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Activity Card Sort's existence and execute in various languages and versions: A scoping review

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ABSTRACT

Background: Activity Card Sort (ACS) measures patient activity participation, especially in older adults. It was developed to evaluate instrumental, social, and leisure activities of low and high demand in various populations. Transferring an ACS tool between diverse settings is challenging due to significant socio-economic, linguistic, and environmental impacts. Hence, to tailor ACS tools to a specific society's socio-cultural context, comprehension of the accessible validated ACS tools and their psychometric attributes is essential.

Objective: This scoping review was conducted to explore the availability of the ACS tool and to summarize the psychometric properties, such as the reliability and validity, of different languages and versions of ACS available worldwide.

Materials and methods: A search was performed in PubMed, PsycNET, Cochrane, and Embase. Two independent reviewers conducted the screening process and extracted the data. The total sample included 370 articles, of which 26 studies met the inclusion criteria, providing information on psychometric properties. English and non-English versions (Arabic, Dutch, and Spanish) in different populations were included.

Results: Among the 26 studies in this review, most ACS studies used the English version (62.5%). All the reported studies revealed "good" internal consistency, in which the Cronbach's alpha (α) ranges between 0.61 and 0.91. Test-retest reliability was measured using ICC values ranging from 0.78 to 0.98 for numeric data and Kappa statistics for binary data. Two studies used Kappa statistics to test the reliability, which ranged from 0.48 to 0.85 for all domains, indicating moderate to good reliability. Measures of content validation, face validity, concurrent, convergent, and discriminative validity were also reported.

Conclusion: Good psychometric properties were reported. No study is available on the Indian population using the ACS tool. Hence, developing and validating an ACS tool for the Tamil Nadu population is needed.

Introduction

The Activity Card Sort (ACS) is a useful occupational therapy tool used to measure the impact of health conditions on participation in activities.[1] The ACS is a robust and consistent measure of involvement for older people and children.[2] It can be used to gather information on a patient's activity patterns, which can assist in establishing routines and encouraging participation in meaningful activities. The ACS has shown increased engagement in instrumental, social, and leisure activities in patients following a stroke when occupational therapy interventions based on occupations were used with specific

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task training.[1] The ACS is a newly established tool that serves as a standardized evaluation tool to measure the quantity and quality of physical activity and the degree of participation in various activities.[3] The domains of ACS include instrumental activities of daily living (IADL) which are essential to preserve self and property, social activities (SC), and both high-demand leisure activities (HDL) that require physical strength, and low-demand leisure activities (LDL).[2]

Adapting an ACS tool from one setting to another, particularly when the settings are vastly different, poses significant challenges. The influence of socio-economic, linguistic, and environmental factors on specific life dimensions is considerable. Consequently, it is imperative to tailor the activities of ACS tools to the socio-cultural context of a specific society. The importance of understanding participation in social activities cannot be overstated, given their direct impact on physical and mental health, as well as well-being perception.[4] India, a developing country, is in the process of analyzing the psychometric properties of this ACS tool. Language serves as a crucial parameter for homogeneity within a population group. Tamil Nadu, the tenth-largest Indian state by area and the sixth-largest by population is predominantly Tamil-speaking.[5] The state is renowned for its rich traditional culture, including the Bharatanatyam dance style, cultural festivals like Pongal and Jallikattu, and unique attire such as dhoti and saree. The participation in daily activities in Tamil Nadu is likely to differ from that in Western populations due to its distinct culture and language. The current scoping review aims to investigate the availability of validated ACS tools for adults in the Tamil Nadu population and summarize the key aspects, including the psychometric properties (reliability and validity) of different languages and versions of ACS available globally. This understanding will facilitate the development of a new ACS for specific conditions in the Tamil Nadu population.

Methods

Study design

This scoping review is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR).[6]

Information sources and search strategy

The search strategy was constructed following the recommendations of the peer review of the Electronic Search Strategies 2015 guidelines.[6] This scoping review included all the published articles on the development of ACS under different conditions and in different cultures. The articles were retrieved from the following electronic databases: MEDLINE/PubMed, Cochrane, Embase, and PsycNET (Includes PsycINFO, PsycBOOKS, PsycARTICLES, PsycTESTS, and PsycTherapy video library). The keywords used in the search included "activity card sort" [Mesh Terms], "activity card sort" [All Fields], "activity card sort" [Title/Abstract], "activity card sort" [All Fields], or "activity card sort" [Title/Abstract].

The articles were then screened for their titles, abstracts, and index terms. A medical librarian (Mr. P) was involved in finding the most appropriate Medical Subject Headings terms for the search and modifying them for the databases used. Based on this exploratory scoping phase, the search strings for each database were finalized. A total of 370 articles were retrieved from all databases. Finally, all retrieved articles from each database were imported into reference management software.

Eligibility criteria

The following inclusion and exclusion criteria were established to focus our review on the availability of validated ACS tools.

Inclusion criteria

1. Studies reporting reliability and validity of Activity Card Sort
2. Articles published from 2003 to through June 30th, 2023
3. All original research studies were included.

Exclusion criteria

Multiple studies of the same version of the ACS tool were excluded.

Study selection

A team of two independent reviewers (JC and XX) consolidated the search results on the different databases. Reviewers screened the titles and abstracts of the articles to exclude those that did not meet the eligibility criteria. At this stage, the divergences were resolved by consensus between the two reviewers. In case of doubt, the study was selected for further evaluation. The full-text article was retrieved for those articles included under level 1 screening. Three categories (yes, no, and maybe) were used to select the full text for inclusion. Consequently, conflicts were resolved by a third reviewer (JS). The final decision to include articles for the data extraction process proceeded only after majority agreement across the team.

Data collection and charting

Data were extracted based on a consistent format for each study. For each article, two reviewers extracted information regarding author details, year of publication, language version, country of study, measurement properties, and ACS version. The extracted data was charted in Microsoft Excel. Discrepancies in the data extracted were negotiated until a consensus was reached. In addition, information on the demography of the study population and age group was also extracted. Based on the data extraction model, the reviewers independently extracted and plotted the data for each article.

Synthesis of results

Each article was analyzed and summarized based on study objectives and outcomes (measurement properties) in a table format.

Result

The research examining psychometric properties has disclosed cross-cultural adaptations, inter- and intra-examiner agreement analysis, internal consistency, reliability, and validity.

Figure 1 shows the results of this scoping review study's search and screening process. A total of 208 records after the removal of duplicates were screened for level 1 (title/abstract) screening. A full-text review (level 2 screening) was completed for 75 articles, of which only 26 met this study's inclusion criteria. The remaining 49 articles were excluded as they did not fall under inclusion criteria, and the same version of ACS was used in multiple studies.

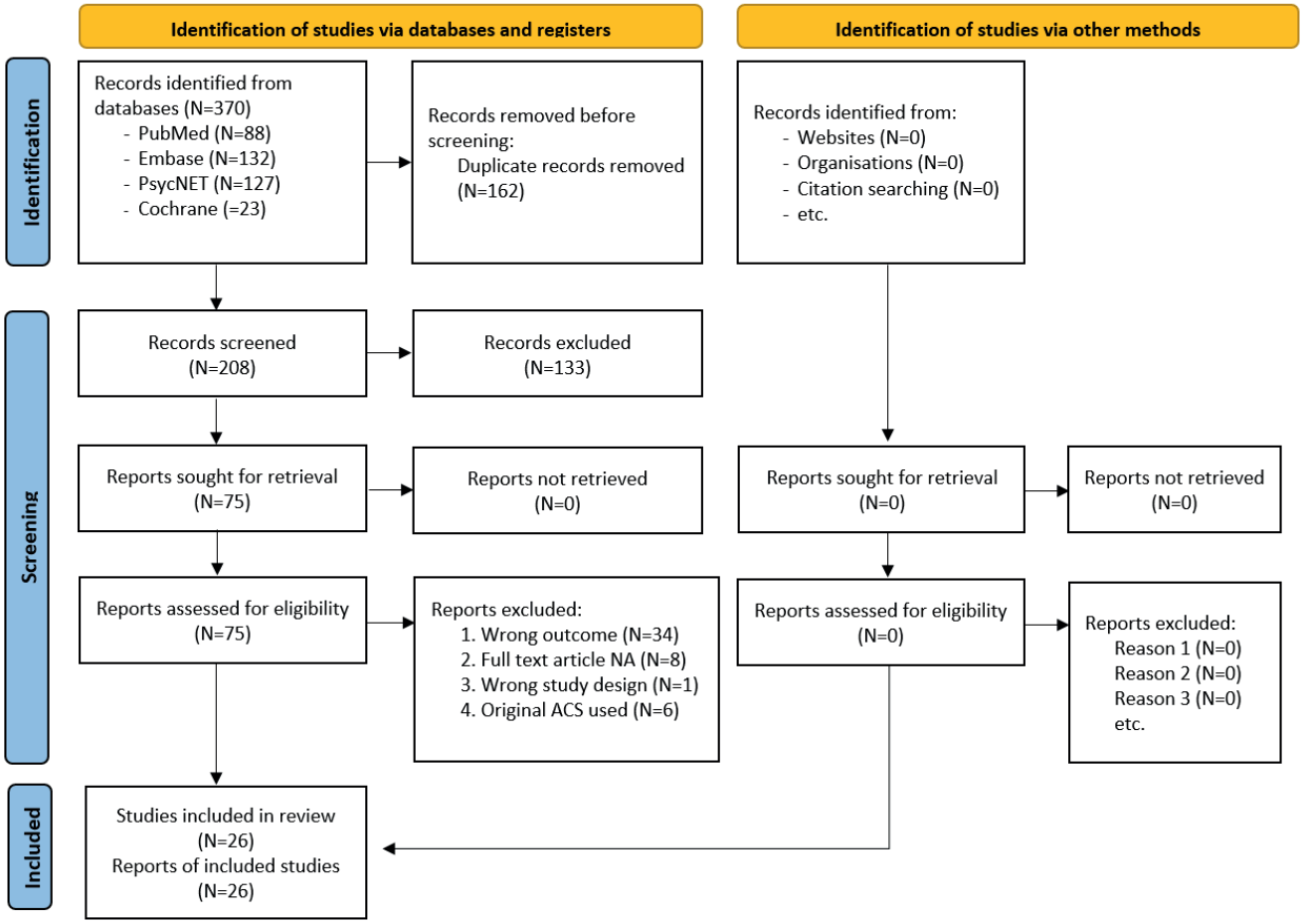

Figure 1. *Flow chart of article selection process.*

Characteristics of the selected study

According to this scoping review, seven distinct variations of the ACS version have been identified, each available in a different language: English, Spanish, Arabic, Puerto Rican Spanish, Dutch, Chinese (Hong Kong), and Israeli. The availability of these versions in different locations is documented in Table 1. While the ACS is predominantly accessible in English, it has also been implemented in several countries, reflecting cultural diversity. These countries include the United States of America (USA), Australia, Lebanon, the Netherlands, the United Kingdom (UK). The ACS has been most extensively studied and utilized in the USA. Studies have yet to be conducted in regional languages within India.

Table 1. Summary of location, language, and version of ACS among included studies.

Location study	Language -Version						
	Israeli	**Chinese HK**	**English**	**Spanish**	**Arabic**	**Puerto Rican Spanish**	**Dutch**
Israel Katz *et al*.[7]	Israeli-adapted ACS						
Hong Kong Chan *et al*.[11]		ACS-HK					
US Berg *et al*.[14] Stoffel *et al*.[20] Orellano *et al*.[8] Gronski *et al*.[27] Berg *et al*.[12] Mc Collum *et al*.[13] Hoyt *et al*.[17] Tyminski *et al*.[18] Hoyt CR *et al*.[10] Boone AE *et al*.[24]			PACS PACS AYA-ACS AYA-ACS ITACS ACS-AIP ITACS ACS3 Electronic version	PACS		PR-ACS	
Australia Doney *et al.*[19] Tse,T *et al*.[9] Gustafsson *et al*.[29] Gustafsson *et al*.[30]			ACS-Aus ACS-Aus ACS-Aus ACS-App				
Lebanon Lyons *et al*.[25]			m-ACS				
Netherland Jong *et al*.[26] Poerbodipoero *et al*.[22] Leenders *et al*.[31]							ACS-NL ACS- NL ACS- NL
UK Laver-Fawcett *et al*.[2] Laver-Fawcett *et al*.[28]			ACS-UK ACS-UK				
Jordan Hamed *et al*.[15] Hamed *et al*.[21] Malkawi *et al*.[16] Malkawi *et al*.[23]					A-ACS A-ACS Arab-PACS Arab-PACS		

Note: ACS: Activity Card Sort, ACS-HK: Activity Card Sort Hong-Kong Version, PACS: Pre-school Activity Card Sort, AYA-ACS: Adolescent and Young Adult Activity Card Sort, ITACS: Infant Toddler Activity Card Sort, ACS-AIP: Activity Card Sort: Advancing Inclusive Participation, ACS 3 electronic version: Activity Card Sort Electronic Version, ACS-Aus: Australian Activity Card Sort, ACS-AAP: Activity Card Sort with Adelaide Activity Profile, PR-ACS: Activity Card Sort Peurto-Rican Spanish Version, mACS: Activity Card Sort (modified), A-ACS: Arab heritage Activity Card Sort, ACS-NL: Dutch Activity Card Sort Institutional Version, ACS-UK: Activity Card Sort United Kingdom, Arab-PACS: Arabic Pre-school Activity Card Sort, Israeli-adapted ACS: Israeli-adapted Activity Card Sort.

Study population

Based on the data presented in Table 2, it can be observed that a significant proportion of the research incorporated a sample of individuals aged 60 years and older, commonly referred to as the geriatric population. The study included individuals from various age groups, including young, middle-aged, and elderly residents. The involvement of parents of preschool children (ages 3-6) and caregivers responsible for children aged 0-3 was observed in specific research investigations. One study was conducted on special populations, specifically homeless individuals, and rehabilitation inpatients. The study also considered individuals afflicted with various medical conditions, such as multiple sclerosis, neuromuscular illness, stroke, or those undergoing stem cell transplantation. A study was conducted on a diverse group, including healthy adults, caretakers, and patients with various diseases. The study included diverse participants, such as children diagnosed with autism spectrum disorder (ASD), pre-schoolers with disabilities, those experiencing developmental delays, and typically developing children.

Measurement properties

Twenty-six studies investigated reliability (test-retest reliability, interrater reliability, or internal consistency) along with its construct, convergent, content, face, and discriminative validity. The summary of measurement property data extracted for each study is shown in Table 2.

Table 2. Summary of psychometric properties of ACS among different age group and population.

S.NO	Author	Age group	Study population	Internal consistency (Cronbach's alpha)	Test reliability (ICC/KAPPA)	Validity measures
1	Katz *et al*.[7]	Average age between 47 to 75 years in various groups	Mixed population (Adults, caregivers, diseased)	Ranging from 0.61 to 0.82	NR*	NR*
2	Chan *et al.*[11]	65 years or older	Stroke patients	0.89: Good internal consistency	ICC; (α=0.98)	NR*
3	Berg *et al.*[14]	3 to 6 years	Preschoolers with disabilities	NR *	NR *	Content validity (To establish content validity, 10 nationally recognized pediatric occupational therapists reviewed the photograph)
4	Doney *et al*.[19]	60 to 95 years	Community-dwelling geriatric population	NR*	NR*	Moderate concurrent validity (r=0.434), Moderate convergent construct validity (r=0.354), and strong discriminative validity (p=0.000)
5	Stoffel *et al*.[20]	children between 3 to 6 years	Parents of preschool children	NR*	NR*	Moderate concurrent validity in self-care domains and low concurrent validity for mobility and social domains
6	Lyons *et al*.[25]	54 years	Patients scheduled to undergo Stem Cell Transplantation-Bone marrow	NR*	ICC (α= 0.86 to 0.96)	NR*
7	Hamed *et al*.[15]	Young and older adults	Jordanians from different age groups and socioeconomic classes	NR*	NR*	Two rounds of content validity (Ranking and reranking)
8	Orellano *et al*.[8]	Diseased: 50 years and above Normal: 60 years and older	Multiple Sclerosis patients and Well older adults - both Puerto Rican origin	0.91: high internal consistency	ICC; (0.82), good test-retest reliability	Good concurrent and construct validity
9	Jong *et al*.[26]	Median age: 77.5 Minimum age: 60 years	Special population (older rehabilitation)	NR*	ICC; inter-rater agreement (0.78 and 0.87) ICC; intra-rater agreement (0.79 and 0.89).	NR*

Table 2. Summary of psychometric properties of ACS among different age group and population (continued).

S.NO	Author	Age group	Study population	Internal consistency (Cronbach's alpha)	Test reliability (ICC/KAPPA)	Validity measures
10	Laver-Fawcett *et al.*[2]	65 years and older	Community-dwelling geriatric population	NR*	NR*	Content validity
11	Hamed *et al.*[21]	Younger: 20 to 60 years Older adults: 61+ years	Multiple Sclerosis patients	ICC; (α= 0.90), excellent internal consistency	ICC; (0.80), good test-retest reliability.	Moderate concurrent, convergent and discriminative validity
12	Gronski *et al.*[27]	3 to 6 years	Preschoolers with and without disability	NR*	ICC=0.93 for test-retest reliability and ICC=0.91 for inter-rater reliability	Internal validity with reliability coefficient (0.85-0.97)
13	Berg *et al.*[12]	17 to 25 years	Young adults	NR*	Moderate test-retest reliability with Kappa; (0.48-0.85) for all domains	Content validity and face validity was assessed
14	Malkawi *et al.*[16]	3 to 6 years	Parents of preschool children	NR*	NR*	Content validation performed using Delphi method
15	Poerbodipoero *et al.*[22]	42 to 87 years	Parkinson's disease (PD)	NR*	ICC; of USER-P (0.84) for the satisfaction scale	Good discriminative validity and poor convergent validity
16	Laver-Fawcett *et al.*[28]	>65 years	Community dwelling older adults	NR*	NR *	Good face validity and content validity were assessed
17	Tse,T *et al.*[9]		Stroke cohort	excellent internal consistency score for total retained participation (α=0.91) at 3 months and (α=0.89) at 12 months	NR*	Moderate to good concurrent and convergent validity (p<0.001) at 3 months and 12 months
18	Mc Collum *et al.* [13]	Young adults (18-25) and caring adults	Diagnosed with ASD	NR*	Excellent test-retest reliability (chores Kappa =0.74, social Kappa=0.72, education Kappa=0.85, And moderate agreement for health Kappa=0.48, leisure Kappa=0.48, and work Kappa=0.53) There was poor agreement for parenting Kappa=0.15	NR*
19	Malkawi *et al.*[23]	3 to 6 years.	Preschool children	ICC; (α=0.85), excellent overall internal consistency	ICC= 0.97, Good test-retest reliability	Moderate Construct and concurrent validity
20	Gustafsson *et al.*[29]	18 to 64 years	Adults	0.83: acceptable internal consistency	ICC;(0.92) acceptable parallel-form reliability	NR*

Table 2. Summary of psychometric properties of ACS among different age group and population (continued).

S.NO	Author	Age group	Study population	Internal consistency (Cronbach's alpha)	Test reliability (ICC/KAPPA)	Validity measures
21	Gustafsson *et al*.[30]	18 to 64 years	Community dwelling adults	NR*	ICC; (0.75), high test-retest reliability for overall retained activity	NR*
22	Hoyt *et al*.[17]	Caregivers of children 0-3 years	Caregivers	NR*	NR*	Content validation
23	Tyminski *et al*.[18]	20 to 70 years	Special population (homeless population)	NR*	NR*	Content validation and face validation
24	Hoyt *et al*.[10]	Caregivers of children's (0-3 years)	Caregivers of Children who were typically developing (TD) or had a developmental delay (DD)	High initial internal consistency (α=0.77 to 0.85)	Moderate test-retest reliability for total sample (ICC=0.73) and TD (ICC=0.73). Low test-retest reliability in DD cohort (ICC=0.62)	Moderate concurrent validity
25	Boone *et al*.[24]	Middle aged and older adults (mean=57.5)	General population	NR*	NR*	Good concurrent validity
26	Leenders *et al*.[31]	18-64 years	Patients diagnosed with neuromuscular disease	NR*	Excellent reliability (ICC=0.92) on retained activities	NR*

**NR: not reported*

Internal consistency and test-retest reliability

Various versions of ACS have been used to investigate its internal consistency using Cronbach's alpha and test reliability using ICC for numeric data and KAPPA statistics for binary data. Considering the internal consistency, among the 26 studies, only seven have reported Cronbach's alpha. All the reported studies revealed "good" internal consistency in which the Cronbach's alpha (α) ranged between 0.61 and 0.91.[7,8,9] Among the 26 studies, 12 revealed test reliability using ICC and were good to excellent overall. The moderate test-retest reliability was noted in the study by Hoyt in 2021 for the total sample (ICC=0.73) and typically developed (TD) (ICC=0.73), with low test-retest reliability in the developmental delay (DD) cohort (ICC=0.62).[10] A study by Chan *et al*. in 2006 showed the highest test reliability (ICC=0.98).[11] Two studies used Kappa statistics to test the reliability, which ranged from 0.48 to 0.85 for all domains, indicating moderate to good reliability.[12,13]

Content validity and face validity:

Eight studies have performed content validation with or without face validation (Table 3). To establish content validity, Berg *et al*. engaged ten nationally recognized pediatric occupational therapists to review a set of photographs.[14] These were also given to parents, who were asked to identify the most frequent activities after collecting 73 images. Content experts accepted 57 photos, and the parents accepted 58. The content validation for the A-ACS was conducted by a two-round process (Round 1: ranking and Round 2: re-ranking) with a cut-off score of mean 2, and 88 activities were selected.[15] Laver-Fawcett *et al*. conducted a content validity study to generate and select culturally relevant activity items for inclusion in the ACS-UK.[2] This was done through a two-round survey (Round 1: activity participation questionnaire, Round 2: review of round 1) with a cut-off score of <2. This process selected 73 activities in round 1 and 107 in round 2.

In another study, the participants were administered the 70 items of the AYA-ACS. Half of this group in this study were shown photographs, while the other half responded to line drawings. Content validation was measured by chi-square, and face validity was measured based on a score of 2 (some do it) and above, which is considered good face validity.[12] Content validation was performed using the Delphi method for validating the A-PACS and ITACS. A cut-off score of a mean of 1.75 was set to select 95 activities. The content validation index was set at 80 percent agreement among the experts in validating the photos. Forty-one items were finalized, respectively.[16,17] In a study by Tyminski *et al.* participants were presented with each card without a written caption and were asked to name the activity depicted.[18] After each response, the participant was verbally given the caption and asked whether they thought it depicted the activity. After the review, 76 validated line drawings were used. It was clear that the occupations occurring in this card sort were not available in other ACS.

Table 3. Summary of internal consistency, reliability, and validity measures among ACS.

Parameter	Number	Percentage (%)
Internal consistency (Cronbach's alpha)		
Not reported	18	69.20
Ranging from 0.61 to 0.82	1	3.85
0.89: good internal consistency	1	3.85
0.91: high internal consistency	1	3.85
0.83: acceptable internal consistency	1	3.85
High initial internal consistency (α=0.77 to 0.85)	1	3.85
ICC; (α= 0.85), excellent overall internal consistency	1	3.85
ICC; (α= 0.90), excellent internal consistency	1	3.85
excellent internal consistency score for total retained participation (α=0.91) at 3 months and (α=0.89) at 12 months	1	3.85
Test Reliability (ICC/KAPPA)		
ICC (α= 0.86 to 0.96)	1	3.85
ICC=0.93 for test-retest reliability and ICC=0.91 for inter-rater reliability	1	3.85
ICC; (0.82), good test-retest reliability	1	3.85
ICC; (α=0.98)	1	3.85
ICC; (0.80), good test-retest reliability	1	3.85
ICC; inter-rater agreement (0.78 and 0.87)	1	3.85
ICC; intra-rater agreement (0.79 and 0.89)	1	3.85
Kappa; (0.48-0.85) for all domains, moderate test-retest reliability	1	3.85
ICC; of USER-P (0.84) for the satisfaction scale	1	3.85
Kappa; (0.48-0.85) for all domains, excellent test-retest reliability	1	3.85
ICC=0.97, good test-retest reliability	1	3.85
ICC; (0.92) acceptable parallel-form reliability	1	3.85
ICC; (0.75), high test-retest reliability for overall retained activity	1	3.85
ICC; (α=0.73), moderate test-retest reliability for total sample	1	3.85
ICC; (α=0.92), excellent reliability on retained activities	1	3.85
Not reported	11	42.25
Validity measures*		
Content validity	8	29.63
Face validity	3	11.11
Concurrent validity	8	29.63
Convergent validity	4	14.82
Internal validity	1	3.70
Discriminative validity	3	11.11
Not reported	8	30.77

**some studies reported multiple types of validity.*

Concurrent and convergent validity

Eight out of 26 studies have demonstrated concurrent validity. The results ranged from good to moderate (Table 3). Concurrent validity testing demonstrated a significant but moderate *(r*=0.43) correlation between the ACS-Aus and the Adelaide Activity Profile (APP), an Australian Assessment of Activities.[19] Stoffel *et al*. showed moderate concurrent validity in self-care domains (*r*=0.73) and low concurrent validity for mobility (*r*=0.28) and social domains (*r*=0.51) in the Pediatric Evaluation of Disability Inventory (PEDI) compared to PACS total activity score.[20] The PR-ACS Spanish version demonstrated good concurrent and construct validity with health-related quality of life (*r*=0.66).[8] The ACS-NL in the overall sample showed weak cross-sectional correlations with the Canadian Occupational Performance Measure (COPM) performance score (*r*=0.19).[22] The ACS-Aus demonstrated moderate to good concurrent and convergent validity with the Stroke Impact Scale (SIS) participation score and modified ranking score (*r*=0.61).[9] In a study about concurrent validity, significant correlations were found between the A-PACS and the Vineland Adaptive Behavior Scale (VABS) in the communication domain (*r*=0.62), social domain *(r*=0.57), and motor domain (*r*=0.69).[23] ITACS demonstrated moderate concurrent validity with the Pediatric Evaluation of Disability Inventory-Computer Adaptive Test (PEDI-CAT) in the domain of mobility in the Developmental Delay (DD) group (*r*=0.34) and the domain of daily activities (*r*=0.27). However, there was no significant correlation among children in the typically developing (TD) group

(range=−0.012 to 012), indicating weak concurrent validity for the TD group.[10] In a study comparing the electronic version of the ACS (ACS3) with the original ACS, high correlations (Spearman's p values) were found across each of the four domains, including IADL, low-demand leisure activities, high-demand leisure activities, and social activities (r=0.83). A high correlation was also found for the total current activities score (r=0.86) between the ACS and ACS3 among middle-aged and older adults.[24]

The Personal Well-being Index (PWI), an Australian measure of subjective well-being (ASWB), was utilized to examine convergent construct validity, which resulted in moderate convergent validity (r=0.35).[19] The A-ACS showed a moderate correlation with the total scores of the Mayo-Portland Adaptability Inventory (MPAI) (r=0.45) and the total score on the Arabic version of the self-report Performance Assessment of Self-care Skills (A-PASS) (r=0.58).[21] The assessment and domains that were correlated with ACS are listed in Table 4.

Table 4. Correlation of ACS with other assessments and domains.

S.No	Activity Card Sort	Correlation with other assessments and domains
1	ACS-Aus[19]	Adelaide Activity profile (APP) Australian Assessment of Activities Personal Well-being Index (PWI) Australian Measure of Subjective Well-being (ASWB)
2	PACS[20]	Self-care, social, and mobility domains of the Paediatric Evaluation of Disability Inventory (PEDI)
3	PR-ACS[8]	Health-related Quality of Life
4	A-ACS[21]	Participation Index of Mayo-Portland Adaptability Inventory (MPAI) Arabic Version of the Self-report Performance Assessment of Self-care Skills (A-PASS)
5	ACS-NL[22]	Canadian Occupational Performance Measure (COPM)
6	ACS-AUS[9]	Stroke Impact Scale (SIS)
7	A-PACS[23]	Vineland Adaptive Behavior Scale (VABS)
8	ITACS[10]	Pediatric Evaluation of Disability Inventory-Computer Adaptive Test (PEDI-CAT) in the mobility domain and domain of daily activities
9	ACS-3[24]	Original ACS with domains of IADL, low-demand leisure activities, high-demand leisure activities, and social activities

Note: PACS : Pre-school Activity Card Sort, ITACS : Infant Toddler Activity Card Sort, ACS 3 Electronic Version : Activity Card Sort Electronic Version, ACS-Aus : Australian Activity Card Sort, PR-ACS : Activity Card Sort Peurto-Rican Spanish Version, ACS-NL : Dutch Activity Card Sort Institutional Version, Arab-PACS : Arabic Pre-school Activity Card Sort, A-ACS : Arab Heritage Activity Card Sort.

Discriminative validity

The most substantial evidence for the validity of the ACS-Aus was demonstrated through discriminative construct validity (p=0.000), as determined by an independent T-test analysis compared to existing measures of activity participation and quality of life.[19] The A-ACS could discriminate between patients and healthy participants based on current and retained levels of participation (F=5.09, p<0.0; F=6.01, p<0.02, respectively).[21] ACS-NL exhibited good discriminative validity.[22]

Discussion

In this scoping review, the psychometric measures of the ACS tool were critically reviewed and evaluated. The tool has been utilized across various populations and in different languages; the review aimed to explore the availability of a language-specific ACS. In the process, some key characteristics of existing ACS tools were summarized, including language, location of use, and the nature of the population studied. The review also attempted to summarize the instruments' internal consistency, reliability, and validity.

According to the review findings, English is the most common language version available. Other non-English language versions used included Arabic, Dutch, and Israeli. Most studies have been contributed by the USA and Australia, followed by Jordan, Puerto Rico, Spain, and the Netherlands. The study's key findings indicated that, in most cases, attempts were made to use the local language version of the tool, with a few exceptions. For instance, in one study by Stoffel *et al.* although the study was conducted in the USA, the authors used the Spanish version of the tool because the participants were Spanish-speaking.[20] Only in one study by Lyons *et al.* was the English language version used on a Lebanese population.[25] This indicates a strong inclination among scientists to prefer the local language version of ACS over the generic English version. Observing the instrument's internal consistency (the degree to which a test measures a single construct) and test-retest reliability (the degree to which the tool yields the same result on repeated tests) have provided us with an objective basis for preferring the local language version of the ACS. If the reported reliability parameters are poor in language-discordant

studies compared to language-concordant studies, we may conclude that language concordance increases the scientific quality of ACS. However, the study by Lyons *et al*. reported high internal consistency (α=0.86 to 0.96).[25] Since there is only one study on the discordance between the instrument's language and the native language, no meaningful conclusions can be drawn.

Three studies have used the Delphi method to report on content validation, the degree to which a test is model-based, and the involvement of experts in test design.[12,14,16] Studies have shown good to moderate concurrent validity, which is the extent to which the test measures a theoretical construct, with other instruments such as the Vineland Adaptive Behavior Scale (VABS),[23] ITACS with the Pediatric Evaluation of Disability Inventory-Computer Adaptive Test (PEDI-CAT),[10] and ACS-Aus with the Adelaide Activity Profile (AAP).[19] A few studies have also focused on how socioeconomic factors and cultural context affect the content validity of ACS leading to the deletion of some activities in the P-ACS study.[14,15] In this study discussed how activities varied according to the Spanish culture population compared to English-speaking people, based on differences in contexts and environments. Also, socioeconomic factors were clearly examined since they can create bias, leading to the elimination of some activities.[14] In another study, the A-ACS selected 19 activities specific to their cultures and socioeconomic status to determine the content validity of ACS. Some culturally irrelevant activities, such as gambling and betting, were removed from the A-ACS, and some activities in the leisure domains of A-ACS were modified. A few other ACS, such as ACS-HK and ACS-UK were also developed based on their respective cultures and languages.[2,11]

The scoping review also highlighted the versatility of the ACS tool for diverse population groups. The age range of population studies included preschool children, adolescents, community-dwelling adults, older adults, and the elderly without any specific health condition. The utility of the ACS instrument in special population groups, such as the homeless population and rehabilitation inpatients, highlighted the broader utility of ACS. The ACS instrument was primarily used for the disease conditions were chronic and degenerative conditions affecting the elderly and older adults. Stroke was the only acute condition with prolonged disability in which ACS was used. Another critical group study was caregivers of various conditions, such as those caring for pre-schoolers' and children aged 0-3 years.

Strengths and limitations

This study represents the first attempt to summarize the critical dimensions of all the available versions of the ACS tool, highlighting the gaps and setting an agenda for future research. The study's primary limitation was excluding non-English-language versions of the literature. As a result, a few other language versions of the tools may have been missed.

Recommendations

Given the potential for poor internal consistency and reliability, applying an English or non-native language version of the ACS could be better. Therefore, there is a need to develop and implement a local language version of the tool, and the different cultural contexts also impact the use of ACS in other cultures. Since we could not find any versions of the tool for the Tamil Nadu population in our comprehensive literature review, developing an ACS for this population is crucial. Additionally, it is essential to consider the composition of the target population and attempt to develop disease- or population-specific versions of the ACS.

Conclusion

Most of the studies indicated that the ACS had good psychometric properties. It was found that using ACS with different groups of people depends on their culture, and different versions of ACS were made for different medical conditions. Based on this identified gap, there is a need to conduct a study on the Indian population with specific population conditions.

Conflict of Interest

No conflict of interest to declare.

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