

SYSTEMATIC REVIEW

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Scales used to assess ageism in the health care sector: a (COSMIN) systematic review of the measurement properties

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Abstract

Background We aimed to systematically assess the measurement properties of ageism scales tested in a population of health care professionals and students.

Methods Eligible studies were peer-reviewed English language publications that sampled a population of health care professionals and/or students and focused on developing and/or evaluating at least one psychometric property of an ageism scale. A systematic review was conducted until 15th December 2023 via the following databases: PubMed, Embase, PsycInfo, and Scopus. Data extraction and quality assessment (including a risk of bias evaluation) of the included studies was undertaken by two reviewers in accordance with COSMIN guidelines.

Results Out of 1,626 articles selected, 51 were eligible for inclusion reporting evidence on the measurement properties and/or on the development of eight ageism scales. Only five scales have been specifically developed for health care professionals or students. Furthermore, the available scales fail to cover all dimensions of ageism, with many focusing solely on stereotypes and the explicit and negative dimensions of ageism and less on the implicit dimension. Our review also revealed that the evidence was often of poor quality and limited to only a few psychometric properties. Finally, we found that the assessed scales had poor theoretical foundations.

Conclusions This study emphasises the need to develop and validate a comprehensive scale that measures the complexity of ageism in the health care sector.

Trial registration PROSPERO registration CRD42021276470.

Keywords Ageism, Age discrimination, Psychometric properties, Measurement, Health care professionals and students

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Background

Society is undergoing a rapid ageing transformation as fertility rates decline and longevity increases. Since 1995, the number of people aged 65 years and over has doubled, reaching approximately 830 million in 2024. By 2050, it is predicted that 16% of the global population will be older than 65 and that 4.4% will be older than 80 [1]. Simultaneously, negative attitudes towards older adults and myths related to ageing are ubiquitous [2].

Ageism was first defined by R. Butler (1969, p.243) more than 50 years ago as a “*prejudice by one age group towards other age groups*”[3]. While ageism can be directed at both younger and older individuals, this article will focus only on ageism towards older adults.

Iversen et al. (2009, p.15), seeking a conceptual clarification of ageism and drawing on a literature review, proposed a broader definition of ageism defined as *negative or positive stereotypes, prejudice and/or discrimination against (or to the advantage of) elderly people on the basis of their chronological age or on the basis of a perception of them as being ‘old’ or ‘elderly.’ Ageism can be implicit or explicit and can be expressed on a micro-, meso- or macro-level*”[4]. According to Iversen et al. (2009) ageism includes three dimensions: the cognitive component which refers to “what we think” and accounts for stereotypes; the affective component which refers to “how we feel” and accounts for prejudice; and the behavioural component which refers to “how we act” and accounts for discrimination [4]. Furthermore, the explicit component corresponds to a person’s conscious ageist thoughts, feelings and behaviours that is, within their awareness and control and the implicit component corresponds to unconscious ageist beliefs, feelings and behaviours, that are largely unintentional and beyond their control [4]. In turn, the self-directed component refers to ageism directed towards oneself, whereas the other-directed component refers to ageism directed from a person (or persons) towards another person (or group of persons). The positive component consists of stereotypes, prejudices and discrimination in favour of someone on the basis of age, whilst the negative component consists of stereotypes, prejudices and discrimination in disfavour of someone on the basis of age [4]. Finally, ageism can be expressed on micro-, meso- and macro-level referring to levels of manifestation [4].

There is growing evidence that ageism may impact the health care that older adults receive [5, 6]. Ageism in health care can manifest at various levels, including social interactions, organisational cultures, and health policies, each presenting multiple forms of discrimination [7]. In this study we will mainly focus on ageist beliefs, prejudice and behaviours directed towards older patients in the health care sector.

As members of society, health care professionals do not appear to be immune to ageist stereotypes, which often develop early in their academic training [5]. Studies have shown that students frequently hold negative stereotypes about older adults, leading to a reduced interest in working with older patients [8, 9]. Caring for older people is often perceived as a less prestigious and less appealing career choice, sometimes even viewed as frustrating or boring work [10, 11]. Stevens (2011) even found that nursing students’ willingness to work with older adults tends to decline as they progress through their academic programme [12]. This is particularly concerning, as professional experience appears to confirm and even reinforce ageist stereotypes [13, 14]. Health care professionals who frequently work with a vulnerable population more susceptible to have physical and/or cognitive impairments necessitating diverse levels of care, services, or daily assistance, are particularly at risk of developing stereotypes and ageist behaviours [14]. Daily contact with older patients—often perceived as frail, dependent, and ill—may contribute to the reinforcement of generalised and negative stereotypes, especially when these encounters are not perceived positively [14]. Such perceptions can have direct consequences on the quality of care provided, influencing how health care professionals treat and communicate with older patients [5].

Ageist biases in health care can lead to the misdiagnosis or underdiagnosis of medical conditions in older adults. Common symptoms such as pain, fatigue, and depression are often dismissed as “normal” aspects of ageing rather than treatable conditions [5]. Additionally, ageist attitudes can influence treatment decisions, resulting in both overtreatment and undertreatment of older patients [5, 15, 16]. Older adults are also frequently excluded from clinical trials, leading to a lack of evidence-based guidelines tailored to their specific medical needs [5]. The way health care professionals communicate with older patients also plays a crucial role in shaping their health care experiences. Research has shown that physicians and nurses tend to spend less time with older patients, provide less information, and engage in more paternalistic decision-making compared to their interactions with younger patients [17, 18]. Physicians are also more likely to bypass older patients in medical discussions, preferring to communicate with younger family members instead [19]. A particular form of ageist communication is the use of *elderspeak* or *babyspeak*—a condescending manner of speaking that involves speaking more loudly and slowly, using overly simplified vocabulary, and addressing older patients with diminutive or infantilising nicknames [20–22]. This type of over-accommodative communication implicitly conveys a message of incompetence and dependence, reinforcing negative stereotypes about ageing [20–22]. Such interactions can

damage the patient-provider relationship, hinder effective communication, limit shared decision-making, and discourage older adults from seeking health care services [20–22]. Additionally, elderspeak has been linked to lower self-esteem [23], a loss of control and autonomy [23], and diminished dignity among older patients [24]. Furthermore, excessive assistance—where health care professionals perform tasks for older patients rather than encouraging independence—can lead to decreased self-confidence, reduced functional ability, an increased perception of dependency and the acceleration of physical and cognitive decline among older patients [25].

Ageism in health care appears to be a pervasive issue and have a detrimental impact on how health care professionals perceive, communicate with, diagnose, and treat older patients, impacting the quality of care they receive [5]. Furthermore, ageist beliefs and behaviours have been shown to impair older people's cognitive and functional performance, contribute to increased morbidity and lead to poorer mental health care and reduced recovery from disability [26]. Ageism has also been associated with a reduced lifespan, increased distress and loneliness, and social exclusion of older adults from meaningful roles in society [6, 26]. Ageism is, therefore, increasingly recognised as a public health issue and as one of the most prevalent forms of stereotyping, prejudice and discrimination [27].

In a time of rapid demographic transformation, it is possible that the prevalence of ageism against older adults will increase. Despite the consequences of ageism and the rapid ageing population, the evidence on how to measure or assess ageism remains a challenge [28]. Quantitative measures are used to assess ageist beliefs, prejudices and behaviours using surveys and questionnaires [29]. The evidence about these measures used to estimate its prevalence is rather limited [30], especially in the health care sector [7, 30, 31]. A systematic review conducted by Ayalon et al. (2017) even if realised among a general population, found that existing ageism scales fail to encompass all dimensions of ageism and often lack thorough psychometric validation. Many scales are supported by fewer than three independent validation studies, and even among those with multiple assessments, evidence is often of low quality and/or provided on only a handful of psychometric properties. Moreover, studies often yield indeterminate or inconsistent results on the measurement properties assessed [28].

The understanding of what existing ageism scales measure is further compounded by the lack of standard and operational definitions in the field [7]. The extent to which these various dimensions and facets of ageism are reflected in existing ageism scales is rarely mentioned [7]. Therefore, existing estimates of ageism prevalence may not be accurate. We also lack systematic knowledge

about the psychometric properties of available scales. Thus, it is currently unclear what existing ageism scales measure and what psychometric quality they have in the health care sector [7, 28]. Without comprehensive and psychometrically valid ageism scales we may not be able to accurately assess the prevalence of ageism and evaluate if available strategies to reduce or prevent it work in the health care sector.

The objective of our study was to systematically evaluate the measurement properties of ageism scales targeting older adults and/or older patients tested in populations of health care professionals and students and to assess the risk of bias in the selected studies. Another objective of our study was to analyse the operationalisation of ageism in the selected scales using the dimensions of the definition by Iversen et al. (2009) as a theoretical framework, as proposed by the authors. Indeed, the authors consider it a theoretical framework to use in any research dealing with ageism and as a foundation for developing measurement instruments [4]. The framework can also be used to critically appraise existing tools, particularly different scales that have been proposed to assess ageism [4]. This systematic review of ageism scale in the health care sector is essential to give some insight on the available scales, their operationalisation and psychometric properties.

Methods

Our systematic review was conducted according to the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) guidelines [32]. To ensure the completeness and transparency of the report of this systematic review, the PRISMA-COSMIN checklist for Outcome Measurement Instruments (OMIs) was used (See Supplementary Table 7). The research protocol was registered in PROSPERO, the International Prospective Register of Systematic Review, under the registration number CRD42021276470.

Search strategy and selection criteria

We searched PubMed, Embase, PsycInfo, and Scopus until 15th December 2023. According to the COSMIN guidelines [32], a search equation was constructed that included the construct of interest (ageism towards older adults), the target population (health care professionals and students), the type of instrument (scale), and the psychometric properties (validity and reliability). All the constructs included in the equation were developed using a comprehensive collection of search terms and then translated using the index terms and search guidelines specific to each database (for more information, see Supplementary Tables 1–3). The search equation was constructed in collaboration with two librarians with expertise in systematic reviews. After removing

duplicates, a researcher (S.D.) screened all titles and abstracts for inclusion, assisted by a second researcher (J.M.D.). The full-text review was conducted independently by the same two raters (S.D. and J.M.D.), who then discussed and resolved disagreements through consensus. The review included peer reviewed studies published in English, French, or Dutch that aimed to develop and/or evaluate a scale of ageism towards older adults and/or older patients for health care professionals and/or students. Studies that used the scale as an outcome or validation measure for another instrument were excluded. To identify additional relevant studies and thus ensure a comprehensive search, we also manually screened the reference lists of the retained records (snowballing technique) and organised a supplementary search using the individual names of each selected scale. Rayyan software [33] was used throughout the selection process. The selection process is depicted in a flowchart (see Fig. 1).

Data extraction and quality assessment

A first table was constructed with the main characteristics of the included scales, such as the name of the authors (date), the number of articles, the description of the construct measured, the original target population, the populations that had been used to validate the scales, the type of instrument, the language of the scale, and the available translations of the scales. A second table was constructed with the study characteristics (such as the

country and setting) and the population characteristics (such as sample size, age, sex, and type of population).

Next, to ensure that the selected studies met a minimum quality standard before our in-depth data extraction and psychometric property evaluation, two independent reviewers (S.D., J.M.D.) used the Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields checklists (QualSyst tool) to conduct a preliminary quality assessment [34]. Any disagreements were debated and resolved by consensus. The quantitative study checklist has 14 items with the following scoring options: “yes” = 2, “partial” = 1, “no” = 0, and n/a. As “not applicable” items were excluded from the calculation of the summary score, we calculated a summary score for each study by summing the score of each item and dividing it by the total possible score (i.e., $28 - (\text{number of “n/a”} \times 2)$ [34]. The qualitative study checklist has 10 items with the same scoring options except for “n/a”. A summary score for each study was calculated by summing the score of each item and dividing it by the total score [34]. Because a minimum number of independent quality studies are needed for the psychometric validation of a scale, we excluded any scales that did not meet the average score on the QualSyst tool and had not been validated in at least two independent studies.

Following this preliminary quality assessment we conducted a more in-depth analysis of the operationalisation

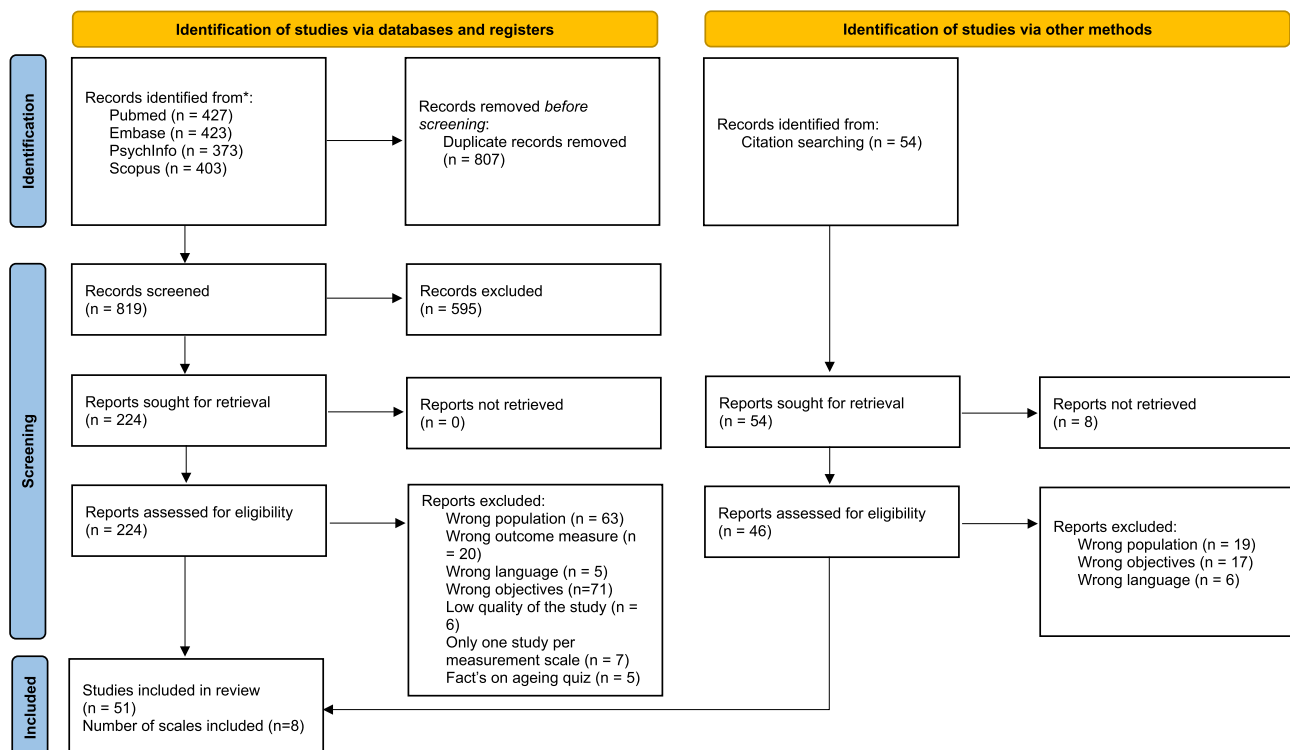


Fig. 1 Flowchart of the included studies

of ageism at the selected scales. We used the definition of Iversen et al. (2009) as a theoretical framework to classify each item individually according to the following components of ageism: the three established dimensions (cognitive, affective, or behavioural), the positive/negative aspect, and the implicit/explicit aspect [4]. We also classified each item on the basis of whether it was directed towards older adults in general or specifically towards older patients.

Furthermore, we extracted the data from the selected studies regarding their psychometric properties according to the COSMIN taxonomy [32]. These properties included content validity, structural validity, internal consistency, cross-cultural validity, reliability, measurement error, criterion validity, hypothesis testing for construct validity, and responsiveness (See Supplementary Table 4 for the COSMIN definitions of the psychometric properties).

To evaluate the methodological quality of the psychometric property results, one researcher (S.D.), assisted by another researcher (J.M.D.), conducted a second quality assessment of each study via the COSMIN risk of bias checklist [32].

Data synthesis

According to the COSMIN guidelines [32], due to inconsistencies in the results across studies for each measurement property, we decided not to pool the data quantitatively. Instead, we provided an overview of the results of the psychometric properties for each scale, presented in a table. The overall evidence for each scale's measurement properties was summarized based on the number of studies, their methodological quality, and the consistency of findings. A qualitative synthesis of evidence for each measurement property was conducted to reach conclusions about the scales' overall quality.

Calculation of the standard error of measurement

In general, most studies concerning the evaluation of psychometric properties report only the reliability coefficient (e.g., Cronbach's alpha coefficient) of the evaluated scale. However, depending on the type of characteristic measured and the method used to estimate reliability, there are several ways to interpret a reliability coefficient of a given value [35]. A reliability coefficient is defined in classic test theory as the proportion of the observed variance that is "true" rather than the "error variance". The main disadvantage of expressing the reliability coefficient as a dimensionless ratio of variances is that it is difficult to interpret in terms of an individual score [35]. Therefore, we computed the standard error of measurement (SEM) whenever possible via the reported reliability coefficient. The SEM, defined as $SEM = \sigma \times \sqrt{1 - \text{reliability}}$, enabled the construction of a 95% confidence interval

(95% CI = $\pm 1.96 \times SEM$) around the observed score of a person, allowing a meaningful quantification of measurement error around that score (See Supplementary File 1 for more information) [36]. To facilitate comparison between the studies, the SEMs and 95% confidence intervals were expressed as percentages.

Results

The initial search identified 1,626 records. After removing duplicates and irrelevant records, 224 studies were selected for full-text review. An additional 46 records were found through snowballing methods, resulting in a total of 270 records for full-text review. Of these, 201 were excluded because they did not meet the inclusion criteria, and 6 studies were excluded after the preliminary quality assessment because they did not meet the minimum quality criteria. This resulted in 63 records evaluating 15 different scales. Seven scales were further excluded because of insufficient studies assessing their psychometric properties. We also excluded the Facts on Ageing Quiz [37] from the selected scales. Although the original authors suggested this scale could also be used to assess stereotypes about older adults, the true/false evaluation method and item wording led us to believe that it was primarily a scale measuring knowledge of ageing and gerontological care rather than ageism. As a result, our systematic review included 51 studies evaluating eight ageism scales tested among health care professionals and students (see Fig. 1). Nonetheless, because we think providing a comprehensive overview of all existing scales and their characteristics is important, we decided to add a supplementary table listing all the excluded ageism scales that were tested among health care professionals and students but had no more than two articles assessing their psychometric properties (See Supplementary Table 5).

Characteristics of the scales (Table 1 and Supplementary Table 6)

All of the 8 ageism scales included in our review are self-reported and are composed of items using a Likert scale (except for the Ageing Semantic Differential [92]). Only five of the eight scales were developed specifically for the health care sector. Additionally, the participants in these studies were mainly health care students ($n = 42$), such as nursing and medical students (see Supplementary Table 6 for more information on the characteristics of the studies). Furthermore, five of the eight scales had six or fewer studies supporting their evidence base. In contrast, the Kogan's Attitudes Towards Older People Scale has the most studies with 17 articles, followed by the Scale of Ageism for Dental Students with 12 articles and the Ageing Semantic Differential Scale with 8 articles (see Table 1 for more information on the characteristics of the scales).

Table 1 Characteristics of the included ageism scales

Scale	N. of st.	Construct	Original target population	Validated among	Type of instrument	Available translations	References
Kogan's attitudes towards older people scale	16	Explicit: stereotype, positive–negative	General population	Health care students (e.g., nursing students) Health care professionals (e.g., nurses)	Self-reported Likert scale of 17 matched positive–negative pairs	Arabic, Turkish, English, Greek, Italian, Japanese, Iranian, Thai, Swedish, Chinese, French, etc.	[38–53]
Ageism scale for dental students	12	Explicit: stereotype/behaviour, positive–negative	Dental students	Dental students Dentists	Self-reported Likert scale of 27 items	French, Greek, German, Serbian, Brazil, English, Romanian, etc.	[54–65]
Ageing Semantic Differential (ASD)	9	Explicit: stereotype, positive–negative	General population	Health care students (e.g., medical students) Health care Professionals	Self-reported differential scale of 32 adjective pairs	Swedish, English, Brazil, German, Australian, etc.	[66–69, 71–73]
UCLA – Geriatric attitudes scale	6	Explicit: stereotype/behaviour, positive–negative	Geriatrician	Health care students (e.g., primary care residents) Health care professionals (e.g., geriatrician, family doctors) Nurses	Self-reported Likert scale of 14 items	English, French, Brazil, Turkish, Persian	[69, 74–78]
Older patients in acute care scale	6	Explicit: stereotype/prejudice, positive–negative	Hospital nursing staff	Nurses	Self-reported Likert scale of 25 items	English, Dutch	[79–84]
Fraboni scale of ageism	3	Explicit: stereotype/prejudice, positive–negative	General population	Nurses and physicians (hospital), Medical students	Self-reported Likert scale of 44 items	English, Turkish, Chinese	[85–87]
Carolina Opinions on Care of Older Adults survey	2	Explicit: stereotype/affective/behaviour: positive–negative	Medical and health care students	Medical students	Self-reported Likert scale of 42 items	English, Israeli	[88, 89]
Ambivalent Ageism Scale	2	Implicit-Explicit: stereotype: negative	General population	Public health students, paramedical students	Self-reported Likert scale of 18 items	English, French	[90, 91]

Some articles evaluated more than one scale

Finally, most of the scales measure the construct of ageism primarily through explicit stereotypes.

Operationalisation of ageism (Table 2)

When analysing each item individually, the results revealed significant imbalances in the attention each component received (see Table 2). Among the classic components, the cognitive component is clearly predominant ($n=203$) compared with the affective ($n=10$) and behavioural ($n=51$) components. Strong contrasts were also found between the explicit ($n=251$) and implicit ($n=13$) components, heavily favouring the explicit aspects. Only the Ambivalent Ageism Scale (for use in the health care sector) [90, 91, 93] included more implicit items, specifically through a form of ageism known as “benevolent ageism” [93]. This is a more implicit form of ageism, manifested in maternalistic, paternalistic, or even condescending behaviour, leading to the infantilisation of older adults. Although well intended, these attitudes have negative consequences for older adults’ physical and mental health [90]. Finally, we find a slight predominance of the negative component ($n=181$) compared with the positive component ($n=115$). As explained earlier, only half of the scales were developed for the health care sector. When analysing each item individually, it is important to clarify that 134 items were directed towards older adults and that 130 items were directed towards older patients, including 86 items only for the Older Patients in Acute Care Scale [79], leading us to conclude that the majority of the items are related to older adults in general.

Psychometric properties and quality of evidence (Table 3)

Development of the scale and content validity

The results indicate that only three studies used qualitative methods for scale development among the study population (specifically, the Australian version of the

Ageing Semantic Differential [66, 94] and the Older Patients in Acute Care Scale [82]). Additionally, while most studies provided a conceptual definition of ageism—albeit some implicitly and approximately—only a minority of the studies explicitly referenced their theoretical framework. Most studies examined the relevance and comprehensiveness of the scales among expert panels (e.g., geriatricians, faculty members from the health care sector, nurses) via quantitative methods such as the content validity index (CVI). Most of the studies also reported pilot tests among the study population (see Table 3).

Structural validity

The structural validity of most of the scales was inconsistent because the proposed factor structures failed to fit the previous ones consistently.

Internal consistency

The internal consistency of the scales was generally satisfactory, with Cronbach’s alpha values mostly above 0.7. For example, the Cronbach’s alphas of Kogan’s Attitudes Towards Older People Scale ranged from 0.62 to 0.89, and for the Ageing Semantic Differential, they ranged from 0.86 to 0.94. However, owing to inconsistent results in the factor analysis, the internal consistency of individual factors/subdimensions was less satisfactory.

Reliability

Only a minority of the studies reported the test–retest reliability of the scales ($n=8$), and when reported, the documentation was often poor, leading to a high risk of bias (see Table 3).

Finally, there was a lack of data on the responsiveness, measurement error and criterion validity for all scales.

Table 2 Operationalisation of ageism in the scales

Scales of ageism	HC ^a	OP ^b	Components of ageism ^c						
			Cognitive	Affective	Behavioural	Explicit	Implicit	Positive	Negative
Kogan’s attitude towards older people	NS	0	34	0	0	34	0	17	17
Ageism scale for dental students	S	22	20	0	7	27	0	12	15
Ageing Semantic Differential	NS	0	32	0	0	32	0	32	32
Geriatrics attitudes scale	S	5	12	0	2	14	0	6	8
Older Patient in Acute Care Scale	S	86	50	0	36	86	0	30	56
Fraboni scale of ageism	NS	0	23	5	1	29	0	7	22
Carolina Opinions on Care of Older Adults survey	S	12	14	5	5	24	0	11	13
Ambivalent Ageism Scale in health care sector	S	5	18	0	0	5	13	0	18
Total ($n=264$)	5	130	203	10	51	251	13	115	181

S specific; NS nonspecific

^aScale specific to the health care sector

^bNumber of items related to older patients

^cComponents of ageism according to definition of Iversen et al. – number of items related to the different components

Table 3 Psychometric evaluation of the included studies

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Hypothesis testing for construct validity
Kogan's Attitude of older people scale Söderhamn et al. 2000 [51]		EFA, 30.1% (24 items) F1: Prejudice F2: Appreciation F3: Resemblance	$\alpha_{scale} = 0.79$ $\alpha_{F1} = 0.84$ $\alpha_{F2} = 0.60$ $\alpha_{F3} = 0.39$			Known-group technique with t test (results confirmed hypotheses)
	Lambrinou et al., 2005 [46]	Back translation + panel of 4 experts EFA, 41.5% (20 items) F1 Appreciation F2 Prejudice F3 Dependence F4 Older people interest in work and politics F5 Feelings of discomfort and tension experienced in the company of older people F6 Capacity of older people	$\alpha_{scale} = 0.80$ $\alpha_{Op-} = 0.73$ $\alpha_{Op+} = 0.65$			Known group comparison with t test (no hypotheses defined)
	Ogiwara et al., 2007 [49]	Translation of the scale with expert panel (process not detailed) EFA, 30.7% (24 items) F1 Prejudice F2 Appreciation F3 Expectation	$\alpha_{scale} = 0.87$ $\alpha_{F1} = 0.84$ $\alpha_{F2} = 0.77$ $\alpha_{F3} = 0.74$			Known-group technique with multiple regression analysis with clinical practice, gender and cohabitation with older adults as independent variable, $R^2 = 0.008$, no hypotheses defined)
Iwasaki & Jones, 2008 [43]			$\alpha_{scale} = 0.83$ $\alpha_{F1} = 0.68$ $\alpha_{F2} = 0.79$			Not specified correlation with R-ASD $r = 54$ ($p < 0.01$), $r = 0.47$ ($p < 0.01$), $r = 0.46$ ($p < 0.01$), no hypotheses
	Yen et al., 2009 [54]	Panel of 9 experts (CVI=0.92) Back-translation process with panel of expert and pilot-testing (not much information) EFA, 54.7% (34 items) F1 Prejudice F2 Appreciation	$\alpha_{scale} = 0.82$ $\alpha_{F1} = 0.83$ $\alpha_{F2} = 0.81$	Pearson correlation coefficients after 2 weeks ($n = 30$) Prejudice (0.86) Appreciation (0.91)		

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Hypothesis testing for construct validity
Erdemir et al., 2011 [41]	Panel expert (CVI=0.94) Back-translation process with panel of 12 experts + pilot-test	EFA, Factor loadings > 0.30 2 factor structure	$\alpha_{\text{scale}} = 0.84$ $\alpha_{F1} = 0.79$ $\alpha_{F2} = 0.77$	Test-retest after 4 weeks ($n = 402$), Pearson correlation coefficient (0.21–0.45) Test-retest interval correlation coefficient = 0.73		
Küçüköçü et al., 2011 [46]	7 Expert panel evaluating relevance, clarity, simplicity on a 10-point scale (not all appropriate—completely appropriate), no statistically difference in scores + pilot test ($n = 30$)	CFA ($n = 237$), F1: positive (17 items) F2: negative (17 items) $\chi^2 = 1137.69$ ($p < 0.001$), RMSEA = 0.071, CFI = 0.90, SRMR = 0.075, NNFI = 0.91.	$\alpha_{\text{scale}} = 0.89$ $\alpha_{F1} = 0.82$ $\alpha_{F2} = 0.85$	Test-retest using Pearson's product-moment correlation ($n = 68$) $r_{\text{scale}} = 0.83$, $p > 0.00$ $r_{F1} = 0.73$, $p > 0.00$ $r_{F2} = 0.77$, $p > 0.00$		
Kiliç & Adibelli, 2011 [44]	Back-translation process (correlation between total score English and Turkish version: 0.63, $p < 0.05$)	EFA ($n = 263$), 26 items (28%) F1 NR	$\alpha_{\text{scale}} = 0.81$	Test-retest ($n = 263$) after 30 days $r = 0.78$ ($p < 0.05$)		Pearson Product-Moment Correlation with Attitude towards Old People in the Family Inventory ($r = 0.68$, $p < 0.05$).
Rejeh et al., 2012 [50]	Expert panel (S-CVI = 0.095) Back-translation process + panel of 20 expert + pilot-test ($n = 20$)	EFA ($n = 350$), 34 items (58.76%) F1 Prejudice F2: Appreciation	$\alpha_{\text{scale}} = 0.83$ $\alpha_{F1} = 0.83$ $\alpha_{F2} = 0.86$	Test-retest ($n = 70$) using Pearson correlation coefficient $r_{\text{items}} = 0.44$ – 0.85 ICC = 0.90		Known group technique Experience of more than 10 years VS. with less than 10, Past experiences of caring for older relatives VS. not significant ($p < 0.001$).
Matarese et al., 2013 [48]	Expert panel (S-CVI = 0.81) Back-translation process (no information)	EFA ($n = 1637$), 78% F1: Prejudice (17 items) F2: Appreciation (17 items)	$\alpha_{\text{scale}} = 0.76$ $\alpha_{F1} = 0.80$ $\alpha_{F2} = 0.66$			

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Hypothesis testing for construct validity
Runkawatt et al., 2016 [51]	Panel of 3 expert (CVI = 0.95) Back translation, ICC _{language} = 0.93 ICC _{interpretation} = 0.94		$\alpha_{\text{scale}} = 0.66-0.70$ $\alpha_{F1-} = 0.65-0.72$ $\alpha_{F2-} = 0.66-0.72$			
Alquwez et al., 2018 [40]	Panel of 5 expert (I-CVI = 1, S-CVI/Ave = 1) Back-translation process + panel of expert	EFA (n = 164), 34 items (60.1%) F1 Appreciation F2 Prejudice	$\alpha_{\text{scale}} = 0.89$ $\alpha_{F1-} = 0.95$ $\alpha_{F2-} = 0.94$			Known group comparison with t test, extend vs. nuclear family, urban vs. rural, living with grandparents, significant)
Abudu et al., 2023 [39]	Pilot-test (No adaptation?)		$\alpha_{22 \text{ items}} = 0.65$			
Wanko et al., 2023 [53]	Only pilot study, no adaptation (n = 20, $\alpha = 0.63$)	EFA (n = 296), 24 items (58.44%) F1 Prejudice F2 Appreciation	$\alpha_{\text{scale}} = 0.62$ $\alpha_{F1-} = \text{NR}$ $\alpha_{F2-} = \text{NR}$			Known group comparison with t test, rural vs. urban, courses on non-verbal communication vs. not, significant)
Fernández-Muñoz et., 2023 [42]	Translation process not descriptive	EFA (n = 381), 34 items (25.69%) F1 Prejudice F2 Appreciation	$\alpha_{\text{scale}} = 0.75$ $\alpha_{F1-} = 0.78$ $\alpha_{F2-} = 0.77$ $\Omega_{\text{scale}} = 0.95$ $\Omega_{F1-} = 0.93$ $\Omega_{F2-} = 0.97$			
Ageism scale among dental students						
Rucker et al., 2018 [61]	Expert panel for item development	EFA, one-factor structure (4 items, 58.5%)	$\alpha_{4 \text{ items}} = 0.75$			Known group comparison (significant white vs. nonwhite/men vs. woman for some items)
Rucker et al., 2019 [62]		EFA, one-factor structure (5 items, 63%)	$\alpha_{5 \text{ items}} = 0.76$			Known Group comparison (men vs. women, $p = 0.013$)
Kossioni et al., 2019 [56]	Back-translation process + panel of expert + pilot-test (n = 20)	EFA, 15 items (56.4%) F1 values/ethics about older people F2 patient compliance F3 barriers to dental care F4 dentist-older patient interaction	$\alpha_{F1-} = 0.71$ $\alpha_{F2-} = 0.72$ $\alpha_{F3-} = 0.57$ $\alpha_{F4-} = 0.64$			Known group comparison: 8th vs. 10th semester, urban vs. rural
Rucker et al., 2020 [63]	Panel of 5 expert, CVI > 0.8 Back-translation process + Pilot-test (n = 10)	EFA, 12 items (51%) F1 negative view of older patient F2 complexity of providing care to older adults F3 positive view of older people	$\alpha_{F1-} = 0.68$ $\alpha_{F2-} = 0.72$ $\alpha_{F3-} = 0.56$			Known group comparison (no significant)

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Criterion validity	Hypothesis testing for construct validity
Veenstra et al., 2021 [65]	Panel expert Back-translation process + panel expert	EFA, 10 items (58%), F1 Cost—benefit of providing care to older patients F2 Perception of older persons and their value in society F3 Exposure to gerontology training and experience of students	α F1: 0.80 α F2: 0.59 α F3: 0.46				Known group comparison (having older person in family vs. not, only significant)
Piaton et al., 2021 [58]	Panel expert, CVI = NR? Back-translation process + pilot test ($n=40$)	EFA, 10 items (57.2%) F1 General negative view of older patients F2 Responsibility for providing care to older patients F3 Education around older patients care	α F1: 0.65 α F2: 0.7 α F3: 0.6				Known group comparison (Men vs. Woman, $p=0.08$), 4th vs. 5th vs. 6th year
Popovac et al., 2021 [60]	Expert panel Back-translation process + panel of experts + pilot-test ($n=30$)	EFA + CFA, 17 items (64.24%) F1 Negative view of older patient's life and dental treatment F2 Ethical values about older patients and patient compliance, F3 Dental care provision F4 Difficulties in taking medical histories F5 Barriers to dental treatment RMSEA = 0.07, 90% CI [0.05, 0.09], $p=0.09$, CFI = 0.91, TLI = 0.88, $\chi^2 = 148.38$, $df = 94$, $p < 0.0001$, SRMR = 0.09.	α F1: 0.77 α F2: 0.70 α F3: 0.68 α F4: 0.83 α F5: 0.50				
Michalopoulos et al., 2021 [57]	Panel of 14 experts, CVR = 0.3–1 Back-translation process + panel of experts + pilot test ($n=15$)	EFA, 11 items (56.6%) F1 Patient compliance F2 Opinions about elderly F3 Barriers/concerns on dental treatment for the elderly F4 Practitioners' perspective	$\alpha_{scale} = 0.63$ α F1: 0.64 α F2: 0.42 α F3: 0.35 α F4: 0.37				
Piaton et al., 2022 [58]	Translation and cross-validation		Guttman's Lambda 4 of 0.92 and of 0.74, respectively, the ASD and the ASDs.				Pearson correlation ASD _{tot} with ASD, $r = 0.32^{**}$, [0.14, 0.48] ASD _{F1} with ASD _{F1} , $r = 0.26^{**}$ [0.09–0.43], ASD _{F2} , $r = 0.31$ [0.14–0.47] ASD _{F3} , $r = 0.28$ [0.11–0.44] ASD _{F4} , $r = 0.35$ [0.17–0.50]
Charoosae et al., 2023 [53]	Expert panel + pretest Cross-cultural adaptation + translation	EFA ($n=275$), 18 items (NR?) F1 Barriers/concerns on dental treatment in older adults F2 Opinions about older adults F3 Practitioner's perspective F4 Older adults' perspective	$\alpha = 0.61$				

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Criterion validity	Hypothesis testing for construct validity
Shenoy et al., 2023 [64]	Expert panel (cross-cultural adaptation) + CVI	EFA (n = 213), 15 items (NR?)	$\alpha = 0.46$ $\alpha_{F1-F6} = 0.51-0.81$				Known group comparison Significant for component 1: final year < residents ($p = 0.06$) Component 4: urban > non urban, female > male ($p = 0.020$) Component 6 : female < male ($p = 0.000$)
		F1 Barriers/concerns in dental treatment of elderly F2 Patient compliance F3 Opinions of elderly F4 Time-consuming F5 Treatment success rate F6 Practitioner perspective					
Voultsos et al., 2023 [66]		EFA (n = 365), 15 items (NR?)	$\alpha = 0.59$ $\alpha_{F1} = 0.773$ $\alpha_{F2} = 0.714$ $\alpha_{F3} = 0.831$				Known group comparison. f 1: < living in town and village ($p = 0.002$), < financial difficulties ($p = 0.021$), F2: woman < men ($p = 0.023$), aged 56 years and older < other age group ($p = 0.026$), living in the past with aged persons in their household < not ($p = 0.020$) F3: working in the public sector > private sector ($p = 0.025$).
		F1 Adherence of the elderly patients to the instructions of the dentist (4 items) F2 Dentist-elderly patient interaction (3 items) F3 Values/ethics of dentists for elderly patients (2 items)					
Ageing Semantic Differential Underwood et al., 1985 [72]		CFA (n = 156), 32 items F1: Instrumental-Ineffective (9 items) F2: Autonomous- Dependent (9 items) F3: Personal acceptability – unacceptability (14 items) $\chi^2 < 0.0001$ AIC = 981.7231 BIC = 691.7951					
		CFA (n = 100), 26 items F1: Instrumental (6 items) F2: Autonomy (8 items) F3: Acceptability (7 items) F4: Integrity (5 items) $\chi^2 = 386.5$ Df = 293, $\chi^2/Df = 1.32$, GFI = 0.838, AGFI = 0.806, NFI = 0.648, CFI = 0.879, RMSEA = 0.057, AIC = 502.5					
Intrieri et al., 1995 [69]			$\alpha_{F1} = 0.75$ $\alpha_{F2} = 0.85$ $\alpha_{F3} = 0.81$ $\alpha_{F4} = 0.81$				

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Criterion validity	Hypothesis testing for construct validity
Iwasaki & Jones, 2008 [43]		EFA (n = 367) + CFA (n = 368), 24 adjectives (47%) Tested several factor structures (one, two, three and four) ∅ no conclusive results. The best fit was a 4-factor structure using an oblique model ($\chi^2=543.36$ df=246 χ^2 /df= 2.21 GFI=0.89 AGFI= 0.86 NNFI=0.91 PNFI=0.78 MSEA =0.06) ∅ no information on the factors name and items	$\alpha_{scale} = 0.93$				
Gonzales et al., 2010 [67]	Based on 112 dissertations of medical students about their experience with older adults during an activity ∅ coded the adjectives used to describe their attitudes towards older adults and found 4 factors of adjectives: personally acceptable–unacceptable (46%), experienced–inexperienced (25%), instrumental–ineffective (19%) and autonomous–dependent (10% of the adjectives)	CFA (n = 199), 24 adjectives, tested different analysis methods ∅ no conclusive results. Best fit was one-factor structure with robust weighted least square estimator for categorical variable ($\chi^2=411.56$, $p=0.0$, df=63, χ^2 /df=6.53, RMSEA =0.16)	$\alpha_{scale} = 0.89$				
Lucchetti et al., 2018 [70]			$\alpha_{scale} = 0.94$				Pearson correlation with UCLA-GAS, $r=-0.67^*$ Known-group comparison with Mann–Whitney U test, training in geriatrics vs. no, $p<0.001$

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Criterion validity	Hypothesis testing for construct validity
Wilson et al., 2019 [73]	Medical students indicate 10 words to describe their attitudes towards older people. Three researchers selected the words based on frequency. Five experts working in aged care assessed the linguistic contrast and psychological bipolarity with help of thesaurus and dictionary. 20 item pairs with 6 response choices + pilot test to assess internal consistency and usability among 140 medical students	EFA ($n = 321$), 19 items (56%) F1 Instrumentality F2 Personal Appeal F3 Experience F4 Sociability	$\alpha_{\text{scale}} = 0.86$ $\alpha_{F1} = 0.82$ $\alpha_{F2} = 0.79$ $\alpha_{F3} = 0.67$ $\alpha_{F4} = 0.67$				
Wilson et al., 2020 [74]		CFA ($n = 188$), 19 items F1 Instrumentality ($\chi^2 = 11.5$ (0.24), CFI = 0.99, TLI = 0.99, RMSEA = 0.04, SRMR = 0.03) F2 Personal Appeal ($\chi^2 = 16.8$ (0.005), CFI = 0.94, TLI = 0.89, RMSEA = 0.11, SRMR = 0.05) F3 Experience ($\chi^2 = 0.65$ (0.72), CFI = 1.0, SRMR = 1.0, RMSEA = 0.00, SRMR = 0.01) F4 Sociability ($\chi^2 = 3.2$ (0.20), CFI = 0.98, TLI = 0.95, RMSEA = 0.06, SRMR = 0.03)	$\alpha_{F1} = 0.84$ $\alpha_{F2} = 0.71$ $\alpha_{F3} = 0.71$ $\alpha_{F4} = 0.60$				
Holmberg et al., 2020 [68]	Back translation + pilot-test among nursing students ($n = 9$)	CFA ($n = 292$), 26 items F1 Instrumentality F2 Autonomy F3 Acceptability F4 Integrity $\chi^2 = 784.90$; $df = 293$; $NC = 2.83$; p value = 0.001; GFI = 0.92; NNFI = 0.82; SRMR = 0.07; RMSEA = 0.07	$\alpha_{F1} = 0.76$ $\alpha_{F2} = 0.71$ $\alpha_{F3} = 0.82$ $\alpha_{F4} = 0.84$				Known group comparison with Fischer nonparametric permutation test (age < 25 vs. > 25, personal relationship with older adults vs. none, bachelor vs. master level, significant for some subscales)

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Criterion validity	Hypothesis testing for construct validity
Schütten-gruber et al., 2021 [71]		CFA (n = 255), 26 items F1 Instrumentality F2 Autonomy F3 Acceptability F4 Integrity $\chi^2 = 647.715$; df = 295; p value = 0.00; CFI = 0.82; TLI = 0.80; SMR = 0.07; RMSEA = 0.07	$\Omega_{scale} = 0.92$ $\Omega_{F1} = 0.74$ $\Omega_{F2} = 0.67$ $\Omega_{F3} = 0.78$ $\Omega_{F4} = 0.79$				Known group comparison with Kruskal–Wallis H test (nursing vs. medicine vs. humanities students, significant for total score and some subscales) and with regression analysis (possibility to talk about personal topics with a person aged 80 and older and knowledge about ageism, significant for some subscales)
Older Patient in Acute Care Scale Malmgreen et al. 2009 [83]	Focus group with US nurses (n=7) to evaluate and reword items Content expert panel (n=4) to review relevance, clarity and validity CVI(OPACS) = 0.918, CVI(Practice) = 0.97, CVI(General opinion) = 0.92						
Van Schelven et al., 2015 [84]	Dutch translation with 5 experts + Assessment of clarity (clear for 89% of the experts), relevance ((CVI = 0.62 (OPACS), CVI = 0.61 (Practice), CVI = 0.64 (General opinion)) and appropriateness (appropriate for 75% of experts) of the scale with 10 experts						
Dikken et al., 2017 [82]		CFA (n = 201) Section A Practice experience (34 items, $\chi^2 = 8475.4$; df = 527; p value = 0.00; CFI = 0.96; TLI = 0.96; RMSEA = 0.21) Section B General opinion (no item contributed significantly to the factor, $\chi^2 = 9200.29$; df = 1127; p value = 0.00; CFI = 0.68; TLI = 0.67; RMSEA = 0.15)	$\alpha_{sectionA} = 0.82$ $\alpha_{sectionB} = /$				

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Hypothesis testing for construct validity
Dikken et al., 2017 [81]		CFA ($n = 130$) Section A Practice experience (30 items, $\chi^2 = 549$, $df = 357$; p value = 0.00; CFI = 0.98; TLI = 0.97; RMSEA = 0.06) Section B General opinion (38 items, $\chi^2 = 647.38$, $df = 551$; p value = 0.00; CFI = 0.99; TLI = 0.99; RMSEA = 0.04) OPACS – US (62 items, $\chi^2 = 2349.75$, $df = 1699$; p value = 0.00; CFI = 0.97; TLI = 0.97; RMSEA = 0.05) EFA ($n = 191$) performed individually on each factor Section A: Practice F1 Practice (36 items, 23%, $\chi^2 = 1618.41$, $p < 0.00$) only 13 items valid) Section B: general opinion F2 Knowledge (21 items, 25.6%, $\chi^2 = 390.7$, $p < 0.00$, only 12 items valid) F3 Attitude (29 items, 22.8%, $\chi^2 = 837.6$, $p < 0.00$, only 15 items valid)	$\alpha_{\text{scale}} = 0.93$ $\alpha_{\text{sectionA}} = 0.89$ $\alpha_{\text{sectionB}} = 0.89$			Pearson correlation between OPACS-US Section B and KOP-Q at $r = 0.25$, $p < 0.05$
Venables et al., 2019 [85]			$\alpha_{\text{sectionA}} = 0.88$ $\alpha_{\text{sectionB}} = 0.90$ $\alpha_{\text{F1, sectionB}} = 0.82$ $\alpha_{\text{F2, sectionB}} = 0.84$			Pearson correlation with Caring efficacy scale and Palmore's fact on ageing quiz (hypotheses not confirmed, low significant correlation or no significant correlations)
UCLA – Geriatrics Attitudes Scale						
Reuben et al., 1998 [77]						
Lee et al., 2005 [75]		EFA ($n = 2$), 14 items (56%) F1 social value (2 items) F2 medical care (4 items) F3 compassion (4 items) F4 resources distribution (4 items)	$\alpha_{\text{scale}} = 0.78$ $\alpha_{\text{F1}} = 0.60$ $\alpha_{\text{F2}} = 0.62$ $\alpha_{\text{F3}} = 0.62$ $\alpha_{\text{F4}} = 0.61$ $\alpha_{\text{scale}} = 0.70$			
Stewart et al., 2006 [79]						
Sahin et al., 2012 [78]	Translation of the scale in Turkish + panel of expert to assess linguistic, cultural adaptation + pilot test ($n = 5$)	EFA ($N = 256$), 14 items (48.1%) F1 social value (2 items) F2 medical care (4 items) F3 compassion (4 items) F4 Resources distribution (4 items)	$\alpha_{\text{scale}} = 0.67$	Pearson correlation ($n = 112$, 2 weeks) = 0.51		Known-group validity with t test (geriatric training vs. not, significant) Pearson correlation with Scale of elderly discrimination attitude ($r = ?$)
Lucchetti et al., 2018 [70]			$\alpha_{\text{scale}} = 0.69$			
Opsommer et al. 2021 [76]	Translation in French with expert panel (health care professionals, linguistic and methodologists) +	CFA ($n = 119$), 14 items F1 perceived social value of older people (2 items) F2 medical care provided to geriatric patients (4 items) F3 compassion towards older people (4 items) F4 Distribution of societal resources for older people (4 items) $\chi^2 = 135.65$; $df = 71$; p value = 0.00; CFI = 0.83; RMSEA = 0.09, SRMR = 0.01)	$\alpha_{\text{scaleT1}} = 0.49$ $\alpha_{\text{scaleT2}} = 0.52$	ICC _{agreement} ($n = 119$, 1 week) = 0.83 (IC95% [0.74–0.89]) Cohen's Kappa = 0.24–0.53 (individual items)		Pearson correlation with ASES ($r = 0.28$, $p = 0.003$) and AAQ ($r = 0.32$, $p = 0.001$), hypothesis confirmed.

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Hypothesis testing for construct validity
Fraboni Scale of Ageism Fraboni et al., 1990 [88]		EFA ($n = 115$), 29 items (37.5%) F1 Antilocution (10 items) F2 Discrimination (9 items) F3 Avoidance (10 items)	$\alpha_{\text{scale}} = 0.86$ $\alpha_{F1} = 0.76$ $\alpha_{F2} = 0.65$ $\alpha_{F3} = 0.77$			Pearson product moment correlation with Acceptance of others scale ($r = 0.40$, $p < 0.001$), FAQ ($r = -0.28$, $p < 0.001$) and Marlowe Crowne scale of social desirability ($r = -0.03$, not significant)
Bilim & Kutlu, 2021 [86]		EFA ($n = 814$?), 29 items (30.23%) F1 Stereotypes (17 items) F2 Discrimination (8 items) F3 Avoidance (4 items) CFA, ($n = 814$?), 29 items $\chi^2 = 1970.33$; $df = 377$; p value = 0.00; CFI = 0.85; SRMR = 0.08; RMSEA = 0.08	$\alpha_{\text{scale}} = 0.72$			Known group comparison (female vs. male, nuclear vs. large family, nurse vs. physician, state hospital vs. university hospital, on call vs. not, job satisfaction vs. not, education status, significant)
Fan et al., 2020 [87]	Transition in Chinese + 6 expert panel for relevance (CVI = 0.93) + pilot-test with medical students ($n = 20$)	EFA ($n = 967$), 22 items (34.84%) F1 Avoidance (8 items) F2 Excluded (7 items) F3 Stereotypes (7 items) CFA ($n = 1007$), CMIN/ $df = 2.6$; GFI = 0.96; IFI = 0.93; CFI = 0.93	$\alpha_{\text{scale}} = 0.81$ $\alpha_{F1} = 0.$ $\alpha_{F2} = 0.$ $\alpha_{F3} = 0.$	ICC ($n = 30$, 4 weeks) = 0.87		
Carolina Opinions on Care of Older Adults survey Hollar et al., 2011 [89]		EFA + CFA ($n = 116$), 24 items (59.5%) F1 Geriatrics as a Career (8 items) F2 Cost Effectiveness of Caring for Older Adults (7 items) F3 Value of Older Adults (3 items) F4 Experience in Caring for Older Adults (2 items) F5 Perception of Older Adults being Helpless (4 items) $\chi^2/df = 0.63$, $p = 1.0$, GFI = 0.90, AGFI = 0.88, RMSEA = 0.01, NNFI = 0.86	$\alpha_{\text{scale}} = 0.80$ $\alpha_{F1} = 0.87$ $\alpha_{F2} = 0.81$ $\alpha_{F3} = 0.71$ $\alpha_{F4} = 0.86$ $\alpha_{F5} = 0.58$			Pearson correlation with GAS at $r = 147$ ($p = 0.036$)
Zisberg et al., 2021 [90]	Adaptation for nursing students by investigators (not more information) + Back translation process in Hebrew	EFA + CFA ($n = 231$), 21 items (59%) F1 Geriatrics as a Career (8 items) F2 Experience in Caring for Older Adults (2 items) F3 Perception of Older Adults as Helpless (3 items), F4 Cost Effectiveness of Caring for Older Adults (6 items) F5 Older versus Younger Adults (3 items) CMIN/DF = 1.55, CFI = 0.93, IFI = 0.93, RMSEA = 0.05	$\alpha_{\text{scale}} = 0.74$ $\alpha_{F1} = 0.80$ $\alpha_{F2} = 0.60$ $\alpha_{F3} = 0.65$ $\alpha_{F4} = 0.71$ $\alpha_{F5} = 0.61$			
Ambivalent Ageism Scale						

Table 3 (continued)

References	Content validity + translation process	Structural validity	Internal consistency	Reliability	Measurement error	Criterion validity	Hypothesis testing for construct validity
D'hondt & Degryse, 2022 [92]	Back translation process with expert panel + pilot test ($n = 15$) with telephonic interviews about exhaustivity, feasibility, comprehensibility and relevance	EFA ($n = 111$), 12 items (56.37%) F1 Overaccommodation (6 items) F2 Infantilisation (4 items) F3 Control (2 items)	$\alpha_{\text{scale}} = 0.85$ $\alpha_{F1} = 0.85$ $\alpha_{F2} = 0.54$ $\alpha_{F3} = 0.80$				Pearson correlation with FSA, confirmed hypotheses. $r(106) = 0.54, p < 0.01$. BA $r(106) = 0.45, p < 0.01$. HA, $r(106) = 0.61, p < 0.01$
D'hondt et al., 2023 [91]	Adaptation to health care sector with expert panel + pilot test with face-to-face interviews ($n = 6$) about feasibility and comprehensibility	EFA ($n = 265$), 18 items (59.76%) F1 Infantilisation (5 items) F2 Control (2 items) F3 Overaccommodation (2 items) F4 Hostile ageism (7 items) F5 Unwanted help (2 items)	$\alpha_{\text{scale}} = 0.87$ $\alpha_{F1} = 0.77$ $\alpha_{F2} = 0.79$ $\alpha_{F3} = 0.83$ $\alpha_{F4} = 0.72$ $\alpha_{F5} = 0.66$				Pearson correlation with GAS, hypotheses confirmed. $r(265) = 0.49, p < 0.01$. HA $r(265) = 0.54, p \leq 0.01$, BA $r(265) = 0.39, p \leq 0.01$.

Calculation of the standard error of measurement (Table 4)

Considering the SEMs and their 95% confidence intervals, the results showed that the majority of the calculated SEMs were based on Cronbach's alpha ($n = 17$), with large confidence intervals around the individual scores. This indicates substantial variability in the measurement precision of the scales Table.4.

Discussion

Our systematic review included 51 studies evaluating eight ageism scales directed towards older adults and patients tested in a population of health care professionals and students. All scales were self-reported, with only half specifically developed for the health care sector. Most participants were health care students. The operationalisation of ageism in these scales revealed significant imbalances, with a predominance of the cognitive and explicit components. The psychometric evaluations revealed satisfactory internal consistency, but the structural validity was inconsistent. Reliability reporting was limited and poorly documented, resulting in a high risk of bias. Limited evidence has been found to document the evaluation of psychometric properties, particularly responsiveness, criterion validity and measurement error. Overall, the quality of evidence ranged from low to moderate. The calculation of the SEMs revealed variability in measurement precision across the scales, as indicated by large confidence intervals around individual scores.

These results align with the findings of another systematic review conducted by Ayalon et al. (2017) that aimed to identify and evaluate ageism scales in a general population [28]. Their conclusions were similar and highlighted several issues: incomplete coverage of all dimensions of ageism, a general lack of psychometric assessments, low-quality evidence for only a few psychometric properties, and indeterminate or inconsistent results regarding the psychometric properties assessed [28].

Successfully measuring ageism in the health care sector will require a comprehensive and valid measurement of ageism that measure the complexity and multidimensionality of ageism in health care. Scales are important to accurately measure different aspects of ageism, assess its prevalence, and evaluate the effectiveness of interventions designed to combat it. Based on our results, the following recommendation can be made to enhance the evidence of scale to measure ageism towards older adults and patients among health care professionals and students.

First, we recommend that future studies adopt a comprehensive conceptual definition of ageism, supported by a clear theoretical framework. This will facilitate higher reliability and validity in measuring ageism [4].

Second, future research should focus on measuring ageist stereotypes prejudices and behaviours specifically

Table 4 Calculation of the standardised error of measurement (SEM)

References	Mean of the score (SD), r	r	SEM (%) ^b	95% CI (%) ^b
Kogan's attitude towards older people				
Lambrinou et al., 2005 [47]	135.53 (9.34) ^a , $\alpha=0.80$	CA	3.08	± 6.04
Iwasaki et al., 2008 [43]	88.76 (11.81), $\alpha=0.83$	CA	5.48	± 10.74
Yen et al., 2008 [54]	144.30 (17.89), $\alpha=0.82$	CA	5.26	± 10.32
Erdemir et al., 2010 [41]	132.94 (14.74), ICC=0.73	ICC	5.78	± 11.33
Küçükçüçlü et al., 2011 [46]	153.28 (23.80), $r=0.83$	Pc	6.40	± 12.54
Kiliç & Adibelli, 2011 [44]	97.76 (11.18), $r=0.78$	Pc	5.36	± 10.50
Rejeh et al., 2012 [50]	98.73 (31.52), ICC=0.9	ICC	10.09	± 19.79
Matarese et al., 2013 [48]	144.3 (17.9), $\alpha=0.76$	CA	6.08	± 11.90
Alquwez et al., 2018 [40]	121.55 (26.92) ^a , $\alpha=0.89$	CA	7.34	± 14.37
Wanko Keutchafo & Kerr, 2022 [53]	126.63 (13.51) ^a , $\alpha=0.62$	CA	6.58	± 12.90
Fernández-Muñoz et al., 2023	113.3 (7.21) ^a , $\alpha=0.75$	CA	3.19	± 6.24
Ageism scale for dental students				
Rucker et al., 2019 [62]	11.97 (3.10) ^a , $\alpha=0.76$	CA	12.67	± 24.81
Kossioni et al., 2019 [56]	$M_{F1}=9.4$ (3.1), $\alpha=0.71$		$SEM_{F1}=17.77$	± 34.83
	$M_{F2}=14.3$ (3.3), $\alpha=0.72$		$SEM_{F2}=12.20$	± 23.91
	$M_{F3}=14.7$ (3.3), $\alpha=0.57$		$SEM_{F3}=14.73$	± 28.87
	$M_{F4}=11.5$ (2.8), $\alpha=0.64$		$SEM_{F4}=14.61$	± 28.63
Ageing Semantic Differential Scale				
Intrieri et al., 1995 [69]	$M_{F1}= 26.95$ (4.82), $\alpha=0.75$	CA	$SEM_{F1}= 8.95$	± 17.54
	$M_{F2}= 31.94$ (7.37), $\alpha=0.85$		$SEM_{F2}= 8.92$	± 17.48
	$M_{F3}= 19.04$ (5.10), $\alpha=0.81$		$SEM_{F3}=11.69$	± 22.91
	$M_{F4}= 19.14$ (4.81), $\alpha=0.81$		$SEM_{F4}= 10.95$	± 21.46
Iwasaki et al., 2008 [43]	79.07 (17.05), $\alpha=0.90$	CA	6.81	± 13.35
Schüttengruber et al., 2021 [71]	125.3 (40), $\Omega=0.921$	O	8.97	± 17.58
Older Patients in Acute Care Scale				
UCLA - Geriatrics Attitude Scale				
Sahin et al., 2012 [78]	49.57 (5.65), $r=0.51$	Pc	9.79	± 19.19
Opsommer et al., 2021 [76]	48.50 (4.23), ICC=0.83	ICC	3.59	± 7.04
Fraboni Scale of Ageism				
Fraboni et al., 1990 [88]	57.89 (11.86), $\alpha=0.86$	CA	7.66	± 15.01
Ambivalent Ageism Scale				
D'hondt & Degryse, 2022 [92]	NR	CA	6.10	± 19.19
D'hondt et al., 2023 [91]	NR	CA	2.31	± 4.5
Carolina Opinions on Care of Older Adults survey				
Hollar et al., 2011 [89]	55.47 (9.14), $\alpha=0.80$	CA	7.37	± 14.44
Zisberg et al., 2021 [90]	$M_{F1}=3.34$ (0.62), $\alpha=0.80$		$SEM_{F1}=8.29$	± 16.25
	$M_{F2}=3.67$ (0.64), $\alpha=0.71$		$SEM_{F2}=9.38$	± 18.38
	$M_{F3}=3.42$ (0.81), $\alpha=0.61$		$SEM_{F3}=14.80$	± 29.01
	$M_{F4}=3.77$ (0.88), $\alpha=0.65$		$SEM_{F4}=13.79$	± 27.03
	$M_{F5}= 2.79$ (1.22), $\alpha=0.60$		$SEM_{F5}= 27.69$	± 54.27

CA Cronbach's alpha coefficient (α); Pc Pearson correlation coefficient (r); ICC intraclass correlation coefficient; O omega (Ω); NR not reported; SEM standard error of measurement calculated with the following formula: $SEM = SDx\sqrt{1-r}$

^aCalculated manually on the basis of the data

^bThe standard error of measurement and the 95% confidence interval were expressed as percentages to facilitate comparison between the studies

directed towards older patients. Indeed Arhiri et al. (2022) found differences in content between ageism toward older adults and ageism toward older patients [95]. In this respect, it is important to recognize that the condition of being an older patient is different from the condition of being an older person, and this leads us to believe that there are stereotypes, prejudices and discriminatory practices specifically related to the condition

of being an older patient. Older patients are disproportionately at risk of ageism. Because they are more likely to be stereotyped as dependent or as possessing diminished capacity simply because of their age, they often start out in a position of amplified disadvantage relative to other actors [96]. The intersection of ageism with other forms of discrimination, such as ableism, can create additional barriers for older adults in health care settings. This

approach could be achieved by targeting items containing stereotypes and prejudices in older patients, enhancing our understanding of ageism in the health care sector, and aiding in the development of tailored interventions. Such interventions are likely to be more effective if they focus on negative stereotypes and prejudices towards older patients [7].

Third, implicit ageism deserves more attention in future research. However, measuring and assessing this component is challenging. The Ambivalent Ageism Scale [93] offers some insights, as it is the first to measure “benevolent ageism”, a more implicit form of ageism, but there remains a significant gap in understanding how implicit biases manifest in naturally occurring social interactions. Studies capable of capturing implicit ageism in real-world interactions are needed in the health care sector [7].

While scales have a pivotal role in combatting ageism in the health care sector by allowing to assess the prevalence of ageism and to evaluate the effectiveness of interventions. Scales primarily address ageism at the micro-level, focusing on individual-level stereotypes, prejudices and discrimination in interactions. Therefore, it is important to note that this perspective does not encompass the multidimensional nature of ageism across the meso- and macro-levels. Indeed, the scales reviewed in this article are designed to measure individual-level attitudes, which, although influential, do not directly assess ageism at the broader organisational or societal levels, contributing to a limitation of the scales used. Addressing ageism at the meso- and macro-levels would require different methods, involving a range of indicators and parameters that are not captured by the scores produced by individual measurement scales. Therefore, further research employing different methodologies is needed to address the complexity of ageism at these broader levels.

Strengths and limitations

Our systematic review focused on identifying and evaluating ageism scales directed towards older adults and/or patients specifically tested among health care workers and health care students. This review provides a comprehensive analysis of how ageism was operationalised and measured across various scales, along with an evaluation of their psychometric properties and quality of evidence. By examining these specific aspects of the ageism scales, our review offers insights into their strengths and limitations, which can guide future studies. Furthermore, to better understand each scale's precision, the review included the calculation of SEMs. This calculation enabled us to determine the extent to which individual scores can be interpreted with confidence, allowing for more precise and meaningful use of the scales in both research and practice.

Our review also has several limitations. One limitation is that we did not contact the original authors for missing or additional data. Additionally, the initial screening was conducted by a single reviewer, which may have introduced errors. Despite the use of careful search strategies, some articles may have been missed. Another limitation is that only peer-reviewed articles written in English were included, excluding studies with non-English full texts or grey literature (e.g., conference abstracts, dissertations, and tool manuals).

Conclusions

Our review highlighted the limitations in current empirical studies on measuring ageism towards older adults and/or patients in the health care sector. The existing scales primarily operationalised ageism in a few major forms, such as cognitive, explicit, and negative components. The multidimensionality and complexity of ageism, particularly implicit ageism, remain underexplored. Furthermore, the psychometric evaluation of these scales is limited and often of low quality. To address these gaps, future research should focus on developing and validating new ageism scales that capture the full complexity of the construct, including implicit aspects, target older patients specifically, and include diverse populations during the validation process, especially health care professionals. A comprehensive and valid measurement of ageism that measure the complexity and multidimensionality of the construct is crucial for identifying ageism and developing effective interventions in the health care sector.

Abbreviations

CVI	Content Validity Index
COSMIN	Consensus-based Standards for the Selection of Health Measurement Instruments
OMIs	Outcome Measurement Instruments
QualSyst tool	Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields checklists
SEM	Standard Error of Measurement
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
PROSPERO	The International Prospective Register of Systematic Review

Supplementary Information

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Supplementary Material 1.

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Authors' contributions

All authors contributed to the conceptualisation and methodology of the study. S.D. and J.M.D. were responsible for screening and selecting articles, extracting data, assessing the risk of bias, and writing the original manuscript.

I.A. provided overall supervision and project administration, reviewed the manuscript, and secured funding for the project. All authors approved the final manuscript before submission.

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Data availability

All search equations used in this review are available in the supplementary information files. All data extracted and analysed during this study are included in this published article and its supplementary information files. The registered protocol for this review is available on PROSPERO (CRD42021276470). Some deviations from the original protocol were made (for further information, see supplementary file 2).

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

SD, JMD, and IA are authors of two of the included articles on one ageism scale. SD and JMD conducted the quality assessment of these articles using an objective checklist. The authors declare no other competing interests.

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