ONLINE FIRST

REVIEW ARTICLE

Factors Influencing Intrinsic Capacity Decline and Its Measurements among Geriatrics: A Scoping Review

Nurhazrina Noordin[1,3], Akkradate Siriphorn[2], Yu Chye Wah[3], Maria Justine[1,2*]

[1]*Centre for Physiotherapy Studies, Faculty of Health Sciences, Universiti Teknologi MARA Selangor, Puncak Alam Campus, Puncak Alam, Selangor, Malaysia*
[2]*Department of Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University, Thailand*
[3]*School of Physiotherapy, Faculty of Allied Health Professions, AIMST University, Kedah, Malaysia*
Correspondence: *maria205@uitm.edu.my*
doi: 10.22442/jlumhs.2025.01300

ABSTRACT

Healthy ageing is dependent on intrinsic capacity (IC), and knowledge of its associated factors is essential for achieving the goal of healthy ageing. This review examines the factors influencing IC decline in older adults by exploring the scope, characteristics, and impacts on healthcare outcomes. Three databases —CINAHL, Web of Science, and PubMed — were systematically searched for full-text English articles published between January 2020 and June 2024 to capture comprehensive evidence across the WHO-ICOPE domains, encompassing allied health, biomedical, and multidisciplinary research on intrinsic capacity in older adults.

Studies on "intrinsic capacity", "older adults," and "health outcomes" were selected through a six-step review process conducted by two reviewers, with a third reviewer resolving any conflicts. This scoping review encompasses 12 studies from 2020 to 2023, spanning eight countries, with sample sizes ranging from 100 to 25,000. Data were extracted using a standardized form and synthesized through descriptive summaries and thematic analysis to map key concepts and identify evidence gaps across the six WHO-ICOPE domains.

The studies examine factors related to intrinsic capacity (IC) decline, including environment, lifestyle, education, and sensory function. Five studies are cross-sectional, and seven are longitudinal. Key influences on the health of older adults include environmental, lifestyle, and sensory factors. Future studies should address the identified evidence gaps by including larger and more diverse populations, expanding research to underrepresented regions, and adopting standardized WHO-ICOPE-aligned outcome measures. Further work should also explore the feasibility, implementation, and cost-effectiveness of multi-domain interventions to inform practice and policy in geriatric care.

KEYWORDS: Ageing, health outcomes, functional ability, older people.

INTRODUCTION

Worldwide increase in life expectancy challenges the healthcare professionals and community, as it will impact the physical and mental capacities, especially of older adults with comorbidities[1]. To address this, the intrinsic capacity (IC) has been introduced by the World Health Organization (WHO), highlighting the main domains for older adults, which include the six intrinsic capacities: locomotor, cognitive, psychological, vitality, and sensory function.

World Health Organization's Integrated Care for Older People (WHO-ICOPE) was introduced in the year 2017 to address the ageing-related health challenges, focusing on IC and functional ability[3]. It emphasizes guidelines for screening and managing IC decline to promote healthy ageing among the community[4]. Apart from that, few studies are adapting the WHO-ICOPE framework, such as the Aptitude Multi-Domain group-based Intervention to improve and or maintain Capacity in older people (AMICOPE), which has limitations in sensory support[5]. The INSPIRE-ICOPE focuses more on high-income and well-educated populations[6]. However, this adapted framework contrasts with particular cultural and social diversities as it is not suitable for every region and is unaffordable and culturally unadaptable for IC interventions[7].

Developing effective interventions for IC requires understanding its components and associated factors to identify early decline, integrate care, and evaluate impacts. Socioeconomic and cultural contexts influence IC differently; studies in China and Japan link it to social fragility, while in India, age, gender, and smoking have adverse effects. Tailored strategies are essential for addressing regional variations[8-10].

Understanding IC and its influencing factors helps healthcare providers transition from disease-focused to patient-centred care, although more research is needed to establish solid evidence. This scoping review maps the existing literature on factors affecting IC decline in older adults, their impact on health outcomes, and measurement methods, and identifies knowledge gaps and variations across different IC domains.

METHODOLOGY

This scoping review follows **Arksey & O'Malley's (2005)** framework, adapting five key steps: identifying the research question, finding relevant studies, selecting eligible studies, charting data, and summarizing results, which includes the gender and demographic details of participants. Quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tool, which categorizes studies as high (>70%), moderate (50%-69%), or low quality (<50%) [11]. We included high-quality studies to minimize bias (**Table I**). The research questions are: (1) What factors are associated with IC domain declines in community-dwelling older adults? And (2) what measures are used to detect IC decline in each study?

Table I: JBI Score for Quality Assessments

Authors (Year)	Results									Percentage
	1	2	3	4	5	6	7	8	Y(n)	
Gao et al. (2020) [12]	Y	Y	Y	Y	Y	Y	N	Y	7	87.50%
Castellanos-Perilla et al. (2020) [13]	Y	Y	Y	Y	Y	N	Y	Y	7	87.50%
Niwayama et al. (2021) [18]	Y	N	Y	Y	N	Y	Y	Y	6	75.00%
Gutiérrez-Robledo et al. (2021) [21]	N	Y	Y	Y	Y	N	Y	Y	6	75.00%
Doğrul et al. (2021) [20]	N	U	Y	Y	Y	Y	Y	Y	6	75.00%
Wang et al. (2022) [10]	N	Y	Y	Y	Y	Y	Y	Y	7	87.50%
Waris et al. (2022) [14]	N	Y	Y	Y	Y	Y	Y	Y	7	87.50%
Muneera et al. (2022) [9]	N	Y	Y	Y	Y	Y	N	Y	6	75.00%
Rao et al. (2023) [19]	N	Y	U	Y	Y	Y	Y	Y	6	75.00%
Shin & Cho et al (2023) [15]	N	Y	Y	Y	Y	Y	Y	Y	7	87.50%
Barreto et al. (2023) [16]	Y	N	Y	Y	Y	Y	Y	Y	7	87.50%
Si et al. (2023) [17]	Y	Y	Y	Y	N	Y	Y	Y	7	87.50%

Note:
Item 1: Were the criteria for inclusion in the sample clearly defined?
Item 2: Were the study subjects and the setting described in detail?
Item 3: Was the exposure measured in a valid and reliable way?
Item 4: Were objective, standard criteria used for measurement of the condition?
Item 5: Were confounding factors identified?
Item 6: Were strategies to deal with confounding factors stated?
Item 7: Were the outcomes measured in a valid and reliable way?
Item 8: Was an appropriate statistical analysis used?

Abbreviations: N = no; U = uncertain; Y = yes.
Selected articles underwent quality assessments using the JBI Critical Appraisal Tools (CAT). Calculations were based on the percentage of related questions per article out of the total number of questions in the JBI checklist.

Searching For Relevant Literature
A literature search identified studies on factors affecting the decline in IC in older adults. Using a 3-step approach, an initial PubMed search helped develop tailored strategies. Four researchers, including a PhD student, screened databases (WoS, PubMed, and CINAHL), followed by a final screening by three experienced academic staff members. The search used

MeSH terms (Appendix 1) such as (((factors OR reason OR contributing factors) AND (decline OR reduce)) AND (intrinsic capacity OR visual OR cognitive)) AND (older person OR geriatric)) and covered studies from January 2020 to June 2024, reflecting recent research and WHO-ICOPE's 2020 establishment.
The inclusion criteria for review are (1) publications from January 2020 to June 2024; (2) participants aged 60-90; (3) cross-sectional or longitudinal studies in English with quantitative data, and (4) studies specifying a particular region. Exclusion criteria included (1) lack of IC decline factors, (2) no full text available, and (3) duplicate publications.

Selecting Studies
The primary studies were converted to CSV format and uploaded to Rayyan, an application used for filtering, tracking, and deciding on study inclusion or exclusion for the scoping review. Following the PRISMA guidelines, four stages were applied: identification, screening, eligibility assessment, and inclusion. Two authors (NN, YWC) independently reviewed titles and abstracts, resolving duplicates and conferring on the inclusion of articles. Full texts were assessed for eligibility by two authors (AS, MJ), and any disagreements were resolved through discussion, with consultation from a third author as needed.
Systematic extraction and synthesis of quantitative data in a scoping review strengthen reliability by ensuring consistent and transparent data handling across studies. Using a standardized extraction form minimizes errors, while organizing findings into tables and themes facilitates clear comparison and reduces bias. This structured approach enhances the accuracy and reproducibility of the review, making the conclusions more robust and reliable for future research and practical applications.

Charting the Data
Eligible studies were reviewed using a standard form. Two authors (NN, YWC) collected key details independently, and disagreements were resolved by (AS, MJ). Data were analyzed to identify trends that would guide research and inform policy. The study selection process is shown in **Figure 1**.

Collecting, Summarising, and Reporting the Results
Authors collaboratively analyzed data, categorized factors by IC domain, and used descriptive synthesis to present findings in tables. **Table I** presents the quality appraisal scores, **Table II** details the study characteristics, Table III highlights the factors linked to IC, and **Table IV** lists the IC measurement tools.

Open Science Registration No: https://osf.io/xm4ea

RESULTS

Literature Search

The initial search across CINAHL (n = 837), WoS (n = 625), PubMed (n = 436), and grey literature (n = 73) identified 1,971 articles. After removing duplicates and unrelated articles from the selection (n = 1504), 467 remained. From 467 records screened, 425 were excluded for reasons including non-IC focus (n=213), non-community-residing older adults (n=147), abstract-only format (n=36), and non-English versions (n=29). For reliability, articles were selected based on JBI-CAT quality scores, with only high-quality (≥70%) studies included. Out of 42 full texts, 30 were excluded (moderate quality: n = 16; low quality: n = 14), resulting in 12 high-quality articles for further review.

Quality Assessments

The importance of performing the quality assessment is to maintain the reliability and quality of the selected articles (**Table I**). The chosen articles had an assessment rate of 87.50% (n = 7) and 75.00% (n = 5).

Study Design and Participant Characteristics

Twelve studies were selected in this review, with 5 cross-sectional and 7 longitudinal studies. Out of the 12 studies, approximately eight (n = 8) were conducted in communities, and the remaining four (n = 4) were conducted in healthcare settings.

Regarding the included studies, the countries of origin are as follows: France (n = 3), India (n = 3), Thailand (n = 1), Taiwan (n = 1), China (n = 1), Korea (n = 1), and Turkey (n = 1).

In terms of trends and publication years, research on the factors leading to IC decline among older adults has been growing recently, with 2020 (n=2), 2021 (n=3), 2022 (n=3), and 2023 (n=4) indicating a notable increase in interest.

A total of 102,359 participants were recruited across the 12 studies included in the review, with sample sizes ranging from 100 to 25,000 participants. Seven studies had a sample size ranging from 100 to 9,996 participants, and five studies had more than 10,000 participants. The study characteristics are shown in **Table II**.

Table II: Characteristics of Studies Included in the Review

Authors (Year)	Research objectives	Country	Study Design	Participants
Gao et al. (2020) [12]	To determine the relationship between hearing loss and cognitive decline, and whether there is a relationship between the leisure activities of older people in declining IC domains.	China	LS	N: 8844 Age: 65years and above Gender distribution: not reported
Castellanos-Perilla et al. (2020) [13]	To determine the relationship of multiple factors associated with a functional status decline in Mexican older adults.	Mexico	LS	N: 12,880 Age: 60 years and above Gender, n: 1. Female: 7214 2. Male: 5665
Gutiérrez-Robledo et al. (2021) [21]	To describe the levels of IC and those factors related to its decline in Mexican older adults.	Mexico	CS	N: 12459 Age: 50 years and above Gender, n: 1. Female: 6815 2. Male: 5644
Niwayama et al. (2021) [18]	To measure locomotive impairment prevalence and its determinants of locomotive function decline among Middle-aged and older people.	Thailand	CS	N: 165 Age: 65 years and above Gender, n: 1. Female: 133 2. Male: 32
Doğrul et al. (2021) [20]	To determine the association of physical IC decline with cognitive and psychological among geriatric.	Ankara Turkey (Division of Geriatric Medicine)	CS	N: 612 Age: 65 years and above Gender, n: 1. Female: 355 2. Male: 257
Wang et al. (2022) [10]	To determine the factors associated IC (cognitive decline) among older people, include physical activity and fruit and vegetable intake.	Taiwan	LS	N: 4440 Age: 60 years and above Gender distribution: not reported
Waris et al. (2022) [14]	To establish the clinical of IC and its prediction of functional decline among older people	New Delhi, India (Hospital)	LS	N: 100 Age: 60 years and above Gender, n: 1. Female: 36 2. Male: 64
Muneera et al. (2022) [9]	To determine the prevalence of IC and factors associated (sociodemographic, lifestyle) with IC decline.	India	LS	N: 24136 Age: 60 years and above Gender, n: 1. Female: 12265 2. Male: 11871
Rao et al. (2023) [19]	To determine the prevalence of IC decline and the factors associated to each IC	Karnataka, South India (Hospital)	CS	N: 1000 Age: 60 years and above Gender, n: 1. Female: 629 2. Male: 371
Shin & Cho et al (2023) [15]	To determine risk factors associated with cognitive decline in community-dwelling Korean adults.	South Korea (Korean Labour Institute)	LS	N: 1369 Age: 60 years and above Gender, n: 1. Female: 658 2. Male: 711
Barreto et al. (2023) [16]	To describe the IC vitality domain for older people living in the community and investigate the relationships between the vitality components	France	CS	N: 14572 Age: > 60 Gender, n: 1. Female: 9034 2. Male: 5538
Si et al. (2023) [17]	To investigate the contribution of early-life factors to the IC of Chinese adults older than 45 years.	China	LS	N: 21 783 Age: 55 years and above Gender, n: 1. Female: 11 183 2. Male: 10 600

Note: The characteristics of the selected study involve country and study settings, study design, sample characteristics, and the suggested screening tools. It provides full details of

each research and acts as baseline information for this review.
N/n: Total sample/sub-sample size. LS: Longitudinal study. CS: Cross-sectional study.

Measures of Intrinsic Capacity Levels

For the locomotors domain, 5 studies[9,10,14,16] used the WHO-ICOPE guidelines' suggested outcome measures, which included three physical activity questions adopted from the WHO, the Short Physical Performance Battery (SPPB), walking speed, gait speed, balance, and level 1 ICOPE screenings. Other studies employed various measures, including the Lawton Brody Scale[13,20], the two-step test[18], the Mexican Health and Ageing Study question[21], and the time up and go test[19].

The vitality domain following the WHO-ICOPE guideline involved 5 studies[9,14,18-20]. Despite these few studies, a study conducted in Mexico utilized the Mexican Health and Ageing Study (MHAS) questionnaire due to its specific reasons and compatibility with local participants[21]. At the same time, China uses the Mini Nutritional Assessment-Short Form (MNA-SF) questionnaire portions in their study[17]. Apart from that, 3 studies did not include the vitality component in their discussion[12-13, 15].

Moving towards the psychological domains, three studies adopted the Geriatric Depression Scale (GDS-15) in their screening. At the same time, two studies adapted screening measures from their origin country, the Mexican Health and Ageing Study (MHAS)[13,21]. Meanwhile, two studies9-10 employed the same outcome measure, the Centre for Epidemiological Studies Depression Scale (CES-D) (**Table III**).

For cognitive domains, two studies[12,20] incorporated the WHO-ICOPE guidelines using the Mini-Mental State Examination (MMSE). At the same time, two studies[15,19] utilized parts of the MMSE. It adapted it to their respective demographics, namely, the Hindi-Mental Status Examination (HMSE) and Korean-Mental Status Examination (KMSE), respectively. Meanwhile, sensory factors, such as hearing and vision, utilized the WHO-ICOPE guidelines, which included tuning forks and the E-Chart to measure sensory decline.

Table III: Intrinsic Capacity Measurement Tools

Authors (Year)	**Intrinsic Capacity Measurement Tools**					
	Locomotors	Vitality	Psychological	Cognitive	Hearing	Vision
Gao et al. (2020) [12]	-	-	-	MMSE	Self-reported question (yes/no) without hearing aids	-
Castellanos-Perilla et al. (2020) [13]	Lawton Brody scale	-	MHAS	Cross-Cultural Cognitive Examination test (CCCE)	-	-
Niwayama et al. (2021) [18]	Two-step test	BMI	-	-	-	-
Gutiérrez-Robledo et al. (2021) [21]	MHAS	MHAS	MHAS	MHAS	MHAS	MHAS
Doğrul et al. (2021) [20]	IADL	MNA-SF	GDS	Clock drawing - MMSE	-	-
Wang et al. (2022) [10]	3 physical activity questions adopted from WHO.	Validated semi-quantitative questionnaire that assessed the frequency of intake of food Categories.	CES-D	SPMSQ	-	-
Waris et al. (2022) [14]	SPPB	MNA-SF	GDS-15	Saint Louis University Mental Status (SLUMS)	Screening audiometer (series of two, three-tone tests)	Tumbling E chart.

Muneera et al. (2022) [9]	SPPB	BMI	CES-D	Word recall, serial subtraction, backward counting.	Screening question – able to hear the sound	Screening questions – able to see objects
Rao et al. (2023) [19]	TUG	BMI	GDS 15	Hindi-Mental Status Examination (HMSE)	Whisper test	2 screening questions -able to see object -able to focus or zoom object
Shin & Cho et al (2023) [15]	-	-	-	Korean MMSE	-	-
Barreto et al. (2023) [16]	***Limited mobility*** Chair rise test: Rise from a chair five times without using arms. Did the person complete five chair rises within 14 seconds?	***Malnutrition*** 1. Weight loss: Have you unintentionally lost more than 3 kg over the last three months? 2. Appetite loss: Have you experienced loss of appetite?	***Depressive syndrome*** Over the past two weeks, have you been bothered by feeling down, depressed, or hopeless? Little interest or pleasure in doing things	***Cognitive*** 1. Remember three words: flower, door, rice (for example) 2. Orientation in time and space: What is the full date today? Where you are now (home, clinic, etc.)? 3. Recall the three words.	***Hearing loss*** Hears whispers (whisper test) or Screening audiometry result is 35 dB or less, or passes automated app-based digits-in-noise test.	***Visual impairment:*** Do you have any problems with your eyes: difficulties in seeing far, reading, eye diseases or currently under medical treatment (e.g. diabetes, high blood pressure)?
Si et al. (2023) [17]	Chair stand test, grip strength, time up and go, Short physical performance battery	The SF-36 Health Survey	Geriatric Depression Scale (GDS)	MMSE	Audiometry	Snellen chart

Note: "MI" Indicates Body Mass Index. "TUG" Indicates Time Up And Go Test. "GSD" Indicates Geriatric Depression Scale. "IADL" Indicates Instrumental Activities Of Daily Living. "MHAS" Indicates the Mexican Health and Ageing Study Question. "MMSE" Indicates Mini-Mental State Examination.

Description: Table III describes the outcome measures used in each selected article to assess the level of intrinsic capacity decline among older people. Studies were screened for measures closely related to the WHO-ICOPE framework.

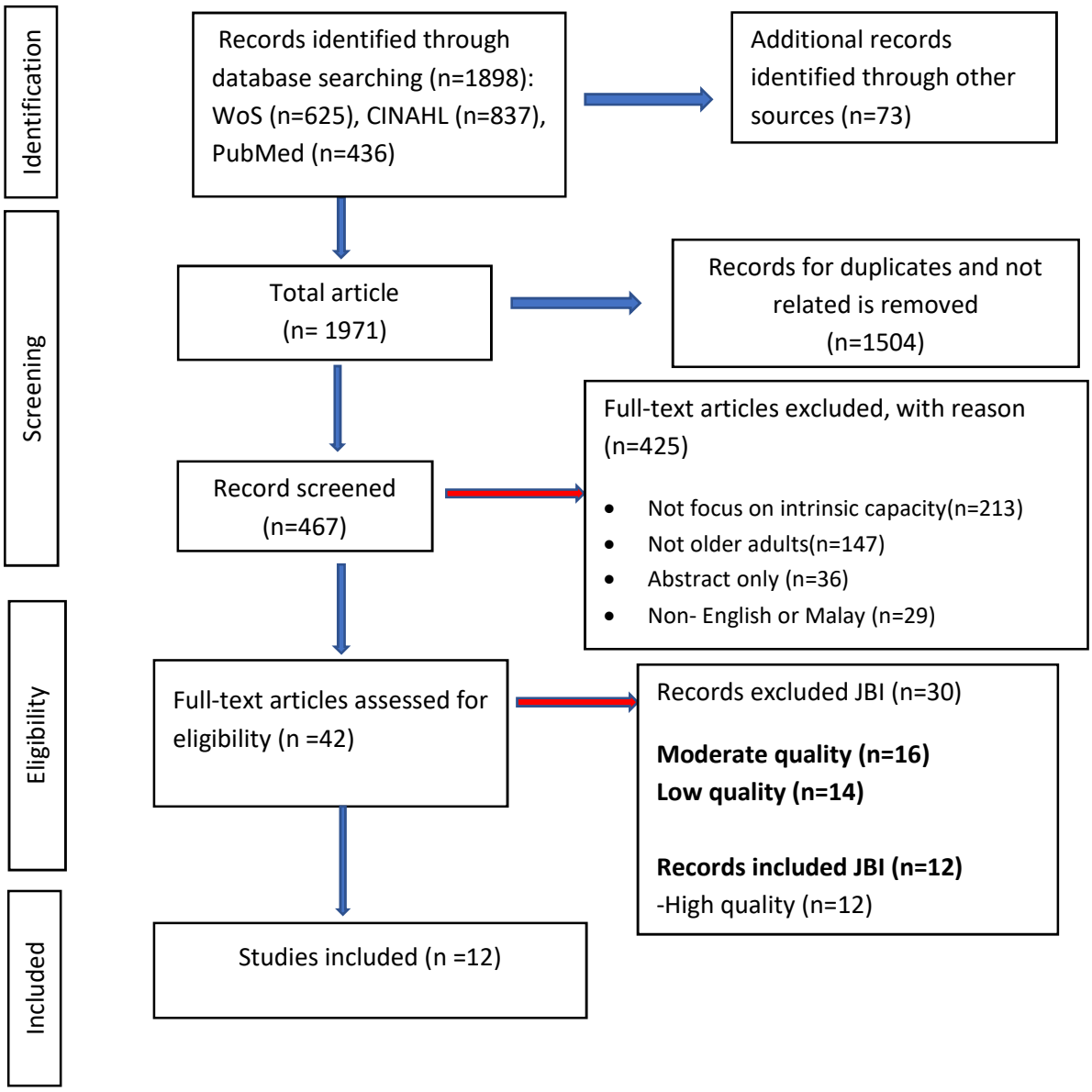

Figure 1: Scoping review result (Preferred Reporting Items for Systematic Review)
Notes: "WoS" indicates Web of Science. "CINAHL" indicates Cumulative Index to Nursing and Allied Health Literature. "JBI" indicates Joanna Briggs Institute.
Description: The figure above illustrates the process of study selection, based on the selection criteria and study quality. This process involves four stages based on PRISMA guidelines.

Factors Related to Decline in Intrinsic Capacity

As shown in Table 4, the factors were arranged according to their significant association with all the domains suggested by the WHO-ICOPE guidelines. We further attempted to classify the risk factors into non-modifiable and modifiable factors.

Locomotors

The non-modifiable factors (NMF) related to the locomotors domain in IC included age[13,18-19,21], women[19], mortality[14], unmarried[19], hypertension(HPT)[19], diabetes (DM)[19], comorbidities or chronic illnesses[13,18-19], hospitalisation[14], financial status[13], education levels[13,18], social participation[18-19],socioeconomic[17], and demographic (living environments)[17].

The modifiable risk factors (MF) associated with the locomotor domain included appetite loss[16], weight loss[16], simultaneous appetite and weight loss16, daily activity and living[14,19], smoking[19], alcohol[19], mood[2], lifestyle[17], continuous walking[18], knee pain[18], difficulty with simple tasks[18], and anxiety about falling[18].

Educational level significantly impacts locomotor domains, with [18] reporting an odds ratio (OR) of 4.46. Modifiable factors, such as financial status (OR=1.04) and social history (OR=3.06), also influence participation, while non-modifiable factors, including comorbidities (OR=1.62), hospitalisation (OR=0.99), and mortality (OR=0.99), have a lesser effect.

Vitality

The NMF related to the vitality domain in IC, including age[19], women[9, 21, 19], mortality[14], unmarried[19], HPT[19], diabetes[19], comorbidities or chronic illnesses[19], and hospitalization[14].

The MF associated with the vitality domain includes appetite loss[16,21], weight loss[16,21], activities of daily living (ADL)[14,19], smoking[9,19], alcohol consumption[19], lifestyle[9,18], and continuous walking[9].

Findings on the vitality indicate that both age and gender, as NMF, influence vitality levels, although most factors affecting vitality are MF. Females are more likely to have lower vitality levels (OR=1.73)[9] compared to other MFs, while age has a more minor impact (OR=1.04)[19]. Modifiable factors remain the primary contributors to vitality, with activity participation (OR = 1.66)[19], obesity (OR = 1.34)[18], and elements of social history playing significant roles.

Psychological

The NMFs related to the psychological domain in IC included age[19,21], women[19,21], mortality[14], unmarried[19], HPT[19], diabetes[19], comorbidities or chronic illnesses[19,20], hospitalization[14], social participation[17], socioeconomic[17] and frailty[20].

The MFs associated with the psychological domain include appetite loss [16], weight loss, [16] simultaneous appetite and weight loss, [16] ADL, [14,19] smoking, [19] alcohol, [19] and continuous walking [9,19].

In psychological domains, MF has a more substantial impact compared to NMF. Nutritional disorders combined with weight loss are highly associated with psychological domain levels (OR =5.33)[16]. In contrast, among NMFs, the most significant association was with chronic illness (OR = 2.75)[19].

Cognitive

The NMFs related to the cognitive domain in IC include age[15,19-21], women[15,19], mortality[14], unmarried[19], HPT[20], diabetes[19], comorbidities or chronic illnesses[15,19], hospitalization[14],

education levels[15,17], social participation[19], socioeconomic[14,17,20], religiosity[15], and demographic[17].
The MFs associated with the cognitive domain include appetite loss[16], weight loss[16], simultaneous appetite and weight loss[16], ADL[14,19-20], smoking[19], alcohol[9,15,19], mood[15], lifestyle[17], continuous walking[10], handgrip strength[15] and sleep quality[20].
Key factors impacting MFs include dietary intake and weight loss (OR = 2.14)[16]. For NMF, a notable factor is the participants' hospitalisation rate (OR = 1.36) [14]. Cognitive decline is linked to both MF and NMF. MFs include alcohol use, activity participation, smoking, and education, while NMFs encompass age, gender, marital status, demographics, and morbidity.

Hearing
The NMFs related to the hearing domain include age[19], men[21], mortality[14], unmarried[19], HPT[19], diabetes[19], comorbidities or chronic illnesses[19], hospitalization[14], social participation and socioeconomic[17] and cognitive impairments[12].
The modifiable risk factors associated with the hearing domain include appetite loss, [16] weight loss, [16] simultaneous appetite and weight loss, [16] ADL, [14,19] smoking, [19] alcohol, [19] and continuous walking [9].
Quantitative findings reveal that, among various MFs and NMFs, social history receives the highest ratings. Smoking (OR = 2.50) and alcohol use (OR = 2.09) are significant factors, while highlighted weight loss (OR = 1.32) and limited activity participation (OR = 1.92) are strongly associated with hearing decline, along with appetite loss (OR = 1.18). Additionally, NMFs like hospitalization demonstrate a high correlation with hearing decline (OR=1.60), alongside hypertension (OR=1.21).

Vision
The NMFs related to the vision domain include age[19], women[19], mortality[14], unmarried[19], HPT[19], diabetes[19], comorbidities or chronic illnesses[19], hospitalization[14], and socioeconomic (financial status) and demographic (living environment)[17].
The MFs associated with the vision domain include appetite loss, weight loss, simultaneous appetite and weight loss[16], ADL[14,19], smoking[19], alcohol[19], and continuous walking[19].
Quantitative findings indicated that MFs were more prominently highlighted compared to the MFs. MFS related to activity participation, such as a decline in instrumental activities of daily living (IADL) (OR = 1.92) and engagement in physical activities (OR = 1.35), were notable. Additionally, nutritional factors, including appetite loss (OR = 1.51) and weight loss (OR = 1.24), significantly impacted the decline in hearing-related intrinsic capacity. Among NMFs, hospitalization rates were associated with vision loss (OR = 1.60).

Table IV: Key Findings on the Factors Associated with Intrinsic Capacity

Authors (Year)	Factor associated with the intrinsic capacity						
	IC status	Locomotors	Vitality	Psychological	Cognitive	Hearing	Vision
Gao et al. (2020) [12]	Cognitive 59% Hearing 43%	-	-	-	Hearing loss (OR)= 1.87	Cognitive impairment (OR=2.48)	-
Castellanos-Perilla et al. (2020) [13]	Locomotors 42.8%	Age (OR=1.08; 95% CI: 1.07-1.10; p=0.023 Financial status (OR=1.04; 95% CI: 1.01-1.01; p=0.016 Educational level (OR=0.80; 95% CI: 0.68-0.94; p=0.008) Comorbidities (OR=1.62; 95% CI: 1.21-2.17; p<0.001)	-	-	-	-	-
Niwayama et al. (2021) [18]	Locomotors 71.5%	School education (OR=4.46) Body mass index (OR=3.06) comorbidities (OR=2.55) continuous walking (OR:2.51) Age (p<0.001) Knee Pain (p=0.048) anxiety about falling in daily life (p=0.026) difficulty with simple tasks (p=0.007)	Obesity (OR= 1.344 , p = 0.027) Lifestyle(social factors	-	-	-	-
Gutiérrez-Robledo et al. (2021) [21]	The total decline in all IC 87.8% Locomotors 47.6% Cognitive 28% Vitality 27.5%	Age, social participation, women's gender	Loss of weight, Loss of appetite, Gender (woman)	Age, gender(woman)	Age	Gender (Man)	Gender
Doğrul et al. (2021) [20]	Cognitive 48.4%	Mood	-	Frailty, physical activity participation, comorbidity,	Age, weight, congestive heart failure, urinary incontinence, hypertension,	-	-

					hyperlipidaemia, history of falls, sleep duration, number of drugs, ADL score, IADL score		
Wang et al. (2022) [10]	Cognitive 63%	-	-	-	Physical activity and high fruit and vegetable intake was combined (OR= 0.37)	-	-
Waris et al. (2022) [14]	-	IADL decline OR= 0.98(0.98–0.99) ,p= 0.005 ADL decline OR= 0.99(0.98–0.99) ,P=0.027 Mortality OR =0.99(0.98–1.00),p=0.43 Hospitalisation OR = 0.99(0.99–1.00) ,p= 0.22	IADL decline OR=0.99(0.89–1.11) ,p=0.98 ADL decline OR= 0.92(0.80–1.06) ,p=0.26 Mortality OR = 0.92(0.76–1.10) ,p=0.385 Hospitalisation OR = 1.04(0.94–1.16), p= 0.40	IADL decline OR=0.987(0.97–0.99),p= 0.8 ADL decline OR= 0.92(0.88–1.32) p= 0.56 Mortality OR = 0.98(0.96–1.21) , p= 0.86 Hospitalisation OR = 1.02(0.98–1.21), p= 0.84	IADL decline OR= 0.495(0.352–0.695) ,p=0.00 ADL decline OR= 0.61(0.48–0.788) ,p=0.00 Decline of Mortality OR = 0.94(0.73–1.21) , p=0.81 Hospitalisation OR = 1.36(1.02–1.81), p= 0.034	IADL decline OR= 1.92(0.96–3.84),p= 0.064 ADL decline OR=1.25(0.5–2.7) p= 0.56 Mortality OR = 0.88(0.32–2.40),p=0.81 Hospitalisation OR = 1.60(0.81–3.14), p= 0.17	IADL decline OR= 1.92(0.96–3.84),p= 0.064 ADL decline OR=1.25(0.5–2.7) p= 0.56 Mortality OR = 0.88(0.32–2.40) ,p=0.81 Hospitalisation OR = 1.60(0.81–3.14), p= 0.17
Muneera et al. (2022) [9]	Vitality 73% Sensory 19%	-	Female (OR=1.73) smoked tobacco (OR=0.60) Chewed tobacco (OR=0.82) Consumed alcohol (OR=0.68) Yoga (OR=1.25) Engagement in vigorous physical activity (OR=0.88)	Vigorous physical activity (OR=1.19)	Alcohol (OR=0.59) Yoga-related activity (OR=1.32)	Vigorous physical activity (OR=1.35)	Vigorous physical activity (OR=1.35)
Rao et al. (2023) [19]	Locomotors 59.3% vision 44.1% hearing 19.3% cognition	Age OR=1.01 (0.99–1.03) Female OR=0.98 (0.75–1.27) Unmarried OR=0.92 (0.46–1.88)	Age OR=1.04* (1.00–1.09) Female OR=1.41 (0.69–2.89) Unmarried OR=1	Age OR=1.00 (0.86–1.05) Female OR=1.01 (0.51–1.98)	Age OR=1.00 (0.97–1.03) Female OR=0.85 (0.56–1.28)	Age OR=1.07** (1.05–1.09) Female OR=0.72* (0.52–0.98) Unmarried OR=0.92 (0.38–2.28)	Age OR=0.98 (0.96–1.00) Female OR=1.01 (0.78–1.31) Unmarried OR=0.81 (0.41–1.68)

	10.6% mood 3.8% vitality 3.7%	Smoking OR=0.78 (0.37–1.61) Alcohol OR=1.35 (0.78–2.36) ADL OR=0.46** (0.33–0.64) IADL OR=0.99 (0.91–1.08) Hypertension OR=1.26 (0.95–1.66) Diabetic OR=1.33 (0.94–1.88) Chronic illness OR=1.67 (1.05–2.65)	Smoking OR=0.89 (0.12–6.71) Alcohol OR=0.45 (0.06–3.19) ADL OR=1.66 (0.69–3.93 IADL OR=1.03 (0.82–1.29) Hypertension OR=0.77 (0.36–1.64) Diabetic OR=1.16 (0.50–2.69) Chronic illness OR=1.19 (0.41–3.43)	Unmarried OR=1 Smoking OR=1 Alcohol OR=0.43 (0.06–3.19) ADL OR=0.73* (0.57–0.94) IADL OR=1.07 (0.85–1.35) Hypertension OR=0.98 (0.48–2.00) Diabetic OR=0.57 (0.20–1.63) Chronic illness OR=2.75* (1.22–6.18)	Unmarried OR=0.25 (0.03–1.89) Smoking OR=0.94 (0.28–3.14) Alcohol OR=0.95 (0.40–2.28) ADL OR=0.69** (0.59–0.83) IADL OR=0.94 (0.82–1.08) Hypertension OR=0.68 (0.42–1.09) Diabetic OR=0.54 (0.28–1.04) Chronic illness OR=0.89 (0.43–1.83)	Smoking OR=2.50* (1.17–5.35) Alcohol OR=2.09* (1.18–3.69) ADL OR=0.81* (0.69–0.96) IADL OR=0.75** (0.67–0.83 Hypertension OR=1.21 (0.87–1.70) Diabetic OR=0.80 (0.52–1.25) Chronic illness OR=0.93 (0.53–1.61)	Smoking OR=0.73 (0.34–1.55) Alcohol OR=1.00 (0.59–1.70) ADL OR=0.97 (0.83–1.13 IADL OR=1.01 (0.93–1.09) Hypertension OR=1.11 (0.85–1.47) Diabetic OR=1.18 (0.84–1.65) Chronic illness OR=0.074 (0.48–1.15) -
Shin & Cho et al (2023) [15]	Cognitive 53.17%	-	-	-	Increased age (p<.001) Female (p= 0.11) Lower education level (p < 0.001) No religion status (p = .026) Living in a small city (p < 0.001) Lower handgrip strength (p < 0.001) A higher number of chronic diseases (p < .001) Higher depressive symptoms (p < .001)	-	-

					Drinking status (p = 0.049) Lower frequency of participation in regular meetings (p <0 .001)		
Barreto et al. (2023) [16]	Vitality 20.27%	Appetite loss OR = 2.19 [1.91;2.51]), p <0.001 Weight loss (OR = 1.64 [1.41;1.91]), p <0.001 Simultaneous appetite and weight loss (OR = 3.38 [2.88;3.98]), p<0.001	Appetite loss, weight loss	Appetite loss (OR = 3.95 [3.46;4.52]) p<0.001 Weight loss (OR = 1.80[1.56;2.07]), p<0.001 Nutritional disorder, Simultaneous appetite and weight loss (OR = 5.33 [4.53; 6.27]), p<0.001.	Appetite loss (OR = 2.14 [1.84;2.48]), p<0.001 Weight loss (OR = 1.65 [1.42;1.93]), p<0.001, Simultaneous appetite and weight loss p<0.001	Appetite loss (OR = 1.18 [1.01;1.37]), p =0.001, Weight loss (OR = 1.32 [1.12;1.55]) p<0.001 Simultaneous appetite and weight loss p<0.001	Appetite loss (OR = 1.51 [1.28;1.79]), p<0.001 Weight loss (OR = 1.24 [1.04;1.47]), p=0.002 Simultaneous appetite and weight loss p= 0.004 -
Si et al. (2023) [17]	-	Socioeconomic, demographic and lifestyle factors (P-value: <0.001;	Socioeconomic, demographic and lifestyle factors (P-value: <0.001;	Socioeconomic, demographic and lifestyle factors (P-value: <0.001;	Socioeconomic, demographic and lifestyle factors (P-value: <0.001; Literate parents 0.077 (95% CI: 0.057 to 0.096)	Socioeconomic, demographic and lifestyle factors (P-value: <0.001;	Socioeconomic, demographic and lifestyle factors (P-value: <0.001;

Notes: "ADL" indicates Activities of Daily Living. "IADL" indicates Instrumental Activities of Daily Living. "OR" indicates Odd ratio. "CI" indicates Confidence interval. "P-value" indicates Probability Value.
Descriptions: Table IV shows the factors associated with each decline in intrinsic capacity domains involving modifiable and non-modifiable factors

DISCUSSION

This scoping review aimed to map the existing literature on factors contributing to the decline in IC among older people. Twelve publications were included, comprising a mix of cross-sectional (n = 5) and longitudinal (n = 7) study designs. These studies examined various factors, including environment, lifestyle, education, and sensory levels across different populations and settings.

The findings of this current study indicate that MFs, such as activity participation, appetite, weight loss, social history, and education level, show strong links to IC decline. In contrast, NMFs, including gender, age, mortality rate, and hospitalization frequency, are also associated with IC decline in older adults.

Longitudinal studies are crucial for tracking IC decline over time, uncovering trends and causes that inform policy[48]. Unlike cross-sectional studies, which show associations but lack causality, longitudinal research offers more profound insights into IC trajectories.

Understanding IC decline involves examining biological, psychological, and social factors that contribute to the decline. Physical activity impacts IC through multiple pathways: biologically, it enhances cardiovascular and cognitive health; psychologically, it reduces stress and boosts mood, and socially, it promotes connections, such as through community walking groups. These mechanisms suggest that encouraging physical activity can benefit multiple IC domains.

Interest in research on IC in Asia is growing due to the rapid ageing of the population, longer life expectancy, and a focus on healthy ageing. With the older population expected to double by 2050, studies on IC in older adults have increased[26]. These studies measured outcomes across six main IC domains from the WHO-ICOPE framework: locomotor, cognitive, psychological, vitality, hearing, and visual. While some studies followed WHO-ICOPE guidelines for outcome measures, others did not. Most research originates from Asia, particularly the ASEAN countries, where the ageing population is experiencing significant growth[27].

IC evaluation involves multiple factors and measures. Locomotion is assessed with the SPPB, vitality with the MNA, cognition with the MMSE, and psychological aspects with the GDS-15. Vision is tested using the Snellen chart, and hearing is assessed with 512 Hz tuning forks. While WHO provides guidelines, studies often adapt measures to suit patient populations and demographics.

Using non-WHO-ICOPE measures can lead to inconsistencies in assessing IC and functional ability in older adults, thereby reducing comparability and accuracy[49]. These measures often lack sensitivity, demand more resources, and may not align with the WHO-ICOPE framework. While tests like the Timed Up and Go (TUG) test, 6-Minute Walk Test (6MWT), and Berg Balance Scale (BBS) are helpful, they may not capture locomotion effectiveness as precisely as WHO-ICOPE methods. Adhering to the WHO-ICOPE ensures standardized, evidence-based strategies for healthy ageing.

Key factors in IC decline include non-modifiable factors such as age, gender, and comorbidities, and modifiable ones like lifestyle, diet, and anxiety. Urban areas offer better healthcare but face stress and pollution, while rural regions provide cleaner environments but often have limited access. Positive ageing attitudes, family support, education, and wealth are linked to better IC[8]. The WHO-ICOPE framework promotes accessible, culturally sensitive care for healthy aging[28].

These findings align with past research on the role of lifestyle in sustaining IC. In India, even active individuals experience IC decline due to other lifestyle behaviors[29]. China studies further link IC decline to smoking, low physical activity, age, education, and psychological factors.

Additionally, economic and educational levels significantly influence lifestyle behaviours, affecting IC[31].

Some discrepancies were found in earlier research, especially regarding locomotors and cognitive domains. Psychological and mental disorders are often linked to declines in mobility and cognition. Research indicates that older adults with better cognitive function and psychological stability tend to experience better mobility outcomes[32]. A recent study in Japan also found that depression levels in older individuals rise as physical activity decreases.

Outcome Measures and Screening Tools

The outcome measures in these studies align with WHO-ICOPE tools, focusing on mobility, nutrition, sensory impairments, cognition, mental health, and continence. Mobility needs controlled tests; nutrition and sensory issues require objective assessments, and cognitive evaluations must consider education and language. Depression is best screened with questionnaires and interviews, while simplified diaries and trained staff improve continence care, ensuring reliable support for healthy ageing.

There are significant gaps in sensory evaluations, such as those related to hearing and vision, due to the reliance on self-reports and the limited availability of tools. Many studies focus narrowly on specific domains, creating a fragmented view of older adults' health. The WHO-ICOPE framework separates IC domains, overlooks interconnected health issues, and relies on subjective data. To improve outcomes, assessments must be integrated, culturally inclusive, and supported by objective and comprehensive tools.

Factors Associated with IC Domains

Food intake and diet are central to discussions on senior health. Overeating can harm IC levels, while a balanced diet supports a healthy BMI and stabilizes locomotors[16,21]. Age and gender also impact IC, with mobility declining due to aging and women facing more pronounced declines due to menopausal changes[19].

Regular physical activity is crucial for maintaining mobility by building and maintaining muscle mass. Innovative methods, such as telephone monitoring, aid rehabilitation by reinforcing routines and tracking progress[18]. Physician visits help monitor engagement in therapeutic activities, and higher education levels are associated with increased proactive health participation.

Dietary imbalances contribute to cognitive decline[16]. Combining a balanced diet with regular physical activity can reduce mental decline by up to 63% [10]. Education and financial stability are crucial for cognitive health, although education and job complexity have a limited impact on midlife when early abilities are taken into account[35].

Studies link higher education to reduced cognitive decline, while recent findings show financial instability and low education impair older adults' ability to manage it[15]. A literate father can also boost IC later in life. Lifestyle factors, such as alcohol consumption and physical activity, influence cognitive performance, although their effects vary significantly[36]. Research on cognitive reserve suggests that engaging in leisure activities helps protect cognitive function from brain deterioration[37].

Both MFs and NMFs significantly influence psychological IC. Nutrition is the key, as appetite loss and weight changes are often a signal of depression. Individuals with mood disorders tend to have poorer dietary habits, and an unhealthy diet is closely linked to worsening mood conditions

like anxiety and depression[39]. Mood disorders can lead to nutritional issues, which the disorders or their treatments may further exacerbate[40].

Physical activity is essential for maintaining psychological well-being and preventing cognitive decline, frailty, disability, and falls[29]. A holistic approach to sustaining vitality includes regular exercise, a balanced diet, reduced sedentary behaviour, and quality sleep[41]. Avoiding smoking and alcohol, along with fostering social and community connections, further supports mental health and vitality[42]. Additionally, socioeconomic factors such as education, financial security, and social ties play a critical role in shaping psychological intrinsic capacity and overall well-being.

Hearing and vision decline are influenced by factors such as diet, chronic health conditions, and socioeconomic circumstances. Ageing exacerbates these sensory changes, often compounded by inadequate nutrition and environmental stressors, such as noise exposure[43]. Nutritional deficiencies, in particular, can adversely affect sensory functions, and sensory decline is strongly associated with cognitive deterioration and neuronal loss, contributing significantly to cognitive aging[45]. Addressing these aspects in alignment with the WHO-ICOPE guidelines is crucial for promoting healthy ageing and maintaining overall functional capacity.

Although research generally aligns with WHO-ICOPE guidelines, there are gaps in the sensory and psychological domains, particularly in assessing intrinsic capacity. These areas often fail to meet the guideline's standards fully. Implementing a longitudinal study based on the WHO-ICOPE framework could provide valuable insights by examining cause-and-effect relationships, offering a clearer understanding of the framework's long-term effectiveness and sustainability.

Implications for Practice and Policy

Healthcare professionals should utilize comprehensive WHO-ICOPE-aligned screening tools in clinical practice to effectively assess health status and guide interventions[46]. Objective assessments and advanced technology are crucial in sensory evaluations, such as those for hearing and vision, to reduce bias and ensure the accurate management of impairments.

Cognitive screening must adhere to WHO-ICOPE recommendations, as deviations can lead to inaccurate evaluations, suboptimal care, and resource inefficiencies. The framework's focus on English-language studies and varying research designs may limit inclusiveness and applicability, highlighting the need for standardized, rigorous data collection to maintain research integrity.

Limitations

The study's data collection relies on both cross-sectional and longitudinal designs, which may limit the capacity to establish causal relationships. The study also notes geographic constraints, with an overrepresentation of certain regions, particularly Asia, in the study selection, compared to Europe or Africa.

In terms of outcome measures, not all studies may use the WHO-ICOPE-recommended measures for IC domains, which can lead to inconsistency. Compared with the IC domains, psychological, cognitive, and hearing are the domains that did not follow the WHO-ICOPE recommendations. Furthermore, reliance on self-reported data in some studies may introduce biases, particularly in subjective measures such as psychological or social factors.

Study design limitations and a lack of sample diversity may weaken conclusions, as variations in outcome measures hinder the comparison and synthesis of results for specific IC domains.

CONCLUSION

This review examines the factors contributing to the decline in intrinsic capacity (IC) in older adults, highlighting the environmental, lifestyle, and sensory influences. It emphasizes the importance of WHO-ICOPE-aligned tools for comprehensive health assessment, with physical activity and balanced nutrition identified as key modifiable factors that affect cognitive, psychological, and locomotor domains.

Lifestyle habits such as smoking, alcohol use, and activity participation also impact IC, though evidence on sensory impairments like vision and hearing remains limited, requiring further research. Standardized assessments and cross-cultural studies are essential for understanding these factors and informing targeted interventions.

Future research should focus on underexplored IC components, early predictors, and the long-term effects of interventions. Examining various groups of people, taking into account their financial situations, and developing care plans tailored to their needs can enhance the effectiveness of interventions. Working together across various fields can also spark new ideas and set a global example for better ageing solutions.

Declaration of generative AI and AI-assisted technologies in the writing process: The authors utilised ChatGPT and QuillBot to assist with rephrasing and structuring paragraphs, while maintaining their own central ideas and framework. They reviewed, edited, and took full responsibility for the final content**.**

Ethical permission: In preparing this article, the authors conducted no experiments on animals or humans.

Conflict of Interest: The authors declare that they have no known competing financial interests or personal relationships that could be perceived to influence the work reported in this paper; therefore, we declare no conflict of interest.

Financial Disclosure / Grant Approval: The research was not supported by or received any specific grant from funding agencies in the public, commercial, or non-profit sectors.

Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Noordin N: Conceptualized the design, data collection, and literature search.

Justine M: Conceptualized the design, data collection, and literature search, data analysis, data interpretation, and drafted the results part in the main manuscript.

Siriphorn A: Proofreading, critical revision of the final version.

Wah YC: Literature search, critical revision of the final version.

REFERENCES

1. Maresova P, Javanmardi E, Barakovic S, Husic JB, Tomsone S, Krejcar O et al. Consequences of chronic diseases and other limitations associated with old age – a scoping review. BMC Public Health. 2019; 19(1): 1-12.
2. Rudnicka E, Napierała P, Podfigurna A, Męczekalski B, Smolarczyk R, Grymowicz M. The World Health Organization (WHO) approach to healthy ageing. Maturitas. 2020; 139: 1-3.
3. Zhou J, Chang H, Leng M, Wang Z. Intrinsic capacity to predict future adverse health outcomes in older adults: A scoping review. Healthcare. 2023;11(4):450.
4. Horgan S, Prorok J, Ellis K, Mullaly L, Cassidy K, Seitz D et al. Optimizing older adult mental health in support of healthy ageing: A pluralistic framework to inform transformative change across community and healthcare domains. Int J Environ Res Public Health. 2024;21(6):664.
5. Alias SB, Cuevas-Lara C, Martínez-Velilla N, Zambom-Ferraresi F, Soto ME, Tavassoli N et al. A multi-domain group-based intervention to promote physical activity, healthy nutrition, and psychological well-being in older people with losses in intrinsic capacity: AMICOPE development study. Int J Environ Res Public Health. 2021;18(11):5979.
6. Tavassoli N, Piau A, Berbon C, De Kerimel J, Lafont C, De Souto Barreto P et al. Framework implementation of the INSPIRE ICOPE-CARE program in collaboration with the World Health Organization (WHO) in the Occitania region. J Frailty Aging. 2020;1-7.
7. López-Ortiz S, Lista S, Peñín-Grandes S, Pinto-Fraga J, Valenzuela PL, Nisticò R et al. Defining and assessing intrinsic capacity in older people: A systematic review and a proposed scoring system. Ageing Res Rev. 2022;79:101640.
8. Huang SW, Yin SM, Hsieh CH. Association of a Low Geriatric Nutritional Risk Index with Higher Adverse Outcome in the Elderly Patients with Fall Injuries: Analysis of a Propensity Score-Matched Population. Risk Manag Healthcare Policy. 2021 Mar 31; 14:1353–61.
9. Muneera K, Muhammad T, Althaf S. Socio-demographic and lifestyle factors associated with intrinsic capacity among older adults: Evidence from India. BMC Geriatr. 2022;22(1).
10. Wang Y, Salamanca LF, Sanchez CS, Fang H. Evaluating smoking cessation interventions in China's primary care facility networks for hypertensive patients aged 45 years and older: A retrospective cohort study. Tob Induc Dis. 2023;21(September):1-11.
11. Munn Z, Barker TH, Moola S, Tufanaru C, Stern C, McArthur A et al. Methodological quality of case series studies. JBI Database System Rev Implement Repts. 2019 Sep 20
12. Gao J, Armstrong NM, Deal JA, Lin FR, He P. Hearing loss and cognitive function among Chinese older adults: The role of participation in leisure activities. BMC Geriatr. 2020;20(1).
13. Castellanos-Perilla N, Borda MG, Fernández-Quilez Á, Aarsland V, Soennesyn H, Cano-Gutiérrez CA. Factors associated with functional loss among community-dwelling Mexican older adults. Biomédica. 2020;40(3):546–56.
14. Waris M, Upadhyay AD, Chatterjee P, Chakrawarty A, Kumar P, Dey AB. Establishment of clinical construct of intrinsic capacity in older adults and its prediction of functional decline. Clin Intervent Aging. 2022 Oct 1; 17:1569–80.
15. Shin J, Cho E. Patterns and risk factors of cognitive decline among community-dwelling older adults in South Korea. Arch Gerontol Geriatr. 2023;104:104809.

16. Gaussens L, González-Bautista E, Bonnefoy M, Briand M, Tavassoli N, De Souto Barreto P et al. Associations between vitality/nutrition and the other domains of intrinsic capacity based on data from the INSPIRE ICOPE-Care program. Nutrients. 2023;15(7):1567.
17. Si Y, Hanewald K, Chen S, Li B, Bateman H, Beard JR. Life-course inequalities in intrinsic capacity and healthy ageing, China. Bull World Health Organ. 2023;101(05):307-316C.
18. Niwayama M, Sakisaka K, Wongwatcharapaiboon P, Rattanachun V, Miyata S, Takahashi K. Prevalence of Locomotive Organ Impairment and Associated Factors among Middle-Aged and Older People in Nan Province, Thailand. Int J Environ Res Public Health. 2021 Oct 15;18(20):10871.
19. Rao AR, Waris M, Saini M, Thakral M, Hegde K, Bhagwasia M et al. Prevalence and factors associated with impairment in intrinsic capacity among community-dwelling older adults: An observational study from South India. Curr Gerontol Geriatr Res. 2023;2023:1–9.
20. Doğrul RT, Varan HD, Kızılarslanoğlu MC, Kılıç MK, Kara Ö, Arık G et al. Association of physical frailty with cognitive function and mood in older adults without dementia and depression. Turk J Med Sci. 2021;51(5):2334–40.
21. Gutiérrez-Robledo LM, García-Chanes RE, Pérez-Zepeda MU. Screening intrinsic capacity and its epidemiological characterization: a secondary analysis of the Mexican Health and Aging Study. Revista Panamericana De Salud Pública. 2021 Sep 13;45:1.
22. Mulser L, Moreau D. Effect of physical exercise on cognitive function in people with epilepsy: Commentary on Alexander and Allendorfer (2023). Epilepsy Behav. 2023 Dec;149:109505.
23. Paillard T. Preventive effects of regular physical exercise against cognitive decline and the risk of dementia with age advancement. Sports Med Open. 2015;1(1):20.
24. Pujari V. Moving to improve mental health – The role of exercise in cognitive function: A narrative review. J Pharm Bioallied Sci. 2024;16(Suppl 1):S26–30.
25. Pollard TM, Guell C, Morris S. Communal therapeutic mobility in group walking: A meta-ethnography. Soc Sci Med. 2020;262:113241.
26. Department of Statistics Malaysia. (n.d.). *Welcome to the DOSM official portal*. Department of Statistics Malaysia. Retrieved February 10, 2025, from https://www.dosm.gov.my/portal-main/landingv2.
27. United Nations. (2022a). *Leaving no one behind in an ageing world*. United Nations. Retrieved February 10, 2025, https://www.un.org/development/desa/dspd/wp-.
28. Rudnicka E, Napierała P, Podfigurna A, Męczekalski B, Smolarczyk R, Grymowicz M. The World Health Organization (WHO) approach to healthy ageing. Maturitas. 2020 May 26;139:6–11.
29. Muneera K, Muhammad T, Althaf S. Socio-demographic and lifestyle factors associated with intrinsic capacity among older adults: evidence from India. BMC Geriatrics. 2022 Nov 12;22(1).
30. Jiang YS, Shi H, Kang YT, Shen J, Li J, Cui J et al. Impact of age-friendly living environment and intrinsic capacity on functional ability in older adults: a cross-sectional study. BMC Geriatrics. 2023 Jun 17;23(1).
31. Gutiérrez-Robledo LM, García-Chanes RE, Pérez-Zepeda MU. Screening intrinsic capacity and its epidemiological characterization: A secondary analysis of the Mexican health and aging study. Rev Panam Salud Publica. 2021;45(1).

32. Kalu ME, Bello Haas VD, Griffin M, Boamah S, Harris J, Zaide M et al. Cognitive, psychological and social factors associated with older adults' mobility: A scoping review of self-report and performance based measures. Psychogeriatrics. 2022;22(4):553–73.
33. Imaoka M, Nakamura M, Tasaki F, Inoue T, Orui J, Imai R et al. Association of depressive symptoms with Geriatric Locomotive Function Scale score in community-dwelling older adults living in the state of emergency. BMC Geriatr. 2023;23(1).
34. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th ed. Washington (DC): American Psychiatric Association Publishing; 2022.
35. Kremen WS, Beck A, Elman JA, Gustavson DE, Reynolds CA, Tu XM et al. Influence of young adult cognitive ability and additional education on later-life cognition. Proc Natl Acad Sci U S A. 2019;116(6):2021–2026.
36. Nichols ES, Nelson G, Wild CJ, Owen AM. A design for life: Predicting cognitive performance from lifestyle choices. PLoS One. 2024;19(4):e0298899.
37. Song S, Stern Y, Gu Y. Modifiable lifestyle factors and cognitive reserve: A systematic review of current evidence. Ageing Res Rev. 2022;78:101624.
38. Balanzá-Martínez V, Kapczinski F, de Azevedo Cardoso T, Atienza-Carbonell B, Rosa AR, Mota JC et al. The assessment of lifestyle changes during the COVID-19 pandemic using a multidimensional scale. Rev Psiquiatr Salud Ment. 2021;14(1):16-26.
39. Adan RA, van der Beek EM, Buitelaar JK, Cryan JF, Hebebrand J, Higgs S et al. Nutritional psychiatry: Towards improving mental health by what you eat. Eur Neuropsychopharmacol. 2019;29(12):1321–32.
40. Pace TWW, Mletzko TC, Alagbe O, Musselman DL, Nemeroff CB, Miller AH et al. Increased Stress-Induced inflammatory responses in male patients with major depression and increased early life stress. Am J Psychiatry. 2006 Sep 1;163(9):1630–3.
41. Haapasalo V, de Vries H, Vandelanotte C, Rosenkranz RR, Duncan MJ. Cross-sectional associations between multiple lifestyle behaviours and excellent well-being in Australian adults. Prev Med. 2018;116:119–25.
42. Anderson P, Gual A, Rehm J. Reducing the health risks derived from exposure to addictive substances. Curr Opin Psychiatry. 2018;31(4):333–41.
43. Heft M, Robinson S, et al. Intrinsic capacity and its role in aging and health. J Aging Health. 2017;29(4):456-467.
44. Izquierdo M, Merchant RA, Morley JE. International Exercise Recommendations in Older Adults (ICFSR): Expert Consensus Guidelines. J Nutr Health Aging. 2021;25(7):824-853.
45. Clay OJ, Edwards JD, Ross LA, Okonkwo O, Wadley VG, Roth DL et al. Visual function and cognitive speed of processing mediate age-related decline in memory span and fluid intelligence. J Aging Health. 2009;21(4):547–66.
46. Ma L, Chhetri JK, Zhang Y, Liu P, Chen Y, Li Y et al. Integrated Care for Older People screening tool for measuring intrinsic capacity: Preliminary findings from ICOPE pilot in China. Front Med. 2020;7:576079.
47. Robledo-Ruiz DA, Pavlova A. Supporting data for the manuscript: Robledo-Ruiz et al. 2021. Mol Ecol Resources. 2021.
48. Salinas-Rodríguez A, Fernández-Niño JA, Rivera-Almaraz A, Manrique-Espinoza B. Intrinsic capacity trajectories and socioeconomic inequalities in health: the contributions of wealth, education, gender, and ethnicity. Int J Equity Health. 2024 Mar 11;23(1).
49. Lu F, Li J, Liu X, Liu S, Sun X, Wang X. Diagnostic performance analysis of the Integrated Care for Older People (ICOPE) screening tool for identifying decline in intrinsic capacity. BMC Geriatr.2023;23(1):509