the 20th and 21st centuries. ¹ By 2012, 8% (562 million) of the world's population was 65 years of age or older (older adults); three years later, the population of older adults increased by 55 million, representing 8.5% of the world's total population. ² In the next decade, the global population of older adults is expected to markedly increase by approximately 236 million, and this number is projected to reach 1.6 billion by 2050. ² This is a significant concern, as aging is a known risk factor for many conditions and diseases.

Frailty is one condition that affects older adults. It manifests as an age-related vulnerability to stressors as a result of diminished physiologic reserves such as energy, physical ability, cognition, and health, resulting in a reduced capacity to maintain homeostasis, which gives rise to vulnerability. ^{3,4} It is associated with a high risk of increased dependency, hospitalization, falls, and mortality. ⁵⁻⁸ According to a systematic review, one out of three older adults is pre-frail, defined as the presence of 1 or 2 modified Fried criteria (unintentional weight loss, low physical activity level, weakness, exhaustion, and slow gait speed), and one out of four older adults is frail. These numbers are expected to rise as the older adult population grows, placing a major strain on healthcare systems around the world. ¹¹ Thus, frailty management will be one of the most significant global public health challenges in the coming century.

Developed nations have acknowledged frailty as a significant burden on the health outcomes of the elderly and, in turn, on the healthcare system. Consequently, methods have been designed to identify frail older adults and frailty management has been implemented into the treatment plan. For instance, the recommendations in clinical guidelines that health practitioners should screen or identify all older adults for frailty using a validated, setting- or context-appropriate tool have been raised.¹² Furthermore, for individuals screened as positive for frailty, a more comprehensive clinical geriatric assessment should be performed, and a full management plan that includes physical activity, social support, and medications management should be applied.¹³ Nevertheless, researchers in developed nations have not yet reached a consensus regarding the operational definition of frailty in clinical settings and nor the most suitable instrument for measuring it in diverse healthcare environments. As a result, researchers in developed nations are conducting ongoing research to gain a better understanding of frailty and identify the most effective care management strategy for frail elderly individuals.

Similar to developed countries, the older adult population in low- and middle-income Countries (LMICs) is increasing rapidly. In fact, approximately 65 percent of the world's population aged 60 years and older resided LMICs in the year of 2015 and this proportion is projected to increase to 80 percent by the year 2050.¹⁴ A systematic review on the prevalence of frailty among community-dwelling elderly in Middle Eastern countries revealed that the prevalence of frailty is higher in Middle Eastern nations compared to other nations worldwide (e.g., western nations).¹⁵ However, there have been few published studies about age-related conditions (e.g., frailty) in developing countries. This is supported by the findings of Nguyen and colleagues (2015), who revealed that

there is little published research from developing countries on the prevalence of frailty, its definition, and the factors associated with it.¹⁶ Therefore, there is a need to conduct more age-related syndromes research, such as frailty, in LMICs in order to mitigate its effects on health policy and care provision for this subpopulation.

Egypt is one of LMICs that is experiencing rapid growth in the older adult population. It has the second-highest proportion of older adults in the Middle Eastern/African region¹⁷, with 4.6 million adults over the age of 65 as of 2015.¹⁷ This number is expected to increase to 8.1 million by 2050.¹⁸ Although much has been learned about frailty in developed countries, the data is not representative of LMICs, such as Egypt. Therefore, the purpose of this research study was to determine what is known about frailty in Arabic speaking countries and whether a Canadian frailty assessment tool could be used by the Egyptian population and implemented within the Egyptian healthcare system. The specific objectives were: 1) conduct a scoping review to determine what is known about frailty and what frailty tools are being used in Arabic speaking countries; 2) determine whether a simple Canadian frailty assessment tool could be used in the Egyptian healthcare system; and 3) to determine what Egyptian healthcare providers, other than geriatricians, thought about frailty and where it should be assessed.

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CHAPTER 2: BACKGROUND

This chapter will examine the concept of frailty, the relationship between frailty and aging, the clinical implications of frailty, and frailty measurement with a focus on some of the measurement tools used to assess frailty. In addition, this chapter will address the state of geriatric medicine and frailty in Egypt.

2.1 Aging

There have been numerous proposed explanations for the natural aging process. However, researchers have not reached a consensus on any theory.¹ One theory defines age as the decline and deterioration of functional properties caused by the lifetime accumulation of molecular and cellular damage at the cellular, tissue, and organ levels.² This decline in functional properties results in a loss of homeostasis, defined as a self-regulatory process by which an organism tends to maintain stability while adapting to external conditions.³ This proportion of organ physiological damage may lead to health conditions such as increases in vulnerability to stressors which manifests as an age-related biologic condition (e.g., frailty), thereby increasing vulnerability to disease and mortality.⁴⁻⁶ Moreover, age is the greatest risk factor for the majority of health conditions (e.g., dementia, Alzheimer's disease, and sarcopenia), which are a direct contributor to the development of frailty, thereby increasing morbidity and mortality among older people.⁷ However, health and functional status for older adults varies considerably over the course of their lifetimes. Individuals vary greatly in the aging process, which is influenced by genetic, biological, environmental, and other physical, psychological, and

social factors.⁸ Therefore, the clinical outcomes of identically aged older adults in response to stressors (e.g., post-surgery, post-infection, or post-illness) are various.⁹ Some older adults may be more vulnerable than others of the same chronological age, placing them at a higher risk of adverse outcomes (e.g., death, institutionalization, utilisation of health services, further deficit accumulation).^{9,10} Observing that people age at the same rate but become vulnerable at differing rates led to the development of the concept of biological aging, also known as functional or physiological aging.¹¹ The scientific literature has conclusively demonstrated that individuals of the same chronological age can differ substantially in their biological age.¹¹ Chronological aging refers exclusively to the passage of time, while biological aging refers to a decline in function. According to studies, genetics, social and nutritional factors, lifestyle, and comorbidities all play a role in determining an individual's biological age.¹² Also, the type and number of comorbidities show that problems related to getting older are increasing. This is large component of biological age, rendering disease and age-related syndromes like frailty more likely in people, regardless of their chronological age.^{11,12} Therefore, aging does not necessitate a decline in health and/or physical function, and frailty is not a necessary consequence of aging. Thus, it is important to understand the underlying causes and pathophysiology of frailty, as well as why it manifests in certain older individuals but not others.

2.2 Frailty

2.2.1 Definitions

Frailty is inconsistently defined, and there is insufficient data to adopt a single definition at this time. In geriatric medicine and among geriatricians, "frailty" is a well-known

term; nevertheless, there is no standardized definition for frailty. In 1988, Woodhouse and colleagues defined frail older adults as over 65 years old, dependent on others for daily activities, and likely hospitalized.¹² Clegg and associates make a compelling case for defining frailty on the basis of its numerous associated symptoms.¹¹ They describe frailty as "a spiral of physiological decline," in which cumulative decline in multiple physiological systems increases the risk of further decline—in the same systems or other systems—leading to disability and worsened frailty.¹¹ Numerous gerontological studies support this theory. For instance, research has established that the pathogenesis of frailty is due to a multidimensional clinical decline in the physiological reserve of multiple systems.¹¹ This decline results in serious consequences such as falls, delirium, disability, hospitalizations, and mortality in response to any stressful event.⁹ Furthermore, a large body of literature implicates multisystem pathophysiologic processes (e.g., chronic inflammation, immune activation, musculoskeletal system decline, and endocrine systems) that all interact as frailty develops.¹³⁻¹⁶ Rockwood has proposed that a successful definition of frailty should be multifactorial, yet it must also manage the many factors in a way that considers their interactions.¹⁷ It is likely to correlate with disability, co-morbidity, and self-rated health and should identify a vulnerable population. In addition to being accurate, the success of any frailty definition is contingent on its usefulness for researchers and clinicians. However, due to the close correlation between frailty and age, it is likely that there will be an age at which nearly everyone will be frail by any definition.

2.2.2 The relationship between aging, other factors, and frailty

There is a commonality between frailty—defined as a multisystem dysregulation resulting in decreased physiologic reserves and increased susceptibility to stressors—and aging—defined as a loss of molecular or cellular functional properties resulting in decreased adaptability to internal or external stress and increased susceptibility to disease and mortality.^{7,8} A loss of homeostasis and functional properties causes both conditions, making individuals vulnerable to stressors and potentially leading to adverse outcomes. Yet, with aging, the homeostasis is general (in most of the body organs), whereas with frailty, the homeostasis is centred on energy metabolism (e.g., weakness and low activity) and neuromuscular changes (e.g., loss of skeletal muscle mass and strength).³ Furthermore, the differences between aging and frailty could also be clarified by the observed changes in some biomarkers, such as elevated cytokines and chemokines; reduced insulin-like growth factor (IGF-I), dehydroepiandrosterone sulphate, and leptin; and changes in white blood cell distribution in frail elderly populations, which differ from the comparable age-related changes observed in normal elderly (non-frail) individuals.^{3,13-16}

There are several precipitating factors that contribute to frailty. Since aging is a cause of cumulative organ injury, it will remain the most influential factor. However, other factors such as individual genetics, sex (i.e., females are more susceptible to being frail), the impact of chronic diseases and comorbidities, and individual social resources (e.g., nutrition) also contribute to the development of frailty.¹¹ Despite the fact that aging is thought to predispose to frailty, determining the biological basis of frailty remains

difficult due to its complex multifactorial etiology, indicating common but not identical pathways between aging and frailty.¹⁹

Understanding the etiology and pathophysiology of frailty will be important for the development of interventions to either prevent frailty or improve the quality of life for frail older adults.

2.3 Clinical Implications of frailty

Frailty significantly raises the risk of a number of adverse health outcomes.⁷ There are numerous studies examining the influence of frailty on the health outcomes of older individuals and their utilization of healthcare settings.^{7-9,11} A meta-analysis revealed, for instance, that frailty increases the risk of developing any adverse health outcome, with a 1.8- to 2.3-fold risk for mortality; a 1.6- to 2.0-fold risk for loss of activities of daily living (ADL); a 1.2- to 1.8-fold risk for hospitalization; a 1.5- to 2.6-fold risk for physical limitation; and a 1.2- to 2.8-fold risk for falls and fractures.²⁰

In addition, many studies have demonstrated that frailty is more prevalent in older populations with specific diseases or conditions, such as cancer patients (42%)²¹ and end-stage renal disease (37%)²², heart failure (45%)²³, dementia (32%)²⁴, and residents of nursing homes (52%).²⁵ Moreover, a systematic review showed a link between depression and an increased risk of incident frailty.^{26,27} The prevalence of frailty, depression, or their cooccurrence in older adults 55 years old was greater than 10%, according to the study.^{26,27} In addition, pre-frailty and frailty increased the risk of mortality and cardiovascular events and increased healthcare utilization in patients with type 2 diabetes, according to a study by Chao and colleagues (2018).²⁸

Recognizing frailty as a risk indicator for severe health outcomes should continue to aid in enhancing advance care planning. Given the multidimensional and heterogeneous nature of frailty and the complex care needs of frail older adults, a multidisciplinary collaborative approach between researchers, clinicians, policymakers, and frail older adults is required to identify the most appropriate care plans that aim to improve the health and well-being of this subgroup. A standardized system that provides evidence-based support for the significance and impact of frailty when making treatment decisions should implement this strategy. For instance, it is well known that frailty is characterized by weight loss, which may increase insulin sensitivity and enhance glucose tolerance due to the loss of abdominal fat.²⁹ Therefore, frail older adults may benefit from this association between frailty and glucose in terms of reducing hyperglycemia. As patients age, regular medication reviews should be conducted, considering gradual reduction or withdrawal when frailty and significant weight loss occur.²⁹ Additionally, this system could also enable the dissemination of important skills to many other health professionals who do not have a background in gerontology or geriatric medicine but are likely to have increasing levels of contact with older people as the population ages.

2.4 Frailty in clinical healthcare settings

2.4.1 Frailty in primary care

Frailty is increasingly prevalent, and its clinical variability is greatest in primary care.^{30,31} Family physicians are frequently the first to encounter frailty due to their long-term relationships with their patients and their first contact with healthcare systems.³⁰ Thus, family physicians are ideally suited to assess and manage frailty among their patients and

family caregivers, who may also be frail. Several physical and biological markers predicted the development of frailty in a systematic review conducted in community-based settings.³¹ These markers include weakness (as measured by handgrip strength), slow gait speed, being underweight or overweight, and exhaustion, as well as measures of insulin resistance, inflammation, endocrine and metabolic dysregulation, the presence of depressive symptoms, and micronutrient deficiencies.³¹ Translating these findings into clinically useful and practical measures for frailty in primary care is challenging because no single marker has been repeatedly identified as definitive for frailty, making it difficult to identify a marker that could be used in routine clinical investigation.³¹ In addition, several factors limit the clinical utility of these markers for identifying frailty, including the high cost of testing and impracticality in some clinical settings, such as primary care. Medical conditions that may or may not be associated with frailty can affect these markers. To use many of these markers, it would be necessary to develop approaches and guidelines that allow clinicians to determine if an underlying medical condition requires further evaluation and treatment or if the marker identifies an individual at high risk of frailty. Lacas and Rockwood (2012) believe that primary care is in a better position than many other specialties to prioritize the frail patient's requirements.³⁰ Frailty poses a challenge to standard health care delivery and requires early and appropriate identification and management, as it often becomes a significant part of many individuals' life course.

Due to the limited time physicians spend with older adults, it is extremely difficult to identify geriatric syndromes and devise a comprehensive diagnostic and treatment plan.³² Primary care providers require simple and expedient methods for identifying frail

patients. The purpose of facilitating the identification of frail patients in primary care setting is to enhance the quality of patient-centred care provided for older, frail patients when invasive therapeutic procedures are being considered. However, the implementation of precise and accurate algorithms in a busy primary care practice remains controversial.

2.4.2 Frailty in emergency department and acute care

Five to ten percent of all emergency department (ED) patients and 30% of patients in acute medical facilities are considered to be frail.³³ Stratifying the risk (i.e., frailty) of older patients entering acute care settings is a potentially beneficial first step in ensuring that the most vulnerable patients have access to optimal care from the onset of an episode; this is especially true for frail older adults, according to reports.³⁴

Another study that examined frailty as an independent predictor of adverse events in older adults concluded that frailty is associated with an increase in delirium during ED stays. This study recommended screening for frailty during emergency triage, which could assist ED clinicians in identifying elderly patients with an increased risk of delirium.³⁵ Moreover, a systematic review that examined the outcomes of older adults discharged from the ED revealed readmission rates as high as 40% for frail individuals at six months.^{36,37} The study authors believe that high readmissions could be the result of unresolved medical issues, a lack of community support, or both.

Another study revealed that frailty assessment at admission to the hospital can be used to predict mortality, the length of stay in the ED, the need for hospital admission, and post-discharge functional decline.³⁸ The Fried and Rockwood methods are common tools utilized in various healthcare contexts. However, the Fried method primarily serves

as an alert to identify frail elderly patients and provides limited guidance on treatment plans, while the Rockwood method has been criticized for being time-consuming.³⁹ Additional research is needed to optimize frailty screening tools that can identify older patients at greater risk of these adverse outcomes and in need of further geriatric assessment and treatment, while being easy to use and reliable in EDs.^{39,40}

2.4.3 Frailty in medical and surgical specialities

Frail older adults exhibit considerable heterogeneity, with specific patterns underlying problems in different domains of functioning, as well as varying needs and health concerns that must be considered when customizing care interventions. Identifying and providing appropriate treatment to older adults with multisystem disease and concomitant physical, social, and cognitive impairments is difficult, especially in some medical care settings such as the Intensive Care Unit (ICU), cardiology, surgery, and orthopedics, which may not be oriented toward treating older adults with such complexity.⁴¹

Frailty assessment may impact surgical risk and prognosis in ways that conventional surgical risk scores do not capture, according to a growing body of evidence.⁴¹ A study that looked at frailty levels before surgery and outcomes in older people having heart surgery and revascularization found that frailty levels, which were measured by mobility, disability, and nutritional status, may be able to predict death and functional decline 6 months after heart surgery.⁴²

Frailty, regardless of the frailty assessment tools used in previous studies or the aspects upon which it has been assessed, has consistently been associated with short- and long-term mortality, complications, prolonged length of hospital stay, post-hospitalization

functional decline, and diminished quality of life across healthcare settings.⁴³ In fact, the Canadian Frailty Network's top ten research priorities focus on using frailty assessment as a means for healthcare practitioners to inform treatment and care decisions and to prevent unnecessary hospitalization and emergency department visits for older adults.⁴⁴

2.5 Frailty measurements

Frailty has been measured using numerous methods as well as numerous instruments.⁴⁵ Researchers determined in the mid-1990s that combining manifestations of frailty, such as slow walking speed and weight loss, to generate combination scores improved the accuracy of predicting adverse clinical outcomes compared to considering individual components.⁴⁵ In 2001, researchers introduced the frailty phenotype (FP) and the frailty index (FI).⁴⁵⁻⁴⁷ These approaches for assessing and identifying frailty are distinct and are among the most widely used frailty measurement instruments.

The ongoing development of frailty assessment instruments aims to make them more accessible to patients, caregivers, and healthcare professionals. For example, the Pictorial Fit Frail Scale (PFFS) is one of the newest tools that uses images to represent its domains and could be easily completed by any rater. In the next section, I will discuss the two most common measures of frailty: phenotype and deficit accumulation theories.

Furthermore, I will explore additional frailty measurements, including the PFFS, which serves as the frailty measurement tool utilized in this dissertation's research.

2.5.1 Frailty Phenotype (FP)

In 2001, Fried, L., and colleagues developed and operationalized a phenotype of frailty in older individuals using data from the Cardiovascular Health Study (CHS). Forty-five researchers identified five main frailty symptoms: weight loss, fatigue, low grip strength, slow walking speed, and physical inactivity.⁴⁸ Deficits or impairments in at least three of these five domains identify frailty, while impairments in one or two domains indicate pre-frailty, and individuals are deemed robust if they display no symptoms of impairment.⁴⁵ Evidence of a hierarchical order in the onset of frailty symptoms over time was found in the Women's Health and Aging Study II, providing a firm foundation for this model based on biological causal theory.⁴⁸ As a result of the study, the five criteria of the FP have been proposed as (i) weakness (grip strength $\leq 17, 17.3, 18, 21$ kg by a JAMAR dynamometer for body mass index [BMI] $\leq 23, 23.1-26, 26.1-29, \text{ and } >29$, respectively); (ii) slowness (usual-pace 4-m walking speed ≤ 0.65 m/s if height ≤ 159 cm or ≤ 0.76 if height greater or equal to 159 cm); (iii) low physical activity (total energy expenditure < 90 Kcal/wk on six activities: walking, doing strenuous household chores, doing strenuous outdoor chores, dancing, bowling, exercise); (iv) weight loss (unintentional weight loss of at least 7.5% between examinations spanning 18-months intervals or 15% between examinations spanning a 36-month interval [examinations 3 and 4], or having a BMI < 18.5); and (v) exhaustion (low energy level [< 3 on a Likert scale of 0–10] or feeling unusually tired or weak most or all the time by self-report).²¹ Frailty is identified as individuals that have deficit in ≥ 3 criteria. Those that only have 1 or 2 deficits are classified as prefrail, and those individuals that have zero deficits are classified as non-frail.⁴⁸

This phenotypic approach has been the most cited and researched frailty measurement tool in population studies.^{3,49} It is simple and provides concurrent and predictive validity for a potential standardized definition of frailty in older adults.³ Moreover, it specifies an intermediate stage for identifying adults at elevated risk of frailty.

Consequently, clinicians can view the FP as a valuable tool for rapidly identifying older individuals at risk for adverse outcomes and incorporating the concept of frailty into clinical practice. It also provides a dichotomous variable (present or not) that is clinically useful for determining the potential need for adapted care and/or interventions. However, the FP focuses on physical frailty, and there are many other components of frailty that are not assessed with this tool, such as cognitive and social factors, medications, and comorbidities.⁴⁹

I believe that additional research employing longitudinal analyses will be necessary to determine what could be the predominant factor(s) underpinning the development of frailty and which factors would provide the most prognostic value as a measurement instrument.

2.5.2 Frailty Index of Accumulative Deficits (FI-CD)

A representative sample of Canadians aged 65 and older were found to accumulate deficits (defined as symptoms, signs, diseases, disabilities, or other abnormalities) at a rate of 3% per year.⁵⁰ The frailty index-cumulative deficits (FI-CD) is a health state measure designed to integrate multiple categories of health information derived from routinely collected clinical data.⁴⁷ Using a standard set of criteria, it categorized health deficits, mainly symptoms, signs, functional impairments, and laboratory abnormalities

(yielding 40 deficits), as either present or absent, regardless of their nature, and assessed how the number (specifically, the proportion) of deficits defines a person's risk state.⁴⁷

The number of deficits is crucial; the more deficits a person accumulates, the higher their likelihood of an adverse health outcome; that is, with more deficits, a person is more vulnerable and therefore frail.⁵¹ To calculate an FI score, the number of health deficits present in an individual is divided by the number of health deficits measured. For example, a person with 20 deficits out of 40 has a FI score of $20/40 = 0.5$; a person with 10 deficits has a FI score of $10/40 = 0.25$. The scale ranges from 0 to 1 where 0= no deficit present (robust), and 1= all 40 deficits present (severe frailty).⁵¹

Numerous studies have demonstrated that the FI score can not only predict susceptibility to adverse outcomes and mortality risk but also the severity of illness.⁵² However, critics argue that implementing this index in clinical contexts is challenging and cumbersome due to its reliance on a large number of variables (40 deficits).⁵²

2.5.3 Clinical frailty Scale (CFS) and Classification tree

Several studies have raised the argument that adding the number of impairments to define frailty is a time-consuming approach that is difficult to implement in some busy clinical settings.⁴⁹ Consequently, a third operational classification, the Clinical Frailty Scale (CFS), which uses clinical judgement to interpret the results of a patient's medical history and clinical examination, has been developed to determine frailty. The scale consists of specific domains, such as comorbidity, function, mobility, and cognition, which are evaluated and scored to produce a frailty score ranging from 1 (very fit) to 9

(very frail or terminally ill)⁵³ (Figure 1).



Figure. 1 Clinical Frailty Scale (CFS) K. Rockwood et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005; 173:489-495.

However, there are concerns about the CFS. For example, the CFS is utilized in numerous health care settings, particularly geriatric medicine, cardiology, intensive care, general medicine, emergency medicine, surgery, and dialysis.⁵⁵ but there is a lack of evidence on whether the scale is valid and can be used in other medical care settings, such as primary healthcare or long-term care facilities. In addition, the scale does not measure other patient-oriented domains such as quality of life, social status, other comorbidities, or the number of medications taken, which can also contribute to frailty.^{11,12} Moreover, experts in the geriatric field have cited the subjective scoring of the CFS by inexperienced raters

or individuals new to frailty assessment as a weakness of the CFS, as it may not always correspond with their clinical estimation.⁵⁵

To address these concerns, the CFS classification tree (Figure. 2) was created to increase the CFS's reliability when used by inexperienced raters and to facilitate routine scoring of the CFS.⁵⁶ Of note, clinical judgment is still required when using the CFS tree, which could potentially limit its use.^{56,57}

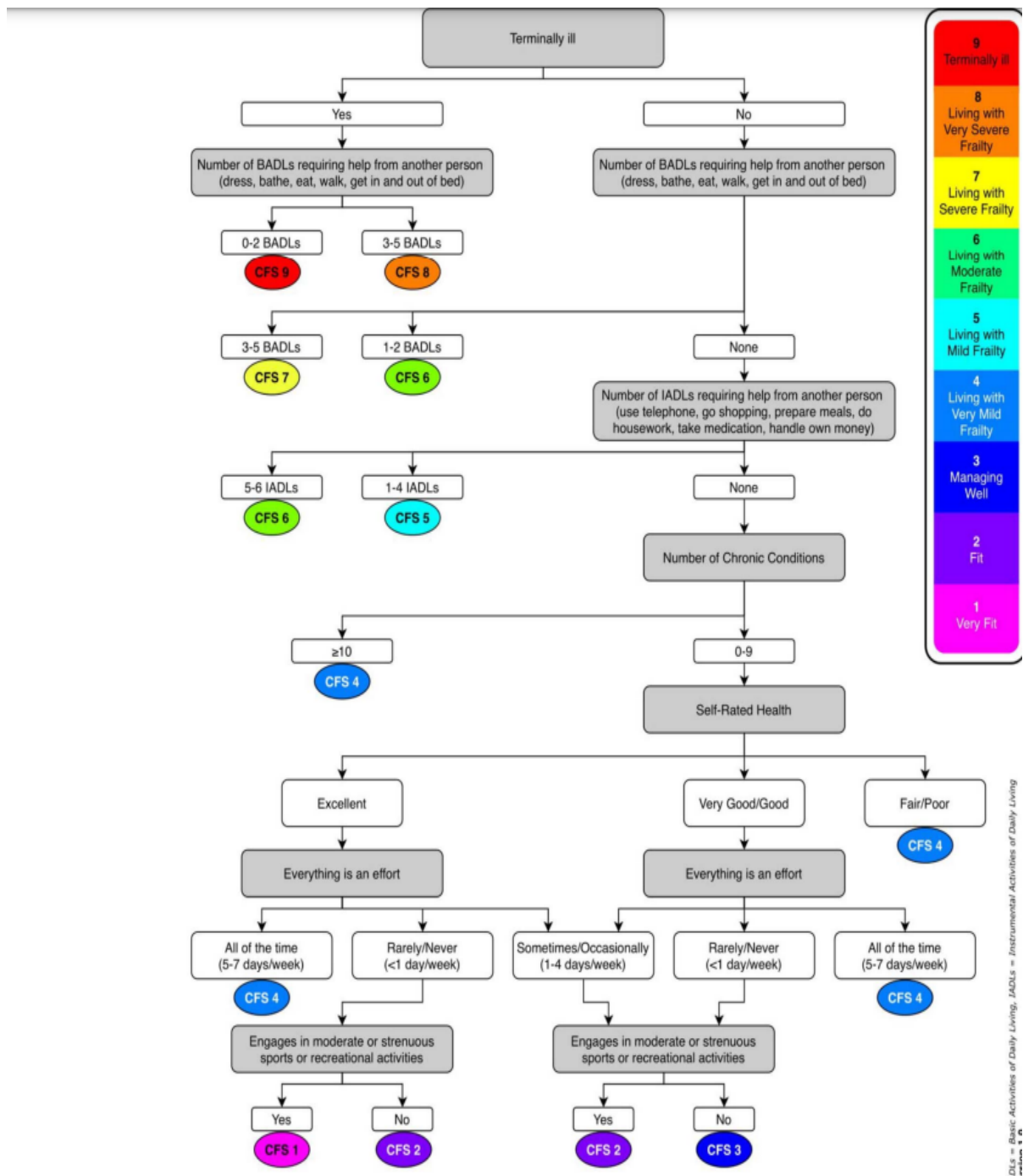


Figure.2 The Clinical Frailty Scale- classification tree (Theou et al., A classification tree to assist with routine scoring of the Clinical Frailty Scale. *Age and Ageing* 2021)

This algorithm demonstrated the ability to accurately predict several COVID-19 pandemic outcomes in frail individuals, including progression from mild to severe frailty, critical illness, mortality, and utilisation of health care services.⁷¹

2.5.4 The Pictorial Fit Frail Scale (PFFS)

The CFS and the CFS classification tree served as the basis for additional pictorial frailty measurement instruments such as the Pictorial Fit Frail Scale (PFFS).⁵⁸ The PFFS is based on visual images (Supplementary Appendix. 1) and was developed in 2019 by a team from Dalhousie University and the Nova Scotia Health Authority (Halifax, Canada). It is thought to help bridge the gap created when using the CFS and CFS classification tree.⁵⁸

When designing the PFFS, the objective was to develop a tool that was user-friendly, simple to administer, and sensitive to cultural differences (it can be used in different nations) and education levels (i.e., health literacy).⁵⁹ The PFFS can be completed by patients, caregivers, and/or health-care professionals. The PFFS consists of 14 domains that depict the typical conditions of the older adult, including mood, medication use, mobility, function, balance, social communication, daytime fatigue, memory and cognition, vision, hearing, pain, weight loss history, aggression, and bladder control.⁵⁹ For each domain, there are different levels, ranging from the optimal to the worst level. Each domain's level has a score range from 0 (fit) to a maximum of 3 or 4 (very frail); the total individual scoring ranges from 0 to 43 (the maximum score for all domain levels). The categories for the total score are 4, 9, 13, and >19 (vulnerability, mild, moderate, and severe frailty).⁵⁹ To calculate the frailty index for the individual, their

total individual score is divided by the total number of possible points (43). The closer the score is to zero, the better the older adult's health condition (e.g. more robust).^{58,59}

The content validity, feasibility, and inter-rater reliability of the scale have been assessed in Canada,⁵⁹ Malaysia,⁶⁰ Iran,⁶¹ and UK.⁶²

Many studies established that patients, caregivers, or healthcare providers can complete the PFFS in less than 5 minutes.⁵⁹ Compared to previously validated frailty measurements, the PFFS demonstrated high feasibility and construct validity in older surgical patients.⁵⁵ In addition, the PFFS is simple to use, even by non-primary health care personnel or individuals with a low level of education. However, as this tool is pictorial based, it cannot be used in patients with visual deficits, and its use in patients with severe cognitive impairment is challenging.⁵⁹ In addition, the validity and reliability of using the scale in different care settings, such as primary care or LTCFs, is still unclear.

For the aforementioned limitations of other frailty assessment instruments and the advantages of the PFFS, as well as to continue validating the PFFS in various cultures and among people with different backgrounds, I have decided to use the PFFS in my research to investigate the feasibility of its use in the Egyptian population.

2.6 Geriatric Medicine and Frailty in the Middle East and North African countries

Middle Eastern and North African (MENA) countries have rapidly aging populations, similar to that of other nations. These countries share similar cultural, social, linguistic, and economic characteristics.⁶³ As with other geriatric populations, the fastest growth

rate will be among the older adults (80+). From 2000 to 2050, the World Health Organization (WHO) projects that the growth rate of the population over 65 will be 4–5% and that the average annual growth rate of the eldest (85 years and older) will exceed 5% in 11 Arab countries.⁶³ Furthermore, it is anticipated that the geriatric population will increase fourfold in the Arab region over the next decade.⁶³ For example, in countries such as Lebanon, the proportion of older people is already substantial and will double by 2050.⁶⁴ Arab nations such as Qatar, Kuwait, and the United Arab Emirates (UAE) should allocate resources to prepare for a fivefold or greater increase in the proportion of their older population.⁶⁵

As in the majority of developed nations, the health situation in this region has greatly improved over the past several decades.⁶⁶ Today, the average life expectancy for a person born in Egypt, the country with the largest population in the region, is 72 years, nearly 20 years longer than if he or she were born in the early 1950s.⁶⁶ As a result, the number of older people increases as life expectancy rises.

Therefore, the need for appropriate care for this subpopulation may present challenges in some MENA countries, as healthcare systems may not be sufficient to care for the increased number of older adults. For example, an article aimed at describing the status of geriatric medicine and the position of geriatricians in 22 developing countries, including MENA, revealed that 55% of respondents reported that geriatric medicine is not a popular specialty in their country, and in general, there is a genuine absence of geriatricians.^{65,67} In fact, only six MENA countries, including Bahrain, Egypt, Iraq, Jordan, Lebanon, Morocco, and the Syrian Arab Republic, have acknowledged geriatric

medicine as a separate specialty.⁶⁵ General internists or general practitioners, who lack the knowledge and training to address the unique concerns and requirements of older individuals, typically treat older patients in the absence of qualified professionals.

Egypt is the most populous nation in the Middle East and the third-most populous nation on the continent of Africa (after Nigeria and Ethiopia).⁶⁶ The gradual increase in the absolute and relative numbers of older people has been one of the most prominent characteristics of the Egyptian population over the past few decades.⁶⁷ Demographic projections indicate that this trend will continue in the coming decades. Every ten years, Egypt conducts a demographic census; the most recent one was in 2016; the percentage of persons aged 60 and older increased from 4.4% in 1976 to 7.2% in 2013. It is anticipated that the percentage will increase to 8.1% in 2016, 9.2% in 2021, and 20.8% in 2050.^{68,69} By 2050, approximately 20 million Egyptians will fall into the category of older adults. Therefore, we can anticipate an increase in the incidence and prevalence of frailty in the coming years. This presents a tremendous challenge for the current Egyptian healthcare system.

Due to the lack of definitive data regarding the concept of frailty and its identification and measurement in this region of the globe, frailty may become a pressing health issue in the near future. Egypt may have an urgent need to implement a national policy for the care of older individuals which takes into account age-related syndromes, such as frailty status. To revitalize and mobilize the resources necessary to provide care for frail elder adults, it is crucial to prioritize the identification of frail older adults and increase frailty awareness, even if such policies may already exist. Caring for frail older adults must be

an integral part of all phases of health policy implementation, including planning, intervention, and evaluation.

There is a critical need to raise awareness and shed light on the significance of identifying older individuals who are frail in Egypt, which has the potential to spread to the rest of the Arabic population and serve as a foundation for future research in the field of frailty. Therefore, to investigate and address frailty and whether a frailty measurement tool could be used among the Egyptian population, we conducted this research presented in this thesis. The specific objectives for this study were to: 1) explore the state of frailty research in Arabic-speaking countries (ASCs); 2) understand what has been reported on frailty and its related domains (e.g., prevalence, sex, comorbidities, and health and social conditions) among people over 60 years who live in ASCs; 3) identify what frailty tools have been used to identify and/or measure frailty in older adults in ASCs; 4) assess the feasibility, reliability, and face validity of the PFFS tool among the Egyptian population; and 5) examine the familiarity of non-geriatric physicians in Egypt with the concept of frailty and their preferences for identifying frail older people.

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Appendix. 1



PICTORIAL
FIT-FRAIL
SCALE

NAME: _____

DATE: _____

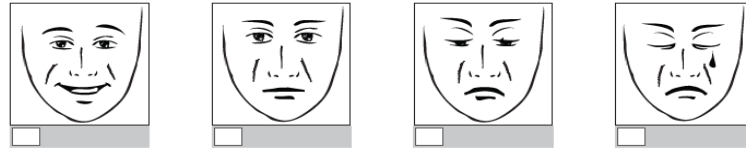
Instructions: This scale is intended to assess your USUAL state in different categories using pictures ordered from best to worst.

For each category, choose ONE picture that is closest to your USUAL state. Mark below that picture. There is no right or wrong answer.

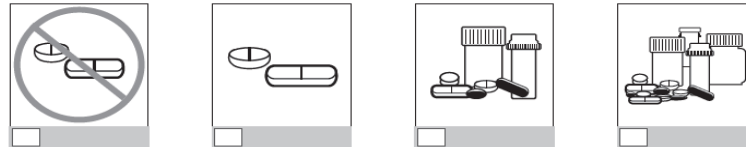
Example: If your USUAL vision is closest to the second picture mark as shown.



1 MOOD



2 NUMBER OF MEDICATIONS



PAGE
1
of 4

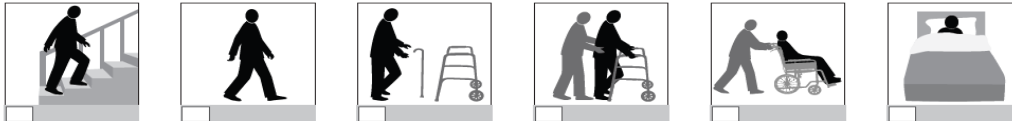
© Theou and Rockwood. Version 1.0



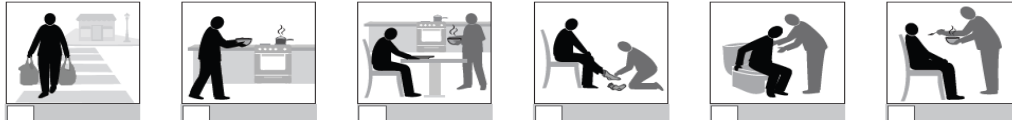
For each category, mark **ONE BOX** that is the closest to your **USUAL STATE**.



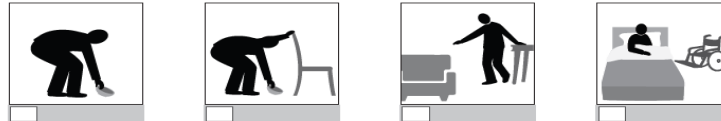
3 MOBILITY



4 FUNCTION



5 BALANCE



PAGE
2
of 4

© Theou and Rockwood. Version 1.0

For each category, mark **ONE BOX** that is the closest to your **USUAL STATE**.



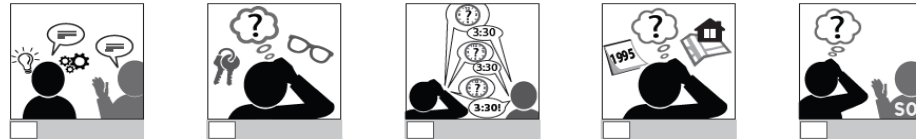
6 SOCIAL CONNECTIONS



7 DAYTIME TIREDNESS



8 MEMORY AND THINKING



For each category, mark **ONE BOX** that is the closest to your **USUAL STATE**.



9 VISION (WITH GLASSES IF NEEDED)



12 UNINTENTIONAL WEIGHT-LOSS



10 HEARING (WITH HEARING AID IF NEEDED)



13 AGGRESSION



11 PAIN



14 BLADDER CONTROL



The Pictorial Fit Frail Scale (Theou et al., The Pictorial Fit Frail Scale: Developing a visual scale to assess frailty. *Canadian Geriatric Journal*, 2019)

CHAPTER 3: FRAILTY IN OLDER POPULATIONS OF ARABIC-SPEAKING COUNTRIES: PROTOCOL FOR A SCOPING REVIEW.

3.1 Prologue

Based on the literature reviewed in the previous chapter, it is clear that frailty has a significant impact on older individuals and has the potential to jeopardize their health, their daily activities, or even their lives. Although frailty receives a large amount of attention and is a research focus in Western countries, little is known about frailty and frailty measurement instruments in Arabic countries. Thus, the purpose of Part 1 of this thesis was to investigate the level and depth of knowledge about frailty in Arabic-speaking countries. A scoping review was conducted to explore the published literature on frailty, its prevalence, and how it is measured in Arab countries.

3.2 Manuscripts information

Status: Published

Citation: Aly, A., Kendall, S. J., MacKnight, C., Theou, O., & Grandy, S. A. (2023).

Frailty in Older Populations of Arabic-Speaking Countries: Protocol for a Scoping Review. *Healthy Populations Journal*, 3(2).

Permission: N/A

Student contribution to manuscript: Amany Aly, with her committee, conceived the ideas and research hypothesis. Amany, in collaboration with other authors, designed and performed all aspects of the literature review. Amany wrote the first draft of the manuscript and revised all subsequent drafts.

3.3 Manuscript

3.3.1 ABSTRACT

Background: With the globally aging population, the impact of frailty is expected to increase, and frailty has come into focus as a challenging manifestation of aging.

Although frailty has been thoroughly investigated in developed countries, it has been understudied in developing countries. Like other countries worldwide, Arabic-speaking countries (ASCs) are experiencing an increase in the aging population; thus, as the risk of frailty increases, it becomes imperative to address the limitations of diagnosis, treatment, and prevention of frailty in this area of the world.

Objective: This protocol describes a scoping review that will investigate what is known about frailty in older adults living in ASCs. The aim is to synthesize and map the literature addressing the concept of frailty, its association with other geriatric conditions, and measurement tools used to identify or assess frailty among this subpopulation in this part of the world.

Methods: This review will employ Joanna Briggs Institute guidelines (JBI). Studies considered for this review must involve the concept of frailty among older adults living in the Arabic-speaking world.

Conclusion/Discussion: This scoping review protocol outlines the specific methodologies to improve the overall quality of the finalized scoping review. The finalized scoping review will present an overview of the current literature on frailty in older adults living in ASCs and summarize the knowledge gaps in frailty assessment and interventions.

3.3.2 INTRODUCTION

Frailty is not a natural consequence of aging; it is a multi-dimensional construct incorporating biological, social, and psychological factors associated with many poor outcomes (National Institute on Aging, n.d.). Although there is no consensus on a definition of *frailty*, many geriatricians and gerontologists view frailty as a syndrome (referred to as the frailty phenotype approach), which is the presence of three or more of the five criteria: unintentional weight loss, low energy, slow gait, reduced grip strength, and reduced physical activity (Fried et al., 2001). Frailty can also be viewed as an age-associated accumulative decline in tissue and organ function (referred to as the frailty index approach), which typically leads to an increased vulnerability to stressors (e.g., infection, acute illness, surgery; Rockwood & Mitnitski, 2007). It is not only a significant risk factor for premature mortality and morbidity in older adults, but it is also associated with a broad range of adverse outcomes such as falls (Cheng & Chang, 2017), disability (Makizako et al., 2015), depression (Brown et al., 2014), lower quality of life (Rizzoli et al., 2013), dementia (Gray et al., 2013), and hospitalization (Fried & Mor, 1997).

Given frailty's complex nature, interventions that mediate biological, socio-economic, and environmental factors contributing to frailty should be considered for pre-frail and frail older adults. Thus, measuring and screening for frailty is essential. With no international standard measurement for frailty, multiple frailty measurements exist and exhibit varying levels of quality. Currently, there is no consensus on which frailty measurement tool is the most accurate or reliable.

With the globally aging population, the impact of frailty is expected to increase as a challenging manifestation of aging (Howlett et al., 2021). Health care providers and decision-makers in developed countries recognize that frailty will likely become a problematic concern even with a highly advanced and supportive health care system (Hajek et al., 2018; Han et al., 2019; Hoogendijk et al., 2019; Kojima, 2019; Mitnitski et al., 2005). In addition to the health care burden of caring for frail people, there is an individual burden on frail older adults and their caregivers, including low quality of life, depression, and loneliness (Gale et al., 2018). Strategies to prevent and slow the progression of frailty are crucial (Chan et al., 2012; Kim & Lee, 2013; Takano et al., 2017). However, in low- and middle-income countries, *frailty* is less acknowledged. Many health care providers may not address or may misdiagnose a patient's frailty level during a clinical investigation (Siriwardhana et al., 2018). Such shortcomings are likely because more research is needed to investigate, identify, and measure frailty in older adults in these countries. Despite the expected increase in life expectancy requiring more comprehensive health care services, most primary care providers in developing countries receive little to no training on health conditions associated with aging and late-life challenges (Nguyen et al., 2015). Moreover, in most developing countries, health care systems are not publicly funded, and patients must pay for most health care services. Additionally, there may be an underestimation of the importance of identifying or predicting frailty compared to other chronic diseases or emergencies (Sibai & Yamout, 2012). With the increase in the aging population, the risk of frailty increases, and it is imperative to address the limitations of diagnosis, treatment, and prevention of frailty in these areas of the world.

Like other developing countries, Arabic-speaking countries (ASCs) are experiencing a demographic transition and are facing challenges such as care for this demographic, resources like a program for the elderly, social assistance, and qualified medical personnel are required (Obermeyer, 1992). By 2050, the proportion of older adults (aged 60 years or more) in ASCs is estimated to be 19%, almost triple the average in 2010 (Yount & Sibai, 2009). These countries, where Arabic is the official language, are located in the region of the Middle East and North Africa (MENA). Precisely 12 countries, namely Bahrain, Egypt, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, Lebanon, United Arab Emirates (UAE), Syria, Yemen, and Tunisia (Omri et al., 2015) will be considered for this panel analysis. Although these countries have a shared history, religion, and culture, there is a great variety within this history, climate, and culture that can affect the health care and health of aging people. Moreover, the concept of culture in all ASCs reflects a medium level of the Human Development Index, which examines life aspects such as education and life expectancy (Kabasakal & Bodur, 2002). This index articulated that life expectancy for people living in ASCs was low compared to other parts of the world. Therefore, this scoping review will consider publications investigating frailty for people aged 60 years or more living in the ASCs. Reviews have yet to articulate the frailty measurements used to identify or screen for frailty in ASCs, which could reliably predict these subpopulation outcomes. Furthermore, knowing which tools have been used to measure and/or screen for frailty in this part of the world and among different nations will support what has been established in international studies. Based on an initial search of the Cochrane Database of Systematic Reviews, PROSPERO, and *JBIC Evidence Synthesis*, no reviews are underway or have been

conducted. A scoping review will elucidate the current gaps in what is known about frailty in ASCs. The objective of the proposed protocol is to improve the quality of the final manuscript, improve examination quality, and minimize author bias.

3.3.3 PROTOCOL METHODOLOGY

This is a scoping review protocol of literature commentary on frailty among older adults living in ASCs. The review aims to outline what is known about frailty in ASCs. The updated JBI scoping review methodology will guide the proposed protocol review (Joanna Briggs Institute, 2015). This protocol details the review's inclusion and exclusion criteria and identifies which and how data will be extracted and presented in alignment with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR; Peters et al., 2021). The following scoping review will highlight and explain deviations from the protocol. A quality appraisal will not be done, as this review aims to map all research activities in this concept.

Research Question

The review will address the following questions:

1. What has been reported on frailty and its related domains (e.g., prevalence, sex differences, association with comorbidities or other health variables) among people aged 60 years and older who live in ASCs?
2. What frailty tools are used to identify or measure frailty among older adults in ASCs?

Inclusion criteria

Participants

The review will include studies involving frail older adults (aged 60 years and above) diagnosed or assessed for frailty by a researcher or health care professional in ASCs.

While frailty can occur in younger adults, researchers selected the specific age criterion because geriatric research is not as comprehensive in ASCs (Hussein & Ismail, 2017).

Researchers plan to highlight gaps in the literature to guide future research. Further, an aged population is often considered to be 65 years or above; however, on average individuals living in ASCs have a lower life expectancy, and, as such, an older adult is defined as 60 years or older (Sweed & Maemon, 2014). The studies should include participants who were investigated, evaluated, or assessed for frailty independently or in association with other syndromes, conditions, or diseases.

Concept

The concept of the review is to summarize the information about frailty in ASCs. This includes any studies that describe or assess frailty and tools used for assessment within any settings in ASCs. Included studies may present but are not limited to qualitative, quantitative, diagnostic, and clinical data.

Context

This review will consider publications that include the term “frailty” and recruited participants from ASCs. Study cohorts of participants from the Middle East and North African regions (MENA) will be considered—specifically, from the countries Bahrain, Egypt, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, Lebanon, United Arab Emirates

(UAE), Syria, Yemen, and Tunisia. Studies recruiting participants from MENA countries where Arabic is not the sole official language (e.g., Algeria and Morocco; Fishman, 2017) or countries located outside of the MENA region where Arabic is not the official country's language (e.g., Iran, Turkey, Niger, Senegal, Mali and Cyprus) will not be considered for this scoping review. The review will only consider reports published in English or Arabic. The review will consider the investigation, assessment, correlations, and interventions performed in any setting (e.g., community-dwelling, acute care, hospital, primary care) in any stated country.

Exclusion criteria

Studies focusing on other aging conditions and not frailty, such as studies looking at geriatric medicine, treatment of diseases, or aging aspects that do not involve “frailty” will be excluded.

Types of sources

The research will be conducted on published studies and grey literature. The review will include experimental and quasi-experimental study designs, randomized controlled trials, non-randomized controlled trials, pre-post studies, and interrupted time-series studies. Observational study designs such as descriptive, analytical, case study, and cross-sectional studies will be included. Researchers will seek to contact the authors of the included studies if more information is required.

3.3.4 METHOD

This proposed review will use the *JBI Manual for Evidence Synthesis* (Joanna Briggs Institute, 2015). Based on a pilot search conducted on July 25, 2022, there are at least 27 reports that meet the inclusion criteria.

Search Strategy

A comprehensive search strategy was developed in collaboration with a research librarian at Dalhousie University and followed JBI's three-step search strategy. The search strategy followed the Peer Review of Electronic Search Strategies (PRESS) guidelines to generate keywords (McGowan et al., 2016). The strategy is presented in Appendix A. The keywords be used to search for unpublished studies and grey literature.

Information Sources

Researchers will use the electronic databases MEDLINE (Ovid), Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycInfo, and Scopus to search for relevant sources. Additionally, researchers will use Google Scholar to investigate journals and websites in the Middle East, such as the *Middle East Journal of Age and Ageing* and *Geriatric & Gerontology International*. The search will be restricted to the English language using words that can be used interchangeably and keywords (Appendix A).

3.3.5 CONCLUSION

This protocol will map the current literature regarding what is known about frailty in ASCs. The protocol will improve the final scoping review manuscript by increasing the methodologies' transparency. The final review intends to identify the prevalence, measurement tools, risk factors, and type of interventions for the frail older population in these countries and make recommendations for future research. The review will follow the JBI guidelines and use the PRISMA-ScR reporting guidelines. Researchers believe the review results will identify gaps in the frailty field, thus improving awareness of frailty in ASCs.

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Appendix A.

Search Strategy

1	(Frailty* OR Frail* OR Aging* OR Vulnerable*)
2	(Elderly* OR Older Adult* OR Over 60* OR Senior* OR Aged* OR Old*)
3	1 AND 2
4	(Frailty measurement* OR Frailty Tool* OR Frailty Index* OR Frailty Assessment*)
5	(EFS OR 'Edmonton Frailty*') OR (mFI OR 'modified Frailty Index*') OR (FP OR ' Frailty phenotype*') OR (FI OR 'Frailty Index*') OR (MFC OR 'Modified Fried Index*' OR 'Modified Fried Criter*') OR (REFS OR 'Reported Edmonton Frail') OR (MFST-HP OR 'Maastrich Frailty*') OR (CFS OR 'Clinical Frailty Scale*') OR (CSHA-CFS OR 'Chinese-Canadian Study of Health and Aging Clinical Frailty Scale') OR FRAIL scale OR 'PRISMA-7' OR (GFI OR 'Groningen Frail*') OR 'Comprehensive Geriatric Assessment*' OR 'Rockwood Geriatric Frail*' OR 'Winograd Index*' OR 'Simplified Frailty Index*' OR (Hip-MFS OR 'Hip-Multidimensional Frailty Score')
6	3 AND 5
7	(Arab* adj2 (World* OR language OR speaking OR countr*)) OR ((Middle East OR Gulf) adj2 countr*) OR Arabic* OR North Africa* OR Yemen OR Iraq OR Egypt OR Bilad Al-Sham OR Syria OR Lebanon OR Jordan OR Palestine OR United Arab Emirates* OR Bahrain OR Oman OR Saudi arabi* OR Kuwait OR Qatar OR Libya OR Tunisia OR Algeria OR moroc*
8	6 AND 7

Appendix B.

Electronic Database Searches Table

Date of search	Electronic database	Keyword used to search	Number of studies retrieved	Number of studies selected

Appendix C

Data Collection Charting Form

Study information	
Study Author(s) and date	
Title of the study	
Publication	
Aim of the study	
Study setting	
Study population	
Study design	
Data collection method	
Data analysis	
Conclusion	
Study outcomes/recommendations	
Most relevant findings/comments	

CHAPTER 4: THE STATE OF FRAILTY RESEARCH IN ARABIC-SPEAKING COUNTRIES: A SCOPING REVIEW

4.1 Prologue

We published the protocol outlined in the preceding chapter in the *Healthy Populations Journal* (2023) and used it to conduct the following scoping review. The purpose of this scoping review was to acquire any relevant data regarding the concept of frailty in Arabic-speaking countries (ASCs). This section of the thesis was essential for identifying the breadth and depth of knowledge about frailty in this region of the globe. Furthermore, comprehending the measurement and identification of frailty, as well as the instruments used, was valuable.

4.2 Manuscripts information

Status: preparing for submission

Citation: Aly, A., Kendall, S. J., Heinz, S. S., MacKnight, C., Theou, O., & Grandy, S. A. (2023). *The State of Frailty Research in Arabic-Speaking Countries: A Scoping Review*

Permission: N/A

Student contribution to manuscript: Amany Aly, with her committee, conceived the ideas and research hypothesis. Amany Aly and Stephanie Kendall designed and performed all the aspects of the literature review. Amany Aly wrote the first draft of the manuscript and revised all subsequent drafts as amended by other authors.

4.3 Manuscript

4.3.1 ABSTRACT

Background: Frailty is an age-related decline in function and/or reserve in one or more physiological systems, which increases the risk of poor health outcomes, hospitalization, and death. Although frailty has been well studied in developed countries, little is known about the state of frailty research in Arabic-speaking countries (ASCs).

Objective: To address this gap in the literature, we conducted a scoping review to map and synthesize the literature on “frailty research” conducted in ASCs.

Method: The Joanna Briggs Institute methodology was used to identify relevant publications. In brief, six databases were searched for key words frailty, frail, vulnerable, older adults, frailty measurement, and Arab countries.

Results: Arabic journals did not yield any relevant articles. Only 27 articles from non-Arabic sources met inclusion criteria, suggesting that frailty research is limited in ASCs. The review showed that the prevalence of frailty varied across different settings (e.g. long-term care, hospitals, etc.), with the highest prevalence observed among older adults in hospital settings. Frailty was associated with older age and female sex. Furthermore, frailty was associated with a number of chronic medical conditions and contributing lifestyle factors. Based on the articles reviewed, there was no consensus on what tool should be used to assess frailty.

Conclusion: Overall, this review indicates that frailty is a significant issue in ASCs, and more research needs to be done to investigate both how to best identify frailty and how to manage those individuals who are frail.

4.3.2 INTRODUCTION

In developed countries, frailty—a state in which an individual has a higher risk of adverse health effects than others of the same age or exposure—is increasingly acknowledged.¹ It is a clinical disorder characterized by a loss of function in one or more physical, psychological, or social areas. Therefore, experts conceptualize frail older people as complex systems teetering on the brink of breakdown or failure.² Frailty is strongly associated with advanced age, comorbidities, a low socioeconomic position, and lifestyle risk factors.³⁻⁵ In addition, it predicts surgical complications, falls, hospitalization, and death.^{6,7} The impact and burden of frailty, its significance in clinical practice, and the importance of frailty management for older individuals' health and well-being must be considered.⁸

The global prevalence of frailty is unknown, and little is known about frailty prevalence and the nature of frailty in different ethnic groups, as frailty research has been conducted predominantly in high-income countries. The concept of frailty has received considerable attention in developed nations (e.g., Europe and North America), as have effective methodologies for diagnosing and quantifying frailty in clinical practice.⁹⁻¹¹ In addition, the incorporation of interventions to reduce the impact of frailty on individual health and the burden on the healthcare system is evolving rapidly in these nations.¹²⁻¹⁵ However, this may not be true in the Arabic world.

Over 422 million people live in Arabic-speaking countries (ASCs) in the Middle East and North Africa, including Egypt, Saudi Arabia, Kuwait, the United Arab Emirates, Lebanon, Yemen, Palestine, Algeria, Libya, Bahrain, Iraq, Morocco, Qatar, Sudan, Syria, and Tunisia.¹⁶ These countries, like more developed ones, are experiencing an increase in

the number and proportion of older adults due to an aging population. Research has established a link between frailty as an age-related syndrome and environmental factors such as low education and inadequate nutrition, resulting in a potentially higher prevalence in low- to middle-income countries like those listed above compared to developed nations.¹⁷ However, frailty research may be underdeveloped in these countries, and in order to offer adequate care for frail older people in this part of the world, it is important to understand what is known about frailty in ASCs.

No reviews of research on ASC frailty have been published, according to the authors' knowledge. Thus, we conducted a scoping review to evaluate, map, and consolidate the ASC's published literature on frailty. The review explored two main areas: 1) the reported findings on frailty and its related domains (e.g., prevalence, impact of gender, comorbidities, or other health and social conditions) among individuals aged 60 years and older residing in ASCs; and 2) the utilization of frailty tools to identify and measure frailty in older adults within ASCs. We believe the findings of this review will serve as a foundation for future research on frailty in ASCs.

3.3.3 METHODS

The Joanna Briggs Institute (JBI) methodology for scoping reviews was used for this research.¹⁸ There was no patient or public participation in the design, conduction, reporting, or dissemination of this research. A comprehensive protocol has previously been published¹⁹ and is summarized below.

Search strategy

A health research librarian from Dalhousie University, Halifax, Canada, helped the first author (AA) create the search protocol. The strategy followed the Peer Review Electronic Search Strategies (PRESS) guidelines to generate keywords including frailty, vulnerability, older adults, frailty measurement, and Arab (global, language, country).²⁰ Experimental, quasi-experimental, randomized, non-randomized, pre-post, and interrupted time-series studies were searched. Additionally, descriptive, analytical, case-study, and cross-sectional observational studies were considered.

Selection criteria

To be included, an article had to meet three criteria: 1) examine the concept of frailty (as previously defined); 2) include participants at least 60 years old living in ASCs; and 3) participants must have been assessed for frailty. We contacted authors directly when we needed additional information about the eligibility of an article. A native Arabic-speaking reviewer (AA) reviewed journal articles written in Arabic or bilingual articles (Arabic/English).

Information sources

The academic databases searched were MEDLINE (Ovid), Embase, CINAHL, PsycINFO, and Scopus. Middle Eastern journals and websites were searched using Google Scholar. We searched the Arabic/English Journal of University Studies for Inclusive Research (USRIJ), Electronic Interdisciplinary Miscellaneous Journal (EIMJ), Zaytuna College Journal, King Saud University Press, and Nile Scientific Journal.

Study selection

To ensure each article met the inclusion criteria, two review team members (AA and SJK) independently screened the title and abstracts followed by the full text of the articles. Any disagreements between the two reviewers were discussed, and a consensus was reached.

Data handling

The search results from each database were uploaded into Covidence,²¹ where duplicates were removed. AA and SJK reviewed the articles independently and then discussed the contradicting results and their relevance to the research. After screening and selecting the articles, both reviewers independently completed a data extraction form for each study that recorded the study's authors, publication year, purpose, design, country, population characteristics, setting(s), frailty measurement(s), tool descriptions, outcomes, and most significant findings. AA and SJK discussed the data they had gathered and reached a consensus regarding any discrepancies.

3.3.4 RESULTS

The database search yielded 201 publications for examination (Figure 1). CINAHL, Medline, Embase, PsycInfo, Scopus, and Google Scholar identified 19, 12, 110, 6, 53, and 1 article respectively. Fifty-five duplicate documents were removed by Covidence. AA and SJK reviewed the titles and abstracts of the remaining 146 publications using the inclusion criteria. Ninety seven of the 146 articles were excluded due to not meeting eligibility criteria (with the reason(s) given). The full-text review rejected 22 publications that did not match all inclusion criteria or were inaccessible. AA and SJK selected 27 English publications to be included. No Arabic articles were found.

In most articles (44.4%) frailty was measured as a participant's characteristic. For example, out of the included articles, 4 articles measured frailty to predict adverse health outcomes such as unplanned hospitalization and mortality,³⁰ falls,³⁸ and post-surgery complications.^{25,47} In Lebanon, 4 studies focused on the association between frailty and malnutrition status of the participants²⁹ or the association of frailty with other health conditions.^{28,31,32}

Characteristics of included studies.

Table 1 summarizes the characteristics of 27 studies included in this review. The review findings identified that most articles (56%; n=15) were published from 2020 onward. Twenty-one (77.7%) of the studies were cross-sectional by design, while four studies were a cohort design,^{25,30,38,47} one was a case-control study,⁴⁶ and one was retrospective.⁴⁰ The number of participants per study ranged from 47 to 1200. Most of the studies, 59.2% (n=16), were conducted at outpatient clinics or hospitals, 29.6% (n= 8) in the community, and 11.1% (n=3) at senior homes/long-term care facilities. The greatest number of studies originated in Egypt (44.4%; n=12), followed by Saudi Arabia and Lebanon (22.2%; n=6 each), then Tunisia (7.4%; n=2) and Jordan (3.7%; n=1). The mean age of participants across the studies ranged from 60 to 89 years. In most studies (n= 15) the number of males and females is nearly equal; however, the number of males is nearly double that of females in studies conducted mainly in Saudi Arabia(n=4)^{22,26,27,33 42} and one study from Egypt⁴⁷.

Table 1: Descriptive characteristics of articles included

Study Author (Year)	Ref.	Study Country	Study Design and Duration (M, Y)	Study Setting	Population Age Total (age ± SD) n of Male (age ± SD) n of Female (age ± SD)	Inclusion and Exclusion Criteria
Alqahtani, B (2021)	²²	Saudi Arabia	Cross sectional (Aug,19-Jun20)	Community	≥60 T:486 (range60-89) M:317 F:169	Inc.: ≥60 living in Alkharj city. Exc.: Non-Saudi, unstable disease, or medical condition
Esmayel, E., (2013)	²³	Egypt	Cross sectional	Hospital	≥ 65 T:100	Inc.: Pre-assessment surgical patients, no chronic diseases or disability. Exc.: NA
Abou-Raya S., (2009)	²⁴	Egypt	Cross sectional	Hospital	≥65 T :83(69.9±4.5) M :41(69.5range65-81) F :42 (70.1 range65-83)	Inc.: Patients with HF defined by an EF± 40%. Exc.: Patients with cancer, advanced liver, or renal disease, systemic inflammatory or connective tissue disease, Parkinson's disease or were on hormonal therapy.

Study Author (Year)	Ref.	Study Country	Study Design and Duration (M, Y)	Study Setting	Population Age Total (age ± SD) n of Male (age ± SD) n of Female (age ± SD)	Inclusion and Exclusion Criteria
Madbouly, K., (2017)	²⁵	Saudi Arabia	Cohort Study (2012-2014)	Hospital	≥ 60 underwent (Range 60-85) penile prosthesis implantation. T:54(64.9± 5.2)	Inc.: Patients with first-time penile prosthesis implantation only Exc.: NA
Alqahtani B. A., (2019)	²⁶	Saudi Arabia	Cross sectional (Aug,19-Jun20)	Community	≥ 60 living in Riyadh region T:47(70±4) M:31 F:16	Inc.: NA Exc.: Any acute illness, unstable health problems that would impair the ability to complete the outcomes measures.
Alqahtani B. A., (2020)	²⁷	Saudi Arabia	Cross sectional (Apr,19-Nov,19)	Outpatient clinic	≥65 visit the Prince Sattam bin Abdulaziz University Hospital T: 84(72±4.7) M:61 F:23	Inc.: 65 years of age or older, and able to walk independently. Exc.: Unable to communicate to answer question.
Boules, C., (2013)	²⁸	Lebanon	Cross sectional (Apr,11-Apr,12)	Community	≥65 T:1200(75.3±7.1) M:591 (75.7±7.2) F:609 (75.0±6.9)	Inc.: Live at home in rural area, no terminal illness, no tube fed. Exc.: NA

Study Author (Year)	Ref.	Study Country	Study Design and Duration (M, Y)	Study Setting	Population Age Total (age ± SD) n of Male (age ± SD) n of Female (age ± SD)	Inclusion and Exclusion Criteria
Boules, C., (2016)	²⁹	Lebanon	Cross sectional (Mar,11-Mar12)	Community	≥65 T:1200 (75.7±7.1) M:555 F:665	Inc.: Live at home in rural area, no terminal illness, no tube fed. Participants living in Gaza or Beirut Exc.: NA
Chakroun-Walha, O., (2020)	³⁰	Tunisia	Cohort Study (Oct,17-May,18)	Hospital	≥65 T:184 (unplanned hospitalization 76.9±7.3) Discharge at home 74.8±6.9 M:91 F:93	Inc.: ≥65 years, presenting at ED during the inclusion period, and consenting participate in the screening, mental disturbance patients are eligible if they accompanied by relatives. Exc.: Patients with Life - threatening condition, patients need immediate management, patients refuse follow-up phone calls.

Study Author (Year)	Ref.	Study Country	Study Design and Duration (M, Y)	Study Setting	Population Age Total (age ± SD) n of Male (age ± SD) n of Female (age ± SD)	Inclusion and Exclusion Criteria
El Zoghbi, M., (2013)	³¹	Lebanon	Cross sectional (Mar,12-Jun,12)	Senior's home	≥ 65 T:111(76.29 ± 8.02) M:55(74.49±1.09) F:56 (78.05 ± 1.02)	Inc.: Participants who had been admitted for more than four weeks. Exc.: Participants refuse to participate, or with renal dialysis, or those with MMSE≤14
El Zoghbi, M., (2014)	³²	Lebanon	Cross sectional (Mar,12-Jun,12)	Senior's home	≥ 65 T:111 M:55(74.49±1.09) F:56 (78.05±1.02)	Inc.: Participants who had been admitted for more than four weeks. Exc.: Participants refuse to participate, or with renal dialysis, or those with MMSE≤14
Hakeem, F. F., (2020)	³³	Saudi Arabia	Cross sectional	Community & hospital	≥ 60 T:362(67.13± 6.5) M:257 F:99	Inc.: Participants should be residents of the city of Medina, physically independent. Exc.: Older adults with communication problems.

Study Author (Year)	Ref.	Study Country	Study Design and Duration (M, Y)	Study Setting	Population Age Total (age ± SD) n of Male (age ± SD) n of Female (age ± SD)	Inclusion and Exclusion Criteria
Hammani, S., (2020)	³⁴	Tunisia	Cross Sectional (Mar,18-Mar,19)	Hospital	≥ 65 T:141 M:80 F:61	Inc.: NA Exc.: Younger than 65, unable to communicate, severe dementia, medical urgencies, or no informed consent.
Hamza, S.A., (2012)	³⁵	Egypt	Cross sectional	Community	NA T :80(67.58±6.27) M:32 F:48	Inc.: NA Exc.: Medical condition that alter the immune system, previous infection with pneumonia, previously vaccinated with the 23- valent pneumococcal polysaccharide vaccine
Hayajneh, A.A., (2021)	³⁶	Jordan	Cross-sectional (2016- 2016)	Community	≥60, Jordanian T:109(67.57±6.95) M:66 F:43	Inc.: Jordanian, >60 and above, able to speak Arabic, no known cognitive impairment. Exc.: NA

Study Author (Year)	Ref.	Study Country	Study Design and Duration (M, Y)	Study Setting	Population Age Total (age \pm SD) n of Male (age \pm SD) n of Female (age \pm SD)	Inclusion and Exclusion Criteria
Khamis, R., (2019)	³⁷	Lebanon	Cross sectional (Feb,15-Apr,15)	Community	≥ 65 , Lebanese T:390(76.1 \pm 7.6) M:191 F:199	Inc.: Residing in urban and rural area of Nabatieh, south Lebanon. Exc.: Sever cognitive dysfunction, very sick.
Khater, M.S., (2012)	³⁸	Egypt	Cohrt Study (Jan,9-May,10)	Senior's home	≥ 60 T:84(71.9 \pm 7.2) M:36 F:48	Inc.: Being mobile, cognitively competent to understand and follow the instruction. Exc.: Subjects with medical or neurological conditions, and participants with MMSE ≤ 24
Mohamed, M., (2015)	³⁹	Egypt	Cross sectional	Outpatient clinic	≥ 60 Frail 69.3 \pm 7.3 Roubest 64.9 \pm 4.5 T:100	Inc.: NA Exc.: Subjects with malnutrition, hypothyroidism, Liver disease, DM, chronic inflammatory or malignant disease, polytrauma, dementia, back deformity, kyphosis, or limb

Study Author (Year)	Ref.	Study Country	Study Design and Duration (M, Y)	Study Setting	Population Age Total (age ± SD) n of Male (age ± SD) n of Female (age ± SD)	Inclusion and Exclusion Criteria
Monib, S., (2021)	⁴⁰	Egypt	Retrospective data analysis (Jun,15-Jun,19)	Hospital	≥65, breast cancer T:578 (71±3.4) M:5 F:573	Inc.: Presented with symptomatic breast cancer. Exc.: ≤65, non symptomatic, previous breast cancer, local recurrence, or metastasis
Rasheedy, D., (2021)	⁴¹	Egypt	Cross sectional (Oct,16-Sep,18)	Hospital	≥60 T:206 (69.45±7.80) M:98(69.30±8.05) F:108 (69.58±7.60)	Inc.: Admitted to the geriatric department. Exc.: NA
Alqahtani., B (2021)	⁴²	Saudi Arabia	Cross sectional (Jan,18-Sept,18)	Outpatient clinic	≥65(69.9±6.2) T:270 M:167 F:94	Inc.: The ability to walk independently within the household with or without assistive device. Exc.: Cognitive impairment (MMSE≤ 24), medical condition that could affect participation, unable to read or understand Arabic.

Study Author (Year)	Ref.	Study Country	Study Design and Duration (M, Y)	Study Setting	Population Age Total (age \pm SD) n of Male (age \pm SD) n of Female (age \pm SD)	Inclusion and Exclusion Criteria
Aly., (2020)	⁴³	Egypt	Cross sectional (Jun,18-Apr,19)	Hospital	≥ 60 T:300 (70.7 \pm 8.3) F:130 (frail)	Inc.: Female and frail Exc.: Moderate or severe dementia, and catheterized patients
Rasheedy, D., (2021)	⁴⁴	Egypt	Cross sectional	Hospital	Total- 82 Phase (1) 20(M:11, F:9) Phase (2) 50(M:24, F:26) Phase (3) 12(M:8, F:4) Age (\pm SD): Phase (1) (67.6 \pm 6.12) Phase (2) (65.02 \pm 4.46) Phase (3) (66.5 \pm 9.82)	Inc.: Able to read and write in Arabic, cognitively intact, no visual and hearing impairment. Exc.: Illiterate patients, dementia, visual and hearing impairment
Atta Saudi, A, R., (2021)	⁴⁵	Egypt	Cross sectional (Jan,18-Jun,19)	Outpatient clinic	≥ 60 T:404(66.5 \pm 4.9) M:215 F:189	Inc.: Agreed to participate and able to answer the questionnaires. Exc.: Subjects with Parkinson's disease, stroke, and depression

Study Author (Year)	Ref.	Study Country	Study Design and Duration (M, Y)	Study Setting	Population Age Total (age ± SD) n of Male (age ± SD) n of Female (age ± SD)	Inclusion and Exclusion Criteria
Shokry, M, M., (2021)	⁴⁶	Egypt	Case control (Mar,19-Dec,19)	Hospital	≥60 type 2 DM T:88(range 66-80) M:32 F:56	Inc.: Patients with type 2 DM, agreed to participate. Exc.: Refused to participate
Tawfik, H, M., (2021)	⁴⁷	Egypt	Cohort study (Oct,18-Jun,19)	Hospital	≥60 T :180 M:137 F:43	Inc.: Patients underwent elective cardiac surgery. Exc.: Patients undergoing emergent or urgent operation, anemic patients, neurologic or orthopedic problem, sever cognitive impairment
Daou, T., (2022)	⁴⁸	Lebanon	Cross-sectional (Sep,19-Feb,20)	Community	≥65 T:112 Non frail:96 Frail:16	Inc.: ≥65, able to understand Arabic, living independently at home. Exc.: Reported sever neurological or psychiatric disorders, suspected cognitive impairment, unable to walk independently, or using canes, history of

						bilateral hip replacements, any event in the last year which had a substantial impact on dietary intake and cognitive function (including death or illness of a family member), and currently diagnosed cancer patients
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T=total; M=male; F=female; Inc=included Exc=excluded; EF=ejection fraction; NA=not applicable; MMSE=mini-mental state examination; DM=diabetes mellitus.

Frailty measurement characteristics of included articles

Table 2 summarizes the characteristics of frailty measurement tools reported in the included articles. Overall, 10 frailty measurement tools were used across all studies. The most commonly used measures were the Fried Phenotype (FP) (n=8)^{22,23,26,33,36,42,43,47} followed by the Study of Osteoporotic Fractures (SOF- FI) (n=6).^{28,29,31,32,39,40} and the Clinical Frailty Scale (CFS) (n=3).^{41,44,45} Two articles used two measures to identify frailty,^{29,34,46} one study used the Study of Osteoporotic Fractures (SOF) and the Frailty Index (FI)²⁹, one study compared FP to FI,³⁴ and the other study used the Comprehensive Geriatric Assessment (CGA) and the FP.⁴⁶ Other measurements used in conjunction with frailty measurements included a comprehensive geriatric assessment (n=7)^{23,34,35,38,39,41,46} and nutritional status using the Mini Nutritional Assessment (n=5).^{28,29,31,32,33} Physical performance (e.g., grip strength and Time Up and Go) was measured in five studies.^{24,26,27,38,45.}

Table 2: Frailty measurement characteristics of included articles

Study Author (Year)	Ref.	Frailty measurement tool	Description of the tool	Categories of the frailty measurement	Results of frailty measurement
Alqahtani, B (2021)	²²	Fried phenotype	weight loss, weak grip strength, exhaustion, slow gait speed, and low physical activity	Non- frail (0) Pre-frail (1-2) Frail (≥ 3)	Non-frail-31.2% Pre-frail – 47.3% Frail- 21.4%
Esmayel, E., (2013)	²³	Fried phenotype	weight loss, weak grip strength, exhaustion, slow gait speed, and low physical activity	Non- frail (0) Pre-frail (1-2) Frail (≥ 3)	Non-frail-36 Pre-frail-35 Fail-29
Abou-Raya S., (2009)	²⁴	Modified Fried	weight loss, exhaustion, walking speed, and grip strength, has a range of 0-4with higher score indicating greater frailty	Non- frail (0) Pre-frail (1) Frail (2-4)	Non- frail 27.7%(CHF) 56% (control) Pre-frail 43.3% (CHF) 46% (control) Frail 29% (CHF) 0% (control)

Study Author (Year)	Ref.	Frailty measurement tool	Description of the tool	Categories of the frailty measurement	Results of frailty measurement
Madbouly, K., (2017)	²⁵	CSHA mFI	Based on the theory of “accumulating deficits”, represents the ratio of the number of parameters present to the total number of parameters assessed.	frailty score (0) no risk factors frailty score (1) those having all the 11 risk factors	Average mFI (0.14 ± 0.08).
Alqahtani B. A., (2021)	²⁶	Fried’s frailty phenotype	Unintentional weight loss, exhaustion, slowness, weakness, low physical activity. Each criterion assigned a score of 0 or 1	Non- frail (0) Pre-frail (1-2) Frail (≥3)	Non- frail 32.9% Pre-frail 37.7% Frail 29.2%
Alqahtani B. A., (2021)	²⁷	TFI	15 self-reporting questions 8 physical domains 4 psychological domains 3 social domains	Score 0-15 ≥5 indicate frailty higher score indicating frailty	Non-frail 72% Frail 28%
Boules, C., (2013)	²⁸	SOF frailty Index	Involuntary weight loss, inability to rise from a chair without using arms, and reduced energy level for at least 3 days during the past week.	Robust (0) Pre-frail (1) Frail (≥2)	Non- frail 33.2% Pre-frail 30.4% Frail 36.4%

Study Author (Year)	Ref.	Frailty measurement tool	Description of the tool	Categories of the frailty measurement	Results of frailty measurement
Boules, C., (2016)	²⁹	Two measurements: SOF and frailty Index	Involuntary weight loss, inability to rise from a chair without using arms, and reduced energy level for at least 3 days during the past week.	Robust (0) Pre-frail (1) Frail (≥ 2)	Non- frail 371 Pre-frail 341 Frail-408
Chakroun-Walha, O., (2020)	³⁰	ISAR	Brief screening tool includes six items representing frequently observed problems in older adults at ED	Those with a score ≥ 2 out of 6 are considered “at risk” of adverse outcomes	Unplanned hospitalization 3.4 \pm 1.8 Discharge at home 2.2 \pm 1.6
El Zoghbi, M., (2013)	³¹	SOF frailty Index	Not stated	Non-frail (0) Intermediate (1) Frail (2)	Association with MMSE Non-frail 24.32 \pm 3.64 Intermediate 22.63 \pm 4.2 Frail 22.45 \pm 4.57
El Zoghbi, M., (2013)	³²	SOF frailty Index	Maximum score of 3 indicates frailty	Non-frail (0) Intermediate (1) Frail (≥ 2)	Non-frail -28 Intermediate- 41 Frail- 42
Hakeem, F. F., (2020)	³³	Fried phenotype	Weight loss, weak grip strength, exhaustion, slow gait speed, and low physical activity	Non- frail (0) Pre-frail (1-2) Fail (≥ 3)	Non-frail-36 Pre-frail-35 Frail--29

Study Author (Year)	Ref.	Frailty measurement tool	Description of the tool	Categories of the frailty measurement	Results of frailty measurement
Hammami, S., (2020)	³⁴	Fried phenotype and frailty Index	FI include 34defecit of multiple system. FI is the number of participant's deficits divided by the total FI number. FP: unintentional wight loss, exhaustion, weakness, slow walking speed, and low physical activity.	FI: Non-frail frail FP: Pre-frail frail	FP: 20.8% FI: 43.5%
Hamza, S.A., (2012)	³⁵	SEGAm	The maximum score is 26 points, each item scored as 0 (most favorable state), 1, or 2 (least favorable state).	Non- frail (0 - 8) Frail (9 t- 11) Sever- frail (≥ 12)	Non-frail- 50 Frail- 40 Very- frail- 51
Hayajneh, A.A., (2021)	³⁶	Fried phenotype	Shrinking, poor endurance, slowness, weakness, and low physical activity	Non- frail (0) Pre-frail (1-2) Frail (≥ 3)	Non-frail-24 Pre-frail- 36 Frail-20
Khamis, R., (2019)	³⁷	TFI	8 Physical domains (0-8) 4 physiological (0-4) 3 social (0-3)	Score ≥ 5 indicated frailty	Non-frail-24 Frail-85 Frailty total score 7 ± 3.4 Frailty physical domain 3.71 ± 2.33 Frailty psychological 1.95 ± 1.03 Frailty social domain 1.34 ± 0.94

Study Author (Year)	Ref.	Frailty measurement tool	Description of the tool	Categories of the frailty measurement	Results of frailty measurement
Khater, M.S., (2012)	³⁸	GFI	Measuring loss of function in four domains (physical, cognitive, social, and psychological)	GFI total score 0-15 Scor (≥ 4) considered moderate to sever frail	Total frailty score 6.8 \pm 3.4 Physical 3.3 \pm 2.4 Cognitive 0.1 \pm 0.3 Social 2.0 \pm 1.0 Psychological 1.4 \pm 0.8
Mohamed, M., (2015)	³⁹	SOF frailty Index	The presence of ≥ 2 : unintentional wight loss, inability to rise from a chair 5 times without using arms, and exhaustion.	Robust (0) Pre-frail (1) Frail (≥ 2)	Robust - 39 Pre-frail- 29 Frail- 16
Monib, S., (2021)	⁴⁰	SOF frailty Index	The presence of ≥ 2 : unintended wight loss, inability to rise from a chair without using arms, and reduced energy level	Robust (0) Robust 64.9 \pm 4.5 Intermediate (1) Frail (≥ 2) frail 69.3 \pm 7.3	Frail-50 Robust -50

Study Author (Year)	Ref.	Frailty measurement tool	Description of the tool	Categories of the frailty measurement	Results of frailty measurement
Rasheed, D., (2021)	⁴¹	CFS	not stated	V fit (1), occasionally active (2), managing well but not dependent (3), managing well but not regularly active (4), mildly frail (5), moderate frail (6), severely frail(7), very severely frail(8), terminally ill(9).	(1 CFS):269 (2 CFS):175 (3 CFS):65 (4 CFS):11 (5 CFS):8 (6 CFS):29 (7 CFS):14 (8 CFS):4 (9 CFS):3
Alqahtani., B (2021)	⁴²	Fried phenotype	Shrinking, poor endurance, slowness, weakness, and low physical activity	Robust (0) Pre-frail (1-2) Frail (≥ 3)	Non- frail 32.9% Pre-frail 37.7% Frail 29.2%
Aly., (2020)	⁴³	Frail-Arabic	Fatigue, resistance(stairs), illness, ambulation, and weight	Best (0) Worst (5) Non-frail (0) Pre-frail (1-2) Frail (3-5)	Non-frail- 6 Pre-frail- 24 Frail- 17
Rasheedy, D., (2021)	⁴⁴	CFS	The CFS ranges from 1 (very fit) to 9 (terminally ill) based on descriptors and pictographs of activity and functional status.	Mildly frail (CFS 5), Moderately frail (CFS 6), Severely frail (CFS 7)	Mild frailty-88 Moderate -15 Sever- 15

Study Author (Year)	Ref.	Frailty measurement tool	Description of the tool	Categories of the frailty measurement	Results of frailty measurement
Atta Saudi, A, R., (2021)	⁴⁵	An abbreviated scale compared to CFS	It includes general health survey such as demographic data, chronic and medical condition, and medications	Not stated	Phase (1)-0 Phase (2)-18 Phase (3)- 2
Shokry, M, M., (2021)	⁴⁶	CGA and Fried phenotype	Weight loss, weak grip strength, exhaustion, slow gait speed, and low physical activity	Non- frail (0) Pre-frail (1-2) Frail (≥ 3)	Non-frail- 186 Pre-frail-140 Frail-78
Tawfik, H, M., (2021)	⁴⁷	Fried phenotype	Unintentional wight loss, exhaustion, slowness, weakness, low physical activity. Each criterion assigned a score of 0 or 1	Non-frail Frail	Non -frail (controlled DM)-22 Non- frail (uncontrolled DM)-22 Frail (controlled DM)-22 Frail (uncontrolled DM)-22
Daou, T., (2022)	⁴⁸	Multidimensional frailty assessment (Robinson score)	Timed up and go, ADL, cognition, comorbidities, venous blood sample for nutrition and hematocrit, and falls	Non-frail (0-1) Pre- frail (2-3) Frail (≥ 4)	Non-frail-60 Pre-frail-60 Frail-60

CHF=congestive heart failure; SHA mFI=Canadian Study of Health and Aging modified Frailty Index; CGA=Comprehensive geriatric assessment; SOF=Study of Osteoporotic Fractures; TFI=Tillburg frailty Indicator; ISAR=Identification of Senior at Risk; ED=emergency department; FP=Fried phenotype; FI=frailty Index; SEGAm=Short Emergency Geriatric Assessment; GFI=the Groningen frailty indicator; CFS=clinical frailty scale; ADL=activity of daily living.

Associated factors to frailty

Table 3 summarizes the studies' objective(s), and which factors the studies assessed (e.g., demographic, social, or health conditions). According to the measurement tools utilized in the studies, the prevalence of frailty and prefrailty (in which one or two criteria are present) among participants ranged between 21.4% to 37.0% and 30.0% to 47.3%, respectively. These findings suggest a high prevalence of pre-frailty and frailty among Arabic populations compared to other populations from different nations (e.g., Western countries and Japan).⁴⁹⁻⁵³

In brief, four studies conducted in Saudi Arabia focused on assessing the prevalence of frailty^{22,23} or analyzed psychometric properties of frailty measures.^{26,27} Of the 6 studies conducted in Lebanon, only one assessed the psychometric properties of a frailty scale.³⁷ Moreover, three publications evaluated the feasibility, effectiveness, and reliability of three Arabic versions of frailty measures in their respective communities.^{26,27,37} Also, four articles used frailty as a predictor of adverse health outcomes (i.e., unplanned hospitalization and death,³⁰ falls,³⁸ and postoperative surgery complications)^{28,50} and found increased adverse outcomes in frail patients compared to robust patients.

Table 3: Factors associated/ investigated/ or correlated to frailty

Study Author (Year)	Ref	Study Objective(s)	Factors	P	D	S
Alqahtani., B (2021)	22	To investigate the prevalence of frailty and socio-demographic and associated clinical factors in Saudi older adults	Sociodemographic, impaired cognition and function	X	X	X
Esmayel, E., (2013)	23	To determine the prevalence of frailty and its association with blood pressure and anthropometric measurements.	Gender, blood pressure, anthropometric measurements (BMI, MUC, MCC)	X		X
Abou-Raya S., (2009)	24	To evaluate the association between osteoporosis and CHF in elderly and the impact of physical activities and vit D on this association	CHF (EF) and BMD		X	X
Madbouly, K., (2017)	25	Association of the m-FI with adverse outcomes after penile prosthesis implantation	No adverse outcome measures were associated with frailty		X	
Alqahtani., B (2021)	26	To adapt and validate the Arabic version of the FRAIL scale in community-dwelling older adults	Age, comorbidities, MMSE, TUG, grip strength and performance battery	X	X	X
Alqahtani B. A., (2021)	27	To translate and adapt cross-cultural TFI and evaluate its usability and construct validity.	Physical and function activities, and psychological domains.		X	X
Boules, C., (2013)	28	To assess the nutritional status of community dwelling elderly.	Socio- demographic, BMI, malnutrition, chronic pain, insomnia, ADL, chronic diseases, cognitive, loneliness, balance, and falls	X	X	X
Boules, C., (2016)	29	To analyze the relationship between malnutrition and frailty	Socio- demographic, nutrition, depression, and cognitive	X	X	X

Study Author (Year)	Ref	Study Objective(s)	Factors	P	D	S
Chakroun-Walha, O., (2020)	30	To evaluate the usefulness of frailty screening in predicting outcome(death) of elderly at ED	Functional (ADL), death, type of medical card at the ED, time of delay in ED, social, and comorbidities factors.	X	X	X
El Zoghbi, M., (2013)	31	To investigate the association between cognitive function and nutritional status in elderly	Cognitive		X	
El Zoghbi, M., (2013)	32	To provide a description of nutritional status and its correlated in older adults.	Malnutrition			X
Hakeem, F. F., (2020)	33	To examine association between normative and subjective oral health indicators and frailty.	Oral health includes the following measures: self-rated oral health, number of teeth, and functional dentition.			X
Hammami,S., (2020)	34	To investigate the association between pro-inflammatory marker and the development of frailty	Age, gender, living in nursing home, BMI, depression, cognitive, nutrition, inflammatory biomarker, and CPR	X		X
Hamza, S.A., (2012)	35	To detect the IgM memory B cell population response in the elderly following vaccination with the 23-valent pneumococcal polysaccharide vaccine and its relation to frailty indices, nutritional status, and serum zinc level.	After vaccination, positive frailty incidence was related to a lower mean IgM B memory cells percentage. A lower baseline percentage of IgM B memory cells was significantly related to age <70 years,	X		

Study Author (Year)	Ref	Study Objective(s)	Factors	P	D	S
Hayajneh, AA, (2021)	³⁶	To explore frailty and its correlates among cognitively intact community dwelling older adults.	Depression, comorbidities, physical function, and social function	X	X	X
Khamis, R., (2019)	³⁷	To assess the psychometric properties of the Arabic version of GFI in urban and rural population	Gender, age, level of education, QoL	X		X
Khater, MS, (2012)	³⁸	To evaluate the incidence of falls in a year and its predictive factors among Egyptian nursing home residence	Falls			X
Mohamed, M., (2015)	³⁹	To clarify the impact of IGF-1 level on muscle and bone mineral density (BMD) in frail elderly males.	IGF-1, BMD-3 anthropometric (MAC, MCC, and hand grip strength), T score of BMD			X
Monib, S., (2021)	⁴⁰	To evaluate patient's performance using the WHO/ECOG performance status score, CFS, and ASA-PS as the outcomes of management of breast cancer in geriatric population	Demographic, physical and performance status	X		X

Study Author (Year)	Ref	Study Objective(s)	Factors	P	D	S
Rasheedy, D., (2021)	⁴¹	To quantify the effect of the association of frailty, sarcopenia, and malnutrition on other geriatric giants e.g., delirium, cognitive impairment, and functional disability in hospitalized older adults.	Sarcopenia, gender (female are frailer and sarcopenic than male, malnutrition co-occurred with sarcopenia and frailty)	X		X
Alqahtani B. A., (2021)	⁴²	Association between physical frailty and sleep quality	Sleep quality, BMI, and cognition		X	X
Aly., (2020)	⁴³	To detect prevalence and risk factors of UI and its effect of Qol among frail elderly female living in Egypt	Urinary incontinence		X	
Rasheedy, D., (2021)	⁴⁴	To assess the usability of self-administrated geriatric assessment phone application	NA			
Atta Saudi, A. R., (2021)	⁴⁵	To assess the prevalence of frailty and to evaluate the association between physical frailty and cognitive function and determine the most impaired cognitive domains among frail patients.	Age, gender (male), low education and income, comorbidities, BMI, comorbidities, ADL, IADL, and depression	X	X	X
Shokry, M, M.,(2021)	⁴⁶	To detect relation between vit C level and DM control and frailty in elderly patients	Vitamin C			

Study Author (Year)	Ref	Study Objective(s)	Factors	P	D	S
Tawfik, H, M., (2021)	47	To determine the association between pre-operative frailty and the incidence of post-operative complication and to validate Robinson score in geriatric Egyptian undergoing elective cardiac surgery	Age, CHF, DM, readmission	X	X	
Daou, T., (2022)	48	To explore the association between adherence LMD and frailty among older adults in Lebanon	Age, cognitive dysfunction, depression, and polypharmacy	X	X	

P=factors related to the population characteristic; **D**=factors related to disease/ illness; **S**=factors related to social issues; CHF=congestive heart failure; EF=ejection fraction; BMD=body mass density; NA=not applicable; m-FI=modified frailty index; TFI=Tillburg frailty Indicator; BMI=body mass index; ADL=activity of daily living; IADL=instrumental activity of daily living; ER=emergency room; MUC= mid upper arm circumference; MCC= mid calf circumference; QoL=quality of life, DM=diabetes mellitus; UI=urinary infection; IGF-=the IGF-1 including IGF-1 and IGF-2 are single chain polypeptide; MAC=mid arm circumference, CFS=clinical frailty scale, ASA-PS=American society of anesthesiologists physical status, WHO/ ECOG=World Health Organization/ Eastern Cooperative Oncology Group; MMSE=mini-mental stat examination; TUG=time up and go; LMD=Lebanese Mediterranean diet.

Of the 27 articles, nine studies investigated the association between frailty and other domains (medical, geriatric, social conditions, and demographic).^{22,23,29,33,34,36,41,42,48}

Three papers, for example, examined the relationship between frailty and age and sex.^{22,23,37} They found an increase in the prevalence of frailty was associated with advanced age (≥ 80) and that there was a greater prevalence of pre-frailty in females.^{22,23}

Several studies evaluated the relationship between frailty and other factors/conditions.

For example, one study found that vitamin C levels are lower in frail elderly patients with type 2 diabetes mellitus.⁴⁶ Another study reported that higher levels of the pro-inflammatory cytokines, TNF- α , CRP, and especially IL-8 are associated with the development of frailty in Tunisian older adults.³⁴ In addition, one study found an

association between low insulin-like growth factor-1 (IGF-1) and an increased risk of being frail in older Egyptian males.³⁹ Two studies investigated factors associated with a healthy life (e.g. diet, sleep). One study found that higher frailty is associated with poor sleep quality in older adults in Saudi Arabia.⁴² A Lebanese study found that greater adherence to the Lebanese Mediterranean diet (LMD) was associated with a decreased prevalence of frailty.⁴⁸ Other studies investigated the association between medical conditions and frailty in older adults. For example, the associations between congestive heart failure (CHF) and sarcopenia,²⁴ urinary incontinence (UI) and the quality of life among frail older women.⁴³ It was found that higher frailty scores are associated with the presence of any one of these medical conditions.

Of all the studies, one study investigated the use of technology to identify frailty.⁴⁴ Specifically, this study assessed a smartphone app's usability and ability to identify older adults with geriatric conditions. The findings of this study shows that the use of such an instrument could help general practitioners provide pre-comprehensive Geriatric Assessment evaluations in areas with limited access to formal geriatric healthcare services, thereby overcoming some obstacles to identifying geriatric syndromes such as frailty.

3.3.5 DISCUSSION

Our scoping review revealed that the prevalence of frailty among individuals aged 60 and above in ASCs differs depending on the study's setting and possibly the assessment tool employed. The prevalence of frailty in hospital settings varied from 12.7% to 51% and in the community context, the prevalence of frailty ranged from 28.3% to 47.3%, while in seniors' homes, the prevalence was 22.4%. Frailty increased with age, sex (female),

comorbidities, sociodemographic factors (low education, living alone, and poverty), polypharmacy, and cognitive impairments. Frail people have twice as many health and functional impairments as robust people. This outcome matches other international frailty research. For example, a Japanese study utilizing the same frailty measurement tools used in several of the studies included in this review indicated that the prevalence of frailty was 1.9%, 3.8%, 10.0%, 20.4%, and 35.1% for those aged 65–69, 70–74, 75–79, 80–84, and ≥ 85 years, respectively.⁴⁹ Another systematic review of the prevalence of frailty in Latin America and Caribbean countries indicated that frailty prevalence was 19.6% among community dwelling older adults.⁵⁰ An additional systematic review revealed that the overall prevalence of frailty was 10.7% among older adults in Europe and North America where the prevalence of frailty among community-dwelling older adults varied from 4.0% to 59.1%.⁵¹ Overall, the prevalence of frailty in ASCs appears similar to what has been reported in developed and developing countries.

Based on the included studies, compared to developed nations, the average age of the ASC population to develop pre- and frailty is younger. To illustrate, the average age of participants in the studies was 60–89 years, with a few participants being over 75 years old. This may be attributed to frailty-risk factors in this region. For instance, a higher rate of medical (comorbidity) conditions and social (poor education or poverty) factors may increase frailty and mortality.⁵² Other demographic variables that may influence the prevalence of frailty in ASCs include sex (females in ASCs may be less likely to participate in research for cultural reasons), indicating a higher proportion or a greater relative risk of frailty among frail females in ASCs.

Furthermore, pre-frailty prevalence in ASCs also varied based on the study's setting. In hospital settings it ranged from 12.7%–51%, 21.4%–36.4% in the community, and 22.6% in the senior home. These results suggest that identifying a subset at high risk of frailty is slightly greater in ASCs than in non-Arabic nations.^{22,25,28} A systematic review found 4.1% of older persons in 10 European nations were frail, whereas 37.4% were prefrail.⁵² This shows that future increases in frailty prevalence among older ASC residents are likely and raises the question of whether the average lifespan variations between ASC residents and other nations may be related to frailty and pre-frailty levels. It is commonly known that older people in ASCs live with their siblings or relatives rather than in retirement centres, resulting in fewer LTCFs than in developed nations, which could lead to inadequate care for this subpopulation. Thus, screening and prevention programs may help healthcare institutions identify at-risk patients and provide appropriate care.

Advanced age, female sex, greater comorbidities, cognitive impairment, poor nutritional status, and loneliness are social and medical factors that are positively correlated with frailty levels in ASCs, consistent with previous research involving non-ASCs. These findings are consistent with previous research involving non-ASCs. In a Chinese study, for instance, advanced age, gender, and ethnicity were substantially associated with higher levels of frailty.⁵³ Additionally, advanced age, greater than 80 years, and female gender were risk factors for increasing frailty among Indian seniors (83.4%).⁵⁴ Data from a meta-analysis also showed that the prevalence of physical frailty was higher among females in 62 countries.⁵⁵ A study among older adults in the United States found that frailty was more prevalent at older ages, among women, racial and ethnic minorities, those in supportive residential settings, and persons of lower income.⁵⁶ Knowledge of the

complexity of frailty's determinants can facilitate the development of measures for prevention and early intervention, thereby enhancing the quality of life for this subpopulation.

Lastly, this review suggests that frailty in ASCs is highly understudied compared to developed nations. The vast majority of articles were published after the year 2020, which suggests that frailty research uptake in ASCs was slower than in more developed countries. Therefore, research on frailty has only recently begun in ASCs, and/or frailty could be an unnoticed or under-researched topic in this part of the world. This lack of data, information, and records regarding the number and conditions of older adults living with frailty in ASCs may pose a challenge when caring for this subpopulation or during a public health emergency such as the COVID-19 pandemic.⁵⁷

Limitations and strengths

The study employed a robust article search strategy. There were no systematic or comprehensive searches for frailty research in this region. Thus, this review is the first to examine frailty in Arabic countries, according to the reviewers. Reviewers examined English and Arabic journal sites for frailty articles, which is another strength.

This may be more of a challenge than a limitation, but the lack of research on frailty, its impact on older people, and its assessment techniques makes it difficult to compare differences in the concept, measurement, and impact of frailty between ASCs and other nations. As with most frailty research globally, the reviewers only included participants 60 and older; hence, the study did not include studies on frailty in lower age groups (<60). The primary limitation with this review is that a patient/public member was not

engaged in the process. Based on language barriers and education levels it deemed not feasible.

3.3.7 CONCLUSIONS

This scoping research found high levels of frailty and prefrailty in ASCs, which related to geriatric factors and health problems. Most research examined the relationship between frailty and health concerns like CHF, urine incontinence, sleep quality, and diabetes in older persons. Cross-sectional and contemporary studies were predominant. Besides Comprehensive Geriatric Assessments (CGAs), research from ASCs utilized FP, FI, and SOF-FI tests to assess frailty. No studies examined frailty management or improvement. However, frailty has a huge influence on individuals, communities, and economies; therefore, future studies should focus on its occurrence, impact, and management to improve research and care for frail older adults in ASCs.

Evidence from the studies

- Frailty appears to be neglected in ASCs, and research into it is progressing slowly.
- Most studies were cross-sectional and lasted almost a year, so more longitudinal observational studies are needed to assess frailty and pre-frailty prevalence and frail patients' mortality and morbidity.
- No research has examined the etiology, pathophysiology, or genetics of frailty in older persons in ASCs. However, frailty studies will benefit from disparities between industrialized and developing nations.
- No studies adjusted intervention(s) or treatment strategies for frailty in ASCs.

- Due to the high prevalence of frailty and pre-frailty and the lack of research on the feasibility and reliability of screening instruments, Arabic frailty assessment methods must be studied. Translating tools into Arabic may work.
- ASC healthcare systems must network and collaborate with developed-country frailty researchers to devise a crisis management approach for frail older individuals.

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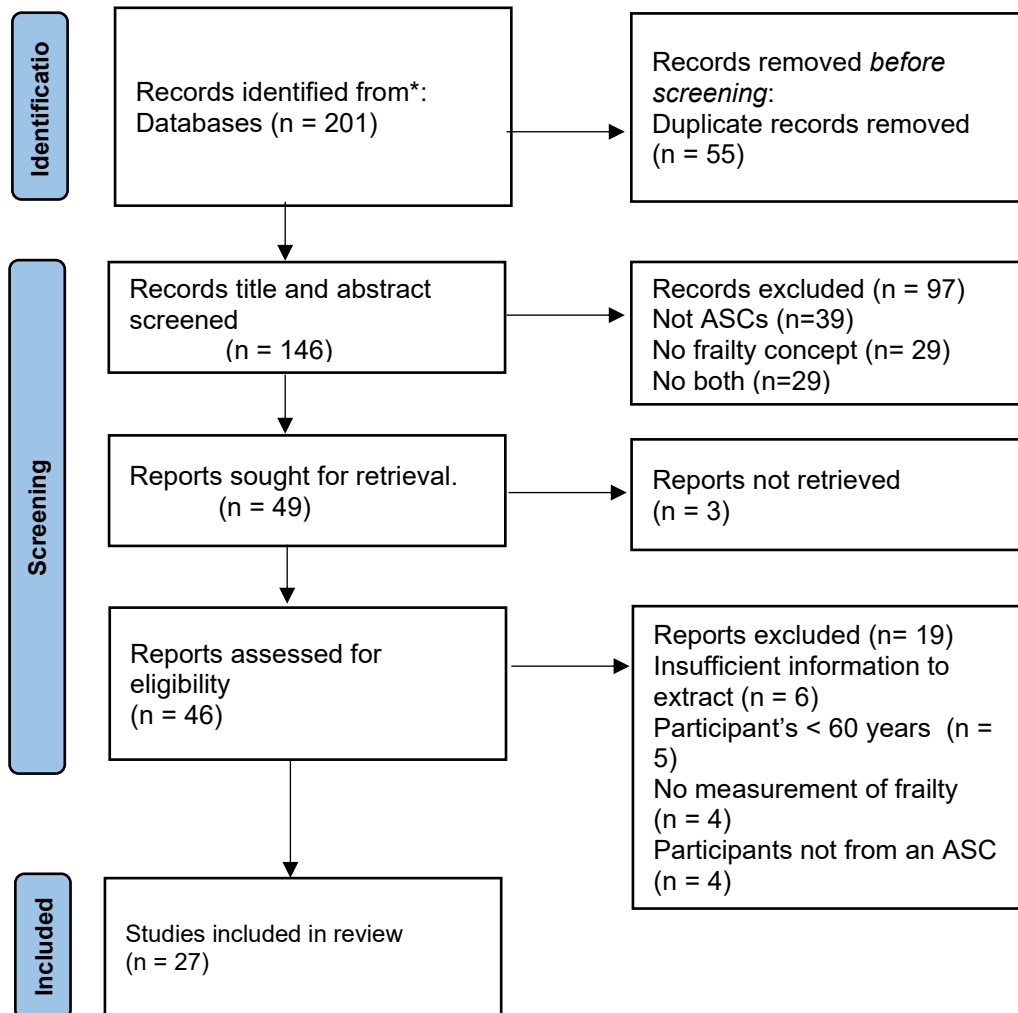
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Figure 1: Article search and screening flowchart



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

CHAPTER 5: ASSESSING THE FEASIBILITY, FACE-VALIDITY, AND RELIABILITY OF THE PICTORIAL FIT-FRAIL SCALE AMONG THE EGYPTIAN POPULATION

5.1 Prologue

The findings of the scoping review in the preceding chapter have revealed the dearth of publications about frailty, its measurements, and factors related to it in Arabic-speaking countries (ASCs). Studies in the review used limited tools to identify frail older adults in specific contexts, but these tools were not used by the frail older adults to assess their own frailty. Additionally, the purpose of utilizing these measurement tools is to identify an older adult's frailty characteristics—whether this older adult is robust, pre-frail, or frail.

Therefore, it was crucial to investigate whether an easy, friendly, and multicultural assessment tool could be used by older adults and healthcare professionals to identify and assess frailty among one Arabic nation, while also evaluating its feasibility and reliability. This section of the thesis was essential to evaluating whether such a tool could be applicable to identify and assess frailty and, consequently, adaptable in this region of the globe.

5.2 Manuscripts information

Status: preparing for submission

Citation: Aly, A., Kendall, S. J., Heinz, S. S., MacKnight, C., Theou, O., & Grandy, S. A. (2023). Assessing the Feasibility, Face-Validity, and Reliability of the Pictorial Fit-Frail Scale (PFFS) Among an Egyptian Population

Permission: Permission to use the Pictorial Fit Frail Scale (PFFS) was obtained from the Geriatric Medicine Research at Dalhousie University, Halifax, NS, Canada (Appendix 1)

Student contribution to manuscript: Amany Aly, with her committee, conceived the idea and research hypothesis. Amany, in collaboration with other authors, designed and performed the research methodology. Amany wrote the first draft of the manuscript and revised all subsequent drafts, which included other authors comments and recommendations.

5.3 Manuscript

5.3.1 ABSTRACT

Background Frailty is a condition of increased vulnerability to adverse health outcomes that affects a substantial portion of older adults, especially in developing nations. Frailty can lead to an increased risk of morbidity and mortality. Thus, screening for frailty has become routine in some parts of the world. Researchers designed the Pictorial Fit-Frail Scale (PFFS) as a user-friendly, universal screening and measurement instrument for frailty in older adults. Although the feasibility, validity, and reliability of the PFFS have been demonstrated in a variety of populations, an investigation in an Arabic population is lacking.

Objectives This study aimed to investigate the feasibility, face validity, and reliability of the Arabic-translated version of the PFFS (PFFS-A) when administered to Egyptian older adults and healthcare providers.

Methods: Three raters (older adults, Medical Residents (MRs), and geriatricians) were asked to complete: 1) the PFFS-A form based on the older adults' current health condition(s); the level of assistance and the time required to complete the form were recorded; 2) A feasibility questionnaire (agree or disagree) regarding the clarity and suitability of the form. To assess the face-validity of the PFFS-A, an additional questionnaire was completed by MRs and geriatricians. The test-retest reliability of the PFFS-A was also evaluated.

Results: A total of 109 participants, including 97 older adults, 6 geriatricians, and 6 MRs, filled out 156 PFFS-A forms. The average completion time (mean (minutes) \pm SD) was 4:47 \pm 1:26 for older Egyptian adults, 2:7 \pm 1:2 for MRs, and 1:9 \pm 0:95 for geriatricians, the mean differences for the three raters were statistically significant ($p < 0.001$). Based on responses, 94.5 % of older adults, 86.17% of geriatricians, and 97.1% of MRs agreed with the six feasibility questions. 69.1% of older adults required assistance in completing ≥ 2 of the scale domains. Context and relevance of scale domains were rated significantly higher by MRs (24 \pm 2.59) than by geriatricians (19 \pm 1.67). The test-retest reliability for the PFFS-A scale was high (ICC = 0.817)

Conclusion: The use of the PFFS was feasible and has face validity for identifying and measuring frailty in the Egyptian population. Its potential clinical application could inform healthcare professionals about the frailty level of their patients, enabling them to make more informed treatment decisions.

5.3.2 INTRODUCTION

By 2050, 22% of the global population is expected to be over the age of 60. ² This is a concern since the risk of frailty increases with advancing age. Estimates suggest that 25% to 50% of individuals over the age of 85 experience frailty.¹ Frailty is widely defined as a physical disability, impairment in basic or instrumental activities of daily living, or basically a higher vulnerability to undesirable outcomes.^{6,3} The most common characteristics of frailty are a decline in function, strength, and physiological reserve, which increases vulnerability to stressors such as minor illnesses, infections, and surgery and results in adverse outcomes including falls, increased dependence, hospitalization, and death.³⁻⁶ Therefore, clinicians must identify frailty in order to detect and manage it. Consequently, clinicians should optimize healthcare for frail people to intervene before the patient develops complex and irreversible frailty-related conditions.

Frail older patients typically exhibit multiple and complex clinical symptoms, making it difficult to identify frailty during a clinical examination.⁷ Researchers have developed several tools to assess frailty. These include tools such as the Fried phenotype (FP) and the Frailty Index (FI).⁹ Identifying and characterizing frailty using the FP and/or the FI is valid but these tools have clinical limitations.¹⁰⁻¹² Specifically, the FP provides a ready clinical operationalization but does not quantify the broad risk of frailty-related adverse outcomes. Whereas the FI can precisely identify the risk but requires additional clinical translation. The other issue with the FI is that it is time-consuming, with no consensus on which deficits should be measured as part of the index and which have a greater impact on frailty.¹³ A

more practical instrument is needed for daily clinical investigations in various healthcare settings.

To address the need for a dependable and easy-to-use frailty measurement tool, the Pictorial Fit-Frail Scale (PFFS) was developed. The PFFS is a practical and user-friendly visual tool that evaluates numerous domains that are related to frailty. It can be completed by the individual themselves, a caregiver, or a healthcare professional.¹⁵ The scale is intended to include the most informative, relevant, and cross-cultural health domains for both sexes, such as memory, weight loss, and the number of medications. Health interventions can be targeted based on the grading of frailty. In Canada and other countries such as Malaysia, Iran, US, and Greece the PFFS has been shown to be a valid and reliable tool that can be used to assess frailty.⁴⁶⁻⁵² However, there are numerous cultures for which the feasibility, reliability, and validity of the PFFS have not been assessed. As a result, there remains a need to determine whether the PFFS can be used in other cultures to assess frailty.

Frailty is not regularly assessed within the Arab population culture. By 2050, the Arab population aged 60 or older is projected to nearly triple²², which will also increase the prevalence of frailty in this population. Therefore, it is necessary to find tools that can identify frailty in this population. One such tool that could fill this role is the PFFS. However, the PFFS has not been translated into Arabic, nor has its feasibility, reliability, and validity been assessed in this population. Therefore, the purpose of this study was to assess the validity and reliability of the Arabic version of PFFS (PFFS-A) for assessing frailty in an Arabic population.

5.3.3 METHOD

Study design and objectives

This was a cross-sectional study designed to determine whether it was feasible to use the PFFS-A in an Arabic culture and whether the PFFS-A was valid and reliable. The primary outcome was to investigate the feasibility and validity of the scale using predetermined surveys. The secondary outcome was to measure the score and frailty index (FI) created by PFFS-A and completed by different raters (older Egyptian adults, MRs, and geriatricians). Data collection took place between March 2021 and March 2022 in Cairo, Egypt. The study was approved by the Dalhousie University Research Ethics Board (2021-5602; Canada) and the local research ethics board at Ein Shams University Hospital, Cairo, Egypt.

Participants

Older Egyptian adults were eligible to participate in the study if they were: 1) Arabic; and 2) 60 years of age or older. Physical or mental impairments (e.g., limb loss, vision loss, memory loss) and activity limitations (seeing, hearing, walking, or problem solving) precluded older persons from completing the PFFS-A, resulting in the omission of study surveys. Older adult participants were recruited from: 1) the ambulatory clinic at Ein Shamis public geriatric hospital, Cairo, Egypt; 2) retirement homes (senior homes); and 3) public entertainment centres for seniors. We recruited geriatricians and MRs from the ambulatory clinic of the Ein Shamis public geriatric hospital. There were no exclusion criteria for geriatricians or geriatric trainee MRs.

Study's Procedures

Participants (older adults, geriatricians, and MRs) provided written informed consent

before completing the PFFS-A and the study surveys. First, participants received the PFFS-A and completed it independently. A study staff member recorded the amount of time and level of assistance required for each participant to complete the PFFS-A. There were three levels of assistance: Level 0 indicated that participants did not need any assistance; Level 1 indicated that participants only needed assistance with the first domain (mood) of the PFFS-A, which involved describing the concept of the domain and explaining its different levels (e.g., the first image to the left indicated a good mood; the second image indicated not feeling good; the third image indicated a bad mood; and the fourth image indicated a very bad mood); and Level 2 indicated that participants needed assistance with describing and explaining two or more domain concepts and levels. After completing the PFFS-A, the participants filled out a survey consisting of sociodemographic questions for older adults and feasibility questions for the PFFS-A, along with a comments section at the end. We asked a subset of older participants, who had a follow-up appointment within 14–21 days of initially completing the PFFS-A, if they would complete the PFFS-A again during their follow-up medical appointment. Geriatricians and MRs completed a PFFS-A for an older adult who did not complete the form themselves. The time and level of assistance required to complete the PFFS-A were recorded. After completing the PFFS-A, geriatricians and MRs completed the surveys, which comprised feasibility and face validity questions. Geriatricians and MRs were asked to complete a second PFFS-A for any of the participants that they evaluated who returned for follow-up appointments within 14–21 days at the time of the visit.

The Pictorial Fit-to-Frail Scale (PFFS)

The PFFS includes 14 health domains: function, mobility, memory, vision, hearing, bladder control, mood, number of medications, balance, social connection, unintentional weight loss, daytime tiredness, aggression, and pain level. Each of these domains has different levels, each represented by a picture. The levels of each domain range from fit (score = 0) to severely poor functioning (score = 4).¹³ Permission to use the PFFS form was obtained from the developers in the Division of Geriatric Medicine, Nova Scotia Health (NS, Canada). We translated and culturally adapted the PFFS following the standard guidelines developed by Beaton et al.²² The first author of the manuscript (AA) and an Egyptian geriatrician translated the PFFS into Arabic. Next, multiple bilingual (English/Arabic) healthcare professionals in Canada reverse translated the PFFS Arabic (PFFS-A) version back into English. A panel of experts, consisting of a qualified language interpreter and two geriatricians, reviewed the back-translated English version of the PFFS-A to ensure linguistic and experiential equivalence with the original PFFS. (Appendix 1).

The participant was asked to select the level of each domain that best reflected the older adult's current situation. Once the subject completed the scale, the score for each frailty domain were summed to obtain the total frailty score. The total score was then divided by 43 (the maximum potential total score) to determine the FI score, where a higher FI indicates greater frailty levels. Frailty thresholds were used to differentiate between non-frail (0 to 0.1), pre-frail (>0.1 to 0.21), moderately-frail (>0.30 to 0.35), and severely frail (0.45+).¹⁵

Study's Surveys

The feasibility, face validity, and reliability of the PFFS-A were assessed using a two-part survey during the initial visit. The surveys were written in Arabic. Part 1 included sociodemographic questions as well as questions about the ease of use (e.g., clarity of the PFFS-A instructions, the appropriateness of font and picture sizes, the ease of understanding the pictures on the scale, and the level of comfort while completing the scale). Older adults, MRs, and geriatricians completed Part 1. Of note, the geriatricians and MRs completed the sociodemographic questions for the older adults assessed. The geriatricians and MRs then completed Part 2 of the survey. The purpose of Part 2, which consisted of a series of questions, was to evaluate the practicability, comprehensiveness, degree of patient frailty representation, and inclusiveness of the PFFS-A domains. All questions in Part 2 were answered using a Likert scale, where a score of 1 indicated strong disagreement, a score of 5 indicated strong agreement, and a score of 3 represented a neutral response. (Appendix 2).

5.3.4 DATA ANALYSIS

IBM SPSS version 27 was used for data analysis. Frequencies (percent) were calculated for sociodemographic variables. Descriptive statistics (mean \pm SD) were calculated for frailty score, frailty index, time to complete the PFFS-A and the level of assistance required. A one-way ANOVA was conducted to determine if there was a significant difference between level of assistance and completion times for the three rater types (older adult, geriatrician, MR). A Tukey's post hoc test was used to determine if the differences between groups differed significantly ($p < 0.05$). A chi-squared test of

independence was conducted to determine if the assistance level needed to complete the scale is independent of rater type. Responses to the validity questions (Likert scale) were analyzed using a Wilcoxon Rank-Sum test to determine if there is a difference between the scores for the MRs and geriatricians. Intraclass correlation coefficients (ICCs) with 95% confidence intervals (CIs) were used to assess test-retest reliability of the PFFS-A. This was estimated based on single measures, absolute agreement, and a two-way mixed effects model. All statistical tests were evaluated at a significance level of 0.05.

5.3.5 RESULTS

Description of study participants

A total of 109 participants (97 older adults, 6 geriatricians, and 6 MRs) completed a total of 156 PFFS-A for older adults. Ninety-seven PFFS-A were completed by older adults for themselves, and an additional fifty-nine PFFS-A were completed by geriatricians (n = 25) and MRs (n = 34) for older adults who did not complete the form for themselves. Of the 97 older Egyptian adults, 62.8% were recruited from the outpatient clinic, 32.1% from entertainment centres, and 5.1% from retirement homes. All PFFS-A completed by geriatricians and MRs from Ein Shamis public geriatric hospital were for older adults that attended the outpatient clinic. For the 156 PFFS-A completed, approximately half of the older adults (51.3%) were between 65 and 74 years old, 23% were between 75 and 84 years old, and 2.6% were over 84 years old. Additionally, 51.3% were female, 33.3% had a university degree, 42.9% rated their overall health as good, and 49.4% were on 5 to 9 medications.

Complete older adult demographics are presented in Table 1 and were collected using the form listed in are presented in Table 1.

Table 1 : Demographics for the 156 older adults

	Variable	N (%)
Sex	Male	76 (48.7)
	Female	80 (51.3)
Age	<65	35 (22.4)
	65-74	80 (51.3)
	75-84	37 (23.7)
	>84	4 (2.6)
Education	No education or primary school	71 (45.5)
	Secondary schooling	33 (21.2)
	Undergraduate or graduate level	52 (33.3)
Patient Health Status	Poor	9 (5.8)
	Acceptable	38 (24.4)
	Good	67 (42.9)
	Very Good	42 (26.9)
Number of Medications	0-4	28 (17.9)
	5-9	77 (49.4)
	>9	51 (32.7)

PFFS-A Feasibility

To evaluate the feasibility and acceptability of the PFFS-A among older adults and healthcare providers, the level of assistance and time needed to complete the PFFS-A by the 109 participants (97 older adults, 6 MRs, and 6 geriatricians) were calculated. In addition, the percentages of participants who agreed (yes) with the six questions of feasibility was calculated. The following is a presentation of the findings:

1- Level of assistance

Of the 97 older adults who completed the PFFS-A, 69.7% needed level 2 assistance (assistance with all domains). Most MRs (83.3%) needed level 1 assistance (assistance

with the first domain), but none required level 2 assistance. The six geriatricians who completed the scale did not need any assistance. (Table 2)

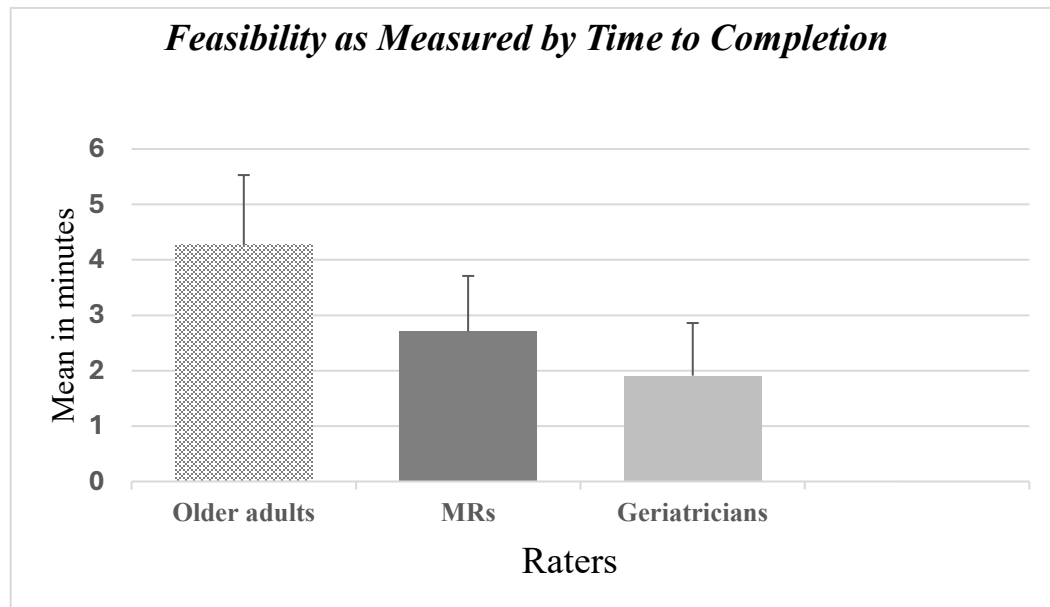
Table 2: Feasibility as PFFS-A level of assistance

Level of Assistance Required	Older Egyptian Adult N (97)	MRs N (6)	Geriatrician N (6)
Level 0	7	1	6
Level 1	23	5	0
Level 2	67	0	0

Level (0) = no assistance with any domain; Level (1) = explain the first domain concept and levels; Level (2) = explain the concepts and levels of ≥ 2 domains.

2- Time of completion

The time required to complete the PFFS significantly difference between older Egyptian adults, MRs and geriatricians The older adults (n=97) took the longest time to complete the scale (4.47 ± 1.26).



The variances of the three groups were not significantly different, as tested by Levene's test ($p > 0.05$). The differences in means, on the other hand, were statistically different, $F(2, 153) = 60.873, p < 0.001$.

Figure (1) completion by the three group Time of the PFFS-A by three raters

3- Agreement and disagreement on feasibility questionnaire.

To assess whether it was feasible for Egyptian older adults and healthcare providers to complete the PFFS-A, the raters responded agree or disagree to six feasibility statements. A full agreement (6 out of 6) on the scale's feasibility statements was 94.5% ($M = 5.67$, $SD = .45$), 97.17% ($M = 5.83$, $SD = .41$), and 86.17% ($M = 5.17$, $SD = 1.17$) by older Egyptian adults, MRs, and geriatricians, respectively. The MRs agreed slightly higher than the other two group raters on the feasibility of the PFFS-A.

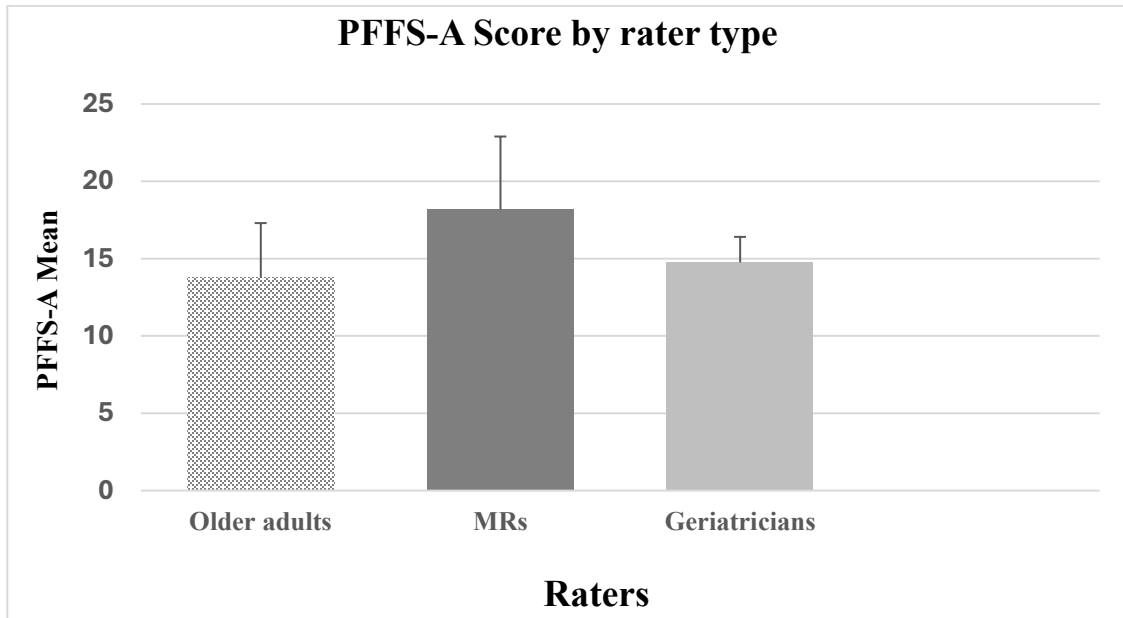
For participants who did not agree with all six feasibility statements, disagreements were limited to one or two of the six statements. Specifically, statement number three "The pictures were easy to understand." was the statement most frequently disagreed with by the three groups followed by statement number one "The instructions of the scale were clear."

In general, the PFFS-A has a high level of feasibility and applicability for identifying frail older adults in the Egyptian population.

PFFS-A scoring and Frailty Index (FI) results

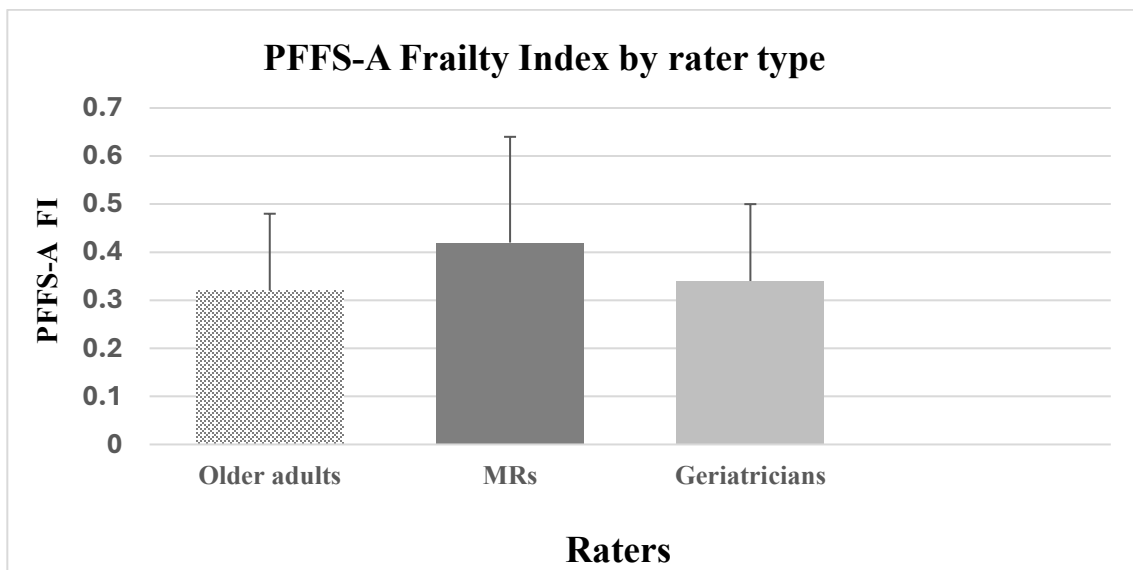
When older adults ($n=97$) completed the PFFS-A for themselves their score was (mean \pm SD) 13.78 ± 7.04 . When the PFFS-A was completed for an older adult by MRs ($N = 6$) who completed 34 scales and geriatricians ($N = 6$) who completed 25 scales the scores were 18.18 ± 9.44 and 14.76 ± 3.3 , respectively. Similarly, the FI for older adults who rated themselves was lower (0.32 ± 0.16 ; indicates moderate frailty) than MRs (0.42 ± 0.22 ; severe frailty) and geriatricians (0.34 ± 0.16 ; moderate frailty). (Figures: 3 & 4)

These results suggest that older adults score themselves lower than an MR or a geriatrician. (Figure 2 & 3)



MR=medical resident; PFFS-A=Pictorial Fit Frail Scale-Arabic

Figure (2) PFFS-A scores by older adults, MRs, and geriatricians



MR=medical resident; PFFS-A FI=Pictorial Fit Frail Scale-Arabic Frailty Index

Figure (3) PFFS-A Frailty Index by older adults, MRs, and geriatricians

PFFS-A Face validity

To assess the PFFS-A's face validity, geriatricians and MR answered six questions using a Likert scale. Table 3 displays the median scores of clinicians on the validity questions. The findings show that MRs tend to score higher on all five Likert questions; however, there was no statistically significant difference between MRs and geriatricians on any of these questions ($p > 0.05$). Nonetheless, there was a statistically significant difference ($p < 0.05$) between the total scores for the five Likert questions, with MRs (Mdn = 24.0) believing the scale is more suitable and comprehensive for assessing frailty than geriatricians (Mdn = 19.0, $p = 0.017$). (Table 3).

Table 3: Likert scale by MRs and Geriatricians

	Likert scale Questions	MRs N=6 (Mdn)	Geriatrician N=6 (Mdn)	P- Value
Q1	Is the Pictorial Fit to Frail Scale suitable for assessing frailty	4.0	4.0	0.49
Q2	Is the content of the Pictorial Fit to Frail appropriate for assessing frailty?	5.0	4.0	0.18
Q3	The scale domains represent all the patient's critical domains of health aspects as they pertain to frailty.	5.0	3.5	0.07
Q4	The domains shown on the Pictorial Fit to Frail Scale are representative of the patient's health condition.	5.0	4.0	0.18
Q5	Enough levels for each domain are present to represent the patient's ability.	5.0	4.0	0.54
	Total	24.0	19.0	0.02*

Q, Question; MRs, Medical Residents

*p-value significantly different <0.05

The PFFS-A test-retest reliability

For 82 older adults two PFFS-A's were completed (52% of initial sample) to determine test-retest reliability. One during their initial visit and the second, 14-21 days after completing the first PFFS-A. The results indicated a high degree of reliability for all participants (ICC = 0.817, 95% CI:.0730 to.0878). The ICC with CI for each rater is shown in Table 5. Reliability was lower when older adults completed the PFFS-A themselves in comparison to when the PFFS-A was completed by a MR or geriatrician. (Table 4)

Table 4: PFFS-A reliability by older adults, MRs, and Geriatricians

Rater (N)[‡]	ICC (95% CI)
Older adults (63)	.740 (.604, .834)
MRs (13)	.999 (.997, 1.000)
Geriatricians (6)	1.000

[‡]Number of the second PFFS-A form completed by the same rater.

5.3.6 DISCUSSION

Given the rapid growth of older adults in Arabic countries, there is a need to identify frail members of this population. To do this, a standard assessment of frailty is required. For this study, the researchers modified the Pictorial Fit-Frail Scale (PFFS-A) for use by Egyptian older adults and healthcare professionals (translated to Arabic) and then assessed the feasibility, validity, and reliability of use for this tool. Overall, Egyptian older adults, MRs, and geriatricians were able to complete the PFFS-A. Older Egyptian adults required more time and assistance to complete the PFFS-A in comparison to MRs and geriatricians. The PFFS-A showed strong face-validity as indicated by the responses

from MRs and geriatricians. This study also showed that test-retest reliability is high for the PFFS-A. Based on these results it appears that the PFFS-A is suitable tool that can be used to assess frailty in older Egyptian adults.

These results are comparable to those of other studies that evaluated the PFFS's feasibility in terms of completion time and required assistance. Specifically, Egyptian older adults required 4.47 ± 1.26 minutes on average to complete the scale, whereas healthcare professionals required less time (2 minutes) and assistance to complete the scale, which is comparable across cultures¹⁵ and healthcare contexts.¹⁶⁻²⁰ For example, when the PFFS was used in a Canadian healthcare setting, patients took longer to complete the scale and required more assistance when compared to nurses and geriatricians (the mean completion time was (mins:sec) $4:38 \pm 2:09$, $1:05 \pm 0:19$, and $0:57 \pm 0:30$ for patients, nurses, and geriatricians, respectively).¹⁶ Thus, the times to completion between Egyptians and Canadians were similar. In contrast to older adults from other cultures who required minimal assistance to complete the scale, most Egyptian older adults required full assistance (we could not compare the level of assistance for Malaysian or Iranian studies, as it was measured).

The reason for requiring full assistance with all domains is to better understand the concept of each domain and its different levels. Moreover, due to cultural beliefs, some older adults were reluctant to respond to certain PFFS-A domains, particularly urinary incontinence and social activity. However, having the conversation in a private setting was an effective strategy for increasing the overall PFFS-A completion rate. Notably, the fact that older Egyptian adults required additional time and comprehensive assistance to

complete the scale does not skew the results of the scale's applicability to the Egyptian population, but it implies the feasibility of the PFFS-A being administered by older Egyptian adults with the assistance of a healthcare provider.

Although the results of the six feasibility statements show that the PFFS-A demonstrated a high level of consensus agreement among the three groups of raters regarding the feasibility, practicability, and relevance of the scale's domains, a few participants were concerned about understanding the images of one domain's level, specifically domain number 7 (daytime tiredness), where they believe that tiredness could last for many hours throughout the day and cannot pinpoint when they feel tired or exhausted. Nevertheless, the results of the high level of feasibility for the scale reflect the appropriateness of scale characteristics such as image size, domain-level thoroughness, and instruction clarity. These findings are consistent with those of other studies evaluating the validity and applicability of the PFFS in comparison to other frailty measurement instruments. The findings of these studies show that the PFFS demonstrated high construct validity and feasibility compared to the other frailty measurements (e.g., a comprehensive geriatric assessment (CGA) and the Frailty Questionnaire (FRAIL) scale) when used in a thoracic surgery department and with older surgical patients in the United States.²⁴ Another study demonstrated the applicability of the scale among individuals with modest cognitive impairment, enabling clinicians to comprehend the areas of concern identified by older adults.¹⁷ Furthermore, the scale demonstrated high feasibility and reliability when utilized by patients, caregivers, and healthcare professionals in different cultures and when translated into different languages. For instance, the Malay version of the PFFS scale proved to be a practical and reliable instrument for identifying and assessing frail older

individuals, and it is intended for use in primary care settings in Malaysia.^{18,19} In addition, the scale demonstrated a high level of consistency and specificity for measuring frailty in hospitalized older Iranians.²⁰ In addition, the study's findings showed that older adults scored themselves lower than MRs and geriatricians (13.78 ± 7.04 for older adults, 18.18 ± 9.44 for MRs, and 14.76 ± 9.31 for geriatricians). These findings align with those of another study, where patients, nurses, and geriatricians reported PFFS mean scores of 9.0 ± 5.7 , 11.2 ± 4.5 , and 11.9 ± 5.9 , respectively.¹⁵ This may be because older adults perceive themselves to be healthier and more active than healthcare providers believe them to be.

Overall, MRs and geriatricians had similar levels of agreement with the Likert scale statements regarding the face validity of the PFFS-A. Nevertheless, there was a discernible distinction between certain statements, specifically statements 3 (if the scale presents all the critical domains of health aspects of frailty) and 4 (if the PFFS-A domains are representative of the patient's health condition), which directly relate to the scale's comprehensiveness and inclusiveness. MRs rated these two statements higher than geriatricians. MRs may believe that the PFFS-A domains are exhaustive and cover all aspects of frailty. However, geriatricians argue that other health factors should be considered when screening for frailty, without specifying the missing or necessary domains. The scale did not receive any suggested modifications based on the general comments from the MRs and geriatricians. These beliefs of the Egyptian clinicians regarding the PFFS-A's face validity are not cause for concern. It may suggest that Egyptian HCPs require more in-depth knowledge of the concept of frailty and its multifactorial domains and/or additional training on how to use frailty measurement

tools. In contrast, comments from a subset of older adults raise serious concerns. For instance, some older individuals advocated for the addition of domains like sleep time, duration, and quality, as well as other domains like bowel movement (e.g., constipation). This concern suggests additional considerations for future research on the content validity of the scale, which may include the addition of additional domains to bolster its content validity.

We assessed the test-retest reliability of the PFFS-A for older adults, MRs, and geriatricians in this study. Despite potential disparities in rater educational level, training, and experience, we discovered that the PFFS has high test-retest reliability among the three raters. These findings are consistent with those reported in the systematic review, which found PFFS ICCs of 0.78 (Pearson correlation of 0.77) for patients and 0.88 (Pearson correlation of 0.87) for nurses.¹⁶

Although other studies aimed at validating different frailty instruments in Arabic-speaking countries²⁵⁻²⁷ as well as other instruments have been used to assess frailty among the Egyptian population²⁷, to the author's knowledge, this is the first study to evaluate the feasibility and reliability of a visual frailty scale in the Arab world.

Strength and limitations

This study has numerous strong points. As stated previously, this is the first investigation into the feasibility of using a visual scale to identify frail older adults in Egypt. The study encompassed a variety of settings (ambulatory clinics, entertainment senior clubs, and senior homes), facilitating educational and socioeconomic diversity among the

participants. Another strength was the consistency of data collection, as the first author (AA) was the only one who interviewed participants and collected the study data.

The COVID-19 pandemic posed the greatest obstacle to conducting the study. Many patients at the ambulatory clinic were in a rush to undergo additional investigations (e.g., COVID test, chest X-ray, or hospitalization), so only those who could return for a second visit and complete the PFFS-A twice for the reliability test were included in the study.

However, we believe that this does not skew the results in such a way as to suggest that the people included in this assessment were more "ill" than the general population because they required a second visit.

In addition, explaining the purpose of the scale and the concept of frailty to older individuals required additional time, which may have been more of a cultural restriction than a limitation. Furthermore, few healthcare professionals were available to contribute to the study; most MRs and geriatricians were caring for quarantined patients and inpatients. Additionally, inter-rater reliability was not feasible because the study was conducted in different settings and there were no healthcare professionals available to evaluate patients at the entertainment centre or retirement home. Therefore, only one rater (either an older adult, an MR, or a geriatrician) evaluated each participant. A lack of trained geriatric nurses with experience in age-related syndromes such as frailty limited the contribution of nurses to the study. Moreover, due to COVID's isolation, we were only able to recruit a small number of older adults from care home facilities. Moreover, although the interval between the two reliability measurements was between 14 and 21 days, there is a possibility that some participants' health may have improved after their acute illness, resulting in higher PFFS-A scores. However, we could contend that

participants in the second assessment were not more "ill" than other participants because they required a second visit; rather, they came for follow-up visits or to confirm the results of certain medical investigations.

5.3.7 CONCLUSION

This study revealed that the PFFS-A is a valid and feasible screening and measurement tool for frailty in older Egyptian adults when administered by older adults or healthcare providers. Older adults required more time to complete the scale with more assistance than HCPs, suggesting that Egyptian older adults need more instructions to complete the scale or the assistance of a healthcare provider for those with low educational levels. In addition, older adults rated their level of frailty as lower than HCPs. This study has the potential to persuade health care providers and decision-makers to implement this frailty measurement tool in healthcare settings. Identifying frail older adults will facilitate early frailty detection, which can aid in the prevention or management of frailty and enhance frail older adults' wellbeing.

Key Points

- The PFFS-A is a feasible and reliable instrument for identifying frailty when used by older adults, geriatricians, and MRs from a diverse cultural background among Egyptian population.
- Older Egyptian adults are able to complete the scale, with many requiring full assistances suggesting the need of a healthcare provider to complete the scale.

- Older Egyptian adults completed the scale in under 5 minutes MRs in under 3 minutes, and geriatricians in under 2 minutes.
- Egyptian healthcare providers (MRs and geriatricians) deemed the PFFS-A to have high face validity for identifying and measuring frailty among older Egyptians.
- The PFFS-test-retest A's reliability by the three study raters and in different Egyptian geriatric settings is excellent.

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Appendix. 1: The PFFS-A

التعليمات: هذه وحدة قياس المقصود بها قياس حالتك العادية باستخدام صور مرتبة من الأفضل للأسوأ و الخاصة بحالات مختلفة لكل حالة إختيار صورة واحدة الأقرب لحالتك العادية وضع علامة (x) تحت تلك الصورة. لا يوجد إجابة



صحيحة أو خاطئة.مثال: إذا كان نظرك العادي أقرب للصورة الثانية ضع علامة (x) كما هو موضح

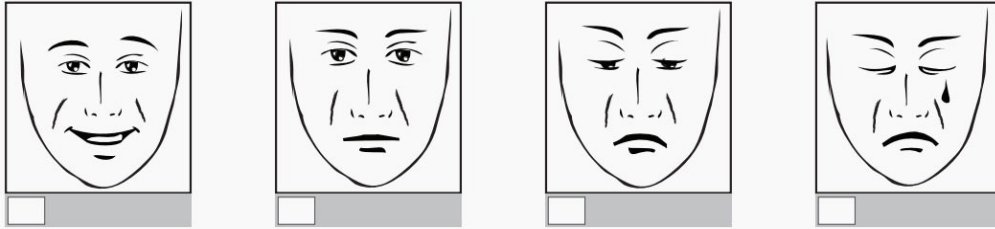


الإسم: _____

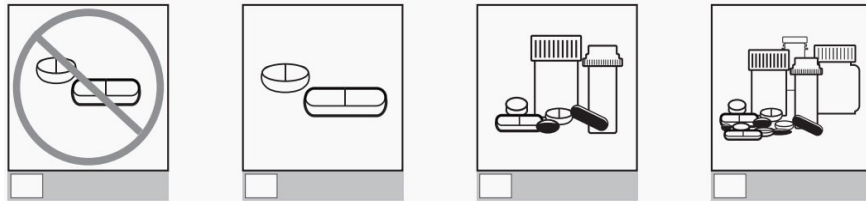
التاريخ: _____

الأفضل ← ————— → الأسوأ

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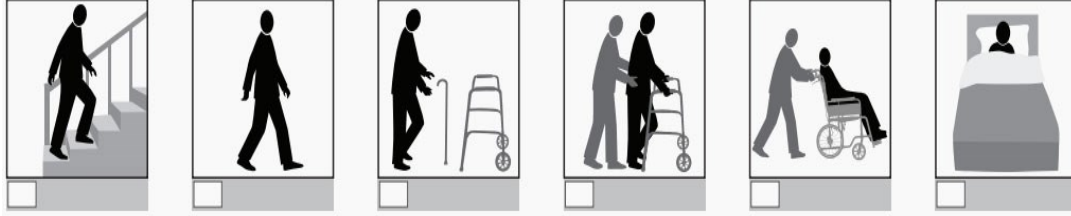
2. عدد الأدوية



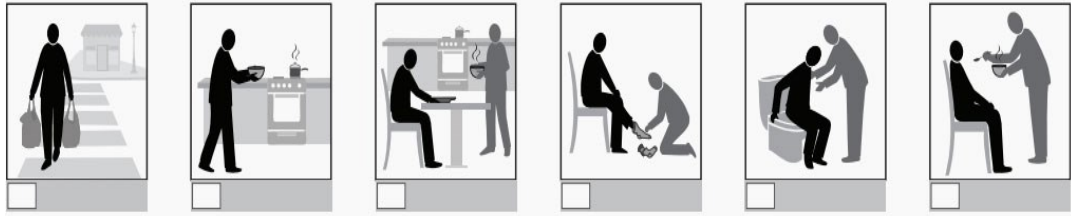
ضع علامة (x) علي صورة واحدة الأقرب الي حالتك العادية لكل فئة

الأفضل ← ————— → الأسوأ

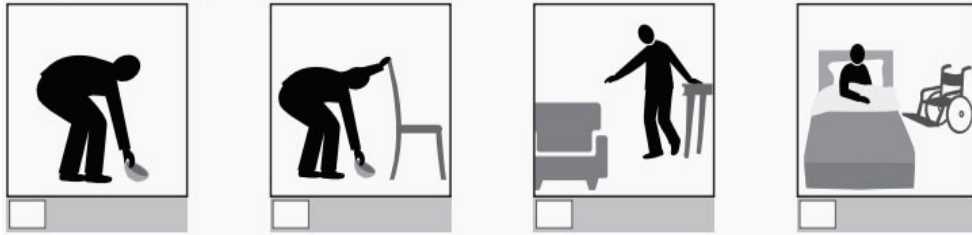
3. إمكانية التنقل



4. القدرة الوظيفية



5. القدرة علي الإتزان



ضع علامة (x) علي صورة واحدة الأقرب الي حالتك العادية لكل فئة

الأفضل

الأسوأ

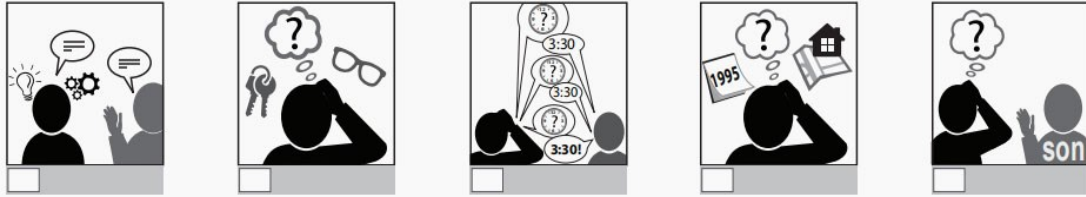
6. التواصل الاجتماعي



7. الإحساس بالتعب خلال النهار



8. القدرة علي التفكير و الذاكرة



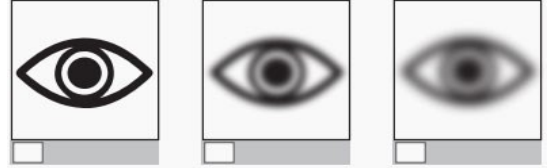
ضع علامة (x) علي صورة واحدة الأقرب الي حالتك العادية لكل فئة



12. فقدان الوزن الغير متعمد



9. الرؤية (بالنظارات إذا لزم الأمر)



13. درجة التعصب و الإنفعال



10. القدرة علي السمع

(بالسماعة المساعدة إذا لزم الأمر)



14. التحكم في البول



11. الإحساس بالألم



Appendix (2) *The feasibility survey for older Egyptian adults, MRs, and geriatricians*
(survey 1)

Part (1) information about the participant

1- *Please cycle your role:*

- a- Patient
- b- Healthcare Provider (HCP)
 - 1. Geriatrician
 - 2. Medical residents

2- *Your research setting:*

- 1- The Outpatient Clinic at the geriatric hospital
- 2- The Senior home
- 3- The Senior club

Information about the patient

3- *Please cycle the following questions*

- 1. Sex of the patient
 - a. Male
 - b. Female
- 2. Age of the patient
 - a. <65
 - b. 65-74
 - c. 75-84
 - d. 85+
- 3. Education level of the patient
 - a. Low
 - b. Secondary
 - c. high
- 4. How would you rate the overall health?
 - a. Excellent
 - b. Very good
 - c. Good
 - d. Fair
 - e. Poor

Part (2) Information about the PFFS scale

Please give your overall opinion about the Pictorial Fit to Frail Scale. Please mark in one of the boxes indicating your agreement or disagreement with the following statements.

	The PFFS's Specification	Agree	Disagree
1	The instructions of the scale were clear		
2	The scale font size was appropriate		
3	The pictures were easy to understand		
4	The picture size was appropriate		
5	I was comfortable while I am filling the Scale		
6	It was easy to fill the scale		

Please add any other comments/concerns/questions you have about the scale (if you need additional space continue back of page).

Appendix (3) *Likert scale to assess the face validity of the PFFS-A by HCPs*
(survey 2)

Please give your overall opinion about the Pictorial Fit to Frail Scale. Please choose on the numbers (1-5) indicating your agreement with the following statements

1) Is the Pictorial Fit to Frail Scale suitable for assessing frailty?
Not Suitable **Extremely Suitable**
1 2 3 4 5

2) Is the content of the Pictorial Fit to Frail appropriate for assessing frailty?
Not Appropriate **Extremely Appropriate**
1 2 3 4 5

3) The scale domains represent all the patient's critical domains of health aspects as they pertain to frailty.
Not Suitable **Extremely Suitable**
1 2 3 4 5

4) The domains shown on the Pictorial Fit to Frail Scale are representative of the patient's health condition.
Not Suitable **Extremely Suitable**
1 2 3 4 5

5) Enough levels for each domain are present to represent the patient's ability.
Not Suitable **Extremely Suitable**
1 2 3 4 5

CHAPTER 6: EGYPTIAN CLINICIANS' PERSPECTIVES OF FRAILTY AND FRAILTY MEASURES

6.1 Prologue

The findings of the previous chapter indicate that the Arabic version of the PFFS frailty instrument is applicable to the Egyptian population. However, non-geriatricians contribute to the diagnosis, treatment, and management of frail older individuals in various healthcare settings in Egypt and around the world. Consequently, it was essential to investigate the breadth and depth of knowledge about frailty in other specialties, as well as how clinicians perceive the concept of frailty, its measurement tools, and what healthcare settings may be appropriate or inappropriate for screening frailty. This section of the dissertation was crucial for comprehending how Egyptian clinicians perceive frailty.

6.2 Manuscripts information

Status: preparing for submission

Citation: Aly, A., MacKnight, C., Theou, O., Grandy, S. A. (2023). Egyptian clinicians' perspectives of frailty and frailty measures

Permission: permission from REB needed to conduct the survey (REB file #: 2022-6294)

Student contribution to manuscript: Amany Aly, with her committee conceived the idea and research hypothesis. Amany in collaboration with other authors, designed, and performed the research methodology. Amany wrote first draft of the manuscript and revised all subsequent drafts that include other authors comments and recommendations.

6.3 MANUSCRIPT

6.3.1 ABSTRACT

Background: Egyptian geriatricians understand the importance of frailty, a well-known age-related syndrome. Nonetheless, there is a paucity of geriatricians in Egypt; accordingly, most Egyptian older adults seek medical advice from other specialties. At present, it is unknown whether or not Egyptian non-geriatric clinicians are familiar with the concept of frailty and its complications. Thus, Egyptian non-geriatric clinicians may neglect or undervalue frailty. This study investigated how Egyptian non-geriatric clinicians conceptualize frailty, their preferences for measuring frailty in a variety of healthcare settings, and whether differences exist between different medical specialties.

Method: Sixty participants, including 40 consultants (i.e. doctors) and 20 medical residents (MRs) from four departments (cardiology, neurology, orthopaedics, and general surgery), were recruited from Ein Shamis general hospital in Cairo, Egypt. Data was collected using a structured written questionnaire with yes-or-no questions about familiarity with frailty and its measurements. Additionally, a Likert scale (ranging from strongly disagree to strongly agree) was used to determine the level of agreement regarding the importance of identifying and assessing frailty and relevant healthcare settings for its measurement.

Results 66.7% of consultants and 15% of MRs were familiar with the term "frailty". However, 72% of consultants and 65% of MRs reported the ability to identify frail patients during clinical investigation. Only 22% of consultants and 5% of MRs were aware of frailty assessment tools. 56.7% of clinicians strongly agreed that frailty should be measured, while 46.7% agreed on patient's frailty could impact clinical investigation. 30% ranked primary

care as the most important setting for assessing frailty, while 30% ranked the emergency department as the least important setting.

Conclusion Egyptian non-geriatric clinicians may be aware of frailty as an age-related syndrome but are not excessively familiar with the term "frailty" or the tools to measure it. However, they support the incorporation of frailty measurement into clinical practice in certain healthcare settings.

6.3.2 INTRODUCTION

The global population is rapidly getting older. In 2004, the global population of senior citizens was approximately 461 million; by 2050, it is anticipated to reach 1.5 billion.¹ Nearly 1.2 billion of the expected 1.5 billion people age 65 or older will live in today's less developed regions.¹

Frailty is a syndrome associated with aging that negatively impacts the quality of life and well-being of older individuals and increases their risk of hospitalization, accidents, fractures, and surgical complications.²⁻⁵ In clinical practice, the traditional disease-centred treatment paradigm presents difficulties for medical practitioners caring for older patients with multiple chronic comorbidities and interrelated health concerns.⁶⁻⁸ Therefore, recent trends indicate that geriatricians are no longer solely responsible for administering care to older adults individuals who are frail and non-geriatricians in other medical specialties are required to contribute to the management of frail older patients' health issues in order to optimize their care.⁹⁻¹²

This may represent an important transition in the care of older, vulnerable individuals and raise some concerns. For example, without consulting a geriatrician, non-geriatric healthcare professionals such as doctors, nurses, and paramedics sometimes diagnose or treat frail older adults based solely on their subjective clinical judgment.¹³⁻¹⁵ A non-geriatrician's determination of whether an older adult patient should be hospitalized or managed in the community may not

correlate well with perceived risks.^{16,17} Moreover, if these frail older adults are admitted to the hospital, they are likely not confined to the geriatric medicine ward; they are dispersed throughout standard medical wards.^{18,19} In addition, if other healthcare professionals evaluate and treat older adults' patients without geriatrician input, certain geriatric conditions may be missed or underestimated.²⁰ So, it is important to screen for or assess frailty in many healthcare settings, not just those for older people, putting frailty detection into clinical practice requires a full understanding of the idea in order to provide the best care for frail patients.

Egypt, one of the Middle Eastern and North African (MENA) nations with the highest population density (1.2 percent of the world's population), faces the issue of an aging population.²¹ Due to the dearth of geriatricians and facilities for the care of older adults in Egypt, this subpopulation frequently seeks medical advice from other specialists, most likely non-geriatricians.²² There are accordingly numerous concerns among non-geriatricians' specialties regarding the level of understanding and conceptualization of frailty in Egypt. Therefore, it is necessary to investigate how clinicians in different Egyptian specialties conceptualize of frailty.

The purpose of this study was to determine how non-geriatric physicians in Egypt conceptualize frailty, in particular their level of knowledge of the term frailty, its clinical symptoms, awareness regarding the readily available frailty assessment tools, preferences for learning about the frailty status of their patients, and their perceptions of the healthcare settings in which frailty should be screened for or assessed.

6.3.3 STUDY DESIGN

A quantitatively structured questionnaire was developed to assess participants' knowledge and perceptions of the term and concept of frailty (Appendix 1). The Human Research Ethics

Committee at Dalhousie University granted ethical approval (REB#: 2022–6294; Canada).

Participants from Ein Shamis University General Hospital in Cairo, Egypt, included consultants (specialists) and medical residents (MRs, defined as graduate medical school students assigned to a specific specialty who completed their undergraduate coursework) from four specialties (cardiology, surgery, orthopedics, and neurology) who were invited to participate in the study via hospital departmental posters. Once a participant was consented, they were given the questionnaire, with no time limit, to complete.

The questionnaire consisted of twelve questions. Section one contains four categorical (yes/no) questions aimed at assessing the participant's overall knowledge of frailty and how likely they are to identify symptoms of frailty during their clinical investigation. The second section consisted of a five-category Likert scale (1 = strongly disagree, 5 = strongly agree) to assess the participants' level of agreement or disagreement with predetermined statements regarding identifying and measuring frailty.

In the third section, participants identified clinical healthcare settings where frailty screening and measurement should occur. Participants were also asked to identify the healthcare setting(s) they believed were most and least important for implementing tools to screen and/or measure frailty during clinical investigation. Participants were also able to provide verbal comments, but these were not mandatory.

6.4 DATA ANALYSIS

Data were analysed using SPSS version 27. Frequencies and proportions were used to describe categorical variables. Chi Square tests of homogeneity were conducted to assess the significance of the differences in various proportions between the four specialties. A comparison of the four specialties using logistic regression was performed to determine if there was a statistically

significant difference between the binary variables (yes/no). Using p-values of .01, the Kruskal-Wallis H test (mean) was used to determine whether there were statistically significant differences between the four specialties responds to the Likert scale statements.

6.5.3 RESULTS

A total of 60 participants, including 10 consultants and 5 MRs from each of four specialities, completed the questionnaire. Most participants (87%) worked in both private and public sectors. The findings are categorised as follows:

Knowledge of the term of Frailty and the Ability to Identify Frailty Using Clinical Judgment

When asked if they were familiar with the term frailty, 27 out of 40 consultants (67%) responded yes, whereas only 3 out of 20 (15%) of the MRs responded yes. When familiarity with frailty was examined by specialty, it was found that 8 out of 10 (80%) of the orthopaedic and the same percentage of the neurology clinicians, followed by 6 out of the 10 surgeons (60%) were familiar with the term. In contrast, 2 out of 5 (40%) orthopedic MRs were familiar with the term frailty, whereas none of the cardiology or neurology MRs were familiar with the term frailty. There were no significant differences between groups in regard to the familiarity with the term frailty (Table 1).

Table 1. Familiarity with the term frailty

Are you familiar with the term frailty prior to this study?						
Title (n)		Speciality n (60)[‡]				Total n (%)
		Cardiology n (%)	surgery n (%)	Neurology n (%)	Orthopedic n (%)	
Consultant (40)	No	5 (50)	4 (40)	2 (20)	2 (20)	13(32.5)
	Yes	5 (50)	6 (60)	8 (80)	8 (80)	27(67.5)
MR	No	5 (100)	4 (80)	5 (100)	3 (60)	17(85)

(20)	Yes	0 (0)	1 (20)	0 (0)	2 (40)	3 (15)
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[‡] 40 consultant and 20 MRs (10 consultants and 5 MRs from each speciality); MR= medical resident
The difference between variables is not statistically significant ($p>.05$).

Interestingly, 72% of the consultants acknowledged their ability to identify frail older adults during clinical investigation. This may suggest that the majority of clinicians are unfamiliar with the term or terminology of frailty. However, once they reached Section 3 of frailty symptoms, they understood the concept of frailty and acknowledged their ability to identify weak, vulnerable, or "fragile" patients, as most clinicians referred to them, through clinical investigation. Clinicians may not be familiar with the term "frailty," but they can identify the symptoms of frailty as a geriatric and age-related syndrome during the investigation. Neurology had the highest proportion (80%) of consultants that reported the ability to identify frailty, followed by other specialties (70%) at an equal rate. More than half of MRs (65%) were able to identify frailty during clinical investigations; the majority were orthopedics and neurologists. All results are displayed in Table 2.

Table 2. Ability to identify frailty by using your clinical judgment

Are you able to identify frailty by using your clinical judgment?						
Title (n)		Speciality n (60) [‡]				Total n (%)
		Cardiology n (%)	Surgery n (%)	Neurology n (%)	Orthopedic n (%)	
Consultant (40)	No	3 (30)	3 (30)	2 (20)	3 (30)	11(27.5)
	Yes	7 (70)	7 (70)	8 (80)	7 (70)	29 (72.5)
MRs (20)	No	2 (40)	3 (60)	1 (20)	1 (20)	7 (35)
	Yes	3 (60)	2 (40)	4 (80)	4 (80)	13 (65)

[‡] 40 consultant and 20 MRs (10 consultants and 5 MRs from each speciality); MR= medical resident
The difference between variables is not statistically significant ($p>.05$).

The Identified Frailty Symptoms

Participants identified multiple symptoms upon which they based their clinical judgment for identifying frail older individuals. Consultants most frequently identify the decline in physical functioning (75%), vulnerability/weakness (65%), and poor strength (60%) as symptoms of frailty. These three symptoms differ significantly ($p < .05$), with increased dependence being the most indicative of frailty ($Ex(B) = 6.53$). Eighty percent of consultant neurologists identified vulnerability or weakness as the primary symptom of frail older adults; orthopedics and surgery consultants used this symptom to a similar degree (70%). However, its use was almost 2-fold lower in cardiology (40%), whereas cardiology consultants (80%) identified decline in physical function as the most important symptom. However, the surgeons determined that decline in physical function and vulnerability were the most serious symptoms. On the other hand, MRs identified an increase in dependency as the primary symptom they use to identify their patients' frailty status. None of these results significantly differed between groups, which means there are no differences between the different specialties. All results are displayed in Table 3.

Table. 3 Frailty symptoms

Title	Symptom	Speciality n (60) †				Total n (%)
		Cardiology n (%)	Surgery n (%)	Neurology n (%)	Orthopedic n (%)	
Consultant	Vulnerability/ Weakness	4 (40)	7 (70)	8(80)	7(70)	26 (65)
MR		3 (60)	2 (40)	3 (60)	4 (80)	12 (60)
Consultant	Poor strength	6 (60)	5 (50)	6 (60)	7 (70)	24 (60)
MR		1 (20)	2 (40)	2 (40)	2 (40)	7 (35)
consultant	Low walking speed	6 (60)	6 (60)	5 (50)	6 (60)	23(57.5)
MR		2 (40)	3 (60)	1 (20)	2 (40)	8 (40)

consultant	Unintended weight loss	2 (20)	1 (10)	3(30)	2 (20)	8 (20)
MR		3 (60)	2 (40)	2(40)	0 (0)	7 (35)
Consultant	Decline in physical function.	8 (80)	7 (70)	7 (70)	8 (80)	30 (75)
MR		2 (40)	1 (20)	1 (20)	3 (40)	7 (35)
Consultant	Increase dependency.	5 (50)	7 (70)	6 (60)	6 (60)	24 (60)
MR		3 (60)	3 (60)	3 (60)	4 (80)	13 (65)
Consultant	Others	1 (10)	1 (10)	0 (0)	1 (10)	3 (7.5)
MR		0 (0)	1 (20)	0 (0)	0 (0)	1 (5)
Consultant	Non of the above	0 (0)	0 (0)	1 (10))	1(10)	2 (5)
MR		0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

‡ 40 consultant and 20 MRs (10 consultants and 5 MRs from each speciality); MR= medical resident
The difference between variables is not statistically significant ($p>.05$).

Acknowledgement of the availability of frailty assessment instruments

The majority of consultants surveyed from the four specialties (77.5%) lacked familiarity with screening and/or measurement instruments for frailty, while the vast majority of MRs (95%) were unable to identify any frailty measurement instrument. The Rockwood Clinical Frailty Scale (CFS) and the Fried phenotype (FP) were the only tools identified among the 22.5% of consultants who could identify frailty measurement tools. None of these differences between the four specialties were statistically significant. Table 4.

Table 4. Awareness of frailty assessment tools

Are you aware of any assessment tools that can be used in screening and/or measuring of frailty?						
Title (n)		Speciality n (60)[‡]				Total n (%)
		Cardiology n (%)	Surgery n (%)	Neurology n (%)	Orthopedic n (%)	
Consultant	No	9 (90)	7 (70)	9 (90)	6 (60)	31(77.5)
	Yes	1 (10)	3 (30)	1 (10)	4 (40)	9 (22.5)
MR	No	5 (100)	5 (100)	5 (100)	4 (80)	19 (95)
	Yes	0 (0)	0 (0)	0 (0)	1 (20)	1 (5)

‡ 40 consultant and 20 MRs (10 consultants and 5 MRs from each speciality).
The difference between variables is not statistically significant ($p>.05$).

Preferences for knowing the frailty status of their patient and screening for frailty

There was variation in the responses to the five Likert scale statements (ranging from 1 strongly disagree to 5 strongly agree) regarding preferences across the four specialties and within each specialty role (consultant versus MR). A Kruskal-Wallis H test revealed that there was no statistically significant difference between the response averages of the four specialties.

However, the difference was statistically significant ($p < 0.1$) for statement 4: "*A practical frailty assessment tool that patients, caregivers, and healthcare professionals can use would be beneficial when assessing and treating patients,*" indicating that the four groups have different perceptions of the benefits of using a frailty assessment tool. Statement 1, "*It is important to know the frailty status of your patient,*" received the highest mean score (4.70) from the orthopedic consultants and MR neurologists (4.80). Among orthopedics, statement 5, "Frailty screening should be included in the routine clinical assessment of older patients," received the highest mean score of 4.50. While statement 4, "A specific frailty assessment tool that can be used by the patient, caregiver, or clinical practitioner would be advantageous when assessing and treating patients," has the highest mean (4.20) for neurologists and orthopaedic consultants, The lowest score for consultants was 3.90 for statement 5 from consultants' cardiologists, which suggests lower agreement that screening for frailty should be part of the routine clinical assessment. In contrast, the lowest score was 3.40 for statement 4 from MRs cardiologists, which shows that most of them believe it is not beneficial to use a frailty tool when assessing and treating patients (Table 5).

Verbal feedback from the four specialties shows strong agreement that a patient's frailty level is an important predictor of patient outcomes; however, this will not alter their decision to continue with medical procedures such as admitting a frail patient with a hip fracture for surgery. One

orthopaedic surgeon stated, "I will consider this patient's fragility before sending him to the operating room for a scheduled procedure, unless it is an emergency." Another general surgeon stated, "From my experience, I would say that the increased risk of death for frail patients varies; I believe it depends on the type of surgery and the patient's age and general health; however, if the patient's condition is urgent, I will not consider whether he is frail or not."

Table 5. Likert scale based on the mean for each speciality in regard to clinicians type.

Likert Scale statement		Speciality n (60) [‡]			
		Cardiology (Mean)	Surgery (Mean)	Neurology (Mean)	Orthopedic ((Mean)
It is important to know your patient frailty status	Consultant	4.50	4.30	4.40	4.70
	MR	3.80	4.20	4.80	4.20
A patient's frailty status can impact clinical investigation	Consultant	4.10	4.20	4.60	4.70
	MR	4.00	4.00	4.40	4.40
Identifying frail patients can help determine and/or guide their treatment plan	Consultant	4.40	4.60	4.70	4.70
	MR	3.80	3.80	4.40	4.60
A practical frailty assessment tool that can be used by patient/care giver/CP would be beneficial when assessing and treating patients	Consultant	4.10	4.10	4.50	4.50
	MR	3.40	3.80	4.20	4.20
Screening for frailty should be part of the routine clinical assessment for older patients	Consultant	3.90	4.20	4.20	4.50
	MR	4.00	4.00	3.60	3.80

[‡]The total is 60 participants (40 consultant and 20 MRs),10 consultants and 5 MRs from each speciality).

* Statement number 4 is statistically significant at $p < .1$

Perceptions in Healthcare Settings Where Frailty Screening or Measurement Should Occur

The geriatric clinic was ranked as the most preferred setting to screen for frailty by the consultants (82.5%) and MRs (85%), followed by a primary care setting (70% and 80%) for consultants and MRs, respectively. On the other hand, emergency departments were the least preferred setting to screen for frailty for the consultants (47.5%) and MR's (40%) (Table 6).

Table 6. Healthcare environments where frailty should be screened

Title	Environment	Speciality n (60) [‡]				Total n (%)
		Cardiology n (%)	surgery n (%)	Neurology n (%)	Orthopedic n (%)	
Consultant	Primary care	6 (60)	7 (70)	7 (70)	8 (80)	28 (70)
MR		5 (25)	3 (15)	5 (25)	4 (20)	17 (85)
Consultant	Emergency Department (ED)	4 (10)	6 (15)	3 (7.5)	6 (15)	19 (47.5)
MR		4 (20)	3 (15)	1 (5)	0 (0)	8 (40)
Consultant	Acute care	4 (10%)	6 (15%)	5 (12.5)	7 (17.5)	22 (55)
MR		4 (20)	3 (15)	1 (5)	1 (5)	9 (45)
Consultant	In-patient	3 (7.5)	6 (15)	5 (12.5)	8 (20)	22 (55)
MR		4 (20)	4 (20)	2 (10)	3 (15)	13 (65)
Consultant	Out-patient clinic	4 (10)	7 (17.5)	7 (17.5)	6 (15)	24 (60)
MR		4 (20)	3 (15)	2 (10)	3 (15)	12 (60)
Consultant	Geriatric clinic	8 (20)	8 (20)	9 (22.5)	8 (20)	33 (82.5)
MR		5 (25)	5 (25)	4 (20)	3 (15)	17 (85)
Consultant	Senior home/LTC	5 (12.5)	5 (12.5)	6 (15)	6 (15)	22 (55)
MR		5 (25)	2 (10)	2 (10)	3 (15)	12 (60)
Consultant	Other setting	1 (2.5)	1 (2.5)	0 (0)	0 (0)	2 (5)
MR		1 (5)	0 (0)	0 (0)	0 (0)	1 (5)
Consultant	Non of the above	1 (2.5)	1 (2.5)	0 (0)	0 (0)	2 (5)
MR		1 (5)	0 (0)	0 (0)	0 (0)	1 (5)

[‡] This includes 40 consultant and 20 MRs (10 consultants and 5 MRs from each speciality); LCT=Long Term Care

Perception on Settings Where Frailty is Most and Least Important to be Screened or Measured.

30% of clinicians (both consultants and MRs) believe that the primary care setting is the most essential environment for measuring frailty, followed by the geriatric clinic (21.7%). Further, participants believe that the ED (30%) and outpatient (20%) are the least important settings where frailty screening should occur. Tables 7 and 8.

Table 7. The Most Important healthcare environments where frailty should be screened.

The clinical environments where it is the most important to assess frailty.					
Environment	Speciality n (60)				Total n (%)
	Cardiology (15)[‡] n (%)	Surgery (15)[‡] n (%)	Neurology (15)[‡] n (%)	Orthopedic (15)[‡] n (%)	
Primary care	4 (26.7)	5 (33.3)	4 (26.7)	5 (33.3)	18 (30)
ED	2 (13.3)	4 (26.7)	2 (13.3)	2 (13.3)	10 (16.7)
Acute care	2 (13.3)	2 (13.3)	1 (6.7)	4 (26.7)	9(15)
In-patient	0 (0)	1 (6.7)	0 (0)	2 (13.3)	3 (5)
Out-patient	0 (0)	1 (6.7)	2 (13.3)	1 (6.7)	4 (6.7)
Geriatric clinic	5 (33.3)	2 (13.3)	6 (40)	0 (0)	13 (21.7)
Senior home/LTC	0 (0)	0 (0)	0 (0)	1 (6.7)	1 (1.7)
Non of the above	2 (13.3)	0 (0)	0 (0)	0 (0)	2 (3.3)

Table 8. The Least Important healthcare environments where frailty should be screened

The clinical environments where it is the least important to assess frailty.					
Environment	Speciality n (60)				Total n (%)
	Cardiology (15)[‡] n(%)	Surgery (15)[‡] n(%)	Neurology (15)[‡] n(%)	Orthopedic (15)[‡] n(%)	
Primary care	1 (6.7)	2 (13.3)	0 (0)	1 (6.7)	4 (6.7)
ED	3 (20)	8 (53.3)	2 (13.3)	5 (53.3)	18 (30)
Acute care	5 (53.3)	0 (0)	3 (20)	2 (13.3)	10 (16.7)
In-patient	2 (13.3)	1 (16.7)	1 (6.7)	1 (6.7)	5 (8.3)
Out-patient	2 (13.3)	2 (13.3)	4 (26.7)	4 (26.7)	12 (20)
Geriatric clinic	0 (0)	0 (0)	2 (13.3)	1 (6.7)	3 (5)
Senior home/LTC	0 (0)	2 (1.3)	1 (16.7)	1 (6.7)	4 (6.7)
Non of the above	2 (13.3)	0 (0)	2 (13.3)	0 (0)	4 (6.7)

‡ This includes 10 consultants and 5 MRs; LTC=long term care; MR= medical resident

6.6 DISCUSSION

This is a novel study in which we examined the awareness of frailty and frailty screening among Egyptian clinicians of various specialties. Much of the participants' awareness about frailty reflected basic knowledge and levels of uncertainty. In other words, Egyptian non-geriatric specialists are familiar with the concept of frailty, but their understanding is likely “we know it when we see it.” According to the majority of verbal feedback, frailty is a complex, age-related condition in which the patient is vulnerable, fragile, weak, and needs assistance in daily activities, putting the individual at risk of negative outcomes. Consequently, symptoms related to functionality, such as a decline in physical functions, poor strength, and vulnerability, are selected more frequently by participants than other frailty symptoms, specifically unintentional weight loss, which they believe could be the result of comorbidities, poor nutrition, or other chronic diseases. However, according to their feedback, physical impairments directly impact a person's dependence and ability to perform daily activities, making it an important aspect to consider in their clinical investigation. Contradicting these beliefs, numerous studies have directly linked weight loss to physical frailty and, consequently, sarcopenia and disability.^{23,24} In addition, other studies have demonstrated that nutritional frailty is a prevalent issue among older individuals, characterized by the unintentional loss of body weight and lean body mass that is mainly accompanied by disability, which frequently indicates the onset of severe physical decline.²⁴

Moreover, participants' familiarity with frailty assessments was very low. Most participants (consultant or MR) reported, "Yes, I've heard of frailty measurement tools, but I know nothing about them." Because they are not geriatricians and there is no requirement to measure frailty in all healthcare settings or by non-geriatricians, as well as the ability to visually identify a frail

individual through their medical history or during a clinical assessment, they believe that knowledge of frailty measurement tools may not be relevant to their clinical practices. These beliefs are generally consistent with prior research that indicates orthopaedic surgeons have limited knowledge of frailty as a geriatric phenotype.²⁵ Another study demonstrates that general practitioners (GPs) are willing to rethink and address frailty in a variety of ways; however, they will need the appropriate teams, tools, processes, and systems (including policy and funding support) to effectively implement change.¹⁴ These thoughts by some healthcare professionals may cause older adults to underreport issues that are essential to be measured or identified, such as frailty symptoms or falls during clinical investigation.

In this study, specialists with access to geriatric services, particularly orthopaedics and neurologists, are more likely to agree that it is advantageous to assess and identify frail older individuals using the operational definition of frailty as weakness and increased dependence. However, they do not endorse the use of any frailty measurement tools on the inpatient ward or outside of geriatric settings. In addition, others acknowledged that a simple frailty screening tool could alert clinicians to potential issues, such as the length of hospitalization. Consequently, they believe that screening for frailty should be conducted upon hospital admission, particularly if the services in Egypt are private and the patients will pay out of pocket. One neurologist stated, "I would love to see screening for frailty at admission and a clear discussion with the patient or family about the patient's expected long stay." This viewpoint is consistent with the findings of numerous research studies that have confirmed the lengthy hospitalizations of elderly individuals who are frail.³¹⁻³³ On the other hand, MRs are likely less in agreement regarding the assessment of frailty or the use of a practical instrument in routine clinical assessment, indicating that frailty

as a concept is not well understood by them or that they prefer to focus on their specialty regardless of their patient's frailty status.

In accordance with previous research, most of our participants frequently cited the geriatric clinic and the primary care setting as the most crucial environments for frailty screening, although these settings are not fully developed in Egypt. For instance, one neurologist stated, "I would love to see screening for frailty in the routine investigation at the new primary care pilot trial; this is where frailty should be assessed alongside other comorbidities and not in other busy settings such as the ED." In contrast, the ED, outpatient clinic, and acute care unit were the least crucial settings where Egyptian clinicians believed frailty screening should be implemented. They argued that screening for frailty in settings such as the ED or outpatient clinic is unnecessary due to the busy environment, a lack of appropriately trained healthcare professionals, or both.

This study has several strengths and limitations. This is the first study to examine the perceptions of non-geriatricians in Egypt regarding the concept of frailty, its symptoms, and measurements, which is a strength. Another strength is that the study considered numerous specialties directly related to the healthcare of older adults in various care settings, which increases the likelihood that these specialties will investigate frail older adults. A further strength of our study is the inclusion of both consultants and MRs, which enhances our comprehension of how both groups conceptualize frailty. As participants work in both the private and public healthcare sectors and interact with older adults in both community and hospital contexts, they gain valuable exposure to geriatric syndromes that increase the value of this research. In addition, the consistency of data collection was important, as the principal researcher was the only one to conduct participant interviews and record data and feedback.

However, there are some limitations to our study. Due to the COVID-19 situation and the fact that the majority of clinicians were preoccupied with postponed medical procedures for their patients or a larger number of delayed investigations, we were unable to recruit a larger number of participants from either group. In addition, we were unable to include nurses, nurse practitioners (NP), or social workers (SW) in the study investigation. This was a constraint rather than a limitation. In the majority of Arabic countries, nurses are not allowed to evaluate older people or provide primary care, which means that the concept of NP as understood in the western and northern continents is not implemented.

Furthermore, SW responsibilities and authorities in Egypt are more limited compared to those in the West. Another limitation is that we considered only one healthcare setting (the Ein Shamis University hospital) for our research, excluding physicians of other specialties who could investigate older individuals in other settings, such as nursing homes or long-term care facilities. Although some consultants/MRs provided written comments there were not enough to perform a qualitative analysis.

In conclusion, this study assessed how a sample of consultants/MRs from different specialties in medicine, as opposed to geriatricians, perceive frailty and its measurement. Egyptian specialists outside the field of geriatrics are familiar with the concept of "frailty," but they rely on visual assessments based on their experience and knowledge to identify frail patients. However, they supported the use of a tool for the early detection of frailty in certain clinical settings. These findings could result in a shift in the responsibilities of non-geriatricians in identifying elderly individuals who are frail. In addition, it can inform future efforts to improve complementary and collaborative approaches between geriatricians and other specialties to recognize and manage frailty and improve frail older patients' clinical and social outcomes. Furthermore, increasing

awareness of the importance of identifying frailty using formal tools in different specialties could prevent complications and improve the health of frail older adults in this region.

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Appendix (1)

Healthcare Providers Survey

Date:

Participant nu#

Designation:

1. Consultant / physician
2. Medical Resident (MR)

Specialty:

1. General surgery,
2. Cardiology,
3. Neurology,
4. Orthopedic,

We would like to know your perception of frailty; we appreciate it if you answer the following:

Part (1)

1- Are you familiar with the term frailty earlier (before participating in this research?)

Yes No

2- Are you able to identify frailty by using your clinical judgment?

Yes No

3- What symptom (s) do you use to identify a patient as frail?

- a. Vulnerability/weakness
- b. Poor strength
- c. Low walking speed
- d. Unintended Weight loss
- e. Decline in physical functioning
- f. Increase dependence
- g. Other: please specify:
- h. None of the above, as I was not familiar with the term frailty.

4- Are you aware of any assessment tools (e.g., questionnaires or scale) that can be used to screen and/or measure frailty?

Yes No

If yes, please identify any tools you know.

Part (2): For each of the following statements please identify your level of agreement.

1- *It is important to know your patient frailty status (i.e., fit/ pre-frail/frail)*

Strongly disagree Disagree Neutral Agree Strongly agree

2- *A patient's frailty status can impact a clinical investigation.*

Strongly disagree Disagree Neutral Agree Strongly agree

3- *Identifying frail patients can help determine and/or guide their treatment plan.*

Strongly disagree Disagree Neutral Agree Strongly agree

4- *A practical frailty assessment tool that can be used by patients/ caregivers/healthcare professionals would be beneficial when assessing and treating patients.*

Strongly disagree Disagree Neutral Agree Strongly agree

5- *Screening for frailty should be part of the routine clinical assessment for older adults.*

Strongly disagree Disagree Neutral Agree Strongly agree

Part (3)

1- Please identify the clinical environments where you think a frailty assessment would be useful:

- 1- Primary care ()
- 2- Emergency Department (ED) ()
- 3- Acute care (ICU) ()
- 4- In-patient (wards) ()
- 5- Out-patients Clinics ()
- 6- Geriatric Clinic / geriatric wards ()
- 7- Senior homes / Long term care facilities (LTC) ()
- 8- Other:
- 9- Non-of the above

2- Of the clinical environments identified which is the environment where it is the most important to assess frailty?

3- Of the clinical environments identified which is the environment where it is the least important to assess frailty?

Additional Comments

CHAPTER 7: DISCUSSION

The concluding chapter of this thesis provides a summary of each of the research chapters, their limitations, their potential implications, and identifies areas for future research.

7.1 SUMMARY OF FINDINGS

The purpose of the research in this dissertation was to investigate the state of frailty in Egypt and the applicability of using the Arabic version of a Canadian frailty measurement tool (PFFS-A) to assess older adult Egyptians. The first part of this research was a scoping review of the literature on frailty in Arabic-speaking countries (ASCs). The objective was to synthesize and map the literature pertaining to the concept of frailty, its association with other geriatric factors and health conditions, and measurement instruments used to identify or assess frailty in this part of the world. Next, an exploratory study was conducted to determine whether an Arabic version of a Canadian frailty assessment tool would work for Egyptians. The last part of the research was a questionnaire-based study to determine what Egyptian clinicians know about frailty and which healthcare settings they thought were the best locations to assess frailty.

In chapter 4, the results of the scoping review are presented, including an overview of the current literature on frailty in older adults residing in ASCs and a summary of the knowledge gaps in frailty assessment and treatment. Only 27 studies were eligible for inclusion. According to the findings of the review, numerous studies examined the relationship between two health conditions, such as CHF and sarcopenia, among frail older adults. Few studies have examined the relationship between frailty and other health issues in older adults, such as congestive heart failure, urinary incontinence (UI), sleep quality, diabetes, or factors such as low insulin-like growth factor-1 (IGHF-1). Fewer studies examined the psychometric validity (e.g., content,

construct, and face validity) of some frailty measuring tools. However, very few studies examined the prevalence of frailty and pre-frailty among older adults residing in ASCs. This low number of studies suggests that the number of frail people in this cultural context has not been assessed thoroughly, which represents a critical gap in investigating the prevalence of frailty and pre-frailty.

Nonetheless, based on the few studies that have been conducted, ASCs have a high prevalence of frailty and pre-frailty in comparison to the prevalence of frailty and pre-frailty worldwide. For example, the prevalence of frailty and prefrailty among older ASC residents ranged from 21.4% to 37.0% of 60-year-olds. However, in Japan, the prevalence of frailty is 1.9% and 20.4% for individuals aged 65–69 and 80–84, respectively.¹ In addition, the prevalence of frailty among community-dwelling older adults in Latin America and Caribbean (LAC) countries was 19.6%.² A systematic review comparing the prevalence of frailty and prefrailty in the US, Canada, and European countries revealed that the overall weighted prevalence of frailty was 10.7%, with a weighted prevalence of 9.9% for physical frailty and 13.6% for the broad phenotype of frailty.³ Another study concluded that the prevalence of prefrailty and frailty was 40.0% and 4.9%, respectively, in Taiwan.⁴ The above statistics from various nations suggest that the prevalence of frailty and prefrailty in ASCs is equal to or greater in other nations worldwide.

The scoping review also showed that few cross-sectional studies on frailty, pre-frailty, and associated factors were conducted in Egypt. Therefore, the prevalence of frail and prefrail older adults in Egypt may be significantly higher than reported in the scoping review. This theory is supported by the fact that the data and research needed to estimate the number of frail and prefrail older persons in Egypt are limited. Additionally, in Egypt, it is well known that the two healthcare sectors of the Egyptian healthcare system (private and governmental) are not

connected, and even for each healthcare sector, most of the time the patient's medical history is not digitized.⁵ This means that unless the healthcare provider asks patients about their medical and medication histories, he or she will not be able to capture all of the patient's current health conditions and/or medications. This lack of communication between the healthcare sectors as well as the lack of a digitalized medical history could be a significant reason for missing frailty and/or its co-related factors. For example, polypharmacy (defined as the use of multiple medications)⁶⁻⁸ is a major issue of concern for older adults as it can lead to adverse health outcomes including falls, functional impairment, adverse drug reactions, increased length of hospital stay, readmissions, mortality, and development frailty.⁶⁻⁸ There is substantial evidence that frailty and polypharmacy are prevalent among older individuals.⁸ In the absence of an integrated healthcare system, not only will the risk of polypharmacy increase, but also the risk of medication discrepancies (e.g., duplicate medications, drug-drug interactions, and incorrect medication dosages), which increases the risk of hospitalization and death.

Frailty and prefrailty were linked to social factors such as living alone, having a low level of education, and eating poorly, as well as physical and mental conditions like having multiple health problems and having less cognitive function, according to the scoping review study. This was true for many other countries as well.^{9,10} For example, in a study in Taiwan, frailty was associated with less education, no spouse, disability, higher rates of comorbid chronic diseases, and depressive symptoms.⁴

A systematic review established that the main factors associated with frailty were age, female gender, black race or colour, schooling, income, cardiovascular diseases, number of comorbidities or diseases, functional incapacity, poor self-rated health, depressive symptoms, cognitive function, body mass index, smoking, and alcohol use. These indicators suggest that the

prevalence of frailty in developing nations such as Egypt may be comparable to or even higher than that of many other nations worldwide.

Due to the lack of longitudinal studies, it was difficult to comprehend whether the development of frailty in these nations is a result of certain health conditions, comorbidities, or socioeconomic factors, as established by numerous international studies. Frailty is a contributing factor in the development of these health or mental conditions, or both. This lack of information hindered our ability to understand the adverse consequences of frailty among ASCs' older populations or to compare them to those of other international studies.

In addition, the scoping review showed a limited number of frailty screening and measurement instruments were being utilized in ASCs. The Fried Phenotype (used in 8 out of 27 studies) and the Study of Osteoporotic Fractures-Frailty Index (SOF-FI) (used in 6 out of 27 studies) were the most commonly used frailty measurement instruments in ASCs. These two tools can only issue an 'alert' about a potential frailty concern; they do not provide information about the causes or the severity of frailty.¹³⁻¹⁵ These study findings are, to some extent, consistent with those of other studies. For instance, according to a scoping review mapping frailty assessment instrument used in North America, Fried's phenotype has been used the most, being present in 25 studies (45.5%), but this was not the situation with the SOF-FI, which has only been used in one study.¹⁵ To conclude, the findings of the scoping review established the dearth of information regarding frailty and its related factors, outcomes, and measurement tools in ASCs. Additionally, no studies conducted in ASCs were found to investigate care and improvement interventions for frailty in ASCs. These findings suggest that healthcare professionals and decision-makers in this region of the world may not fully recognize or may neglect the concept of frailty and its implications, which could explain why the care of frail older adults is still in development or has

not yet begun. Nevertheless, the high prevalence of frail and pre-frail older adults, according to the studies included, could be a warning sign for healthcare systems to start initiating appropriate care for older adults residing in this region.

Chapter 5 presented the data from an exploratory study that assessed the feasibility of using the Arabic version of the Pictorial Fit Frail Scale (PFFS-A) to identify and quantify frailty among the Egyptian population. We determined the scale feasibility by measuring the time it took old Egyptian adults, medical residents (MRs), and geriatricians to complete the tool as well as how much assistance was required to complete the scale. Feasibility was also assessed using a questionnaire to determine the practicability, comprehensiveness, and simplicity of the scale from the perspective of the Egyptian population's older adults, or healthcare providers.

Moreover, I determined the test-retest reliability of the PFFS-A by completing the form 14–21 days after the initial completions by the same rater. The findings of this study confirmed that the PFFS is applicable to Egyptian populations. These results are consistent with those of previous research, which has shown that the PFFS is a valid, reliable, uncomplicated, and user-friendly tool for identifying and measuring frailty in Canada, Malaysia (translated into Malay), Iran, and Greece (translated into Greek language).^{16–19} In our study, the PFFS had high test-retest reliability (ICC = 0.817). These results are comparable to other studies' findings. In the Malaysian study¹⁰, for instance, the test-retest reliability of the PFFS was 0.94 (ICC). In addition, test-retest reliability was acceptable in the Canadian study for both patients (ICC = 0.78) and nurses (ICC = 0.88). In the present study, elderly adults required more time and assistance than other raters (HCPs) to complete the scale, but this is also consistent with other studies.¹⁶

Compared to MRs (2:7±1:2 minutes) and geriatricians (1:9±0:95 minutes), older Egyptian

citizens required 4:47±1:26 minutes to complete the procedure. These times are comparable to the Canadian study,¹⁶ in which the completion times for patients, caregivers, nurses, and geriatricians were (min:sec) 4:38, 3:11, 1:05, and 0:57, respectively. Together, these findings suggest that the reliability and usability of the PFFS are similar across a range of cultures. Additionally, when older people completed the PFFS-A, their average frailty score and FI were lower than their averages when geriatricians and medical residents did the same. These results are quite consistent with those of other studies in which HCPs and caregivers rated the elderly higher than the elderly themselves.^{16,17}

Even though it was not the primary focus of our study, it was fascinating to find that Egyptian older adults with a high level of education were more likely to have a lower frailty score than those with a low level of education or who were in an ambulatory setting. Panza and colleagues (2006) established the relationship between cognitive frailty, race (African American), and educational level in their study.¹² In addition, the longitudinal aging study in Amsterdam (2014) found that older individuals with a low level of education were more likely to be frail than those with a high level of education. These distinctions persisted throughout the 13-year follow-up period.²¹ The findings from our study and others confirm the influence of social and environmental factors, such as education, on the lifetime development of frailty. As frailty can impact disease development, progression, and treatment, it should be addressed in other medical specialties.²¹ Therefore, it was necessary to determine what other medical specialties thought about frailty.

In chapter 6, I used a written, structured questionnaire to determine how non-geriatrician Egyptian physicians (consultants and MRs) conceptualize frailty. In particular, the study aimed

to investigate their understanding of frailty and its clinical symptoms, their awareness of frailty assessment tools, their preferences for learning about the frailty status of their patients, and their perceptions of healthcare settings where frailty should be assessed.

The results of the study revealed that, in contrast to western nations such as the United States and Canada, frailty is not a popular or commonly used term by Egyptian non-geriatricians' clinicians. Among the four specialties of participants (cardiology, neurology, orthopedics, and general surgery), slightly more than 50% of consultants (specialists) participants were familiar with the term "frailty," while 85% of MRs were unfamiliar with the term. In contrast, 70% of consultant participants could recognize frail patients during clinical examinations, suggesting that 30% of specialists could miss identifying frail older adults during clinical investigations. Furthermore, specialists in the study identified three important indicators of frailty: vulnerability or physical weakness, a decline in physical function, and an increase in dependence. This is concerning, as it is known that there are many more factors that contribute to frailty.¹⁻⁴ For example, environmental factors, socioeconomic factors (e.g., age, sex, nutrition, level of education, living alone, etc.), chronic diseases, and polypharmacy can also contribute to frailty.¹⁻⁴ Thus, determining the presence or absence of frailty in a person solely based on physical impairments may be misleading. As a result, neglecting, overlooking, or underestimating these factors may result in inappropriate and incomplete medical action and treatment plans.

Results from this study also showed that Egyptian non-geriatrician medical practitioners considered primary care as the most important healthcare setting for frailty evaluation. A large body of evidence supports these findings, and family physicians are well-suited to measure frailty in primary care.^{22,23} However, I think that choosing primary care as the most important setting to measure frailty may be a sign that Egyptian clinicians do not fully understand the

frailty concept and believe it is an inevitable consequence of aging that cannot be prevented or treated and that only primary care providers and geriatricians can manage this syndrome.

According to Egyptian geriatricians' emergency departments, outpatient clinics were the least important locations for frailty assessment. This could indicate that clinicians do not need to consider frailty when developing treatment and care plans for their patients in their specialties.

By selecting the emergency department (ED) and outpatient clinic as the least significant healthcare settings for identifying and measuring frailty, clinicians may have underestimated the correlation between increasing hospitalization length or adverse outcomes and frailty at the ED, as established by numerous studies.²⁴

Taking into account the global aging phenomenon, Egypt may face a crisis in the near future, and caring for frail older adults could place a significant strain on the Egyptian healthcare system.

Therefore, it is crucial to find solutions to improve care for this subpopulation, including the measurement and identification of frail older adults, as well as the identification and organization of care plans for frail older adults.

7.2 STRENGTHS/ LIMITATIONS

This thesis has numerous strengths. It is original research in the field of frailty in this region of the world. No previous research on frailty in Egypt has been conducted. Furthermore, this thesis presents an original investigation into the applicability of using a pictorial tool to identify and measure frailty among older Egyptian adults, by various raters, and in different settings.

According to the author's knowledge, no similar research has previously been conducted in Egypt. Thus, the findings of Chapter 5 will allow clinicians to consider using such a tool to their clinical investigations.

Additionally, in Chapter 6, evaluating the perception and depth of knowledge about frailty and the most appropriate and inappropriate healthcare settings to screen and assess frail older adults from the perspective of Egyptian healthcare clinicians rather than geriatricians was an original work.

No prior research has investigated this topic in Egypt, and there is little information on how clinicians from various specialties view frailty or where they believe it should be measured internationally.

Lastly, I believe that being the sole researcher and data collector for the research studies provides fortitude and consistency for data collection and enhances the precision of data centering, collection, and interpretation.

However, this thesis has numerous limitations. Due to the lack of research in the field of frailty, the lack of statistical data on the number of older adults in Egypt, and the lack of digitalized systems for patient records in most Egyptian healthcare settings (like hospitals and senior homes), it was hard to complete a retrospective study. The cross-sectional study design was the best way to make sure the data was accurate. The COVID-19 pandemic posed challenges in reaching older adults in various contexts, including senior homes, during the thesis research.

Furthermore, in Chapter 5, we tested the scale's feasibility and face validity. Other psychometric properties of the PFFS-A, such as construct and/or content validity (which refers to the degree to which the instrument covers the content that it is supposed to measure)²⁵, were not investigated.

The aforementioned properties are deemed beyond the scope of this study. The primary objective of my study is to ascertain the feasibility of implementing a Canadian frailty scale among the Egyptian population.

Lastly, which I consider to be more of a challenge than a limitation, the lack of similar research focusing on the same thesis objectives makes it difficult to compare the results of this thesis to those of similar previous work, thereby rendering this work original and making it difficult to agree or disagree with its conclusions.

7.3 IMPLICATIONS AND FUTURE RESEARCH

This thesis has significant implications. According to the scoping review, there isn't much research on frailty in this region of the world. In contrast to western societies, which recognize the impact of frailty on the individual, society, and healthcare systems, these societies reorient their health policies toward health promotion and disability prevention among the elderly.

Consequently, the outcome of this thesis has the potential to serve as the basis for future research into the concept of frailty in Egypt. Additional research will enhance our understanding of the concept of frailty and its associated factors and outcomes in this part of the world. Consequently, early interventions could be used to identify senior populations at risk for frailty and modify treatment for these subpopulations. This is not the case in Egypt at present.

In addition, the findings of the thesis support the use of frailty instruments, such as the PFFS-A, in this population. The feasibility of using the PFFS-A with older individuals from various settings and with varying backgrounds, social standings, and educational levels, as well as by healthcare professionals, could serve as the premise for adapting this instrument to clinical research for older adults. I believe this proposal is feasible. The Egyptian healthcare system, for instance, has successfully implemented pilot programs to identify and treat patients infected with the Hepatitis C virus and to screen Egyptian women for breast cancer.^{20,21} The successful

implementation of these two programs demonstrates that the Egyptian healthcare system is capable of effecting positive changes in the treatment of the elderly.

Furthermore, from a social standpoint, the findings of this thesis will increase awareness of frailty and its complications for older adults' health and wellbeing, which will have a significant social impact on Egyptian society. For example, older individuals and their caregivers, who are likely their siblings, will be more aware of this concept and will increase their understanding of frailty as a common syndrome associated with aging rather than a natural consequence of the aging process. Adequate care programs that involve interventions such as improving physical functions and healthy nutrition could be announced and implemented as a result. In addition, increasing awareness about frailty will increase the confidence of older adults to discuss their frailty status with healthcare professionals and diminish their hesitation to speak about being vulnerable.

Moreover, the findings of this thesis revealed that, in developing nations such as Egypt, the predicament of frail older individuals may be unknown, and, as a result, their voices may go unheard by healthcare professionals and decision-makers. Consequently, healthcare professionals and decision-makers disregard and neglect age-related syndromes such as frailty. This occurrence requires action. Conducting additional research in the field of frailty in this region will be essential for cultural and practical changes that could extend to other developing nations in the Middle East.

This research and similar research have the potential to increase awareness of frailty as a geriatric syndrome, emphasize the implications of frailty on the health and well-being of older adults, and articulate the significance of interventions to enhance the quality of life of frail older

adults. In addition, other researchers seeking to develop more in-depth research on the context of frailty among the Egyptian population and/or strategies for older patients with frailty can build on the findings outlined in this manuscript. Finally, the findings of the thesis suggest that this understanding and awareness of frailty may be applicable to other Arabic nations.

7.4 CONCLUSION

According to this thesis, ASCs do not fully understand, recognize, or study frailty. Lack of clinical trials investigating the concept of frailty, associated factors, and adverse outcomes in this region of the world reduces the likelihood of identifying and caring for this subpopulation and raises the probability of an increase in the number of frail older adults and the severity of their condition. Furthermore, we were unable to identify specific tools used by the Egyptian population to recognize and assess frailty in ASCs. This thesis demonstrated that it is possible to adapt an Arabic version of a useful and straightforward visual tool that older people and healthcare professionals can use to assess frailty in a variety of settings. The tool's practicability, validity, and dependability were comparable to those of other cultures, indicating its applicability in this region of the globe and among Egyptians.

Furthermore, Egyptian clinicians who are not geriatricians may be unfamiliar with the concept of frailty. The majority of clinicians in Egypt believe that geriatricians should be responsible for identifying frail older adults and that frailty should primarily be measured in geriatric settings, although they still value raising awareness of frailty and its effects on the health and quality of life of older adults. The findings of my thesis indicate a prospective avenue for increasing the value of understanding frailty and its complications among the Egyptian population and

clinicians. In addition, it established the fundamentals of a simple-to-use instrument for measuring frailty.

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THESIS APPENDIX A. Copywrite Permission for use of manuscript in chapter 3

October 3, 2023
Healthy Populations Journal

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I am preparing my IDPhd 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 Populations of Arabic-Speaking Countries: Protocol for a Scoping Review.

Aly, A., Kendall, S. J., MacKnight, C., Theou, O., & Grandy, S. A. (2023)

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Name **Co-Editor in Chief,**
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Date: **October3, 2023**

THESIS APPENDIX B. Permission for use of manuscript in chapter 5 (PFFS)

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Position/Title:	IDPhD student			
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Telephone:	(902)-403-4422			
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<input checked="" type="checkbox"/> Research study/clinical trial <i>Expected duration of study:</i> Start date April 21 End date November 21 <i>Describe use in study:</i> <i>Is research sponsored or funded by pharma or industry?</i> <input type="checkbox"/> Y <input checked="" type="checkbox"/> N <i>If yes, please specify:</i>				
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By your signature below, you attest that you understand the conditions under which permission is granted.				
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Date:	January 05/01/21			
<i>Send completed, signed form by fax or email to:</i>		Geriatric Medicine Research 1421-5955 Veterans' Memorial Lane, Halifax, NS B3H 2E1 Canada 73-1050 Email: gmru@dal.ca		
Approved by	[Redacted] Date: 2021/01/18			
<small>¹A copy of the PFFS will be sent to the user upon review and approval of this permission form. Valid only when signed by all parties.</small>				

THESIS APPENDIX C. Permission to conduct the reserach in chapter 5

To: The head of the Research Department, Ain -Shams University cc:
the head of the geriatric hospital, Ain Shams University
Cairo, Egypt.

Date: December 4, 2020

Subject: Permission to conduct research.

Dear Sir/Ms.

I am Amany Aly, a student at Dalhousie University, Halifax, NS, Canada. My Egyptian adjunct professor is Dr. Hala Sweed, a geriatric medicine and gerontology professor at Een Shamis university, Cairo, Egypt.

I am writing to you regarding my Ph.D. research project, my research topic is about investigating a visual tool's feasibility to assess frailty among the senior population. As you know, frailty (weakness) is a common condition associated with aging increasing the older adults' vulnerability to any illness and, consequently, leads to medical health complications or death.

Our research objective is to assess the feasibility and reliability of the Pictorial Frail Scale (PFFS) to identify frailty. The PFFS is a visual tool developed by the geriatric medical team at Dalhousie University. Our research team will be recruited by Prof. Sweed, Dr. Mohamed Mortada (Geriatrician). and myself (AA) as the principal investigator. AA will interview patients and assess their eligibility to join the study. The eligible participant will be asked to complete the PFFS visual scale; each participant's time and level of assistant to complete the form (scale) will be calculated. Our eligible criteria are patients 60 years and older, with no cognitive, mental, or physical impairments, and can read and write. Before obtaining signatures on the Informed Consent Form, AA will discuss and answer all potential participants' questions. Should a patient, at any point in time, request that data collection stop or request withdrawal from the study, data collection will stop, and the research team will permanently destroy all data gathered from the patient up until that point.

We are confident that this is harmless research with minimal risk factors.

The collected data will be confidential and will be used for this research only, if it could be used for any further studies, the research team will inform the organization and the participants.

I shall be highly grateful for your support and cooperation.

Attached is a copy of both the visual scale form and the informed consent.

jjj

Best Regards

Amany Aly

X

Ain Shams University Hospital
Manger

THESIS APPENDIX D. Permission for use of manuscript in chapter 5

To: The principle of "Family House "senior home 18
Abu baker EL sedeek, New Egypt area, Cairo, Egypt
Telephone: 0226356454

Subject: Permission to conduct research.

Dear Sir/Ms.

I am Amany Aly, a student at Dalhousie University, Halifax, NS, Canada. My Egyptian adjunct professor is Dr. Hala Sweed, a geriatric medicine and gerontology professor at Ain-Shams University, Cairo, Egypt.

I am writing to you regarding my Ph.D. research project. My research topic is about investigating a visual tool's feasibility to assess frailty among the old adults' population. As you know, frailty (weakness) is a common condition associated with aging increasing the older adults' vulnerability to any illness and, consequently, leads to medical health complications or death.

Our research objective is to assess the feasibility and reliability of the Pictorial Frail Scale (PFFS) to identify frailty. The PFFS is a visual tool developed by the geriatric medical team at Dalhousie University. Our research team compounded me, as the research investigator (AA), nurses, medical residents, and geriatrician from the geriatric hospital, Een Shamis university. AA will interview patients and assess their eligibility to join the study. The eligible participant will be asked to complete the PFFS visual scale; each participant's time and level of assistant to complete the form (scale) will be calculated. Our eligible criteria are patients 60 years and older, with no cognitive, mental, or physical impairments, and can read and write. Before obtaining signatures on the Informed Consent form, AA will discuss and answer all potential participants' questions. Once the patients complete the PFFS form, they will be asked to fill a survey present their experience with the form. Should a patient, at any point in time, request that data collection stop or request withdrawal from the study, data collection will stop, and the research team will permanently destroy all data gathered from the patient up until that point.

We are confident that this is harmless research with minimal risk factors.

The collected data will be confidential and used for this research only; if it could be used for any further studies, the research team will inform the organization and the participants. I shall be highly grateful for your support and cooperation.

Attached is a copy of, the visual scale form, the survey, and the informed consent.

Best Regards
Amany Aly

Ethics Submission (Prospective)

