Frailty among Community-Dwelling Older Adults: Prevalence and Associated Factors

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Abstract

Background: Frailty is a highly prevalent health problem in older adults that negatively impact health-related outcomes. The importance of studying frailty comes from the fact that it is merely associated with aging but not an inevitable process. **Aim**: To assess the prevalence of frailty and its associated factors among community-dwelling older adults. **Method**: A community-based cross-sectional study was used with a cluster sampling technique targeting 300 older adults in six urban and rural regions affiliated with the Dakahlia governorate. Data was collected using, Mini-mental State Examination, demographic and health-related data structured interview questionnaire, Katz and Akpom scale, Lawton and Brody scale, the Mini Nutritional Assessment questionnaire, and Frailty was measured using the survey of Health, and Aging, and Retirement in Europe of The Frailty Indicator. **Results**: The prevalence of frailty was 64.7% among the studied older adults. Age, current work, comorbidity, polypharmacy, dependence on the instrumental activity of daily living, and malnutrition were significant independent predictors for frailty (β 0.136, -0.148, 0.117, 0.118, -0.209, and 0.401 respectively), $p < 0.05$for all. **Conclusion**: Frailty was highly prevalent among community dwellers in Egypt's urban and rural regions. Female gender, widowhood, illiteracy, living arrangements, previous hospitalization, drug compliance, periodic checkup, engagement in social practices, and smoking. Moreover, Older adults' age, work status, income, comorbidities, polypharmacy, functional status, and nutritional status were found as the main factors associated with frailty. **Recommendations**: Assessment of associated risk factors of frailty in older adults should be done through community-based healthcare programs for early diagnosis and management.

Keywords: Older Adults, Community-Dwelling, Egypt, Frailty, Prevalence.

Introduction:

An “older adult” or elderly is defined as an individual over the age of 60 years. The elderly population is growing rapidly worldwide. In 2030, the elderly population in the world will be 1 in 6 people as they will increase from 1 billion in 2020 to 1.4 billion in 2030 and in 2050 will double to 2.1 billion **(World Health Organization, 2021).**

Old age represents a transitional period where older adults meet changes in physical health and social roles; these transitional changes are significant **(Sun et al., 2021)** resulting in significant adverse outcomes including frailty development **(Delbari, Zanjari, Momtaz, Rahim, & Saeidimehr, 2021**). Frailty in older adults is known to be a reversible condition and is considered a strong, common, and independent predictor of disability characterized by physical, social, psychological, and economic aspects. Despite, frailty is a lifelong condition; it is not an inevitable consequence of the aging process **(Sobhani et al., 2021 & Hazuda et al., 2021).**

According to **Fried et al., (2001)**, frailty is defined as "A condition meeting 3 of the 5 phenotypic criteria namely, unintentional weight loss, exhaustion, low grip strength, slowed walking speed, and low physical activity". However, a common definition and assessment tools for clinical practice and research are yet to be achieved; the conceptual and theoretical basis of frailty as a dynamic, complex, and multifaceted process, is well established **(Sobhani et al., 2021)**.

The prevalence of frailty varies considerably, typically as a result of varying definitions, assessment tools, as well as varying populations, and diagnostic criteria **(Richards, D’Souza, Pascoe, Falloon & Frizelle, 2019).** The prevalence of frailty among community-dwelling older adults ranges from 4.9% to 27.3% worldwide **(Jang & Kim, 2021)**. Recent systemic review and meta-analysis (2018) reported the prevalence in community dweller older adults to be

17.4% (95% CI 14.4% to 20.7%) **(Siriwardhana, Hardoon, Rait, Weerasinghe &Walters, 2018).** In Egypt, Frailty prevalence was 77.1% among the elderly in nursing homes compared to 66.3% among community dwellers **(Sabbour, Abdul Rahamn, Amin, & Mohamed, 2018)** and 58.7% in a study done on elderlies in primary health care centers **(Naeem, Mostafa, & El-Said, 2020).**

Frailty progression extent a wide range of risk factors including (i) socio-demographic influences such as poverty, low education level, living alone, advanced age, and sedentary lifestyles **(Walters et al., 2017)**, (ii) psychological factors, (iii) nutritional issues (iv) polypharmacy; (v) diseases and complications such as cancer, endocrine disorders, dementia **(Moon, Huh, Won & Kim, 2019; Di Ciaula & Portincasa, 2020)**. Frailty captures the combined effects of age-related diseases and an increased vulnerability to adverse health outcomes **(Bello et al., 2021)**.

Therefore, minimizing the number of frail elderly is crucial both to prolong the healthy life span of older adults and to lower medical and long-term care costs. On the other hand, nurses in all healthcare settings (e.g., primary care, hospital, and nursing home) are in frequent contact with frail elders and play a vital role in assessing high risk elderly for frailty in their area of practice using validated assessment and screening tools. Also, nurses should direct patients and caregivers to supportive services and interventions to reduce frailty risk, as well as prevent or delay adverse health outcomes **(Craig, 2019 and Chen, Gan, & How, 2018).**

Significance of the study:

Over the last decades, one of the main features in the Egyptian population is a gradual increase in life expectancy for both males and females. In the Arab world, Egypt has the highest percentage of elderly (7.2%) in which the percent of older people was 7.2% in 2013, 8.1% in 2016, and projected to be 9.2% in 2021, and it is predictable to reach 20.8% in 2050 **(Aly, Dessoki, Eldeeb, & Mohamed, 2021)**. Frailty is a common geriatric condition characterized by physical decline and diminished age-related physiologic reserve leading to inability to cope with stressors and an increase in the risk of developing dependency, morbidity, and/or mortality. There has been a growing interest in frailty among elderly adults to identify those most in need of medical attention and healthcare services and thus decrease the risk of disability, morbidity, and mortality. With the rapidly aging population, health care providers including nurses will be challenged to recognize and manage frail older adults and their associated chronic conditions with judicious use of the limited available geriatric specialist resources. On the other hand research on frailty assessment and its associated factors in Egypt is scarce **(Saudi, Tosson, & Salama, 2021).** So, this study aimed to shed light on the frailty among community-dwelling older adults.

Aim of the study

Assess the prevalence of frailty and its associated factors among community-dwelling older adults.

Research questions:

- What is the prevalence of frailty among community-dwelling older adults?
- What are the associated factors of frailty among community-dwelling older adults?

Methods

Study Design:

A community-based cross-sectional research design was used.

Setting:

The study targeted 3 urban and 3 rural areas affiliated with Dakahlia governorate in Egypt to produce nationally representative samples. Starting with urban areas; representing 3 out of 18 centers of Dakahlia selected randomly namely; Mansoura, Dekernes, and Mitt-Salsil. While rural areas representing 3 villages selected randomly from each selected urban area; 1 out of 57 villages affiliated to Mansoura namely Baramoun, 1 out of 33 villages affiliated to Dekernes namely Ashmon, and finally, 1 out of 5 villages affiliated to Mitt-Salsil namely Al-Eitihad.

Sample size calculation:

The sample size was calculated using DSS research software (https://Dss.research.com). A previous study found the prevalence of frailty among the elderly was 36.4% (**Boulos, Salameh, &Barberger-Gateau, 2016)** and it was expected to be 46.4% in our locality, with an alpha error of 5%, study power of 80%. Then the calculated sample size was 300 older adults (150 elderly subjects in urban and 150 elderly subjects in rural areas).

Subjects:

Sample technique:

A cluster sampling technique (multiple-stage cluster sampling) was utilized in this study; community-dwelling older adults have lived in Dakahlia governorate and had been selected from each urban and rural area. Clusters were divided based on regions/buildings. Firstly, randomly pick clusters by standing in a central landmark in the areas of Mansoura, Dekernes, Mitt-Salsil, El- Baramoun, Ashmon, and Al-Eitihad, then choosing one direction to follow and to start with (i.e., by spinning a bottle). Next, the number of buildings in that direction is then counted, and one house was simply randomly chosen by giving each building of the houses a numerical label of the same length, another direction taken from a central starting point was chosen as described above and the houses were contacted in the next chosen direction until the required information was gathered from the whole the direction (cluster). Through house to another to reach the target population fulfilling the following criteria: Aged 60 years and more, Both sexes, Able to communicate and willing to participate in the study voluntarily, and Available at the time of data collection.

Exclusion criteria:

1. Elders who suffered from any disability as handicapping or paralysis.
2. Elders who suffered from cognitive impairment diagnosed by mini-mental state (scoring less than 24 on MMSE adjusted for age and education).
3. Elders who were acutely ill patients requiring urgent management.

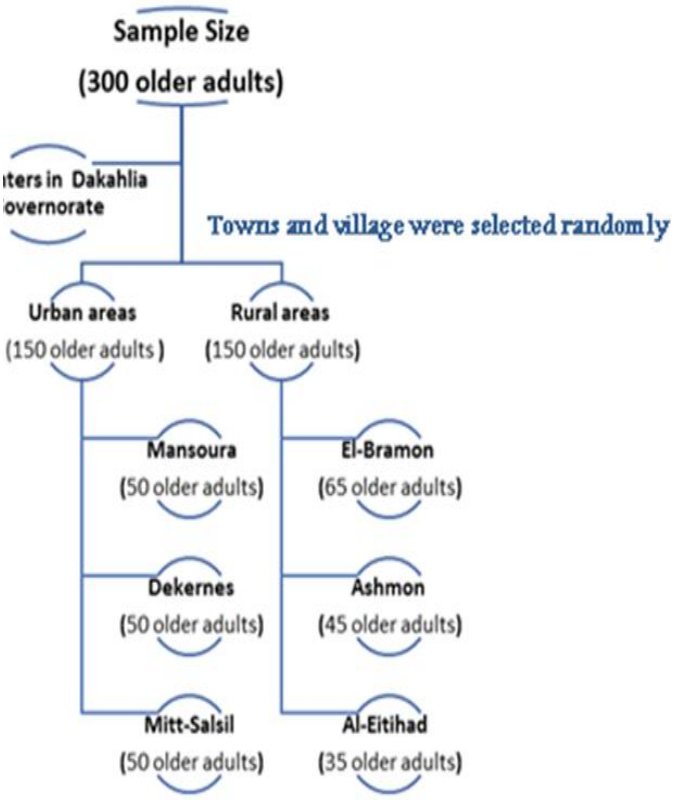

Figure A: Flow chart clarifying sampling technique in each stage

Tools of data collection:

Tool I: Mini-Mental State Examination (MMSE): This tool was developed by **Folstein, Folstein, & McHugh (1975)** and translated into the Arabic language validated and tested for its reliability (r =.093) by **Abd El Moniem, (2012)**. It was designed for assessing the elder's cognitive function and consists of 11 items that investigate memory, orientation to time, person and place, and attention. The MMSE scale score is 30 points and classified as follows: - Score of 24-30 indicates normal cognitive function. - Score of 18-23 indicates mild cognitive impairment. - Score of 0-17 indicates severe cognitive impairment.

Tool II: Demographic and Health-Related Data Structured Interview Questionnaire:

This tool was developed after a review of relevant literature and divided into two parts:

Part (1): Demographic characteristics of the elderly such as age, gender, level of education, marital status, income, occupation before retirement, and living condition. **Part (2):** Health-related data such as a medical history of chronic diseases, intake of medications,

previous hospitalization, previous surgery, drug compliance, and Body Mass Index (BMI). **Part (3):** Lifestyle-related data such as consumption patterns of different foods, smoking consumption, caffeine intake, and social engagement.

Tool III: Katz and Akpom scale: This tool was developed by **Katz &Akpom, (1976)** to assess functional status by assessing the client's ability to perform independently six activities of daily living (ADL) (bathing, dressing, toileting, transferring, continence, and feeding). Translated into Arabic language and tested for validity and reliability (r = 0.83) by **Sorour, Khalil, Sharaan, & El Geneidy, (2019)**. A score of 6 or less is considered Independent, 7 to 12 is considered *partially dependent*, and 13 to 18 is considered *totally dependent*.

Tool IV: Lawton and Brody scale: This tool was developed by **Lawton & Brody, (1969)** to assess the ability to perform eight domains of instrumental activities of daily living (IADL) (ability to use the telephone, go shopping, food preparation, housekeeping, laundry, transportation, responsibility for own medication, and ability to handle finances). Translated into Arabic language and tested for validity and reliability (Cronbach's alpha α = 0.923) by **Rasheedy, & Abou-Hashem, (2020).** Females are scored on all 8 areas of function but in males, the domains of food preparation, housekeeping, and laundering are excluded. Therefore, the score ranges from 0 (low function, dependent) to 8 (high function, independent) in females, and 0 through 5 for males. Participants' functional level was then categorized as independent (≥75%), assisted (25% <75%) or dependent (<25%) accordingly **(Naeem et al., 2020).**

Tool V: **Mini Nutritional Assessment Questionnaire (MNA®):**

This tool was developed by **Guigoz&Vellas, (1999)** and used to assess nutritional status among elderly people. This tool includes 18 questions with a score less than 17 considered malnourished, 17 - 23.5 considered at risk of malnutrition, and 24 - 30 considered normal nutritional status **(Vellas et al., 2006).**

Tool VI: Survey of Health, Aging, and Retirement in Europe of the Frailty Indicator (SHARE FI): This tool was developed by **Alcser& Benson (2005)** to evaluate frailty which approximates Fried's frailty definition which includes 5 criteria; exhaustion, weight loss, weakness, slowness, and low physical activity. Frailty is defined in terms of three categories each of which is defined by the sum of the number of individual criteria present (0: non-frail "robust", 1 or 2: prefrail, and 3, 4 or 5: frail) **(Romero-Ortuno, Walsh, Lawlor& Kenny, 2010)**.

Data collection process:

Phase I: Preparatory phase included:-Administrative stage: Official approval was obtained from the dean of the Faculty of Nursing- Mansoura University to be used in the selected setting in order to obtain the approval and to permit the researcher to carry out the study. **Literature review;** reviewing national and international literature on the various aspects of older adults, frailty, and activity level, were proposed from scientific published articles, internet searches, and textbooks which were a guide for developing the study tools. **Developing the study tools** of data collection, tool I (Demographic and Health-Related Data Structured Interview Schedule) was developed, then the researcher translated tool V (MNA) & tool VI (SHARE-FI) into the Arabic language and the validity of the translation was checked by an expert of English language from the Faculty of Education. To ensure the validity of the translation, a backup translation technique had been used in this study.

Content validity of the study tools (tool I, tool II, tool III, tool IV, tool V & tool VI) was tested by a jury of five experts in the fields of Gerontological Nursing and occupational health in Community Medicine. Accordingly, there was no recommended modifications had been done and the final forms were used for data collection. Then, the interview schedule had been put in its final form. ***Face validity;*** was carried out by

conducting **a pilot study** on 10% of the study subjects (30) older adults to ensure the clarity, feasibility, and applicability of the developed tools and to estimate the time needed to fill the questionnaire sheet, and they were excluded from the study sample. The time needed to fill the interview schedule was 40-45 min. ***The reliability***; tool V (MNA) & tool VI (SHARE-FI) had been tested through the Cronbach Alpha test (α =0.834, and, α=0.831, respectively).

Ethical considerations approval was obtained from the Research Scientific Ethical Committee of the Faculty of Nursing, Mansoura University. Informed consent was obtained from each study subject enrolled in the study, after clarification of the aim of the study, the researcher highlighted that the collected data were treated confidentially and only used for the study. Safety, anonymity, and privacy had been assured throughout the whole study. Each older adult was assured that their participation was voluntary, and they have the right to refuse to participate or withdraw from the study at any time without penalty.

Phase II: Operational phase; this phase extended for 5 months; started from the beginning of March 2020 and ended in July 2020. This phase consisted of the following steps: The researcher used to go to the previously selected setting 6 hours/ day, 3 days/week. Study subjects who match the sample criteria and accept to participate in the study were interviewed individually at their homes; starting by the researcher introduced herself, then explanting the aim of the study to collect the necessary data using all study tools. Assessing cognitive status using tool I (MMSE) (participants who scored less than 24 were excluded), demographic, health-relevant data, lifestyle using tool II, functional status through tools III & IV, nutritional status via tool V (MNA), and frailty via tool VI (SHARE-FI). Comorbidity; defined as the coexistence of two or more chronic conditions **(Espinoza, Quiben, & Hazuda, 2018)**, polypharmacy ≥ 5 drug use were accepted as polypharmacy includes over-the-counter medication and/or complementary and alternative medicines **(Guillot, Maumus-Robert, & Bezin, 2020).**

- **Hand Grip Strength** (HGS) The researcher was used a Futaba Professional Hand Grip Dynamometer; capacity (CAP); 0-130Kg, older adults asked to squeeze the dynamometer with maximal effort for two trials on each hand. The highest recorded HGS on each hand through two consecutive measurements between each attempt, they took a break of 1 min, the highest of the four had been selected **(Alonso et al., 2018).Weight;** so, it was measured using a Granzia Ultra-slim Digital Standing Bathroom Scale, Elega EB9380 - CAP up to 180 kg; with an accuracy of 0.1 kg. **Height;** was measured using a measuring tape; EMVANV - A UK Brand CAP 0-150 cm. **Body mass index (BMI);** was then calculated using the following equation: $\frac{\text{weight (in kg)}}{\text{height (m2)}}$ **(Chen, Winterstein, Fillingim, & Wei, (2019).**
- The time taken to fill the study tools ranged from 30 to 40 minutes.
- Due to the widespread of COVID-19 pandemic, the researcher used to keep a physical distance, change face masks & disposal gloves, and disinfect used equipment with alcohol from an elderly to another.

Statistical analysis of the data: -

The data collected were coded, tabulated, and analyzed using the statistical package of social science (SPSS) version 21. Descriptive appropriate statistical tests were utilized as frequent, percentage, mean, and standard deviation. As well as inferential statistics were used; Reliability Statistics was assessed using Cronbach's Alpha test; is an international measure of reliability with a maximum value 1.0 (high reliability) and the minimum accepted value is 0.65 below this value indicating an unreliable tool. Pearson's Chi-square was used to compare categorical variables and to study bivariate associations between explanatory variables and Monte Carlo exact test was used as alternative if there were many small expected values. Pearson coefficient was used to correlate between two normally distributed quantitative

variables. Multivariate linear Regression was used to detect the most independent predictors for frailty. A significant level (the p-value) ≤ 0.05 was considered significant. Graphs were done for data visualization by Spss.

Results:

The age of the studied older adults was between 61 and 93 years, with a mean age of 67.99 ± 6.32 years. Males were more prevalent (57.3 %), 94.3% were suffering from chronic diseases, and 90.8% had more than one disease (multi-morbidity), and 67.0% had polypharmacy of the studied older adults.

Table 1 shows that self-reported exhaustion in the past week or one month earlier was the most prevalent frailty criterion (86.3%) while; low physical activity was the least prevalent one (54.7%). Based on SHARE FI, Frailty was present in more than two third of the studied older adults (64.7%) and only 5.3% were robust with Mean±SD (3.36 ± 1.62).

Table 1: Prevalence of frailty criterion among the studied older adults

Frailty criterion	**N=300**	**100%**
I. Self-reported exhaustion in the past week or one month earlier.		
- No	41	13.7
- Yes	259	86.3
II. Shrinking/ Loss of appetite than usual		
- More	98	32.7
- Less	202	67.3
III. Slowness/ Functional difficulties		
- No	107	35.7
- Yes	193	64.3
IV. Low physical activity		
- Once to three times monthly	136	45.3
- Rarely or never	164	54.7
V. Low grip strength/ Weakness		
- More than the normal Cutoff value	107	35.7
- Less than the normal Cutoff value	193	64.3
Total score		
- No frail/ Robust (0 point)	16	5.3
- Pre-frail1 (1-2 point)	90	30.0
- Frail (3-5 point)	194	64.7
Mean ± SD (Min- Max)	**3.36 ± 1.62 (0 .00- 5.00)**	

Table (1) shows that frailty prevalence increases with age; older adults aged 70 years and above were frail with the highest percentage (84.3%). Frailty was more prevalent among females (79.7%), widows (87%), illiterate (81.5%), housewife (78.7%), those who didn't work after retirement (79.5%), hadn't enough monthly income (87.6%), and lived with other than family (100%) with a highly significant relationship. While place of residence either urban areas (66.7%) or rural areas (62.7%) did not affect frailty prevalence (p=0.746).

Table (2): Demographic characteristics of the studied older adults by frailty status

Demographic characteristics		Total (300)	Frailty			Chi-Square tests	
			Robust N (%)	Pre-Frail N (%)	Frail N (%)	X^2	P
Age (years)	≥ 60	107	11 (10.3)	42 (39.3)	54 (50.5)	27.75	< 0.001**
	≥ 65	104	5 (4.8)	34 (32.7)	65 (62.5)		
	≥ 70	89	0 (0.0)	14 (15.7)	75 (84.3)		
Mean ± SD			***67.99 ± 6.32***				
Sex	Male	172	12 (7.0)	68 (39.5)	92 (53.5)	22.05^	< 0.001**
	Female	128	4 (3.1)	22 (17.2)	102 (79.7)		
Marital status	Single	10	0 (0.0)	2 (20.0)	8 (80.0)	33.40^	< 0.001**
	Married	192	16 (8.3)	74 (38.5)	102 (53.1)		
	Widow	77	0 (0.0)	10 (13.0)	67 (87.0)		
	Divorced	21	0 (0.0)	4 (19.0)	17 (81.0)		
Place of Residence	Rural	150	8 (5.3)	48 (32.0)	94 (62.7)	0.586	0.746
	Urban	150	8 (5.3)	42 (28.0)	100 (66.7)		
Educational level	Illiterate	151	2 (1.3)	26 (17.2)	123 (81.5)	61.57^	< 0.001**
	Read &write	75	9 (12.0)	23 (30.7)	43 (57.3)		
	Primary	22	0 (0.0)	9 (40.9)	13 (59.1)		
	Preparatory	4	0 (0.0)	3 (75.0)	1 (25.0)		
	Secondary	22	1 (4.5)	14 (63.6)	7 (31.8)		
	University	26	4 (15.4)	15 (57.7)	7 (26.9)		
Work before retirement	Employed	72	7 (9.7)	37 (51.4)	28 (38.9)	53.08^	< 0.001**
	Farmer	51	3 (5.9)	4 (7.8)	44 (86.3)		
	Occupational	55	2 (3.6)	27 (49.1)	26 (47.3)		
	Housewife	122	4 (3.3)	22 (18.0)	96 (78.7)		
Current work	No	210	4 (1.9)	39 (18.6)	167 (79.5)	69.79^	< 0.001**
	Yes	90	12 (13.3)	51 (56.7)	27 (30.0)		
Monthly income	Not enough	153	1 (0.7)	18 (11.8)	134 (87.6)	72.78^	< 0.001**
	Enough	147	15 (10.2)	72 (49.0)	60 (40.8)		
Living arrangements	Alone	38	0 (0.0)	3 (7.9)	35 (92.1)	17.22^	0.008*
	With spouse	258	16 (6.2)	87 (33.7)	155 (60.1)		
	With others [b]	4	0 (0.0)	0 (0.0)	4 (100.0)		

X^2: Chi-Square tests **P**: p-value for the association between different categories

*: Statistically significant at p ≤ 0.05**: Statistically highly significant at p ≤ 0.01

[b] Other Living arrangements: like friends, son, and siblings - ^ P value based on Monte Carlo exact probability

Table (2) shows that frailty was more prevalent among older adults who had more than one disease (74.3%), who took 5 medications (80.1%), and non-adherent to medication (82.4%) with a statistically significant relationship (p=< 0.001,p=< 0.001&p=0.002 respectively). Also, engagement in social practices (78.3%), previous hospitalization (82.9%), smoking habit (78.7%), caffeine intake (66.5%), and periodic checkups (72.5%) were statistically significant with frailty. While there is no statistically significant relationship between following a special diet and frailty (p=0.202).

Table (3): Health-related and Lifestyle characteristics of the studied older adults by frailty status

Items		Total 300	Frailty						Chi-Square tests	
			Robust		Pre-Frail		Frail		X^2	P
			N	%	N	%	N	%		
Number of diseases	No diseases	17	5	29.4	12	70.6	0	0.0	95.03	< 0.001**
	One disease	26	7	26.9	16	61.5	3	11.5		
	≥ 2 disease "Comorbidity"	257	4	1.6	62	24.1	191	74.3		
Cardiovascular disease	No	127	14	11.0	57	44.9	56	44.1	44.042	< 0.001**
	Yes	173	2	1.2	33	19.1	138	79.8		
Diabetes Mellitus	No	144	9	6.2	62	43.1	73	50.7	24.530	< 0.001**
	Yes	156	7	4.5	28	17.9	121	77.6		
Respiratory disease	No	226	16	7.1	86	38.1	124	54.9	38.651	< 0.001**
	Yes	74	0	0.0	4	5.4	70	94.6		
Renal disease	No	215	16	7.4	83	38.6	116	54.0	38.521	< 0.001**
	Yes	85	0	0.0	7	8.2	78	91.8		
Liver disease	No	204	16	7.8	82	40.2	106	52.0	45.536	< 0.001**
	Yes	96	0	0.0	8	8.3	88	91.7		
Osteoarthritis	No	105	15	14.3	42	40.0	48	45.7	38.632	< 0.001**
	Yes	195	1	0.5	48	24.6	146	74.9		
Osteoporosis	No	143	16	11.2	59	41.3	68	47.6	41.488	< 0.001**
	Yes	157	0	0.0	31	19.7	126	80.3		
Cancer	No	286	16	5.6	90	31.5	180	62.9	8.024	< 0.001**
	Yes	14	0	0.0	0	0.0	14	100.0		
Depression	No	274	16	5.8	89	32.5	169	61.7	12.373	< 0.001**
	Yes	26	0	0.0	1	3.8	25	96.2		
Dental problems	No	145	12	8.3	67	46.2	66	45.5	45.042	< 0.001**
	Yes	155	4	2.6	23	14.8	128	82.6		
Number of medications	No medications	38	3	7.9	25	65.8	10	26.3	88.80	< 0.001**
	> 5 medications	61	13	21.3	25	41.0	23	37.7		
	≥5 medications "polypharmacy"	201	0	0.0	40	19.9	161	80.1		
Drug compliance	No	91	0	0.0	16	17.6	75	82.4	12.80	0.002**
	Yes	171	13	7.6	49	28.7	109	63.7		
Previous hospitalization	No	171	16	9.4	68	39.8	87	50.9	36.40	<0.001**
	Yes	129	0	0.0	22	17.1	107	82.9		
Periodic-checkup	No	178	4	2.2	45	25.3	129	72.5	15.19	0.001**
	Yes	122	12	9.8	45	36.9	65	53.3		
Engage in social practices	No	115	0	0.0	25	21.7	90	78.3	19.52	<0 .001**
	Yes	185	16	8.6	65	35.1	104	56.2		
Smoking habit	No-smoker	160	9	5.6	42	26.2	109	68.1	13.15	0.007**
	Current smoker	93	7	7.5	38	40.9	48	51.6		
	Ex- smoker	47	0	0.0	10	21.3	37	78.7		
Caffeine intake/day	No	22	2	9.1	11	50.0	9	40.9	5.86	0.043*
	Yes	278	14	5.0	79	28.4	185	66.5		
Follow Special diet	Ordinary diet	249	14	5.6	71	28.5	164	65.9	7.98	0.202
	Hypertensive diet	30	0	0.0	13	43.3	17	56.7		
	Diabetes diet	17	2	11.8	6	35.3	9	52.9		
	Renal diet	4	0	0.0	0	0.0	4	100.0		

Table (3) shows that, frailty prevalence increases with increasing dependency and all studied older adults who were dependent in ADL & IADL were frail (100%). Moreover, frailty prevalence was 94% in malnourished older adults.

Table (4): Functional status and nutritional status of the studied older adults by frailty status

Functional Status		Total 300	Frailty						Chi-Square tests	
			Robust		Pre-Frail		Frail		X^2	P
			N	%	N	%	N	%		
ADL	Totally dependent	23	0	0.0	0	0.0	23	100.0	109.74	< 0.001**
	Need assistance	130	0	0.0	11	8.5	119	91.5		
	Independent	147	16	10.9	79	53.7	52	35.4		
IADL	Totally dependent	74	0	0.0	0	0.0	74	100.0	155.36	< 0.001**
	Need assistances	156	0	0.0	43	27.6	113	72.4		
	Independent	70	16	22.9	47	67.1	7	10.0		
MNA	Normal nutritional	35	15	42.9	20	57.1	0	0.0	212.564	< 0.001**
	High risk for	114	1	0.9	61	53.5	52	45.6		
	Malnourished	151	0	0.0	9	6.0	142	94.0		

ADL: Activity of Daily Living, IADL: Instrumental Activity of Daily Living, MNA: Mini Nutritional Assessment

Figure 1, shows a strong positive correlation between frailty, and ADL (P< 0.001). Figure 2 shows a strong negative correlation between frailty, and IADL (P< 0.001). As well, figure 3 shows a strong negative correlation between frailty and nutritional status (p < 0.001).

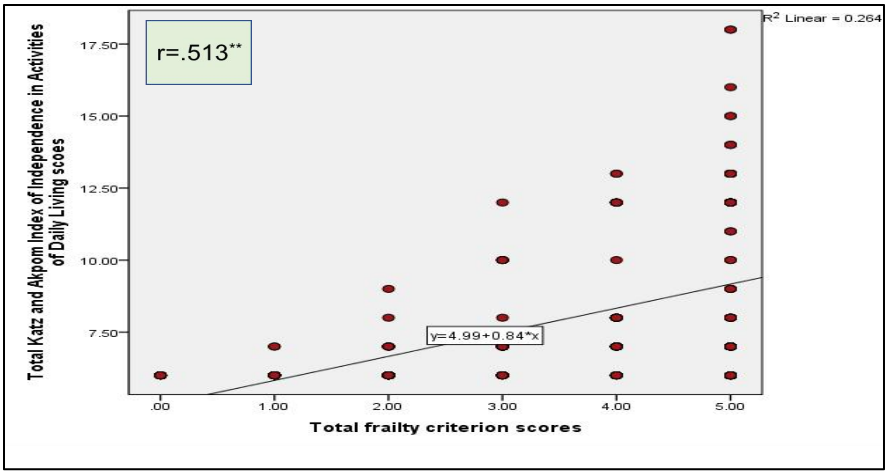

Figure 1: Correlation between frailty criterion and Activity of Daily Living of the studied older adults

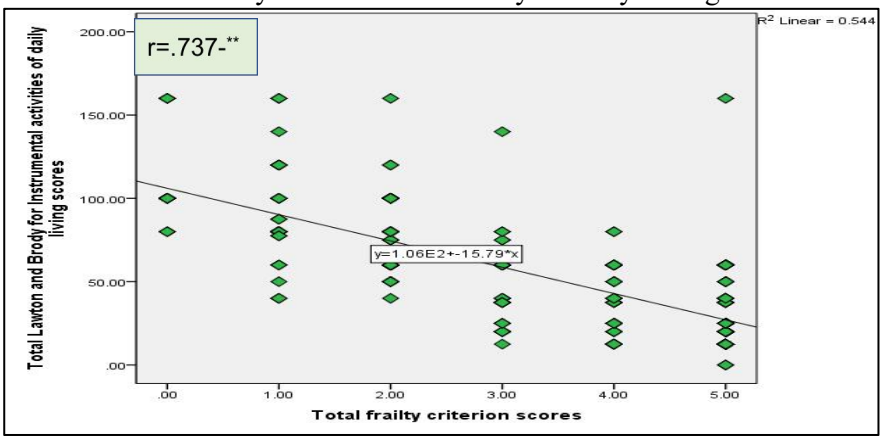

Figure 2: Correlation between frailty criterion and Instrumental Activity of Daily Livings of the studied older adults

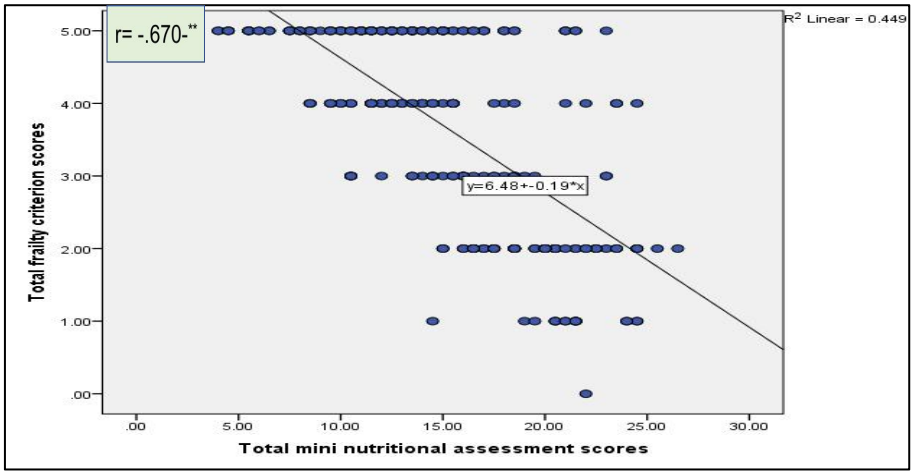

Figure 3: Correlation between frailty criterion and nutritional status of the studied older adults

Table 5: Correlation between frailty and anthropometries of the studied older adults

Anthropometrics measurements	Frailty	
	(r)	P
Body weight on a fixed	-.199-**	< 0.001
Height	-.275-**	< 0.001
BMI[a]	-.149-**	< 0.001
CC[b]	-.306-**	< 0.001
MAC[c]	-.282-**	< 0.001
HGS[d]	-.793-**	< 0.001

**Correlation is significant at the 0.01 level * Correlation is significant at the 0.05 level

Table 5 shows that body weight, height, BMI, calf circumference (CC), mid-arm circumference (MAC) and handgrip strength (HGS) of the studied older adults were negatively correlated to frailty (P< 0.001 for all).

[a]**BMI:** body mass index**,** [b]**CC**: calf circumference, [c]**MAC**: mid-arm circumference, [d]**HGS**: handgrip strength

*r:*Pearson's rank, *r* <0.3 weak correlation, *r* =0.3-0.5 moderate correlation, *r* >0.5 strong correlation

* (*P*) Significant (p< 0.05), ** Highly significant (p< 0.01)

Table 6: Multivariate regression analysis model for the frailty

Predictors	B	Beta	T	P-value
Age	**0.035**	**0.136**	**3.257**	**0.001**
Gender	0.142	0.044	1.116	0.265
Marital status	0.028	0.011	0.325	0.746
Educational level	-0.028-	-0.028-	-.760-	0.448
Current Work	**-0.521-**	**-0.148-**	**-3.878-**	**< 0.001**
Comorbidity	**0.361**	**0.117**	**2.746**	**0.006**
Polypharmacy	**0.270**	**0.118**	**2.840**	**0.005**
ADL	-0.005-	-0.002-	-0.035-	0.972
IADL	**-0.488-**	**-0.209-**	**-4.036-**	**< 0.001**
MNA	**0.945**	**0.401**	**9.102**	**< 0.001**

R^2 =0.724, F =75.980, p <0.001*

F, p: f, and p values for the model, R^2: Coefficient of determination, B: Unstandardized Coefficients, Beta: Standardized Coefficients, t: t-test of significance

*: Statistically significant at p ≤ 0.05, Note: **Bold** for those variables with statistically significant

Table 6 revealed that age, current work, comorbidity, polypharmacy, IADL, and malnutrition were significant independent predictors for frailty (β 0.136, -0.148, 0.117, 0.118, -0.209, and 0.401respectively), p < 0.05for all, and responsible for 72.4% of frailty (R^2 = .724).

Discussion:

Aging leads to the coexistence of several pathological conditions producing a negative impact on health status that may lead to frailty **(Richter et al., 2021).** Frailty is considered to be a serious public health concern that results in severe adverse health outcomes such as decreased quality of life, functional disability, increased hospitalization and death rate **(Lyu, Wang, Jiang, Wang, & Cui, 2021)**. The importance of studying frailty comes from the fact that it is merely associated with aging and not an inevitable process; hence, it can be prevented or treated. Unfortunately, the frailty prevalence among the elders in Egypt is barely known **(Naeem et al., 2020)**. Therefore, this study aimed to study the prevalence and associated factors of frailty among community-dwelling older adults.

In studying frailty prevalence, we found that according to the SHARE frailty index, 64.7% of the 300 elderly participants were frail; whereas 30% were prefrail and only 5.3% were robust (non-frail). The high frailty prevalence in the current study may not be surprising but rather expected for many reasons; first, the fact that our study was carried out in two settings, urban and rural areas may partly explain this high prevalence. Indeed the elderly population in our study may be more vulnerable because of their lower socioeconomic status and limited access to healthcare services which have been associated with frailty. Finally, most of the geriatric syndromes and factors attributing to the development of frailty were very common in the studied older adults.

Previous studies reported slight differences in prevalence rates of frailty among elderly people; a study done in Egypt by **Gasser, Elbanouby, Abou-Hashem, & Maamoun (2020)** showed that the prevalence of frailty and pre-frailty was 48% and 22.1% respectively according to the clinical frail scale, **Sabbour et al., (2018**) depicted that 71.7% of the elderly participants were considered frail, and **Tayel and Elkady (2016)** found that 58.7% of the elderly residents in geriatric homes were frail.

Whilst many other studies reported a much lower rate, the prevalence of frailty was 33.5% in the study of **Naeem et al., (2020)** in Egypt, 13.9% in the study of **Thinuan, Siviroj, Lerttrakarnnon, & Lorga, (2020)** in Thailand, 26% in the study of **Rivas-Ruiz et al., (2019)** in Spain, 34% in the study of **Thompson et al., (2018)** in Australian. The difference between our study and other studies may be due to many factors including study settings "eg: our sample were collected from the community and other studies collected participants from geriatric homes or outpatient clinic", study population, sample size, and assessment tools. There is an association between all these factors and the different risk of frailty and prefrailty among the elderly **(Ofori-Asenso et al., 2018).**

The present study revealed that frailty was encountered more with increasing age and in female older adults with significant relation. This may be due to the hypothesis of the fact that females live longer than males. The physiological changes, co-morbidity, and disability that occur along body systems that accompanied aging make older females frailer than males **(Gordon et al., 2017).** This result in agreement with the studies done in Korea by **Kim, Yang, & Kim, (2021),** in Latin America by **Da Mata et al., (2021),** and in Italy, by **Collins et al., (2020)**, in the U.S. by **Denfeld et al., (2021)**, in China by **Zhang, Liu, Van der Schans, Krijnen, & Hobbelen (2020).** On the other hand, studies done in Korea by **Kim et al., (2021)**, in Malaysia by **Norazman, Adznam, & Jamaluddin, (2020)**, found no association between frailty and sex despite the higher percentage of frailty in females than in males.

Living alone, being a widow and having lower socioeconomic status (SES) as

measured by low education and/or low income and occupation, were significantly correlating with frailty in this study. Similar findings were reported in prior studies; a study done in China by **Kong, Lyu, Yao, Yang, & Chen, (2021),** meta-analyses from studies done by **Kojima, Taniguchi, Kitamura, & Fujiwara, (2020)** and by **Kojima, Walters, Iliffe, Taniguchi, & Tamiya, (2020**) showed that being unmarried was have a twice risk to be frail than being married, studies done in Italy by **Salaffi, Di Carlo, Carotti, Farah, & Giovagnoni, (2021),** in Spain by **Soler-Vila et al., (2016),** which found a relationship between lower educational level and frailty, a study done in Egypt by **Saudi et al., (2021),** in China by **Zhang et al., (2020),** and in Belgium **Maseda et al., (2018)** found that those elderlies with low income were frail. Moreover, **Van der Linden et al., (2020)** in Switzerland, and **Franse et al., (2017)** in The Netherlands found a positive relationship between lower SES and the development of frailty in the elderly.

Frailty was found to be linked to various risk factors among which is the comorbidities and polypharmacy. When assessing the medical history of the studied older adults via a self-reported number of diagnosed chronic diseases and the number of medications used, it was found that the majority of those who had more than one disease, and who took more than 5 medications were frail with a highly statistically significant association. This may be justified by the fact that geriatric comorbidities courses decline in many physiological systems in older adults that leads to homeostatic imbalance or frailty and increased risk to adverse drug events and medication-related harm **(Liau et al., 2021).** Similar result was reported by other studies done in Egypt by **Saudi et al., (2021), Gasser et al., (2020)** in India by **Panda, Pathak, Islam, Agarwalla, Singh, & Singh (2020).**

Moreover, the prevalence of frailty was higher among older adults who did not engage in social practice, were ex-smoker, and take caffeine daily in the current study. These results were supported by; a study done in China by **Wang, Chen, & Zhou, (2021)** and in Korea by **Chon, Lee, Kim, & Lee (2018)** which revealed that participating in social activities had a significantly lower frailty risk than participants who never engaging in those activities. Contrariwise, studies done in Canada by **Verschoor et al., (2021),** in Korea by **Jung, Lyu, & Kim, (2021),** in China by **Li, Xue, Odden, Chen, & Wu, (2020)**, found that the majority of those who were current-smoker had frailty but without statistically significant association. In inverse, a study done in China by **Jing et al., (2020)**, found that non-tea drinkers were more likely to frailty than tea drinkers, in Spain by **Machado-Fragua, Struijk, Graciani, Guallar-Castillon, Rodríguez-Artalejo, & Lopez-Garcia, (2019),** and by **Brunelli et al., (2021),** showed no association between coffee/tea consumption/day and frailty.

The present results found a negative correlation between body weight, & body mass index (BMI), HGS, mid-arm circumference (MAC), and calf circumference (CC) of the studied older adults with frailty. This result may be because of those who with weak hand grip strength, reduced their physical ability and increased their fragility which were considerable factors in the frailty, and those with too low body weight also had decreased overall strength. In the same line with the current results, studies done in China by **Yuan, Chang, & Wang (2021),** in San Francisco by **Lai, Dodge, McCulloch, Covinsky, & Singer, (2020)**, and in Australia by **Tembo et al., (2020**), in USA by **Chen et al., (2019)** shown that BMI was associated with frailty. In the agreement with current results, studies done in Egypt by **Naeem et al., (2020)**, and in Italy by **Valentini, Federici, Cianfarani, Tarantino, &Bertoli (2018)** found a statistical correlation between frailty and hand grip strength. Moreover, **Closs, Ziegelmann, Flores, Gomes, & Schwanke, (2017)** in Brazil reported that

anthropometric measurements can predict frailty in the elderly.

Disability is historically known as having difficulty in performing the essential activities of independent living i.e. difficulties on performing activities of daily living (ADL) and/or instrumental activities of daily living (IADL). Frailty is a well-known predictor of disability **(Kojima, 2017)**. Supporting this, the current study showed that, older adults who were frail were dependent in ADL and IADLs, with a statistically significant association between frailty and ADL& IADL. A Similar result was reported by the study done in Egypt by **Saudi et al., (2021)** & **Naeem et al., (2020)** and in Sri Lanka by **Siriwardhana, Weerasinghe, Rait, Scholes, & Walters, (2020)** showed that frailty was significantly associated with ADL and IADL.

When studying frailty and nutritional status, a strong negative association between frailty and malnutrition was found. Thus, among frail studied older adults, the majority had poor nutritional status. This finding points toward the fact that malnutrition usually occurs due to the inability to regulate nutritional needs or poor absorption of nutrients, and then leads to severe weight loss, a state of easy fatigability, tired, exhaustion, increased vulnerability and lack of power that end by increased vulnerability or frailty and vice versa, alongside the significant association of poor oral health with frailty that found by **Bassim et al., (2020)**. Further studies were in line with the present result, a study was done in Egypt by **Shokry, Hamza, Fouad, Mohammed, & Aly, (2021) & Sabbour et al., (2018),** in China by **Zhang, Zhang, Hu, Meng, Xi, Xu, & Yu, (2021),** and **Zhang et al., (2020**), showed that malnutrition was significantly associated with frailty. Similarly, studies done in Korea by **Seo et al., (2021),** and in the Netherlands by **Benraad, (2021)** found negative correlation of frailty with nutritional status.

The present study revealed that age, current work, comorbidities, polypharmacy, IADL, and nutritional status were significant independent predictors for frailty. Similarly, studies done in China, by **Xu et al., (2021**), found age, multimorbidity, and IADL scores showed significant associations with frailty (all $P < 0.05$),vin Indonesia by **Setiati et al., (2019)**, found age a predictor for frailty, and in Italy, by **Valentini et al., (2018),** found IADL predictors for frailty. This result may be justified as older adults are at greater risk of iatrogenic events due to age-related functional deficits, disease progression, comorbidities, and polypharmacy. Also, older adults complain of limited physical activity, feel exhausted, lack energy, and weight loss. All these conditions make older adults more prone to frailty syndrome **(Papathanasiou et al., 2021).**

In light of the finding of this study and the fact that frailty is a highly prevalent syndrome in aging populations, it is essential to assess and manage frailty properly. In this regard, knowledge about frailty-associated factors and the complexity of their determinants support the construction of early preventive and intervention measures **(Pegorari & Tavares, 2020).**

Strength and limitation:

To our knowledge, research on frailty is rarely covered in developing countries, especially in Egypt. This study highlighted frailty as critical problem for older adults which will contribute to the literature on frailty among older adults in Egypt; the study evaluated an extensive list of sociodemographic factors, lifestyle and health-relevant, clinical characteristics, functional, and nutritional status, that could influence the frailty among community-dwelling older adults. The study was conducted in 6 geographical regions (3 urban and 3 rural areas) in Dakahlia, which may result in the generalizability of the findings. However, there are some limitations. First, cross-sectional study design may limit the ability to conclude the direction of causality. Second, self-reported information in the

questionnaire may be affected by memory and information bias due to educational inequality. Third, also an extra budget was required for safety maintenance during the COVID-19 pandemic.

Conclusion:

Frailty was highly prevalent among community dwellers in Egypt's urban and rural regions. Risk factors of frailty include female gender, widowhood, illiteracy, living arrangements, previous hospitalization, drug compliance, periodic checkup, engagement in social practices, and smoking. Moreover, older adults' age, work status, income, comorbidities, polypharmacy, functional status, and nutritional status were found as the main factors affecting frailty. Hence, it is important to identify older adults who are frail, to provide comprehensive care to improve the outcome for this vulnerable population and increased attention should also be placed on intervention studies that look at the impact on the frailty of older adults.

Recommendations:

1. Assessment of associated risk factors of frailty in older adults should be done through community-based healthcare programs for early diagnosis and management.
2. Develop standardized care for older adults with frailty, in acute care and primary care settings. Since there are no specific guidelines for providing care to the frail, such standard care may include for example; comprehensive geriatric assessment, continuous monitoring for risk factors and early symptoms, educational programs, and orientation to available resources and cost-effective services that supports aging in place for the elderly.
3. Designing an educational program about frailty, how to manage associated symptoms, and to locate resources that may decrease its progress to mitigate negative consequences and provide older adults with clear educational materials regarding primary, secondary, and tertiary prevention.
4. Implementation of an intervention program is especially important for older adults and family caregivers in which elderly individuals can be empowered to live independently within their communities. This would enable the seniors and community as a whole to build resilience and thereby combat frailty.

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Declaration of Competing Interest

The authors declared no potential conflicts of interest.

References:

- **Abd El Moniem, M. (2012).** Comparative study of the effect of three types of restorative Nursing Interventions on the health-related functional status of geriatric patients with Parkinson's disease. Unpublished doctorate thesis, Alexandria: university of Alexandria, Faculty of Nursing.
- **Alcser, K. H., & Benson, G. (2005).** The SHARE train-the-trainer program. The Survey of Health, Ageing and Retirement in Europe–Methodology. Mannheim: MEA, 70-74.
- **Alonso, A. C., Ribeiro, S. M., Luna, N. M. S., Peterson, M. D., Bocalini, D. S., Serra, M. M., Brech, G. C., Greve, J. M. D., & Garcez-Leme, L. E. (2018).** Association between handgrip strength, balance, and knee flexion/extension strength in older adults. *PloS one*, *13*(6), e0198185.
- **Aly, A. G., Dessoki, H. H., Eldeeb, A. M., & Mohamed, A. S. E. (2021).** Challenges being Faced by the Elderly People in Accessing Health Services in Beni-Suef University Hospital. NILES journal for Geriatric and Gerontology, 4(2), 346-364.
- **Bassim, C., Mayhew, A. J., Ma, J., Kanters, D., Verschoor, C. P., Griffith, L. E., &Raina, P. (2020).** Oral health, diet, and frailty at baseline of the Canadian longitudinal study on aging. Journal of the

American Geriatrics Society, 68(5), 959-966.

- **Bello, G. A., Ornstein, K. A., Lucchini, R. G., Hung, W. W., Ko, F. C., Colicino, E., Taioli, E., Crane, M. A., & Todd, A. C. (2021).** Development and Validation of a Clinical Frailty Index for the World Trade Center General Responder Cohort. Journal of Aging and Health, 0898264321997675.
- **Benraad, C. E. M. (2021).** Geriatric syndromes and multimorbidity in older adults with psychiatric disorders: An integrated perspective (Doctoral dissertation, [Sl]:[Sn]).
- **Boulos, C., Salameh, P., &Barberger-Gateau, P. (2016).** Malnutrition and frailty in Community-Dwelling older adults living in a rural setting. Clinical nutrition, 35(1), 138-143.
- **Brunelli, L., Davin, A., Sestito, G., Mimmi, M. C., De Simone, G., Balducci, C., Pansarasa, O., Forloni, G., Cereda, C., Pastorelli, R., & Guaita, A. (2021).** Plasmatic Hippuric Acid as a Hallmark of Frailty in an Italian Cohort: The Mediation Effect of Fruit-Vegetable Intake. The journals of gerontology. Series A, Biological sciences and medical sciences, 76(12), 2081–2089.
- **Chen, C. Y., Gan, P., & How, C. H. (2018).** Approach to frailty in the elderly in primary care and the community. *Singapore medical journal*, *59*(5), 240–245.
- **Chen, C., Winterstein, A. G., Fillingim, R. B., & Wei, Y. J. (2019).** Body weight, frailty, and chronic pain in older adults: a cross-sectional study. BMC geriatrics, 19(1), 1-10.
- **Chon, D., Lee, Y., Kim, J., & Lee, K. E. (2018).** The association between frequency of social contact and frailty in older people: Korean Frailty and Aging Cohort Study (KFACS). Journal of Korean medical science, 33(51).
- **Closs, V. E., Ziegelmann, P. K., Flores, J. H. F., Gomes, I., & Schwanke, C. H. A. (2017).** Anthropometric measures and frailty prediction in the elderly: an easy-to-use tool. *Current gerontology and geriatrics research*, *2017*.
- **Collins, J. T., Short, R., Carter, B., Verduri, A., Myint, P. K., Quinn, T. J., Vilches-Moraga, A., J. Stechman M., Moug, S., McCarthy, K., & Hewitt, J. (2020).** The clinical frailty scale: estimating the prevalence of frailty in older patients hospitalized with COVID-19. The COPE studies. Geriatrics, 5(3), 58.
- **Craig, L. (2019).** The role of the registered nurse in supporting frailty in care homes. British Journal of Nursing, 28(13), 833-837.
- **Da Mata, F. A. F., Miranda Forte Gomes, M., Lício Ferreira Santos, J., Aparecida de Oliveira Duarte, Y., & Gomes Pereira, M. (2021).** Depression and frailty in older adults: A population-based cohort study. PloS one, 16(3), e0247766.
- **Delbari, A., Zanjari, N., Momtaz, Y. A., Rahim, F., & Saeidimehr, S. (2021).** Prevalence of frailty and associated socio-demographic factors among community-dwelling older people in southwestern Iran: a cross-sectional study. Journal of Diabetes & Metabolic Disorders, 1-10.
- **Denfeld, Q. E., Habecker, B. A., Camacho, S. A., Roberts Davis, M., Gupta, N., Hiatt, S. O., Medysky, M. E., Purnell, J. Q., Winters-Stone, K., & Lee, C. S. (2021).** Characterizing Sex Differences in Physical Frailty Phenotypes in Heart Failure. Circulation: Heart Failure, 14(9), e008076.
- **Di Ciaula, A., & Portincasa, P. (2020).** The environment as a determinant of successful aging or frailty. Mechanisms of Ageing and Development, 111244.
- **Espinoza, S. E., Quiben, M., & Hazuda, H. P. (2018).** Distinguishing Comorbidity, Disability, and Frailty. *Current geriatrics reports*, *7*(4), 201–209.
- **Folstein, M. F., Folstein, S. E., McHugh, P. R. (1975).** "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res, 12(3), 189-198.
- **Franse, C. B., van Grieken, A., Qin, L., Melis, R. J., Rietjens, J. A., & Raat, H.**

(2017). Socioeconomic inequalities in frailty and frailty components among community-dwelling older citizens. PloS one, 12(11), e0187946.

- **Fried, L.P., Tangen, C.M., Walston, J., Newman, A.B., Hirsch, C., Gottdiener, J., Seeman, T., Tracy, R., Kop, W.J., Burke, G. (2001).** Frailty in older adults: Evidence for a phenotype. J. Gerontol. Ser. A Biol. Sci. Med. Sci., 56, 146–156
- **Gasser, H. M., Elbanouby, S. M., Abou-Hashem, R. M., & Maamoun, M. M. (2020).** Relationship between frailty status and polypharmacy and co-morbidities among elderly patients attending outpatient clinics at Ain Shams University Hospitals. Eur J GeriatrGerontol, 7, 1-7.
- **Gordon, E. H., Peel, N. M., Samanta, M., Theou, O., Howlett, S. E., & Hubbard, R. E. (2017).** Sex differences in frailty: a systematic review and meta-analysis. Experimental gerontology, 89, 30-40.
- **Guigoz, Y., &Vellas, B. J. (1999).** The Mini Nutritional Assessment (MNA) for grading the nutritional state of elderly patients: presentation of the MNA, history and validation. In Nestle Nutritional Workshop Series Clinical and Performance Programme 1 (2) pp. 3-11.
- **Guillot, J., Maumus-Robert, S., & Bezin, J. (2020).** Polypharmacy: a general review of definitions, descriptions and determinants. Therapies, 75(5), 407-416.
- **Hazuda, H. P., Pan, Q., Florez, H., Luchsinger, J. A., Crandall, J. P., Venditti, E. M., ... & Bray, G. A. (2021).** Association of Intensive Lifestyle and Metformin Interventions with Frailty in the Diabetes Prevention Program Outcomes Study. The Journals of Gerontology: Series A.
- **Jang, H. Y., & Kim, J. H. (2021).** Factors Associated with Frailty According to Gender of Older Adults Living Alone. In Healthcare 9(4) p. 475. Multidisciplinary Digital Publishing Institute.In 2017; 17: 2629–2634.
- **Jing, Z., Li, J., Wang, Y., Ding, L., Tang, X., Feng, Y., & Zhou, C. (2020).** The mediating effect of psychological distress on cognitive function and physical frailty among the elderly: Evidence from rural Shandong, China. Journal of affective disorders, 268, 88-94.
- **Jung, Y., Lyu, J., & Kim, G. (2021).** Multi-group frailty trajectories among older Koreans: Results from the Korean Longitudinal Study of Aging. Archives of Gerontology and Geriatrics, 98, 104533.
- **Katz, S., & Akpom, C. A. (1976).** A measure of primary sociobiological functions. International journal of health services, 6(3), 493-508.
- **Kim, Y. M., Yang, N., & Kim, K. (2021).** Effects of Perceived Food Store Environment on Malnutrition and Frailty among the Food-Insecure Elderly in a Metropolitan City. Nutrients, 13(7), 2392.
- **Kojima, G. (2017).** Frailty as a predictor of disabilities among community-dwelling older people: a systematic review and meta-analysis. Disability and rehabilitation, 39(19), 1897-1908.
- **Kojima, G., Taniguchi, Y., Kitamura, A., & Fujiwara, Y. (2020).** Is living alone a risk factor of frailty? A systematic review and meta-analysis. Ageing research reviews, 59, 101048.
- **Kojima, G., Walters, K., Iliffe, S., Taniguchi, Y., & Tamiya, N. (2020).** Marital status and risk of physical frailty: a systematic review and meta-analysis. Journal of the American Medical Directors Association, 21(3), 322-330.
- **Kong, L. N., Lyu, Q., Yao, H. Y., Yang, L., & Chen, S. Z. (2021).** The prevalence of frailty among community-dwelling older adults with diabetes: a meta-analysis. International Journal of Nursing Studies, 103952.
- **Lai, J. C., Dodge, J. L., McCulloch, C. E., Covinsky, K. E., & Singer, J. P. (2020).** Frailty and the burden of concurrent and incident disability in patients with cirrhosis: a prospective cohort study. Hepatology communications, 4(1), 126-133.
- **Lawton, M. P., & Brody, E. M. (1969).** Assessment of older people: self-

maintaining and instrumental activities of daily living. The gerontologist, 9(3_Part_1), 179-186.

- **Li, Y., Xue, Q. L., Odden, M. C., Chen, X., & Wu, C. (2020).** Linking early life risk factors to frailty in old age: evidence from the China Health and Retirement Longitudinal Study. Age and ageing, 49(2), 208-217.
- **Liau, S. J., Lalic, S., Sluggett, J. K., Cesari, M., Onder, G., Vetrano, D. L., Morin, L., Hartikainen, S., Hamina, A., Johne, K., Edwin, C. K., Visvanathan, R., & Bell, J. S. (2021).** Medication management in frail older people: consensus principles for clinical practice, research, and education. Journal of the American Medical Directors Association, 22(1), 43-49.
- **Lyu, H., Wang, C., Jiang, H., Wang, P., & Cui, J. (2021).** Prevalence and determinants of frailty in older adult patients with chronic coronary syndrome: a cross-sectional study. BMC geriatrics, 21(1), 1-9.
- **Machado-Fragua, M. D., Struijk, E. A., Graciani, A., Guallar-Castillon, P., Rodríguez-Artalejo, F., & Lopez-Garcia, E. (2019).** Coffee consumption and risk of physical function impairment, frailty and disability in older adults. European journal of nutrition, 58(4), 1415-1427.
- **Maseda, A., Diego-Diez, C., Lorenzo-López, L., López-López, R., Regueiro-Folgueira, L., &Millán-Calenti, J. C. (2018).** Quality of life, functional impairment and social factors as determinants of nutritional status in older adults: The VERISAÚDE study. Clinical nutrition, 37(3), 993-999.
- **Moon, J. H., Huh, J. S., Won, C. W., & Kim, H. J. (2019).** Is Polypharmacy associated with cognitive frailty in the elderly? Results from the Korean frailty and aging cohort study. The journal of nutrition, health & aging, 23(10), 958-965.
- **Naeem, E. H., Mostafa, N. S., & El-Said, S. M. S. (2020).** Prevalence of frailty among elderly patients attending primary health care centers in sixth of October city, 7(2):5-11.
- **Norazman, C. W., Adznam, S. N. A., &Jamaluddin, R. (2020).** Malnutrition as key predictor of physical frailty among Malaysian older adults. Nutrients, 12(6), 1713.
- **Ofori-Asenso, R., Chin, K. L., Mazidi, M., Zomer, E., Ilomaki, J., Zullo, A. R., Gasevic, D., Ademi, Z., Korhonen, M. J., LoGiudice, D., Bell, J. S., & Liew, D. (2019).** Global incidence of frailty and prefrailty among community-dwelling older adults: a systematic review and meta-analysis. JAMA network open, 2(8), e198398-e198398.
- **Panda, M., Pathak, R., Islam, F., Agarwalla, R., Singh, V., & Singh, F. (2020).** Interplay of multimorbidity and polypharmacy on a Community-Dwelling frail elderly cohort in the peri-urban slums of Delhi, India. Journal of Family Medicine and Primary Care, 9(3), 1647.
- **Papathanasiou, I. V., Rammogianni, A., Papagiannis, D., Malli, F., Mantzaris, D. C., Tsaras, K., Kontopoulou, L., Kaba, E., Kelesi, M., & Fradelos, E. C. (2021).** Frailty and Quality of Life among Community-Dwelling Older Adults. *Cureus*, *13*(2), e13049.
- **Pegorari, M. S., & Tavares, D. M. D. S. (2020).** Frailty-associated factors among Brazilian community-dwelling elderly people: longitudinal study. Sao Paulo Medical Journal, 137, 463-470.
- **Rasheedy, D., & Abou-Hashem, R. M. (2020).** Overestimated functional dependency in older patients: Can we blame gender difference, unneeded assistance or assessment tools? Archives of gerontology and geriatrics, 88, 104018.
- **Richards, S. J., D'Souza, J., Pascoe, R., Falloon, M., & Frizelle, F. A. (2019).** Prevalence of frailty in a tertiary hospital: A point prevalence observational study. Plos one, 14(7), e0219083.
- **Richter, D., Guasti, L., Walker, D., Lambrinou, E., Lionis, C., Abreu, A., &Asteggiano, R. (2021).** Frailty in cardiology: definition, assessment and

clinical implications for general cardiology. A consensus document of the Council for Cardiology Practice (CCP), Association for Acute Cardio Vascular Care (ACVC), Association of Cardiovascular Nursing and Allied Professions (ACNAP), European Association of Preventive Cardiology (EAPC), European Heart Rhythm Association (EHRA), Council on Valvular Heart Diseases (VHD), Council on Hypertension (CHT), Council of Cardio-Oncology (CCO), Working Group (WG .... European Journal of Preventive Cardiology, 29(1), 216-227

- **Rivas-Ruiz, F., Machón, M., Contreras-Fernández, E., Vrotsou, K., Padilla-Ruiz, M., Díez Ruiz, A. I., de Mesa Berenguer, Y., Vergara, I., & Group GIFEA (2019).** Prevalence of frailty among community-dwelling elderly persons in Spain and factors associated with it. European Journal of General Practice, 25(4), 190-196.
- **Romero-Ortuno, R., Walsh, C. D., Lawlor, B. A., & Kenny, R. A. (2010).** A frailty instrument for primary care: findings from the Survey of Health, Ageing and Retirement in Europe (SHARE). BMC geriatrics, 10(1), 1-12.
- **Sabbour, S. M., Abdul Rahamn, S. A., Amin, G. E. E., & Mohamed, B. A. (2018).** Frailty and malnutrition among Egyptian elderly: prevalence and risk factors in nursing home and Community-Dwelling elderly. The Egyptian Journal of Geriatrics and Gerontology, 5(2), 1-5.
- **Salaffi, F., Di Carlo, M., Carotti, M., Farah, S., & Giovagnoni, A. (2021).** Frailty prevalence according to the Survey of Health, Ageing and Retirement in Europe-Frailty Instrument (SHARE-FI) definition, and its variables associated, in patients with symptomatic knee osteoarthritis: findings from a cross-sectional study. Aging Clinical and Experimental Research, 33(6), 1519-1527.
- **Saudi, R., Tosson, E., & Salama, H. (2021).** Association between frailty status and cognitive performance of elderly patients attending the Family Medicine Outpatient Clinic in Ismailia, Egypt. Family Medicine & Primary Care Review, 23(2), 232-238.
- **Seo, A. R., Kim, M. J., Kim, B., Seo, Y. M., Lee, G. Y., Park, K. S., &Yoo, J. I. (2021).** Associations between Frailty in Older Adults and Malnutrition in Rural Areas: 2019 Updated Version of the Asian Working Group for Sarcopenia. Yonsei Medical Journal, 62(3), 249.
- **Setiati, S., Laksmi, P. W., Aryana, I. G. P. S., Sunarti, S., Widajanti, N., Dwipa, L., Seto, E., Istanti, R., Ardian, L. J., & Chotimah, S. C. (2019).** Frailty state among Indonesian elderly: prevalence, associated factors, and frailty state transition. BMC geriatrics, 19(1), 1-10.
- **Shokry, M. M., Hamza S. A., Fouad N. T., Mohammed M. H., Aly W. W., (2021).** The Relationship between Vitamin C and Frailty Among Elderly Patients with Type 2 Diabetes Mellitus.
- **Siriwardhana, D. D., Hardoon, S., Rait, G., Weerasinghe, M. C., & Walters, K. R. (2018).** Prevalence of frailty and prefrailty among community-dwelling older adults in low-income and middle-income countries: a systematic review and meta-analysis. BMJ open, 8(3), e018195.
- **Siriwardhana, D. D., Weerasinghe, M. C., Rait, G., Scholes, S., & Walters, K. R. (2020).** Association between frailty and disability among rural community-dwelling older adults in Sri Lanka: a cross-sectional study. BMJ open, 10(3), e034189.
- **Sobhani, A., Fadayevatan, R., Sharifi, F., Kamrani, A. A., Ejtahed, H. S., Hosseini, R. S., Mohamadi, S., Fadayevatan, A., & Mortazavi, S. (2021).** The conceptual and practical definitions of frailty in older adults: a systematic review. Journal of diabetes and metabolic disorders, 20(2), 1975–2013.
- **Soler-Vila, H., García-Esquinas, E., León-Muñoz, L. M., López-García, E.,**

Banegas, J. R., & Rodríguez-Artalejo, F. (2016). Contribution of health behaviours and clinical factors to socioeconomic differences in frailty among older adults. J Epidemiol Community Health, 70(4), 354-360.

- **Sorour, D. M., Khalil, M. I. M., Sharaan, M. A., & El Geneidy, M. M. (2019).** Effect of Deep Breathing Exercises versus Incentive Spirometry on Pulmonary Complications among Geriatric Patients Undergoing Upper Abdominal Surgery. International Journal of Novel Research in Healthcare and Nursing, 6(3), 537-555.
- **Sun, C., Ding, Y., Cui, Y., Zhu, S., Li, X., Chen, S., Zhou, R., & Yu, Y. (2021).** The adaptation of older adults' transition to residential care facilities and cultural factors: A meta-synthesis. BMC geriatrics, 21(1), 1-14.
- **Tayel, D.I., and Elkady, H.M. (2016).** Frailty in relation to poor dietary intake among institutionalized elders in Alexandria, Egypt. International Journal of Advanced Scientific and Technical Research, (1), 404-14
- **Tembo, M. C., Holloway-Kew, K. L., Sui, S. X., Dunning, T., Low, A. C., Yong, S. J., & Pasco, J. A. (2020).** Prevalence of frailty in older men and women: cross-sectional data from the Geelong Osteoporosis Study. Calcified tissue international, 107(3), 220-229.
- **Thinuan, P., Siviroj, P., Lerttrakarnnon, P., & Lorga, T. (2020).** Prevalence and potential predictors of frailty among community-dwelling older persons in Northern Thailand: a cross-sectional study. International journal of environmental research and public health, 17(11), 4077.
- **Thompson, M. Q., Theou, O., Adams, R. J., Tucker, G. R., &Visvanathan, R. (2018).** Frailty state transitions and associated factors in South Australian older adults. Geriatrics & gerontology international, 18(11), 1549-1555.
- **Valentini, A., Federici, M., Cianfarani, M. A., Tarantino, U., & Bertoli, A. (2018).** Frailty and nutritional status in older people: The Mini Nutritional Assessment as a screening tool for the identification of frail subjects. Clinical interventions in aging, 13, 1237.
- **Van der Linden, B. W. A., Cheval, B., Sieber, S., Orsholits, D., Guessous, I., Stringhini, S., Gabriel, R., Aartsen, M., Blane, D., Courvoisier, D., Burton-Jeangros, C., Kliegel, M., & Cullati, S. (2020).** Life course socioeconomic conditions and frailty at older ages. The Journals of Gerontology: Series B, 75(6), 1348-1357.
- **Vellas, B., Villars, H., Abellan, G., Soto, M. E., Rolland, Y., Guigoz, Y., Morley, J.E., Chumlea, W., Salva, A., Rubenstein, L.Z., & Garry, P. (2006).** Overview of the MNA®-Its history and challenges. Journal of Nutrition Health and Aging, 10(6), 456.
- **Verschoor, C. P., Dales, R. E., Duong, M., Bourque, C., Mian, O., Ma, J., & Griffith, L. E. (2021).** Respiratory Symptoms Are Associated with Frailty in Older Adults with Normal Spirometry, Independent of Smoking, in the Canadian Longitudinal Study of Aging. Respiratory Care. 66 (12) December 2021. 1848-1857.
- **Walters, K., Frost, R., Kharicha, K., Avgerinou, C., Gardner, B., Ricciardi, F., Hunter, R., Liljas, A., Manthorpe, J., Drennan, V., Wood, J., Goodman, C., Jovicic, A., & Iliffe, S. (2017).** Home-based health promotion for older people with mild frailty: The Home-Health intervention development and feasibility RCT. Health Technology Assessment (Winchester, England), 21(73), 1
- **Wang, Y., Chen, Z., & Zhou, C. (2021).** Social engagement and physical frailty in later life: does marital status matter?. BMC geriatrics, 21(1), 1-11.
- **World Health Organization (2021).** Ageing and health. Accessed on 24 January 2021. Available at: https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

- **Xu, L., Zhang, J., Shen, S., Liu, Z., Zeng, X., Yang, Y., Hong, X., & Chen, X. (2021).** Clinical frailty scale and biomarkers for assessing frailty in elder inpatients in China. The journal of nutrition, health & aging, 25(1), 77-83.
- **Yuan, L., Chang, M., & Wang, J. (2021).** Abdominal obesity, body mass index and the risk of frailty in community-dwelling older adults: a systematic review and meta-analysis. *Age and ageing*, *50*(4), 1118–1128.
- **Zhang, Q., Zhang, M., Hu, S., Meng, L., Xi, J., Xu, A., & Yu, S. (2021).** Prevalence and risk factors of preoperative frailty in Chinese elderly inpatients with gastric and colorectal cancer undergoing surgery: a single-center cross-sectional study using the Groningen Frailty Indicator. Supportive Care in Cancer, 1-10.
- **Zhang, X., Liu, Y., Van der Schans, C. P., Krijnen, W., &Hobbelen, J. S. M. (2020).** Frailty among older people in a community setting in China. Geriatric nursing, 41(3), 320-324.