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Cross-Cultural Adaptation, Translation, Validation and Reliability of the Malay Dementia Knowledge Assessment Tool 2 (DKAT2-M) among Malaysian Caregivers

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ABSTRACT:
Dementia is a growing public health concern globally and in Malaysia. Informal caregivers play a central role in care provision; however, limited knowledge may compromise the quality of care. The lack of a validated Malay-language instrument limits the assessment of caregiver knowledge.
To adapt, translate, and evaluate the validity and reliability of the Malay version of the Dementia Knowledge Assessment Tool Version 2 (DKAT2-M) among Malaysian informal caregivers. A cross-sectional study was conducted among 355 caregivers recruited from geriatric clinics at Hospital Kuala Lumpur and University Malaya Medical Centre. The 21-item DKAT2 underwent forward-backward translation, followed by content validation, face validation and pilot testing, exploratory factor analysis for construct validity, and reliability testing.
Participants had a mean age of 51.96 years (SD = 15.73), with most being female, Malay, Muslim, married, and tertiary-educated. The DKAT2-M showed excellent content validity (I-CVI = 1.00 for all items; S-CVI/Ave = 0.992) and face validity (S-FVI/Ave = 1.00). Exploratory factor analysis supported a two-factor structure: Dementia and Its Progress and Support and Care, explaining 30.8% variance (KMO = 0.871; Bartlett's test, $p < 0.001$). Internal consistency was good ($\alpha = 0.868$), and test-retest reliability demonstrated moderate to substantial agreement ($\varkappa = 0.568–0.786$). One item (Item 6) demonstrated low communality (0.182) but was retained due to acceptable factor loading (0.514) and conceptual relevance.
The DKAT2-M is a valid and reliable instrument for assessing dementia knowledge among Malaysian informal caregivers and may be useful in similar caregiver populations for clinical, educational, and research purposes.

Keywords: Dementia, Caregivers, Health Knowledge, Validation, Malaysia

1. Introduction

Dementia has emerged as a major global public health priority, driven largely by population ageing. As life expectancy continues to increase, the societal and economic

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burden of dementia is expected to rise substantially. Recent estimates indicate that the number of people living with dementia (PLwD) will increase from 57.4 million in 2019 to 152.8 million by 2050. This growing burden inevitably leads to increased reliance on PLwD caregivers (World Health Organization [WHO], 2017; Nichols et al., 2022).

In Malaysia, dementia follows a similarly concerning trajectory as the country transitions into an ageing society. The National Health and Morbidity Survey (NHMS) 2018 reported that 8.5% of adults aged 60 years and above screened positive for dementia (Abdullah et al., 2024; Institute for Public Health [IPH], 2018). Care for PLwD in Malaysia is predominantly provided by informal caregivers, usually family members. However, caregiving is often associated with significant psychological, physical, and social strain. These challenges are further compounded by limited community-based support services and insufficient public awareness and knowledge of dementia (Loh et al., 2024; Ministry of Health [MOH], 2024; WHO, 2017).

Knowledge is a key determinant of caregiving capacity and behaviour. Within the Knowledge, Attitude, and Practice (KAP) framework, knowledge serves as the cognitive foundation that shapes attitudes and influences caregiving practices (Bano et al., 2013). Improved knowledge of dementia can enable informal caregivers to better manage behavioural and psychological symptoms of dementia (BPSD), thereby reducing both mental and physical caregiver burden. This, in turn, contributes to enhanced quality of life for both the caregiver and the PLwD (Teichmann et al., 2022).

Evidence suggests that dementia caregivers often possess poor to moderate levels of knowledge. A scoping review reported limited caregiver knowledge, particularly in complex care tasks such as medication management, restraint use, and patient positioning, which contributed to feelings of inadequacy and a lack of support (Ab Ghani et al., 2022). Similarly, a cross-sectional study in China reported inadequate dementia knowledge among family caregivers (mean score: 58.54, SD = 7.41) (Guilin et al., 2019). In Indonesia, caregivers demonstrated moderate knowledge (mean score: 33/50, SD = 7.37), with strengths in care considerations but weaker understanding of communication and behavioural management (Andrews et al., 2024). In Telangana, India, 67.1% of caregivers had above-average knowledge, while 28.6% and 4.3% had average and below-average knowledge, respectively; knowledge levels were significantly associated with education and income (Superior et al., 2020). A study in Kuala Lumpur, Malaysia, reported moderate knowledge of ageing among individuals exposed to the PLwD (mean score: 13.11, SD = 2.76) (Subramaniam et al., 2025).

Accurate measurement of dementia knowledge requires instruments that are both psychometrically robust and practically feasible. The Alzheimer's Disease Knowledge Scale (ADKS), although widely used, focuses specifically on Alzheimer's disease rather than the broader spectrum of dementia syndromes (Carpenter et al., 2009; Valdevila Figueira et al., 2025). The Dementia Knowledge Assessment Scale (DKAS) provides a multidimensional approach with strong psychometric properties; however, its 25-item length and relative complexity may limit its usability in clinical settings or among individuals with lower health literacy (Annear et al., 2017; Andrews et al., 2024; Anantapong et al., 2026; Mulyani et al., 2023).

In contrast, the Dementia Knowledge Assessment Tool Version 2 (DKAT2) offers a more practical alternative. It is a concise 21-item instrument using a simple

"Yes/No/Don't know" response format, thereby reducing respondent burden (Toye et al., 2014). The DKAT2 assesses dementia knowledge in a general context, making it suitable for diverse caregiver populations. While the instrument has demonstrated reliability in other languages, such as Greek, German, Spanish and Brazilian Portuguese (Gkioka et al., 2020; Parra-Anguita et al., 2018; Piovezan et al., 2018; Teichmann et al., 2022), its cross-cultural adaptation remains limited. Based on the literature review, there is no validated Malay version of the DKAT2.

This represents a critical gap in the Malaysian context, where culturally and linguistically appropriate tools are essential for accurately assessing caregiver knowledge and evaluating interventions. Therefore, this study aims to translate, culturally adapt, and validate the Malay version of the DKAT2 among dementia caregivers in Malaysia.

2. Methods

Study Design and Setting

A cross-sectional study was conducted between March and July 2025. Data collection took place within the geriatric clinics of two major tertiary institutions, Hospital Kuala Lumpur (HKL) and Universiti Malaya Medical Centre (UMMC).

Participants

Participants were recruited through convenience sampling. Inclusion criteria consisted of informal caregivers aged 18 years or older who provided at least 4 hours of unpaid daily care and were proficient in the Malay language. Those informal caregivers who had participated in the pilot testing phase were excluded from the study.

The Dementia Knowledge Assessment Tool Version 2 (DKAT2)

The DKAT2 is a 21-item instrument developed to assess foundational knowledge of dementia and dementia care among caregivers and healthcare professionals. The instrument utilises a simple response format (Yes/No/Don't know), which enhances ease of administration and minimises response bias associated with guessing. The instrument assesses key domains related to dementia, including disease progression and care practices, thereby enabling the identification of knowledge gaps and the evaluation of educational interventions. Total scores reflect overall dementia knowledge, with higher scores indicating greater levels of knowledge (Toye et al., 2014).

Psychometric evaluation has demonstrated acceptable internal consistency, with Cronbach's alpha of approximately 0.79 reported for both caregiver and staff populations. Content validity has been established through expert panel review, and evidence of construct validity is supported by the instrument's ability to discriminate between groups with differing levels of training and experience (Toye et al., 2014).

Instrument Translation and Cultural Adaptation

The original DKAT2 underwent a standardised forward-backward translation process to produce the Malay version (DKAT2-M). Two independent forward translations from English to Malay were conducted by a bilingual linguist and a bilingual medical practitioner. The translations were compared, and differences in terminology, wording,

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and sentence structure were documented and discussed by the translators and research team. Disagreements were resolved by consensus, with preference given to wording that preserved the original meaning and was easily understood by Malaysian caregivers.

Two other bilingual experts, a linguist and a medical doctor, then independently translated the reconciled Malay version back into English. The backward translations were compared with the original DKAT2 to assess semantic and conceptual equivalence. Any inconsistencies were reviewed and resolved through consensus. Most modifications involved minor wording changes to improve clarity and cultural appropriateness, without changing the intended meaning of the items. This process resulted in the harmonised preliminary DKAT2-M (Rejab et al., 2022).

Content Validity

The content validity of the DKAT2-M was established by a multidisciplinary six-member expert panel. The panel comprised one public health medicine specialist from the Universiti Teknologi MARA (UiTM) Sungai Buloh Campus, one public health medicine specialist from the Ministry of Health (MOH) Malaysia, two geriatricians (one from an MOH facility and one from a university hospital), a dementia caregiver with more than ten years of caregiving experience and a certified linguist (Rejab et al., 2022; Yusoff, 2019a).

Following established guidelines, each expert independently evaluated the items based on relevance, clarity, simplicity, and ambiguity. Panellists received both the English and Malay versions by email and were asked to verify the accuracy of the translations and propose culturally appropriate modifications. Feedback from the panel was incorporated into the instrument to refine the pre-final version of the DKAT2-M (Rejab et al., 2022; Yusoff, 2019a).

Face Validity and Pilot Testing

Face validity of the pre-final DKAT2-M was assessed through pilot testing conducted in March 2025 among 30 dementia caregivers (aged ≥18 years) recruited from the Geriatric Clinic at Hospital Kuala Lumpur. Participants involved in the face validation were excluded from subsequent recruitment for construct validity analysis. After completing the questionnaire, participants were interviewed regarding item comprehension, wording, and response clarity. They were encouraged to identify unclear or culturally unfamiliar terms. Their feedback resulted in minor wording refinements to improve readability. No major changes were made to the content or intended meaning of the items. The final DKAT2-M was then used for further psychometric evaluation (Rejab et al., 2022; Yusoff et al., 2019b).

Sample Size Determination for Construct Validity and Reliability Testing

The required sample size was determined using a participant-to-item ratio of at least 5:1 (Clark & Watson, 1995; Kyriazos, 2018; Rejab et al., 2022). For the 21-item DKAT2-M, this ratio necessitated a minimum of 105 participants. To mitigate the impact of a potential 20% non-response rate, the recruitment target was adjusted to 126 participants. Ultimately, 355 caregivers were enrolled in the study through convenience sampling at the geriatric clinics of HKL and UMMC, which significantly exceeded the minimum requirement, thereby enhancing the statistical power and stability of subsequent

validity and reliability analyses. For test-retest reliability, a subsample of 30 caregivers from a similar population was reassessed after a two-week interval (Gwet, 2001; McHugh, 2012).

Statistical Analyses

Statistical analyses were performed using IBM SPSS Statistics (Version 30.0) and Microsoft Excel. Descriptive statistics were employed to summarise the sociodemographic characteristics of the participants. The psychometric evaluation of the 21-item DKAT2-M included comprehensive assessments of content, face, and construct validity, as well as internal and temporal reliability (DeVon et al., 2007; Moore et al., 2017; Pallant, 2020).

Content validity was quantitatively determined using the Content Validity Index (CVI). Following established psychometric benchmarks, an item-level CVI (I-CVI) of 0.78 was required for item retention, while a scale-level CVI (S-CVI/Ave) of 0.80 indicated robust overall instrument validity (Polit & Beck, 2006; Rejab et al., 2022; Yusoff, 2019a).

Face validity was subsequently evaluated using the Face Validity Index (FVI) with a pilot cohort of 30 participants. Items were retained if they achieved I-FVI and S-FVI values of 0.80. Items that failed to meet this threshold underwent qualitative refinement based on participant feedback to enhance linguistic clarity and cultural resonance (Rejab et al., 2022; Yusoff, 2019b).

Construct validity was explored through Exploratory Factor Analysis (EFA) to examine the underlying factor structure of the Malay version of the DKAT2-M. The analysis was performed using Principal Axis Factoring (PAF) with Promax rotation, as the latent constructs were expected to be conceptually related and potentially correlated. PAF was selected to identify underlying latent constructs rather than for simple data reduction. Promax, an oblique rotation method, was applied because the domains of dementia knowledge are theoretically related (Costello & Osborne, 2005; Hajjar, 2018). Factor retention was determined by the Kaiser criterion (eigenvalues > 1.0) and visual inspection of the scree plot. In accordance with best practices in scale development, factor loadings < 0.32 were considered to indicate poor structural contribution (Clark & Watson, 1995; Costello & Osborne, 2005). Items exhibiting loading patterns inconsistent with the original theoretical framework underwent qualitative review prior to any final decision regarding exclusion.

Reliability was established by evaluating the internal consistency and test-retest reliability of the finalised factor structure. Internal consistency was measured using Cronbach's alpha (α), with a threshold of 0.70 considered acceptable (Hajjar, 2018; Tavakol & Dennick, 2011). Cohen's kappa (κ) was used to assess test-retest reliability of the DKAT2-M. Based on established benchmarks, κ values <0 indicate poor agreement, 0.00–0.20 indicate none to slight agreement, 0.21–0.40 indicate fair agreement, 0.41–0.60 indicate moderate agreement, 0.61–0.80 indicate substantial agreement, and 0.81–1.00 indicate almost perfect agreement (Gwet, 2001; McHugh, 2012).

3. Results

Sociodemographic and Caregiving Characteristics of Participants

The study included 355 dementia caregivers with a mean age of 51.96 ± 15.73 years (range: 18–86 years). The majority of participants were female (75.7%), of Malay

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ethnicity (69.6%), and practised Islam (71.5%). In terms of socioeconomic characteristics, 63.7% were married, and 45.7% had attained tertiary education; however, more than half (54.1%) were unemployed or retired. Economic constraints were evident, with 51.8% of participants reporting a monthly household income below RM2,000. Although 74.9% did not receive formal financial support, 63.4% reported receiving some form of assistance from family or social networks.

Regarding caregiving characteristics, the largest proportion of participants were children (45.6%), followed by other relatives (41.7%) and spouses (12.7%). Most caregivers resided in urban areas (63.4%) and lived with the PLwD (55.8%). Caregiving demands were substantial, with 79.7% providing care for 1 to 5 years, and 60.8% dedicating more than 9 hours per day to caregiving. In terms of the clinical status of the PLwD, 37.7% were classified as having mild dementia (see Table 1).

Table 1. Sociodemographic and Caregiving Characteristics of Participants

Characteristics	Mean (SD)	Range
Age (years)	51.96 (±15.73)	18–86

Characteristics	n=355	Percentage (%)
Gender		
Male	87	24.5
Female	268	75.7
Ethnicity		
Malay	247	69.6
Chinese	55	15.5
Indian	43	12.1
Others	10	2.8
Religion		
Islam	254	71.5
Buddha	38	10.7
Hindu	34	9.6
Christian	25	7.0
Others	4	1.1
Marital status		
Married	226	63.7
Single	75	21.1
Divorced/ Separated	54	15.2
Educational level		
Primary education	53	14.9
Secondary education	140	39.4
Tertiary education	162	45.7
Working status		
Working	163	45.9
Not working/ Retired	192	54.1
Relationship with PLwD		
Spouse	45	12.7
Children	162	45.6
Others	148	41.7
Co-inhabitant		
Yes	198	55.8
No	157	44.2
Housing area		

Characteristics	n=355	Percentage (%)
Urban	225	63.4
Rural	130	36.6
Monthly household income (RM)		
< 2,000		
2,000 – 5,000	184	51.8
5,001 – 10,000	128	36.1
> 10,000	33	9.3
	10	2.8
Financial support		
Yes	89	25.1
No	266	74.9
Family/ social support		
Yes	255	63.4
No	130	36.6
Length of caregiving (years)		
1-5 years	283	79.7
> 5 years	72	20.3
Daily caregiving time (hours)		
4-6 hours	115	32.4
7-9 hours	24	6.8
> 9 hours	216	60.8

Note. SD = standard deviation; PLwD = people living with dementia.

Content and Face Validity

The content validity was evaluated by six experts using a four-point Likert scale across four domains: relevance, clarity, simplicity, and ambiguity. Ratings of 3 (quite) and 4 (highly) were considered acceptable and recoded as 1, while ratings of 1 (not) and 2 (somewhat) were recoded as 0 for the calculation of the CVI.

The results demonstrated excellent agreement among experts. All 21 items achieved an I-CVI of 1.00 for relevance. For clarity, simplicity, and ambiguity, nearly all items also showed perfect agreement, with only 1 item (Item 10) having a slightly lower I-CVI of 0.833. At the scale level, the instrument showed excellent content validity, with an S-CVI/Ave of 0.992 and a universal agreement (S-CVI/UA) of 0.952. These values exceed the recommended threshold of I-CVI ≥0.78 for a six-expert panel (Polit & Beck, 2006; Yusoff, 2019a).

Face validity was assessed among 30 dementia caregivers to evaluate the clarity and comprehensibility of the 21 items. Each item was rated on a four-point Likert scale (1 = not clear to 4 = very clear). Ratings of 3 or 4 were considered acceptable and recoded as 1, while ratings of 1 or 2 were recoded as 0 (Yusoff, 2019b).

The findings demonstrated excellent clarity across all items. All 21 items achieved an I-FVI of 1.00, indicating complete agreement among the raters. Accordingly, both the scale-level FVI using the average method (S-FVI/Ave) and the universal agreement method (S-FVI/UA) were 1.00. These values exceed the recommended threshold of ≥ 0.80, confirming that the DKAT2-M is clear, understandable, and culturally appropriate. All items were therefore retained for subsequent analyses of construct validity and reliability.

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Construct Validity and Factor Analysis

Prior to factor extraction, the suitability of the data for factor analysis was assessed. The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.871, indicating meritorious adequacy according to Kaiser's classification (Kaiser, 1974), and reflecting a high level of sampling adequacy for factor analysis (Hair et al., 2019). Bartlett's Test of Sphericity was statistically significant ($\chi^2 = 2102.654$, $df = 210$, $p < 0.001$), confirming that the correlation matrix was not an identity matrix and that sufficient correlations existed among the variables to justify factor extraction. These results indicated that the dataset was appropriate for factor analysis (DeVon et al., 2007; Hajjar, 2018; Kyriazos, 2018).

The factorial structure was examined via PAF with Promax rotation, an oblique method selected based on the theoretical expectation that the underlying attitudinal dimensions would be correlated (Hajjar, 2018). Item retention was strictly guided by factor loadings exceeding 0.32 and communalities above 0.20, ensuring that each retained item contributed meaningfully to the latent structure (Kyriazos, 2018).

Based on the eigenvalue criterion (> 1) and inspection of the scree plot, four factors were initially extracted. The initial eigenvalues showed that the first four factors had eigenvalues greater than one (5.9, 1.7, 1.6, and 1.1, respectively), accounting for 49% of the total variance. Although the Kaiser criterion suggested four factors, visual inspection of the scree plot demonstrated an inflection after the second factor, supporting the retention of a two-factor solution (see Figure 1). This solution was selected based on the scree plot, its conceptual interpretability, and its consistency with the theoretical structure of the original DKAT2 instrument.

The extraction sums of squared loadings indicated that the retained factors explained 30.8% of the total variance, with Factor 1 accounting for 25.2% and Factor 2 for 5.6%. The EFA supported a two-factor solution, consistent with the conceptual domains of the original DKAT2 instrument. The extracted factors represented meaningful groupings of dementia knowledge items among caregivers (Clark & Watson, 1995; Costello & Osborne, 2005; Hajjar, 2018).

The first factor (Support and Care) comprised 12 items related to practical aspects of dementia care, including knowledge of late-stage symptoms, caregiving strategies, communication approaches, environmental modification, and supportive management of PLwD. Items loading on this factor included Items 6, 8, 9, 10, 14, 15, 16, 17, 18, 19, 20, and 21, with factor loadings ranging from 0.311 to 0.618. The second factor (Dementia and Its Progress) comprised 9 items assessing knowledge of the underlying pathophysiology, causes, disease trajectory, and clinical manifestations of dementia. Items loading on this factor included Items 1, 2, 3, 4, 5, 7, 11, 12, and 13, with factor loadings ranging from 0.332 to 0.828. The extracted communalities ranged from 0.182 to 0.765, with most items demonstrating adequate shared variance with the retained factors. Item 6 had the lowest communality (0.182); however, it was retained because its factor loading was acceptable (0.514) (see Table 2).

Figure 1. Scree plot of eigenvalues for the exploratory factor analysis of the DKAT2-M.

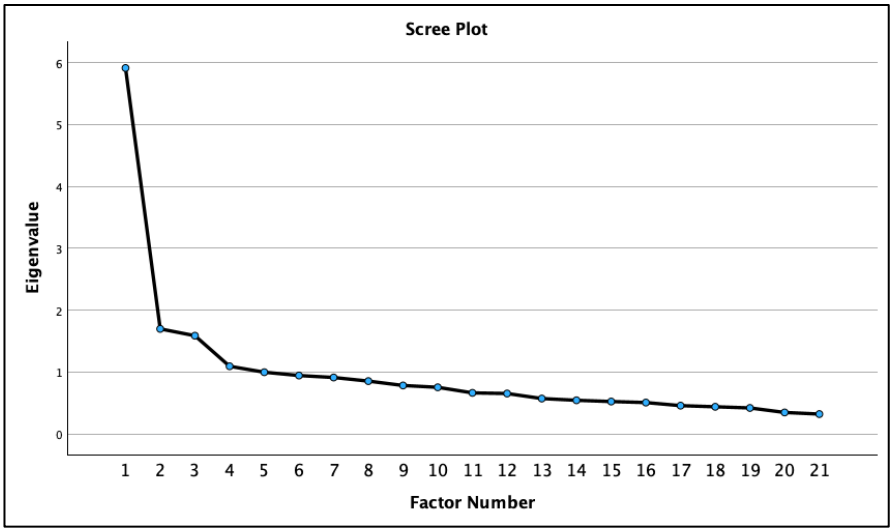

Table 2. Exploratory Factor Analysis (EFA) of the Items of DKAT2-M

No.	Item of DKAT2-M	Mean (SD)	Factor 1 (Support and Care)	Factor 2 (Dementia and Its Progress)	Communalities	Interpretation
1	Dementia occurs because of changes in the brain. **Demensia berlaku disebabkan oleh perubahan dalam otak.**	1.30 (0.714)		0.767	0.421	Retained
2	Brain changes causing dementia are often progressive. **Perubahan dalam otak yang menyebabkan demensia berlaku secara beransur-ansur dan semakin teruk dari semasa ke semasa.**	1.28 (0.666)		0.828	0.765	Retained
3	Alzheimer's disease is the main cause of dementia. **Penyakit Alzheimer adalah penyebab utama demensia.**	1.75 (0.914)		0.604	0.395	Retained
4	Blood vessel disease can also cause dementia.	1.89 (0.948)		0.491	0.27	Retained

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No.	Item of DKAT2-M	Mean (SD)	Factor 1 (Support and Care)	Factor 2 (Dementia and Its Progress)	Communalities	Interpretation
	Penyakit salur darah juga boleh menyebabkan demensia.					
5	Confusion in an older person is almost always due to dementia. **Kekeliruan dalam kalangan golongan berusia selalunya disebabkan oleh demensia.**	1.46 (0.733)		0.332	0.255	Retained
6	Only older adults develop dementia. **Hanya golongan berusia menghidap demensia.**	1.66 (0.659)	0.514		0.182	Retained
7	Knowing the likely cause of dementia can help to predict its progression. **Mengetahui punca demensia dapat membantu meramal perkembangannya.**	1.47 (0.794)		0.33	0.322	Retained
8	Incontinence always occurs in the early stages of dementia. **Masalah inkontinens (tidak dapat mengawal buang air kecil atau air besar) kerap berlaku di tahap awal demensia (demensia ringan).**	1.68 (0.812)	0.53		0.283	Retained
9	Dementia is likely to limit life expectancy. **Demensia berkemungkinan dapat mengehadkan jangka hayat seseorang.**	2.03 (0.837)	0.34		0.395	Retained
10	When a person has late-stage dementia, families can help	1.46 (0.798)	0.311		0.296	Retained

No.	Item of DKAT2-M	Mean (SD)	Factor 1 (Support and Care)	Factor 2 (Dementia and Its Progress)	Communalities	Interpretation
	others to understand that person's needs. **Apabila penghidap demensia berada pada tahap akhir (demensia teruk), ahli keluarga boleh membantu orang lain memahami keperluan mereka.**					
11	People who have dementia may develop problems with visual perception (understanding or recognizing what they see). **Penghidap demensia mungkin boleh mengalami masalah persepsi visual (mengenali apa yang dilihat).**	1.47 (0.798)		0.448	0.408	Retained
12	Sudden increases in confusion are characteristic of dementia. **Peningkatan tahap kekeliruan yang mendadak adalah salah-satu tanda demensia.**	1.36 (0.720)		0.441	0.375	Retained
13	Uncharacteristic distressing behaviors (for example, aggressive behavior in a gentle person) may occur in people who have dementia. **Perubahan tingkah laku yang tidak biasa (seperti menjadi agresif walaupun biasanya bersikap lemah lembut) boleh berlaku dalam**	1.34 (0.708)		0.403	0.382	Retained

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No.	Item of DKAT2-M	Mean (SD)	Factor 1 (Support and Care)	Factor 2 (Dementia and Its Progress)	Communalities	Interpretation
	kalangan penghidap demensia.					
14	Difficulty swallowing occurs in late-stage dementia. **Kesukaran untuk menelan berlaku pada tahap akhir demensia (demensia teruk).**	1.98 (0.924)	0.35		0.564	Retained
15	Movement (for example, walking or moving in a bed or chair) is limited to late-stage dementia. **Pergerakan penghidap demensia (seperti bergerak ke katil) adalah terbatas pada tahap akhir (demensia teruk).**	1.76 (0.899)	0.502		0.486	Retained
16	Changing the environment (for example, putting on a CD, opening or closing the blinds) will make no difference to a person who has dementia. **Mengubah persekitaran (seperti membuka dan menutup langsir) tidak memberi sebarang perbezaan kepada penghidap demensia.**	1.85 (0.796)	0.409		0.213	Retained
17	When a person who has dementia is distressed, it may help to talk to them about their feelings. **Berbual tentang perasaan mereka dapat membantu**	1.32 (0.682)	0.58		0.404	Retained

No.	Item of DKAT2-M	Mean (SD)	Factor 1 (Support and Care)	Factor 2 (Dementia and Its Progress)	Communalities	Interpretation
	penghidap demensia apabila mereka berasa tertekan.					
18	It is important to always correct a person who has dementia when they are confused. **Apabila penghidap demensia berasa keliru, adalah penting untuk memperbetulkan mereka.**	1.40 (0.655)	0.618		0.535	Retained
19	A person who has dementia can often be supported to make choices (for example, what clothes to wear). **Penghidap demensia perlu sering dibantu untuk membuat pilihan (seperti memilih pakaian untuk dipakai).**	1.36 (0.631)	0.567		0.419	Retained
20	It is impossible to tell if a person who is in the later stages of dementia is in pain. **Sukar untuk mengetahui sama ada penghidap demensia tahap akhir (demensia teruk) dalam kesakitan.**	1.74 (0.896)	0.533		0.305	Retained
21	Exercise can sometimes be beneficial to people who have dementia. **Senaman kadangkala memberikan manfaat kepada penghidap demensia.**	1.37 (0.749)	0.356		0.376	Retained

Note. SD = standard deviation. Factor loadings below the reporting threshold are not displayed.

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Reliability Analysis

Item Selection, Internal Consistency, and Test-Retest Reliability

The internal consistency reliability of the DKAT2-M was assessed using Cronbach's alpha coefficient (α). The overall scale demonstrated good internal consistency (α = 0.868), which is higher than the reliability reported for the original DKAT2 (α = 0.79), indicating satisfactory reliability of the Malay version of the instrument. At the domain level, the Support and Care factor (12 items) demonstrated acceptable internal consistency (α = 0.756), while the Dementia and Its Progress factor (9 items) showed good reliability (α = 0.804). These findings suggest that the items within each domain consistently measure the intended constructs of dementia knowledge among caregivers (see Table 3) (Hajjar, 2018; Rejab et al., 2022; Tavakol & Dennick, 2011).

Test-retest reliability was assessed in a subsample of 30 caregivers using Cohen's Kappa, and the analysis demonstrated good test-retest reliability. The kappa coefficients ranged from 0.568 (95% CI: 0.307–0.829) to 0.786 (95% CI: 0.386–1.000), indicating moderate to substantial agreement across items. All kappa values were statistically significant ($p < 0.001$), confirming the instrument's stability over time (Gwet, 2001; McHugh, 2012).

The psychometric evaluation of the DKAT2-M established strong construct validity and satisfactory reliability. The EFA supported a clear two-factor structure: Support and Care, and Dementia and Its Progress, representing the theoretical dimensions of the construct. The combination of acceptable internal consistency and stable test-retest reliability confirms the DKAT2-M as a robust and culturally appropriate instrument for assessing dementia knowledge among Malaysian caregivers.

Table 3. Internal Consistency of the Items

Construct	N Items	Cronbach's α	Interpretation	Original Cronbach's α
Overall	21	0.868	Good	0.79
Support and Care	12	0.756	Acceptable	
Dementia and Its Progress	9	0.804	Good	

Note. N = number of items; α = Cronbach's alpha.

4. Discussion

This study provides robust evidence supporting the cross-cultural validity and reliability of the DKAT2-M. The findings align with the original DKAT2 and its subsequent adaptations in Greek, German, Spanish, and Brazilian Portuguese, reinforcing the instrument's stability across diverse linguistic and cultural settings. The original DKAT2 was conceptualised around two primary domains: Dementia and Its Progress, and Support and Care, reflecting the essential knowledge required for effective caregiving (Toye et al., 2014). The factor structure of the DKAT2-M is broadly consistent with these domains, with items related to disease mechanisms and clinical features predominantly loading onto the Dementia and Its Progress factor, while items concerning management strategies and caregiver responses cluster under the Support and Care factor.

Although the retained two-factor solution explained 30.8% of the total variance, this proportion is considered acceptable in behavioural and social science research, where complex psychological constructs are influenced by multiple underlying factors and lower proportions of explained variance are common (Hair et al., 2019; Costello & Osborne, 2005). Furthermore, a similar proportion of explained variance (30.8%) was reported in the Malay validation of the Communication Skills Attitude Scale (CSAS-Malay), which demonstrated acceptable construct validity and reliability (Mohamad-Isa et al., 2021).

The assignment of items in the DKAT2-M was guided by these distinct dimensions. Factor 2, representing Dementia and Its Progress, comprises Items 1–5, 7, and 11–13, which address foundational knowledge of aetiology, brain changes, and symptom development. The relatively higher loadings of these items on Factor 2 support their classification as representing foundational disease knowledge. In contrast, Factor 1, reflecting Support and Care, encompasses Items 6, 8–10, and 14–21, covering practical aspects like communication approaches, environmental modifications, and symptom management. The clustering of these items suggests that caregivers interpret these concepts within a care-oriented framework.

Although Items 6, 8, and 9 loaded onto a different factor than in the original DKAT2 structure, the overall conceptual domains remained consistent with the theoretical framework of the original instrument. Items 6 (Only older adults develop dementia), 8 (Incontinence always occurs in the early stages of dementia), and 9 (Dementia is likely to limit life expectancy) loaded under Factor 1: Support and Care in the DKAT2-M, whereas these items were originally categorised under Factor 2: Dementia and Its Progress. Their stronger loadings on the Support and Care factor suggest that Malaysian caregivers may contextualise the age onset of dementia, incontinence symptoms and life expectancy of PLwD in terms of support and care. This shift may reflect differences in how caregivers interpret disease-related knowledge within the context of caregiving and practical support. Minor variations in item distribution are commonly observed in cross-cultural adaptation studies due to linguistic, cultural, and contextual influences (Cruchinho et al., 2024).

Although Item 6 had a relatively low communality of 0.182, it demonstrated an acceptable factor loading of 0.514. Following discussion, the expert panel recommended retaining the item because it addresses an important misconception regarding the age at which dementia may develop. Some caregivers may incorrectly perceive dementia as a condition that occurs exclusively in older adults, despite the possibility of younger-onset dementia. Retaining the item therefore preserved an important aspect of the instrument's content coverage.

The sociodemographic profiles of the DKAT2-M and the Brazilian DKAT2 cohorts exhibit both cross-cultural parallels and distinct regional variations. While female caregivers predominated in both studies, the Malaysian sample (75.7%) showed greater gender diversity than its Brazilian counterpart (93.3%). Regarding caregiver kinship, adult children constituted the largest group in both the DKAT2-M and Brazilian samples. Nevertheless, the Malaysian sample demonstrated greater heterogeneity, with children accounting for 45.6%, other relatives for 41.7%, and spouses for 12.7%, compared with the more child-dominant Brazilian sample, in which 56.7% of caregivers were adult children. Caregiving duration was largely consistent, with the Brazilian mean of 4.7 years

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aligning with the majority of Malaysian caregivers (79.7%) who had served for 1 to 5 years. However, the Malaysian cohort reported high caregiving intensity, with 60.8% providing more than 9 hours of daily care, a metric not explicitly detailed in the Brazilian study. While both cohorts reflect the gendered nature of informal care, the DKAT2-M sample highlights a more diverse caregiver composition and substantial daily demands, both of which may uniquely shape dementia knowledge and caregiving experiences in the Malaysian context.

The DKAT2-M demonstrated good psychometric properties that were comparable with those reported in previous cross-cultural adaptations of the DKAT2. While the original tool reported acceptable internal consistency (Cronbach's $\alpha = 0.79$), the DKAT2-M achieved a higher coefficient ($\alpha = 0.868$). This value was also higher than that reported in the German ($\alpha = 0.78$), Spanish ($\alpha = 0.76$ for nursing professionals and $\alpha = 0.83$ for students), and Greek ($\alpha = 0.68$) adaptations (Gkioka et al., 2020; Parra-Anguita et al., 2018; Teichmann et al., 2022). Differences in psychometric performance across studies may reflect variations in study populations, sampling methods, educational backgrounds, and caregiving experience. For example, the German adaptation was validated in the general population, the Greek version among psychology students, and the Spanish version among nursing professionals and students, whereas the DKAT2-M was validated among informal dementia caregivers who were actively involved in day-to-day care (Gkioka et al., 2020; Parra-Anguita et al., 2018; Teichmann et al., 2022). Consequently, the greater relevance of the questionnaire items to caregivers' lived experiences may have influenced response consistency and internal consistency estimates. Furthermore, the Brazilian Portuguese adaptation, which also targeted caregivers, demonstrated good psychometric performance but was validated in a relatively small sample ($n = 30$) (Piovezan et al., 2018). In comparison, the present study included a substantially larger caregiver sample, providing more robust evidence for the reliability and construct validity of the DKAT2-M among Malaysian informal dementia caregivers.

The high content validity indices of the DKAT2-M highlight the rigour of the expert-driven cultural adaptation process. By involving multidisciplinary experts and a caregiver representative, the instrument achieved not only semantic equivalence but also profound cultural relevance. A primary strength of this study is its large sample size ($n = 355$), which provided sufficient power for robust factor analysis and enhanced the cohort's representativeness. Additionally, the systematic validation approach, encompassing content, face, and construct validity, as well as reliability testing, supports the instrument's overall psychometric integrity. Furthermore, the "Yes/No/Don't know" response format remained consistent across all versions, proving to be a culturally effective structure that minimises cognitive burden for respondents with varying educational backgrounds.

In addition, the DKAT2-M demonstrated moderate to substantial test-retest agreement across items (Cohen's $\varkappa = 0.568$–0.786). Although this was lower than the excellent test-retest reliability reported for the German adaptation (Intraclass Correlation Coefficient, ICC = 0.918), it was comparable to and slightly higher than that reported for the Greek adaptation (ICC = 0.630), supporting the instrument's temporal stability (Gkioka et al., 2020; Parra-Anguita et al., 2018; Teichmann et al., 2022).

However, several limitations should be acknowledged. The use of convenience sampling from two tertiary geriatric clinics may have introduced selection bias, as the

sample may underrepresent caregivers from rural areas, those with limited access to healthcare, and those from different cultural or socioeconomic backgrounds. Therefore, the findings may not be fully generalisable to all dementia caregivers in Malaysia. In addition, confirmatory factor analysis was not performed, and parallel analysis was not conducted because it was not included in the original analysis plan. Although parallel analysis is increasingly recommended as an additional factor-retention method, the present study relied on the scree plot, conceptual interpretability, and consistency with the original DKAT2 framework, which are recognised approaches in exploratory scale development.

5. Conclusion and Recommendations

The DKAT2-M demonstrated satisfactory psychometric properties, including excellent content and face validity, good internal consistency, and acceptable test–retest reliability. Exploratory factor analysis supported a two-factor structure comprising Dementia and Its Progress and Support and Care, which was conceptually consistent with the original DKAT2 framework. The instrument was also found to be clear, culturally appropriate, and comprehensible among informal dementia caregivers attending tertiary geriatric clinics in Malaysia.

These findings support the potential use of the DKAT2-M for assessing dementia-related knowledge among similar caregiver populations in Malaysian clinical and research settings. Future studies should confirm the factor structure using confirmatory factor analysis and parallel analysis, assess measurement invariance across relevant demographic and cultural groups, assess responsiveness and validate the instrument among rural, community-based, and more socioeconomically diverse caregiver populations.

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Ethical Considerations: The study adhered to the Declaration of Helsinki and received ethical approval from multiple boards. Primary approval was obtained from the UiTM Faculty Ethics Research Committee (7 November 2024; Ref: REC/11/2024 [PG/MR/549]), followed by the Ministry of Health Malaysia Medical Research and Ethics Committee (16 December 2024; NMRR ID: 24-03494-W6I [IIR]) and the UMMC Medical Research Ethics Committee (21 May 2025; Ref: 2025122-14637). Operational permissions were granted by HKL and UMMC, and formal authorisation to use the study instruments was obtained from the original developers and copyright holders.

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