

# Pain Assessment Tools for People with Dementia: A Literature Review

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## Abstract

**Background:** Dementia, ranked as the 7th leading global cause of death, poses challenges for pain assessment due to cognitive and communication impairments. Recent research addresses this gap by examining pain assessment tools for moderate to severe dementia. This review analyses the psychometric properties and clinical utility of these tools, including a comparison with the novel ePAT tool and its potential impact on health. **Method:** The study used the PRISMA checklist to analyse literature from 2003 to 2023. Online searches with specific keywords and free-text terms were conducted. Titles, abstracts, and full texts of potential studies were evaluated for inclusion, along with relevant bibliographic lists. Selected studies underwent appraisal and analysis. **Results:** 34 pain assessment tools used for elderly individuals with moderate to severe dementia were found, with PAINAD, CNPI, DOLOPLUS-2, APS, PACSLAC, NOPPAIN, PADE, MOBID, DS-DAT, CPAT, and ePAT being the most frequent. While most tools showed moderate to good validity, reliability, and internal consistency, ePAT showed strong results and a positive health service impact. **Conclusions:** Based on the evidence reviewed, no definite gold standard tool was detected. Although ePAT shows positive outcomes, its testing has mainly been done in Residential Aged Care Facilities. Further validation and testing across various healthcare settings are needed.

## Keywords

Dementia, Pain Assessment, Pain Measurement, Psychometrics, PainChek

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## 1. Introduction

Dementia, the 7th leading cause of death globally, affects over 55 million people and sees around 10 million new cases annually (WHO, 2022). It involves cognitive deterioration beyond the normal aging process, impacting memory, com-

prehension, language, and decision-making (WHO, 2022). With over 200 subtypes, each disturbing brain functions, Alzheimer's disease is the most usual form [1]. *This literature review aims to answer the following question: "Which pain assessment tools demonstrate the strongest psychometric properties and clinical utility for assessing pain in older adults with moderate to severe dementia?"* For this review, "moderate to severe dementia" refers to individuals with clinically diagnosed dementia exhibiting significant cognitive impairment and functional decline. This typically corresponds to commonly used severity thresholds such as:

**Mini-Mental State Examination (MMSE):** moderate (10 - 20), severe (<10);

**Clinical Dementia Rating (CDR):** moderate (CDR = 2), severe (CDR = 3);

**Functional Assessment Staging Tool (FAST):** stages 5 - 7.

*These stages are generally associated with reduced reliability of self-report pain measures and increased reliance on observational or behavioural pain assessment tools.*

## 1.1. Pain and Dementia

Elderly people face higher pain risks due to age-related conditions like osteoarthritis, etc. Dementia intensifies this risk due to under-detection and under-treatment, stemming from cognitive impairment and communication limitations [2]. Formerly, it was thought that people with dementia didn't feel pain due to brain cell injury. However, a 2006 study in Melbourne using fMRI found pain-related brain activity in Alzheimer's patients, revealing they do feel pain but struggle to express it [3]. In recent years, the inadequacy of pain assessment and management in dementia has earned attention [4] [5]. Pain, crucial for avoiding harm, is defined by the International Association for the Study of Pain as an unpleasant sensory and emotional experience [6]. Assessing pain in non-communicative demented elderly patients is challenging and depends heavily on observational tools due to the progression of cognitive decline [7].

## 1.2. Pain Assessment Tools

For effective pain management, the presence of appropriate pain assessment tools is crucial [8]. In the past two decades, several tools, including self-reporting and behavioural-observational ones, have been designed, and classified as one-dimensional or multi-dimensional [9]. However, self-reporting remains a paradigm; it may not always be possible, particularly in cases of advanced dementia, where behavioural/observational tools are needed.

### 1.2.1. Commonly Used Self-Reporting Tools

**Coloured Analogue Scale:** Like a thermometer, it assesses pain intensity by using colours, with white denoting no pain and red showing intense pain. Patients slide a bar along the scale to specify their pain level which correlates with a numerical rating on the back (ranging from 0 to 10). In a study on older adults, 80% with moderate dementia correctly understood the CAS, but tool reliability reduces with

progression in dementia severity [10].

Verbal Rating Scale: offers patients options to specify their pain severity level, ranging from no pain to extreme pain, each analogous to a number on the back of the scale.

Numeric rating scale: evaluate pain intensity across different ranges, like 0 - 5 or 0 - 10, where 0 shows no pain and the highest number signifies severe pain.

Visual Analogue Scale: includes lines with verbal descriptors like “no pain” and “severe pain.” Patients indicate their pain level with a cross on the line, and the distance from the start of the line to the cross specifies the score, suggesting pain severity [11].

### 1.2.2. Observational-Behavioural Tools

In advanced dementia, where verbal communication is impaired, behavioural observation and alternative pain-reporting methods are crucial for pain detection. The American Geriatrics Society (AGS) Panel on Persistent Pain in the Elderly has drawn a comprehensive framework based on behavioural cues to help in non-verbal elderly pain assessment. The framework recognizes 6 behavioural domains for observational pain assessment: facial expressions, verbalizations, body movements, changes in interpersonal interactions, changes in activity patterns, and mental status changes [12]. Many tools have been developed to enhance accuracy in evaluating pain in dementia.

Commonly used tools include the APS, Algo plus, CPAT, and PAINAD [13]. However, various existing tools lack advanced technology and innovative design. Lichtner *et al.* in a meta-review on pain assessment tools in dementia, highlighted the need for such tools emphasizing the importance of incorporating advanced technology to enhance pain assessment in non-verbal demented patients [14]. In 2017, the electronic Pain Check tool appeared and was approved for assessing pain in non-vocal elderly patients, including those with dementia [15].

### 1.3. Description of Some Frequently Utilized Pain Assessment Tools

- APS:

Utilized in advanced dementia patients. It assesses vocalizations, facial expressions, body language, behavior changes, psychological well-being, and physical aspects. Each part is rated on a 4-point scale, with scores ranging from 0 - 18. Qualitative and quantitative evidence support its worth, and it can be completed in one minute [16].

- CNPI:

A checklist-based tool that assesses pain using 6 elements: vocalization, facial expression, rubbing, restlessness, response to stimuli, and verbal expressions. Each element is noted as either “present” (1) or “absent” (0) while the patient is active or at rest. Scores range from 0 to 12, with the highest possible score of 12 points [17] [18].

- CPAT:

Assesses pain-related behaviors by focusing on 5 domains: facial expressions,

behavior, mood, body language, and activity level. Each domain is marked as either pain-related (1) or indicating no pain (0), with a maximum total score of 5. When the collective score reaches 1 or more, a follow-up assessment is conducted, prompting caregivers to note their actions. However, none of the reviewed studies on toll offer interpretation guidelines for the total score [19].

- DOLOPLUS-2:

An upgraded version of the doloplus, designed for non-verbal elderly patients, with 10 elements grouped into somatic, psychometric, and psychosocial domains and covers 5 of the 6 pain behavior categories outlined in the AGS guidelines [20]. Each item in doloplus-2 is graded with 4 escalating behavioral depictions indicating pain intensity, rated from 0 to 3. Scores are added to calculate a total score ranging from 0 to 30 points, with a threshold of 5 points indicating pain presence. The tool shares similarities with other commonly used pain assessments like PAINAD, PACSLAC, PADE, and APS as they all assess facial expression, body posture/movement changes, and verbal expression [21].

- MOBID:

Assesses pain during active body movements, with health personnel performing 5 movements involving the trunk and limbs individually. The assessment is paused instantly and marked if pain behaviors such as utterances, facial expressions, or defense are observed by the assessor [22].

- MOBID-2:

The tool has demonstrated its clinical suitability in multiple studies [22] [23] and entails 2 segments: the first involves 5 active movements from the MOBID, while the second involves the caregiver reporting pain, starting from the head, and progressing through various body regions [22].

- MPS:

Measures pain by assessing facial expressions, body language, vocalization, breathing, agitation cues, sleep/appetite changes, vital signs fluctuations, and pain history. It differentiates between pain and agitation and allows pain to be indicated on a diagram. Patients are ideally monitored at rest, and trained assessors gently tap 22 body regions and mark an “x” on a paper sketch where behavioral reactions or pathology evidence are observed.

- NOPPAIN:

Mainly administered by nursing assistants during caregiving activities and identifies pain-related behaviors in people with dementia both at rest and in motion. The tool comprises 4 main divisions as documented by Lints-Martindale *et al.* [18]:

- 1) Observation of pain behaviors during care tasks like dressing and bathing.
- 2) Measurement of pain behaviors' presence through 6 items such as pain noises and facial expressions etc.
- 3) Rating pain behavior intensity using a 6-point Likert scale.
- 4) Using a pain thermometer for overall pain intensity assessment [11].

- PACSLAC:

Evaluates both obvious and subtle pain behaviors' and entails 4 subscales: facial expressions (13 items), activity/body movements (20 items), social/personality/mood (12 items), and physiological indicators/eating and sleeping changes/vocal behaviours' (15 items), totalling 60 items [18] [20]. Each item is assessed on a binary scale (present or absent), yielding a total score ranging from 0 to 60. However, there is currently no established interpretation for this total score.

- PADE:

Aims at assessing pain in advanced dementia patients and allows healthcare professionals to observe patient behaviors suggest ing pain. It involves 24 items divided into 3 parts:

Part 1: Physical assessment, focusing on facial expressions, breathing patterns and posture.

Part 2: Global assessment, where caregivers assign an overall pain rating for their patients.

Part 3: Assessment of activities of daily living, including feeding, dressing, and transferring from bed to wheelchair [18].

- PAINAD:

Developed for people with advanced dementia, it offers a straightforward and clinically relevant pain assessment by covering 5 behavior categories: respiration, negative vocalizations, facial expressions, bodily movements, and comfort-seeking actions. Each category has 3 components with specific indicators, for identifying pain presence or absence [17] [18] [24]. Items are rated on a 3-point scale (0 to 2) to reflect severity. Notably, this tool is a modified version of the DS-DAT and the FLACC.

- PAINE:

Consists of 22 items divided into 2 sections. The first 15 items comprise certain motor repetitive behaviors, certain vocal repetitive behaviors, unusual behaviors, and activity-related behaviors. The remaining 7 items assess clinical markers such as falls, trembling, vital sign variations, blood stains, edema, and broken bones [13].

- ADD:

Developed to identify and manage physical discomfort and uses a checklist with 5 categories of pain-related behaviors: facial expressions (8 items), body language (9 items), vocalizations (9 items), emotional state (5 items), and behavioral responses (11 items) [25]. Even though ADD may not be a conventional tool for pain assessment [11], when potential pain behaviors are noted, the protocol involves 5 steps:

- 1) Evaluate physical signs and symptoms.
- 2) Assess the individual's current and past pain history.
- 3) If Steps 1 and 2 yield negative outcomes, assess environmental factors, and try nonpharmacological interventions accordingly.
- 4) If proven ineffective, administer nonnarcotic analgesics as prescribed in a

written order.

5) If symptoms persist, seek consultation with a medical professional or another qualified healthcare provider.

- DS-DAT:

Initially designed for research purposes, it assesses discomfort in elderly with advanced dementia who rely on caregivers for pain management. It has also been applied in research to measure pain in dementia [11]. It consists of 9 behavioral items and evaluates discomfort in patients with Alzheimer-type dementia through behaviors like noisy breathing, negative vocalizations, and facial expressions. Each item is scored based on presence, frequency, duration, and severity, resulting in a total score ranging from 0 - 27 (indicating the highest level of detected discomfort).

- REPOS:

A potential tool for patients at varying cognitive levels (van Herk *et al.*, 2009) and comprises 10 behavioral items. Observers mark these items as present or absent after observing the non-communicative patient for 2 minutes during a possible painful care moment [26].

- PAIC:

It includes 15 pain-related indicators that help in assessing patients who may struggle to verbalize their discomfort.

- EPCA:

Assesses pain severity in non-verbal elderly patients through 8 behavioral items [5].

- PIMD:

It assesses pain severity in moderate-severe dementia using 7 items. Each item is rated on a scale of 0 - 3, with 0 indicating 'Absence' and 3 indicating 'Severe'. Total scores range from 0 - 21, with higher scores signifying the highest pain intensity [27].

#### **1.4. Electronic Pain Assessment Tool (ePAT)/PainChek**

The ePAT, or PainChek, is a smart device application designed to support healthcare providers in assessing pain in patients with moderate to severe dementia. It utilizes automated facial recognition and clinical markers to assess pain. The PainChek software system comprises 2 main components:

- 1) Mobile application;
- 2) Web Admin Portal [28].

The mobile app consists of 6 domains: FACE, VOICE, MOVEMENT, BEHAVIOUR, ACTIVITY, and BODY, totaling 42 items. Domain 1 evaluates 9 micro facial expressions, automatically detected by the app using AI algorithms. Domains 2 - 6 involve clinical observations completed by the user. The final pain assessment score is automatically calculated for each domain, classifying pain as no pain (0 - 6), mild pain (7 - 11), moderate pain (12 - 15), or severe pain ( $\geq 16$ ). The second component, WAP, is a protected website for managing patient data

and user access [28] [29].

## 2. Aims of the Review

This review evaluates pain assessment tools (2003 - 2023) for individuals with moderate to severe dementia, identifying evidence-supported instruments and examining the potential health service impact of newer tools such as ePAT.

## 3. Objectives of the Review

- Reviews pain assessment tools (2003 - 2023) for moderate to severe dementia;
- Highlights evidence-supported tools;
- Examines implications of newer tools (e.g., ePAT).

## 4. Method

### 4.1. Methodology

*For this study, a literature review methodology was selected due to its value in examining connections across studies, identifying research gaps, and guiding future inquiry. In addition, Kable, Pich, and Maslin-Prothero's 12-step documentation framework was followed, together with the PRISMA 2020 checklist to ensure clarity and methodological rigor.*

### 4.2. Strategy and Studies Selection

A systematic literature search was conducted across PubMed, Google Scholar, Academia, and the University of South Wales Library. The search strategy combined MeSH terms and free-text keywords related to *dementia*, *pain assessment*, and *psychometric properties*.

Example PubMed search strategy:

“Dementia” [MeSH] OR dementia OR “Alzheimer Disease” [MeSH])  
AND (“Pain Measurement” [MeSH] OR “pain assessment”)  
AND (validity OR reliability OR psychometric\*).

Limits applied:

English language; publication date January 2003 - January 2023; human subjects; aged  $\geq 65$  years.

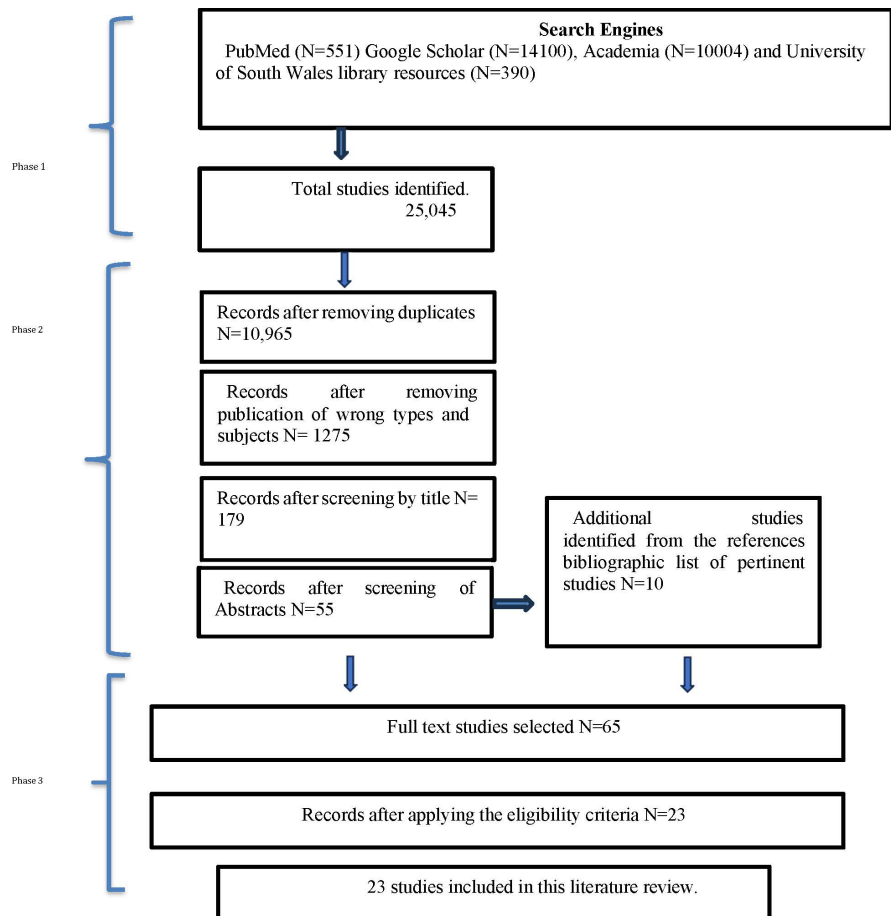
Google Scholar searches used the string:

“dementia” AND “pain assessment” AND “psychometric properties”,  
with results restricted to 2003 - 2023.

The study selection process comprised three phases. Phase 1 involved database searching, yielding 25,045 records. Phase 2 included duplicate removal and title/abstract screening, reducing the dataset to 179 studies. Phase 3 applied predefined inclusion and exclusion criteria, resulting in 55 studies eligible for further review. An additional 10 studies were identified through citation tracking, producing 65 articles for full-text assessment. Following full-text evaluation, 23 studies and two guidelines met the eligibility criteria (**Table 1**). Guidelines discussed narratively but not counted as included records (see **Figure 1**).

**Table 1.** Criteria for study selection.

	Inclusion Criteria	Exclusion Criteria
Population	Elderly with a mean age of 65 or above, diagnosed with moderate to severe dementia regardless of its type	Elderly with a mean age of less than 60 years, not diagnosed with moderate to severe dementia
Intervention	Studies that include a pain assessment tool used for assessment of pain in patients with moderate to severe dementia	Studies without the mention of any pain assessment tools used for assessment of pain in dementia patients
Types of studies	Literature reviews, Systematic reviews, RCT, non-RCT, quantitative & qualitative studies & evidence-based guidelines	Case studies, case reports, editorials, comments, letters, and unpublished articles
Setting	Studies in hospitals, acute care, residential aged care facilities, or nursing homes	Residential homes of patients
Outcome	Studies with information on the psychometric properties of the pain assessment tools such as validity, reliability, or clinical utility and studies with the impact of ePAT on health services Studies that have been published in the English language Studies published between the period of 2003 to January 2023	Studies published before January 2003 Studies not in the English Language



**Figure 1.** Strategy & study selection.

Characteristics of the included studies:

See Appendix 1: Summary of the characteristics of the included studies.

### 4.3. Quality Assessment of the Studies

The quality of the included studies underwent assessment using various tools. Observational studies and RCTs were evaluated using the Newcastle Ottawa Scale, typically scoring 6 out of 9, suggesting medium quality. Reviews were assessed with the AMSTAR tool and Oxford Centre for Evidence-Based Medicine (CEBM) Criteria. Although most reviews demonstrated thorough searches, they lacked specific details. Among them, two studies were rated as low quality, four as medium, and two as high, resulting in an overall assessment of medium quality for the included studies.

### 4.4. Study Selection and Data Extraction

Screening of titles, abstracts, and full-text articles was conducted by a single reviewer using predefined inclusion and exclusion criteria. Due to the study being undertaken as part of an MSc dissertation, duplicate screening was not feasible.

Data extraction was performed by the same reviewer using a standardized data extraction form. Structured procedures were applied to ensure consistency. While single-reviewer processes may introduce bias, predefined criteria and systematic methods were used to minimize this risk.

The following data was derived from the selected studies:

- 
- Author and year of publication
  - Type of study such as systematic review, observational study, experimental study, etc.
  - Pain assessment tools/ tools used, their psychometric properties such as internal consistency, reliability (inter-rater and intra-rater), and validity (construct and concurrent/criterion).
  - Main aims and objectives of the study
  - Key conclusions
  - Important recommendations made
  - Quality assessment
- 

### 4.5. Data Analysis and Synthesis

Given the diverse range of studies, a narrative synthesis approach was employed to draw meaningful conclusions from the included literature. The review compared tools based on criteria such as construct, concurrent/criterion validity, internal consistency (homogeneity), inter-rater, intra-rater reliability, and applicability/clinical utility, while also evaluating the impact of ePAT on health services. Inter-rater reliability was measured using correlation, intra-class correlation, kappa and Spearman's correlation coefficients, and percentage agreement. Intra-rater reliability was reported using correlation and intra-class correlation coefficients, while internal consistency was assessed using Cronbach's alpha.

### 4.6. Influence of Quality Appraisal on Evidence Synthesis

The methodological quality of the included studies was considered during the ev-

idence synthesis process. Given that most studies were appraised as medium quality, the strength of the conclusions was framed with appropriate caution. Findings originating from low-quality studies were interpreted conservatively and were not relied upon as primary evidence when formulating comparative judgments regarding psychometric performance. Accordingly, any statements indicating the relative superiority of one pain assessment tool over another should be understood as reflecting moderate rather than conclusive evidence, in recognition of the methodological constraints identified across the reviewed literature.

## 5. Results

In total, 34 pain assessment tools were identified across the included studies for evaluating pain in moderate to severe dementia patients, including APS, ADD, Algoplus, Behavioural Checklist, CNPI, Comfort Checklist, CPAT, Doloplus-2, DS-DAT, ECPA, ECS, EPCA, EPCA-2, FACS, FLACC, MPS, MOBID, MOBID-2, OPB, PACSLAC, PACSLAC-2, PACI, Pain PADE, PAIC, PAINAD, PAINE, PATCOA, PBM, PIMD, PPQ, RaPID, REPOS, NOPPAIN, and ePAT (**Table 2**).

The frequently cited pain assessment tools in the included studies were PAINAD, CNPI, DOLOPLUS-2, Abbey Pain Scale, PACSLAC, NOPPAIN, PADE, MOBID, DS-DAT, CPAT, and ePAT.

**Table 2.** Comparison of the psychometric properties of the tools.

Pain Assessment tool	Total item in the tool	Validity (construct and concurrent/criterion)	Reliability (internal consistency, inter-rater, and intra-rater reliability)
APS	6	CV = 0.49 - 0.91 CCV compared with holistic measures 0.586	IC = 0.65 - 0.81, IR = 0.75 - 0.88, IRR = 0.66 - 0.88
ADD	5		
Algoplus	5	CV ( $r^2 = 0.81$ )	IR = 0.812, (Kuder Richardson 20) KR20 IRR = 0.712
Behavioural checklist	20		
Comfort Checklist	5	Descriptive tool /No numerical rating	Descriptive tool/No numerical rating
CNPI	6	CV = 0.60 - 0.90, CCV Compared with VAS 0.30 - 0.50	IC = 0.60 - 0.90, IR = 0.45 - 0.59, IRR = 0.23 - 0.65
CPAT	5	CV = 0.25, CCV compared with DS-DAT $p = 0.076$	IC = 0.72 - 0.84, IR = 0.71, ICC = 0.55 - 0.57, IRR = 0.67
Doloplus-2	10	CV = 0.33 - 0.70, CCV compared with; PAINAD 0.34; PACSLAC 0.29 - 0.38; Self-report 0.31 - 0.65	IC = 0.67 - 0.95, IR = 0.35 - 0.86, ICC = 0.77 - 0.90, IRR = 0.71
DS-DAT	9	CCV compared with; PAS 0.51, CMAI 0.25; VAS 0.31 - 0.65	IC 0.86-0.89, IR = 0.61 - 0.98, IRR = 0.60
ECPA	11	VAS-EPCA Pearson $r = 0.67$	IC = 0.70, ICC = 0.80
ECS	10	-	-

## Continued

ePAT	42	Concurrent validity $r = 0.882 - 0.911$	IC = 0.925 - 0.950, IR measured through kappa = 0.74 - 0.86
EPCA			IC = 0.70
EPCA-2	8	CCV compared with VAS 0.846	IC = 0.73 - 0.79, ICC = 0.85 - 0.89
FACS	46	CCV compared with PBM 0.02-0.41	IR = 0.82 - 0.92, IRR = 0.88 - 0.97
FLACC	5	-	IR = 0.40
MPS	8	CCV compared with proxy pain report $K = 0.86$	IC = 0.76, IR = 0.55 - 0.77
MOBID	10	CV = 0.51 - 0.54, CCV compared with proxy pain report 0.41 - 0.64	IC = 0.82 - 0.90, ICC = 0.70 - 0.96, IR = 0.86 - 0.97, $K = 0.05 - 0.90$ , IRR = 0.79 - 0.92
MOBID-2	10	good	IC = 0.82 - 0.94, ICC = 0.80 - 0.94, IRR = 0.85 - 0.92
NOPPAIN	17 (discrepancies)	CV = 0.48 - 0.88	IC = 0.65 - 0.84, IR = 0.79 - 0.94, $K = 0.70 - 0.87$ , IRR = 0.71 - 0.89
OPB	25	-	-
PACSLAC	60	CV = 0.54 - 0.72, CCV compared with proxy pain report 0.35 - 0.54	IC = 0.74 - 0.92, IR = 0.52 - 0.96, ICC = 0.77 - 0.96, IRR = 0.86
PACSLAC II	31	CV = 0.54 - 0.96	IC = 0.74 - 0.77, IR = 0.63 - 0.86
PACI	11	-	-
PADE	24	CCV compared with CMAI 0.30 - 0.42	IC = 0.54 - 0.96, ICC = 0.70 - 0.98
PAIC	15	-	-
PAINAD	5	CV = 0.48 - 0.88, CCV compared with; DS-DAT 0.56 - 0.76; proxy pain report 0.84; self-report 0.75 - 0.76	IC = 0.50 - 0.88, IR = 0.72 - 0.97, ICC = 0.76, IRR = 0.71 - 0.89
PAINE	22	CCV compared with PADE $r = 0.65$	IC = 0.75-0.78, IR = 0.71 - 0.99
PATCOA	9	CCV compared with VAS 0.41	IC = 0.44
PBM	5	CCV compared with; proxy pain report 0.62 - 0.73; VAS $r = 0.11 - 0.33$	ICC = 0.10 - 0.87
PIMD	7	Compared with ECPIR during movement for concurrent pain ( $p = 0.75$ ) and worst pain ( $p = 0.49$ ) with the MOBID ( $p = 0.59$ )	During movement - IC = 0.72, IR (ICC = 0.82) During rest - IC = 0.18, IR (ICC = 0.77)
PPQ	3	-	-
RaPID	18	CCV compared with; McGill Pain Scale 0.8 - 0.86; VAS 0.8 - 0.86	IC = 0.79, IR = 0.97, IRR = >0.75
REPOS	10	CCV compared with; PAINAD 0.61 - 0.75; proxy pain report 0.12 - 0.39	IC = 0.49, IRR = 0.90 - 0.96 (measured through ICC)

### 5.1. Psychometric Analysis of the Frequently Mentioned Pain Assessment Tools

APS: Across included studies conducted predominantly in nursing homes/residential aged-care contexts, APS demonstrated internal consistency  $\alpha = 0.65 - 0.81$ , inter-rater reliability 0.75 - 0.88, intra-rater reliability 0.66 - 0.88, and construct

validity 0.49 - 0.91. Where criterion/concurrent validity was reported (typically against broader “holistic” clinical judgement approaches in long-term care), the correlation was 0.586.

CNPI: In the cross-sectional descriptive work explicitly reporting rest vs movement, CNPI’s internal consistency differed by condition:  $\alpha = 0.92$  and  $0.97$  at rest versus  $\alpha = 0.74$  and  $0.90$  during movement (*i.e.*, the same residents were scored in two conditions, producing separate psychometric estimates). Inter-rater reliability also varied by condition, with ICC  $0.70$  (rest) vs  $0.65$  (movement) and kappa  $0.25$  (rest) vs  $0.43$  (movement). Construct validity correlations with agitation (PAS) were low at rest ( $0.16 - 0.17$ ) and higher during movement ( $0.33 - 0.41$ ), again reflecting the same cohort assessed under two observation contexts. Other included studies (typically in long-term care/nursing settings, often nurse-completed) reported broader ranges: internal consistency  $0.60 - 0.90$ , inter-rater  $0.45 - 0.59$ , intra-rater  $0.23 - 0.65$ , and construct validity  $0.46 - 0.88$ ; concurrent/criterion validity against self-report anchors remained low-moderate (e.g., VDS  $r \approx 0.372$  rest;  $0.428$  movement; VAS  $\sim 0.30 - 0.50$ ).

CPAT: Certified Nursing Assistant Pain Assessment Tool (CPAT)—Evidence comes primarily from nursing home settings in residents with cognitive impairment, with assessments aligned to care staff (CNA) use. Reported internal consistency was  $\alpha = 0.72 - 0.84$ . Reliability indices included ICC  $0.55 - 0.57$ , inter-rater reliability  $0.71$ , intra-rater reliability  $0.67$ , and construct validity  $0.25$ . Validity evidence was generally reported as comparisons with other observational tools (e.g., DS-DAT), but the synthesis should note that these studies reflect institutional long-term care workflow rather than acute settings.

DOLOPLUS-2: Validation evidence derives mainly from geriatric facilities and palliative care settings, where the tool is intended to capture progressive/ongoing pain rather than momentary procedural pain. Across studies, internal consistency ranged  $\alpha = 0.67 - 0.95$ ; inter-rater reliability  $0.35 - 0.86$ ; ICC  $0.77 - 0.90$ ; intra-rater reliability  $0.71$ ; and construct validity  $0.33 - 0.70$ . Concurrent/criterion validity varied depending on the comparator: PAINAD  $\sim 0.34$ , PACSLAC  $\sim 0.29 - 0.38$ , and self-report  $\sim 0.31 - 0.65$  (where self-report was feasible).

DS-DAT: Used largely in Alzheimer-type dementia/severe cognitive impairment cohorts, typically in care environments where observation is feasible. Across studies, internal consistency was consistently high ( $\alpha = 0.86 - 0.89$ ). Inter-rater reliability was reported either as % agreement ( $84\% - 94\%$ ) or correlations ( $0.61 - 0.98$ ), and intra-rater reliability was reported around  $0.60$ . Concurrent/criterion validity varied by comparator (e.g., CMAI  $0.25$ ; PAS  $0.51$ ; self-report VAS  $0.31 - 0.65$ ).

MOBID and MOBID-2:

These tools are explicitly movement-evoked pain assessments, with pain judged during standardized mobilizations performed by staff; evidence is therefore anchored to movement-based observation rather than rest-only scoring. MOBID showed internal consistency  $\alpha = 0.82 - 0.90$ , inter-rater reliability  $0.86 - 0.97$ , ICC

0.70 - 0.96, kappa 0.05 - 0.90, and intra-rater reliability 0.79 - 0.92; construct validity was 0.51 - 0.54 with concurrent validity against proxy reports 0.41 - 0.64. MOBID-2 studies reported internal consistency  $\alpha = 0.82 - 0.94$ , inter-rater ICC 0.80 - 0.94, intra-rater 0.85 - 0.92, with good construct/concurrent validity in clinical settings.

#### NOPPAIN:

Designed for nursing assistants during caregiving tasks (*i.e.*, pain observation embedded in care activity), and therefore best interpreted as care-activity/movement-linked observation rather than quiet rest observation. Across studies/reviews, internal consistency was  $\alpha = 0.65 - 0.84$ ; inter-rater reliability 0.79 - 0.94; agreement 82% - 100%; kappa 0.70 - 0.87; intra-rater reliability 0.71 - 0.89; and construct validity 0.48 - 0.88.

#### PAINAD:

Evidence includes observation during contrasting activity conditions (e.g., pleasant vs unpleasant activity), which should be stated explicitly because some reliability coefficients are condition-specific rather than different samples. Internal consistency ranged  $\alpha = 0.50 - 0.88$ ; inter-rater reliability 0.72 - 0.97; ICC 0.76. One study reported Pearson correlations 0.97 during pleasant activity vs 0.82 during unpleasant activity—these are best read as the same cohort rated under two activity contexts rather than separate cohorts. Intra-rater reliability ranged 0.71 - 0.89, construct validity 0.48 - 0.88, and concurrent/criterion validity varied by comparator (DS-DAT 0.56 - 0.76, proxy report 0.84, self-report Pain VAS 0.75, discomfort VAS 0.76).

#### PACSLAC I & II:

PACSLAC I evidence is largely drawn from dementia care settings where repeated observation is feasible; internal consistency ranged  $\alpha = 0.74 - 0.92$  with inter-rater reliability 0.52 - 0.96, ICC 0.77 - 0.96, agreement 94%, intra-rater reliability 0.86 (and intra-rater ICC 0.72 - 0.96). Construct validity ranged 0.54 - 0.72, with concurrent/criterion validity against proxy pain report 0.35 - 0.54. For PACSLAC II, reported internal consistency was  $\alpha = 0.74 - 0.77$  and inter-rater reliability 0.63 - 0.86; note that reported construct validity values should be explicitly labelled by statistic type (e.g., correlation/ICC) to avoid confusion.

#### PADE:

Evidence is primarily from long-term care facilities, including a study in four LTC facilities ( $n = 25$ ) and an experimental reliability design using two raters over 10 days (784 observations). Internal consistency was wide ( $\alpha = 0.54 - 0.96$ ) and differs by subscale/part, so the synthesis should state that Part I was stronger ( $\alpha = 0.76 - 0.88$ ) than Part III ( $\alpha = 0.23 - 0.63$ ). Inter-rater reliability (ICC) ranged 0.54 - 0.96, with very high ICCs reported by part (I 0.93, II 0.81, III 0.96) in the repeated-observation design; intra-rater reliability ranged 0.70 - 0.98.

#### ePAT/PainChek (novel tool):

The key point for synthesis is that psychometric estimates are frequently derived from paired assessments on the same residents, split into rest vs movement,

and that assessor roles differ by tool. In one prospective observational study across three Australian residential aged-care facilities ( $n = 40$ ; mean age  $\sim 79.7$ ), APS was administered by facility staff, while ePAT was administered mainly by the researcher (with some staff assistance). The dataset comprised 353 paired assessments (209 at rest; 144 during movement)—these are the same cohort measured twice under different conditions, not separate samples. Reported ePAT properties were internal consistency  $\alpha = 0.925$ , inter-rater reliability vs APS weighted kappa = 0.74 (rest 0.71; movement 0.78), and concurrent validity  $r = 0.882$ . A second prospective observational study in two residential aged-care facilities ( $n = 34$ ) also used paired rest/movement assessments (400 paired assessments: 204 rest; 196 movement). It reported overall internal consistency  $\alpha = 0.950$ , with condition-specific alphas  $\alpha = 0.766$  (rest) and  $\alpha = 0.797$  (movement)—again, same cohort, different conditions. Inter-rater reliability was weighted kappa = 0.857; ICC 0.902 (rest) and 0.879 (post-movement); concurrent validity vs APS was  $r = 0.911$  overall (rest 0.897; movement 0.904).

## 5.2. Evidence of the Clinical Utility of the Frequently Mentioned Tools

Clinical utility is defined as the usefulness of the measure for making decisions [26] and helps in the management of the patient. Assessing clinical utility involves considerations like the availability of cut-off scores, item numbers, and scoring interpretation for decision-making. However, evidence regarding clinical utility is often lacking, with scoring criteria and cut-off scores frequently scarce. Numerous pain assessment tools mentioned were mostly evaluated in nursing homes or residential care facilities, with limited data on their application in other healthcare settings. Most studies on clinical utility lack detailed evidence, except Lichtner *et al.* [14] which reviewed the utility of pain assessment tools but stressed the need for further research. Abbey's pain scale, with clear scoring and extensive use in residential facilities, is included in Australian Pain Guidelines. PAINAD shows potential in emergency departments for elderly patients with cognitive impairment, with studies revealing significant pain score improvements post-analgesia. CNPI is ideal for its ease in clinical settings, but its binary scoring may limit sensitivity to pain changes. NOPPAIN requires minimal training and is valued by nursing assistants. DS-DAT shows potential across facilities with proper training, but lack of training leads to incorrect use. CPAT's clinical utility is renowned but needs further validation. ePAT's cutoff score ( $\geq 7$ ) and high clinical utility (0.95) are validated, with strong sensitivity (96.1%), specificity (91.4%), and accuracy (95.0%) in dementia pain assessment. Its user-friendly app design and comprehensive training materials enhance accessibility and usefulness in various settings.

## 5.3. Impact of ePAT/PainChek on Health Services

ePAT shows positive impact on Health Services by simplifying pain assessment with objective scoring [30]. Its structured methodology aids in assessing pain in non-

verbal dementia patients, improving interdisciplinary communication for better pain management [29]. The electronic data collection streamlines pain profiling, allowing researchers to identify patterns and enhance treatment outcomes over time, aligning with recommendations for dementia patient management [14].

## 6. Discussion

Pain assessment in older adults heavily relies on verbal expression, yet advanced dementia presents challenges due to cognitive limitations. Despite efforts to develop effective tools, no gold standard has emerged for severely demented patients. Caregivers in various healthcare settings utilize diverse assessment tools like PAINAD, DOLOPLUS-2, CNPI, and PACSLAC, with DOLOPLUS-2 showing higher reliability than APS [21] but data suggest that nurses prefer APS because of its clear score interpretation and brevity.

Some long-term care facilities also recommend PADE [31] and CPAT [19] but based on, based on standardized movement, pain behaviors, and pain drawings, MOBIZ-2 is regarded as valid, reliable, and effective for nurses assessing pain in advanced dementia patients [22].

Zwalkhen *et al.* [20] suggested PACSALC and DOLOPLUS-2 as the most suitable currently available tools. However, all the relevant literature emphasized the need for further research to enhance these tools by testing their psychometric properties and clinical utility.

For non-communicative patient, various studies suggested that PAINAD as an excellent tool, because of its ease of administration, utility, reliability, good concurrent validity, and the ability to differentiate the effects of pain relief medication and different intensities of pain [14] and one study referred to it as a valuable adjunct for assessing in emergency settings [32]. However, a hospital-based observational study raised the possibility that PACSLAC might exhibit greater reliability than PAINAD, underscoring the crucial need for thorough assessor training and comprehension of the tool [33].

While PACSLAC provides thorough pain assessment, its 60-item checklist poses challenges and time constraints for daily use in nursing or residential care settings. Conversely, PAINAD is widely accepted as the most suitable method for pain assessment in clinical environments. Despite this, the PACSLAC scale remains preferred for research purposes. Nonetheless, the 2018 UK national guidelines advocate for PAINAD and DOLOPLUS-2 due to their established reliability and validity in evaluating pain in moderate to severe dementia [34].

Smith and Harvey [35] conducted a recent COSMIN systematic review examining the psychometric properties of commonly utilized pain assessment tools in dementia. Their analysis revealed robust evidence supporting the construct validity of PAINAD, CNPI, Abbey Pain Scale, MOBID, MOBID-2, and DOLOPLUS-2, with Algoplus exhibiting particularly strong evidence. Moreover, the review found high reliability, both inter-rater and intra-rater, for PAINAD, Abbey Pain Scale, CNPI, MOBID-2, PACSLAC II, Algoplus, and DOLOPLUS-2. Internal consistency was

also notably strong for PAINAD, PACSLAC II, DOLOPLUS-2, and MOBID-2.

Traditional pain assessment methods for elderly individuals with dementia are often prone to errors and bias. ePAT, a novel technology, provides reliable pain detection through automated analysis of facial expressions and behaviors [15] [28] [29] [30]. Timely and precise pain management is crucial for dementia patients, underscoring the importance of tools unaffected by environmental constraints [36].

## 7. Conclusion

This review identified 34 pain assessment tools for elderly patients with moderate to severe dementia, comprising 33 conventional observational/behavioural tools and one novel technology-based tool (ePAT). Most tools were evaluated primarily in residential aged-care facilities or nursing homes, with limited evidence from other healthcare settings. Data on clinical utility were generally scarce, although most instruments demonstrated moderate to good psychometric properties. ePAT showed strong internal consistency, concurrent validity, and inter-rater reliability, alongside promising indications of clinical utility. However, the supporting evidence is largely derived from observational studies with small sample sizes and settings predominantly confined to residential care, limiting the generalizability of findings to acute or hospital environments.

## 8. Limitations of the Study

The review encompassed diverse study designs such as systematic reviews, observational studies, and experimental studies in various healthcare settings. Not all the included studies fully met the inclusion criteria, with most focusing on either psychometric properties or clinical utility. Furthermore, none directly addressed the impact of ePAT on health services. The psychometric aspects reported were narrated through different approaches; some studies provided numerical data, and some provided descriptive data, which made it difficult to compile all the psychometric aspects together; therefore, only construct and concurrent/criterion validity were reported.

## 9. Recommendation for Future Research

ePAT represents a significant advancement in objective pain assessment, particularly for chronic pain. However, its testing primarily in residential aged-care facilities necessitates further research to validate its efficacy across diverse dementia populations and settings, as well as to evaluate its direct impact on health services. Furthermore, innovative smart wearable devices and Smart Home technology also need more validation.

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## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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## Appendix 1: Summary of the Characteristics of the Included Studies

Author /date of publication	Type of Study	Pain Assessment tools	Main aims & objectives	Key conclusions	Important recommendations
<b>Warden, Hurley &amp; Volicer, 2003 [24]</b>	Experimental (Instrument development) study	PAINAD.DS-DAT.	To develop a clinically appropriate and user-friendly pain assessment tool for people with advanced dementia that has suitable psychometric properties.	The PAINAD is a simple, reliable, and valid tool for the measurement of pain in non-communicative patients.	Further research is required in different populations before it can be unanimously recommended.
<b>Abbey <i>et al.</i>, 2004 [16]</b>	Experimental and Validation study	APS	To develop a highly reliable, effective, and efficient pain scale for patients with dementia that can be utilized by care staff.	The Abbey pain scale is valid when assessed against holistic measures.	Further evaluation of the use of scale in a clinical setting is needed.
<b>Herr, Bjoro &amp; Decker, 2006 [11]</b>	Systematic review	APS; ADD; CNPI; DS-DAT; DOLOPLUS-2; FLACC; NOPPAIN; PACSLAC; PAINAD; PADE	To critically analyse the available tools utilised for pain assessment in non-verbal elderly and to provide recommendations to all health professionals.	On the basis of nonverbal behavioural pain indicators, there is no standardized tool in English, that has been recommended for extensive use in clinical practice.	Available tools have not yet reached an acceptance and validation level, more research is required until a credible tool that can be used with certainty develops. Furthermore, clinicians can pilot selected tools if initial testing corresponds to their setting and population.
<b>Smith, 2005 [37]</b>	Systematic review	Comfort Checklist; Observed Pain Behaviors tool; DS-DAT. CNPI. PAINAD. PADE	To recognise pain assessment tools that are exclusively endorsed for use with nonverbal patients with dementia.	A limited number of sensitive, reliable, and valid tools, each having some pros and cons are reported for use by nurses and allied health personnel.	There is a need for planned trials or other procedures to further test the tools, to ensure that valid and reliable measures, which are adequate to detect pain in routine care settings are available.
<b>Zwakhalen <i>et al.</i>, 2006 [20]</b>	Systematic review	DOLOPLUS-2; Observational Pain Behaviour Tool; ECPA; ECS; CNPI; PACSLAC; PAINAD; PADE; RaPID; APS; NOPPAIN; PACI	To Identify which behavioural pain assessment tools are available to assess pain in elderly with dementia and what are their psychometric qualities.	On the basis of psychometric qualities and clinical utility, the PACSLAC and DOLOPLUS2 are the most suitable tools currently available.	Further research should be done to improve these tools by testing their validity, reliability, and clinical utility.
<b>Cervo <i>et al.</i>, 2009 [19]</b>	Experimental instrument development study	CPAT	To assess the psychometric properties and clinical utility of the CPAT in dementia patients residing in a nursing home.	Evidence from the study suggested that CPAT is a valid and reliable pain assessment tool when utilized with dementia patients in nursing home residents. Furthermore, it has suitable clinical utility and feasibility.	

## Continued

<b>Ersek <i>et al.</i>, 2010 [17]</b>	Randomised Controlled Trial	CNPI PAINAD	To evaluate and compare the psychometric properties of two common observational pain assessment tools utilized in persons with dementia.	Significant discrepancies in mean CNPI and PAINAD scores were noted, both at rest and during movement. However, both tools displayed evident floor effects, specifically when participants were at rest.	The tools should be used carefully both in research and clinical situations and only as part of a detailed process of pain assessment. Further studies with clinical users are needed.
<b>Husebo <i>et al.</i>, 2010 [22]</b>	Cross-sectional Study	MOBID-2	To examine the psychometric properties of the MOBID-2 Pain Scale.	On the basis of pain behaviours, standardized movements and pain drawings MOBID-2 is reported to be a reliable, valid, and time-effective tool for use by nurses, in patients with severe dementia.	In order to gain more understanding of the association between pain and behavioural indicators in dementia, further investigation that follows the elderly with dementia in the nursing home is needed.
<b>Neville &amp; Ostini, 2013 [38]</b>	Observational study	APS; DOLOPLUS-2; CNPI	To assess the relative psychometric qualities of the APS, the DOLOPLUS-2 Scale and CNPI, used for pain assessment in dementia.	The CNPI seems less compatible than the APS or the DOLOPLUS-2 for measuring chronic pain in nursing home patients with moderate to severe dementia.	
<b>Hadjistavropoulos <i>et al.</i>, 2014 [5]</b>	Literature review	APS; CPAT; CNPI; DS-DAT; DOLOPLUS-2; EPCA; MPS; NOPPAIN; MOBID; PACI; PAINE; PAINAD; REPOS	To highlight the effectiveness of non-verbal indicators as a means of measuring the pain experience.	Numerous observational behavioural pain assessment tools have been narrated to be reliable and valid in people with dementia.	The tools need to be studied in the context of observer bias, contextual variables, and the general state of the person's health.
<b>Lichtner <i>et al.</i>, 2014 [14]</b>	Meta review	APS; ADD. Behaviour checklist CNPI; Comfort checklist; CPAT DOLOPLUS-2. DS-DAT; ECPAECs; EPCA-2; FACS; FLACC MPS; MOBID. NOPPAIN. Observational pain behaviour tool PACSLAC; PADE; PACI; PAINAD. PAINE; PATCOA PBM; PPQ. RaPID; REPOS	To review and summarise evidence regarding the psychometric properties and clinical utility of pain assessment tools in people with dementia or cognitive impairment.	There are a considerable number of existing pain assessment tools. However, evidence on their reliability, validity and clinical utility is limited. Therefore, not a single tool could be recommended for use in the cognitively impaired elderly population.	Further research on the psychometric properties, feasibility and clinical utility in clinical setting and guidance on the use of the tools is needed.
<b>Atee <i>et al.</i>, 2017 [29]</b>	Prospective Observational study	ePAT	To briefly describe a new pain assessment tool, ePAT and evaluate its psychometric properties compared to the Abbey Pain Scale (APS).	On the basis of psychometric properties, ePAT is deemed suitable for use in non-verbal patients as it uses automated facial expression assessment which provides empirical and reproducible proof of the presence of pain.	

## Continued

<b>Atee <i>et al.</i>, 2017 [15]</b>	Prospective Observational study	ePAT	To evaluate the psychometric properties of the ePAT in residents of residential aged care facilities with moderate-to-severe dementia, and to compare these findings to those reported in the previous study.	The ePAT is reported to be appropriate for pain assessment in this vulnerable population.	Additional research on technology and refinements in the use of facial expressions is required.
<b>Kim <i>et al.</i>, 2017 [36]</b>	Literature Review	APS; DOLOPLUS-2; PAINAD.PACSLAC. CNPI. PADE. CPAT	To identify practical methods that could be used to assess pain in elderly patients with or without cognitive impairment.	A number of reliable and valid methods for pain assessment in the elderly were found.	There is a need for the development of a pain assessment tool that is not subjected to variations, arising from differences in settings.
<b>Atee <i>et al.</i>, 2018 [28]</b>	Observational study	ePAT	To examine the interrater reliability of the ePAT among raters when evaluating pain in patients with moderate-to-severe dementia.	ePAT exhibits good reliability which favours its suitability for use in patients with advanced dementia.	Attempts to work toward the development of a gold-standard pain assessment tool for non-verbal patients should be encouraged.
<b>Atee, Hoti &amp; Hughes, 2018 [30]</b>	Report article	Painchek (ePAT)	To describe a new approach and system of pain assessment using a blend of technologies: automated facial recognition and analysis (AFRA), smart computing, affective computing, and cloud computing for people with severe dementia.	PainChek is an inclusive and evidence-based pain management system, with the potential to be employed in routine clinical practice by clinicians and carers.	
<b>Fry &amp; Elliot, 2018 [32]</b>	Observational study	PAINAD	To evaluate the effectiveness of PAINAD in the emergency department.	The PAINAD has the potential to be used as an effective pain assessment tool for elderly with cognitive impairment presenting in emergency settings.	Similar studies should be replicated in diverse healthcare settings, including ICU and acute wards. Furthermore, standardizing the use of pain assessment tools for individuals with cognitive impairment is needed to provide the best care, maintain quality standards, and ensure patient safety in clinical settings.
<b>Ersek <i>et al.</i>, 2018 [27]</b>	Observational study	PIMD	To conduct an initial psychometric analysis of PIMD that was devised by using items from available pain observational measures.	A preliminary assessment of the PIMD supports its validity and reliability.	Further testing of the tool to assess the sensitivity to variations in pain severity is needed.
<b>Rababa, 2018 [25]</b>	Literature review	PAINAD; NOPPAIN; CPAT; PACSLAC; DOLOPLUS-2; MPS; MOBID	To review the controversies around pain assessment in dementia.	It is still contentious whether self-reporting and Observational tools or self-reporting and observational collectively are enough for pain assessment in patients with dementia.	Future research is recommended to. to acquire a more detailed pain-assessment protocol. Furthermore, a new model for pain assessment is required which incorporates neuroimaging techniques.

## Continued

<b>Adeniji &amp; Oyeyemi, 2019 [2]</b>	Systematic review	PAINAD; PACSLAC DOLOPLUS-2. NOPPAIN; CNPI	To analyse current practices and guidelines on pain management and to provide insights into general care that comprises non-pharmacological pain management in non-verbal cognitively impaired patients. To find interrater reliability of the PACSLAC and PAINAD in evaluating pain behaviours in patients with the same pain stimulus and to find the constancy of the reliable changes between and within the tools.	PAINAD might be the best pain assessment tool available.	
<b>Natavio <i>et al.</i>, 2020 [33]</b>	Experimental study (A single group within the subject)	PACSLAC; PAINAD	To discover what pain assessment tools have been employed globally in care homes for pain assessment of advanced dementia patients and what are their psychometric properties. And usage implications in practice.	PACSLAC might be the more reliable tool over the PAINAD; however, rater training and knowledge of the tool are crucial.	Future studies that comprise observational ratings could potentially shed light on how the detected pain is professed by the non-practitioner.
<b>Felton <i>et al.</i>, 2021 [39]</b>	Integrative literature review	ADD; APS; CNPI; DS-DAT; DOLOPLUS-2; ePAT; FACS; MOBID; MOBID-2; MPS; NOPPAIN; Observational Pain Behavioural Tool; PACSLA II; PADE; PAIC; PAINAD; PAINE; PIMD	To determine the psychometric properties of the most commonly used pain assessment tools in the studies of people living with dementia.	Use of a comprehensive, multi-disciplinary approach which is beyond the use of tools for pain assessment in advanced dementia patients residing in care homes is effective. There is strong and moderate evidence to authenticate the use of the facial action coding system, PACSLAC and PACSLAC-II, CNPI, DOLOPLUS-2, ALGOPLUS, MOBID, and MOBID-2 for the measurement of pain in people living with dementia.	There is an extreme lack of precise guidelines to support decision-making in this setting Hence, further research needs to be done to study the view of the individuals in that particular area. Further consideration on how they reflect clinical practice and instructions on how to execute these tools in clinical settings should be studied in order to improve the detection and management of pain in people with dementia.
<b>Smith &amp; Harvey, 2022 [35]</b>	Systematic review	FACS; PACSLAC I & II; CNPI; DOLOPLUS-2; ALGOPLUS; MOBID; MOBID-2; APS; PAINAD			

## Appendix 2: List of Abbreviations

ADD	Assessment of Discomfort in Dementia
APS	Abbey Pain Scale
CAS	Coloured Analogue Scale
CNPI	Checklist for Nonverbal Pain Indicators
CPAT	Certified Nursing Assistant Pain Assessment Tool
DS-DAT	Discomfort Scale Dementia of Alzheimer Type
ECPA	Echelle Comportementale pour Personnes Agées
ECPIR	Expert Clinician Pain Intensity Ratings
EPCA	Elderly Pain Care Assessment
ECS	Edmonton Classification System
ePAT	Electronic Pain Assessment Tool
FACS	Facial Action Coding System
FLACC	Face, Legs, Activity, Cry, and Consolability
LTC	Long term care
MOBID	Mobilization-Observation-Behaviour-Intensity-Dementia Pain Scale
MPS	Mahoney Pain Scale
NOPPAIN	Non-communicative Patient's Pain Assessment Instrument
NRS	Numeric Rating scale
OPB	Observational Pain Behavioural Tool
PACSLAC	Pain Assessment Checklist for Seniors with Limited Ability to Communicate
PACI	Pain Assessment in Cognitively Impaired
PADE	Pain Assessment for the Dementing Elderly
PAIC	Pain Assessment in Impaired Cognitions
PAINAD	Pain Assessment in Advanced Dementia
PAINE	Pain Assessment in Noncommunicative Elderly Persons
PATCOA	Pain Assessment Tool in Confused Older Adult
PBM	Pain Behaviour Method
PIMD	Pain Intensity Measurement in Persons with Dementia
PPQ	Proxy Pain Questionnaire
RaPID	Rating Pain in Dementia
REPOS	Rotterdam Elderly Pain Observation Scale
MeSH	Medical Subject Headings
RACF	Residential aged-care facilities
VAS	Visual Analogue Scale
VRS	Verbal rating scale