

# Validity of the Thai Version of Disability of the Arm, Shoulder and Hand Questionnaire (KKU-DASH) in Patients with Brachial Plexus Injury

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**Objective:** To assess the reliability and validity of the Thai version of the Disability of the Arm, Shoulder, and Hand (KKU-DASH) questionnaire in patients with brachial plexus injuries.

**Material and Method:** The Thai KKU-DASH version was performed based on translation/back translation methodology. Thirty-four Thai-speaking patients with brachial plexus injuries completed the KKU-DASH and the 36-item short-form health survey (SF-36) questionnaires preoperatively and then were reassessed for test-retest reliability two months later. Reliability was investigated for reproducibility and internal consistency. The validity was evaluated by using component analysis and the correlations coefficients between the KKU-DASH and the SF-36.

**Results:** The internal consistency of the degree of difficulty, severity of pain, and social activity domains of the KKU-DASH was good to excellent (Cronbach's alpha 1.00, 0.75, and 1.00). The intraclass correlation coefficient (ICCs) for the test-retest reliability was 0.52. For the degree of difficulty, severity of pain, social activity, and psychological effect on self-image, the ICC were 0.5, 0.45, 0.57, and 0.53 respectively. The convergent validity between the KKU-DASH and SF-36 was -0.76. The convergent validity of each domain between both instruments ranged from 0.46 to 0.69 and the strongest correlation was observed in the social activity domain.

**Conclusion:** According to the reliability and validity testing, the KKU-DASH questionnaire is suitable for Thai-speaking patients with brachial plexus injuries.

**Keywords:** Thai KKU-DASH, Brachial plexus injuries

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Brachial plexus lesions frequently lead to significant physical disability, psychological distress, and socioeconomic hardship. These lesions can result from a variety of etiologies, including birth injuries, penetrating injuries, falls, and motor vehicle trauma. Most of these injuries occur in males aged 15 to 25 years and some patients with this injury will experience persistent pain. Present surgical treatments have yielded superior outcomes to historical results. A better understanding of the pathophysiology of nerve injury and repair, as well as recent advances in microsurgical techniques, have allowed reliable restoration of elbow flexion and shoulder abduction, in addition to useful prehension of the hand in some cases. Appropriate

monitoring tools are needed to demonstrate treatment efficacy. Therefore, these tools have become an important part for evaluating the outcome of the management of patients who developed brachial plexus injuries. There are several measurement methods that have been used in clinical evaluations, most of them are region specific or disease-specific evaluations. The Disability of the Arm, Shoulder, and Hand (DASH) questionnaire is one of the methods for measuring the disability that can be used in these patients.

The DASH questionnaire was devised as a region-specific measure of health status by the American Academy of Orthopedic Surgeons<sup>(1-3)</sup>. It is now available in several languages<sup>(1,4-15)</sup>. The applicability of this questionnaire for the Thai population, however, is questionable because there is a difference in culture between Thais and people in the Western countries, where the questionnaire was originally developed. The objective of the present study

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was to develop a Thai version of the KKU-DASH and to evaluate its validity and reliability.

## **Material and Method**

### ***Development of the Thai version of the DASH***

The English version of the DASH was translated into Thai and synthesized after being reviewed and discussed by two of the orthopedic hand surgeons, one orthopedist, one physiatrist and one rheumatologist whose the first language was Thai. In terms of cultural adaptation, the authors modified this Thai KKU-DASH version and translated it back into English by a language expert who had no medical background. The final Thai KKU-DASH version was then evaluated with regard to reliability and validity.

### ***DASH questionnaire***

The DASH contains the main part plus two optional modules concerning the ability to work and to perform sports or play musical instruments. The main part is a 30-item disability/symptom (DASH-DS) scale concerning the patient's upper extremity. Each item has five response choices, ranging from no difficulty to unable to perform an activity, which is scored on a scale 0 to 5. Item numbers 1 to 21 ask about the degree of difficulty when performing various activities because of arm, shoulder, or hand problems. Items numbers 24 to 28 ask about the severity of pain, activity-related pain, tingling, weakness, and stiffness. The items numbers 22, 23 and 29 ask about the effect of the upper extremity problem on social activities, work, and sleep. The final item number 30 assesses the psychological effect on self-image. The total DASH-DS score ranges from 0-100 after the summation and transformation of all items. The four experts were two hand surgeons, an orthopedist, and a physiatrist from the Faculty of Medicine, Khon Kaen University. They were asked to evaluate the face and content validity of the Thai KKU-DASH version. Each expert rated each item as either 1 (agreed), 0 (undetermined), or -1 (disagreed). The index of content validity (ICV) for each item was calculated using the summation of scores from each expert divided by the number of experts.

### ***Patients and setting***

Thirty-five patients who had brachial plexus injuries were included in the present study. All patients had no systemic involvements, spinal disease, or lower extremity diseases. After informed consent was obtained from the patients to participate in the present study, they completed the Thai KKU-DASH-DS

questionnaire and the 36-item short-form health survey (SF-36). The data were collected from the 34 patients' questionnaires twice preoperatively and 2 months after surgery. One patient did not complete the SF-36 on the second data collection and was excluded from the present study.

### ***Assessment of validity and reliability***

Convergent validity was evaluated in 34 patients with brachial plexus injuries by comparing the scores of the KKU-DASH questionnaire with those of the SF-36. Reliability was investigated by looking at the reproducibility and internal consistency based on the test-retest method. Convergent validity was analyzed using Spearman's correlation. The test-retest reliability was analyzed using Spearman's correlation and intra-class correlation. The internal consistency was measured using Cronbach's  $\alpha$ . Statistical analyses were performed using SPSS 11.0 for Windows (SPSS, Chicago, IL, USA). A p-value < 0.05 was considered statistically significant.

## **Results**

### ***Patients' data***

Thirty-four patients who had brachial plexus injuries were included in the present study. There were 33 male and one female, 27 patients were right-handed. Twenty-five patients had injuries on the dominant hand. The type of brachial plexus injuries was complete in 29 patients and incomplete in five patients. Ten cases were patients who already had been operated on before filling out the questionnaire and the rest were patients who completed the questionnaires before and 2 months after operations (Table 1).

### ***Questionnaire development phase***

The back-translated version of KKU-DASH was compared with the original English version. All of the 30-items of the KKU-DASH questionnaire had face validity, according to the content experts' opinions. The ICVs of all 30 items are shown in Table 2. Question 20 that had an ICV of 0 was removed as being irrelevant. As a result, the present version of KKU-DASH contained 29 items with the ICV ranging from 0.75-1.00.

### ***Completeness of questionnaires***

All patients had no difficulty in completing the Thai KKU-DASH questionnaire and they found that this questionnaire was explicit and understandable. No patient failed to respond to any item. The means

**Table 1.** Patient characteristics

Male (n)	33
Female (n)	1
Mean age (range in years)	28.62 (16-50)
Dominant hand (n)	Right = 27 Left = 7
Pathology (n)	Right = 21 Left = 13
Type of injury (n)	Complete total arm = 29 Upper arm = 5
Time between the interviews	8 weeks
Mean KKU-DASH	First interview = 64.56 ± 21.59* Second interview = 60.94 ± 24.06
Mean SF 36	First interview = 44.14 ± 16.47** Second interview = 46.77 ± 21.33

\* p = 0.38, \*\* p = 0.46

and standard deviations of Thai KKU-DASH and the SF-36 scores are shown in Table 1.

The means scores for KKU-DASH of each domain are presented in Table 3. No patient recorded the minimum zero score of the SF-36 and all domains of KKU-DASH except for one patient in the social activity category. No patient recorded maximum score of 100 in the SF-36 questionnaire. However, some patients recorded the maximum score in each domain of the KKU-DASH questionnaire (Table 4).

#### **Reliability and validity**

The internal consistency using Cronbach's  $\alpha$  for each of the three domains were calculated for each of three domains by eliminating each item, one by one, the results were 1, 0.75 and 1 for degree of difficulty, severity of pain and social activity, the fourth domain had only one item therefore it was not calculated. No domains were found to change the internal consistency substantially.

Questionnaire test-retest reliabilities for each domain were assessed using the intra-class correlation coefficient (ICC) and Spearman Rho. The period between the first and second tests was 2 months.

The overall reliability measured by the intra-class correlation of the KKU-DASH first and the second interviews was 0.52 and the reliabilities of the degree of difficulty, severity of pain, social activity, and psychological effect on self image were 0.51, 0.45,

0.57, and 0.53 respectively. Moreover, the reliabilities of the degree of difficulty, severity of pain, social activity, and psychological effect on self-image based on Spearman Rho tests were 0.41, 0.41, 0.56, and 0.71 respectively. All ICCs and Spearman Rho calculations indicated mild reproducibility (Table 5).

The convergent validity between the KKU-DASH and SF-36 was -0.76. The convergent validity of each domain between both instruments ranged from 0.46 to 0.69 (Table 6). The strongest correlation was observed in the social activity domain. The degree of difficulty domain of both instruments had the weakest correlation. The results indicate that the Thai KKU-DASH version and the SF -36 have moderate negative convergent validity ( $r = -0.76$ ).

#### **Discussion**

The Thai KKU-DASH version was performed following a systematic standardized approach. The KKU-DASH score consisted of a 30-item scale; the patients complied and responded to this questionnaire without any difficulty. Most of them were young, active patients. The mean scores of the first and second interviews were not different in both KKU-DASH and SF-36. Eight weeks after surgical intervention was too short to detect the clinical differences.

In the process of content validity, the item 20 was removed according to the experts' opinion in that getting from one place to another may not be relevant to patients with brachial plexus injuries. The internal consistency of the Thai KKU-DASH version was good to excellent. McHorney and Tarlov suggested that internal consistency higher than 0.95 is necessary if a scale is to be used for tracking individual patients<sup>(11)</sup>. The KKU-DASH was comprised of only 29 items that had a good content validity as demonstrated by negligible floor and ceiling effects.

The KKU-DASH and SF-36 were moderately correlated in the same domains such as degree of difficulty, pain severity, social activity, and psychological effect of self-image. Among the pairs of the same domains, the social activity had the strongest correlation. There was less correlation between the different domains. Among the pairs of different domains, the pain severity to social activity had the strongest correlation. This finding means that pain and social activity may be closely related in the patients with brachial plexus injuries. The KKU-DASH was correlated to SF-36 with the Spearman Rho coefficient of -0.76. This magnitude of correlation was not different from the studies in other languages<sup>(1,2,4-15)</sup> (Table 7).

**Table 2.** ICV of the back translated 30-item Thai-DASH score

	Hand	Hand2	Ortho	PMR	ICV
1. Open a jar, making sticky rice	1	1	1	1	1
2. Writing	1	1	1	1	1
3. Turn a key	1	1	1	1	1
4. Prepare a meal	1	1	1	1	1
5. Push open a heavy door or push the heavy object such as table, cabinet ect.	1	1	1	1	1
6. Place an object on a shelf above your head	1	1	1	1	1
7. Wash walls, wash floors	1	1	1	1	1
8. Garden or do yard work	1	1	1	1	1
9. Make a bed	1	1	1	1	1
10. Carry a shopping bag	1	1	1	1	1
11. Carry a heavy object (over 5 kgs)	1	1	1	1	1
12. Change a light bulb overhead	1	1	1	1	1
13. Wash or blow dry your hair	1	1	1	1	1
14. Wash your back	1	1	1	1	1
15. Put on a pullover sweater	1	1	1	1	1
16. Use a knife to cut food	1	1	1	1	1
17. Recreational activities which require little effort (e.g. knitting, making baskets etc)	1	1	1	1	1
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g. hammering, digging the ground, etc)	1	1	1	1	1
19. Recreational activities in which you move your arm freely (e.g. Thai dancing, badminton, etc)	1	1	1	1	1
20. Getting from one place to another (go to the market)	0	0	0	0	0
21. Sexual activities	1	1	0	1	0.75
22. During the past week, to what extent has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?	1	1	1	1	1
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	1	1	1	1	1
24. Arm, shoulder or hand pain	1	1	1	1	1
25. Arm, shoulder or hand pain when you performed any specific activity	1	1	1	1	1
26. Pins and needles sensation in your arm, shoulder or hand	1	1	1	1	1
27. Weakness in your arm, shoulder or hand	1	1	1	1	1
28. Stiffness in your arm, shoulder or hand	1	1	1	1	1
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand?	1	1	1	1	1
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem	1	1	1	1	1

Scores: 1 = agreed, 0 = undetermined, and -1 = disagreed, ICV (index of content validity) = Summation of the scores from each expert divided by the number of experts (n = 4)

**Table 3.** Score of each domain of the first KKU-DASH

Domains of KKU-DASH	n	Means $\pm$ SD	Lower limit	Upper limit
Degree of difficulty	34	91.18 $\pm$ 22.45	40	120
Severity of pain	34	16.18 $\pm$ 4.14	8	25
Social activity	34	9.42 $\pm$ 2.96	3	15
Psychological effect on self-image	34	3.61 $\pm$ 1.17	1	5

KKU-DASH range from 0-100

**Table 4.** Ceiling and floor scores for KKU-DASH, SF36

Instrument scale	No.	No. (%) 100% ceiling scores	No. (%) 0% floor scores
SF-36	34	0	0
DASH	34	1 (2.94%)	0
Degree of difficulty	34	5 (14.71%)	0
Severity of pain	34	1 (2.94%)	0
Social activity	34	2 (5.88%)	1 (2.94%)
Psychological effect on self-image	34	10 (29.41%)	0

**Table 5.** The reliability of the 29-item KKU-DASH (n = 34)

Domains of KKU-DASH	Cronbach's $\alpha$ coefficient	Intra-class correlation	Spearman' Rho
Degree of difficulty	1.0	0.51	0.41
Severity of pain	0.75	0.45	0.41
Social activity	1.0	0.57	0.56
Psychological effect on self-image	NA*	0.53	0.71

\* This domain has only one item

**Table 6.** Correlation coefficients between KKU-DASH and SF-36

	SF-36	SF-36 degree of difficulty	SF-36 severity of pain	SF-36 social activity	SF-36 psychological effect on self-image
DASH	-0.76	-	-	-	-
Degree of difficulty	-	-0.46	-0.18	-0.22	-0.33
Severity of pain	-	-0.25	-0.5	-0.25	-0.26
Social activity	-	-0.28	-0.58	-0.69	-0.55
Psychological effect on self-image	-	-0.06	-0.2	-0.41	-0.49

**Table 7.** Internal consistency and reliability of various languages of DASH questionnaires compared with SF-36

Languages	Number	Spearman*	Cronbach's $\alpha$ coefficient	Types of patient	Authors
Italian	30	-0.27 to -0.70	0.90	Shoulder, elbow Carpal tunnel syndrome	Padual et al. 2002
Spanish	42	-0.85 to -0.97	0.95	Carpal tunnel syndrome	Rosales et al. 2002
Dutch	50	-0.98	0.95	Not mentioned	Veehof et al. 2002
Chinese	88	-0.29 to -0.74	0.92-0.97	Non-specific upper extremity conditions	Lee et al. 2004
Japanese	72	-0.29 to -0.73	0.962-0.967	Non-specific upper extremity conditions	Imaeda et al. 2005
KKU-Thailand	34	-0.76	0.90-1	Brachial Plexus injuries	Present

\*  $p > 0.05$

This is the first study, however, to test validity of Thai-version of DASH and the first study to validate the DASH in patients with brachial plexus injuries.

In the present study, the test was performed in patients who had brachial plexus injuries, which were chronic and had severe loss of upper extremity functions. The symptoms of the patients did not change during the period of the present study.

### Conclusion

According to Spearman Rho and Cronbach's  $\alpha$ , the authors think this form of questionnaire is suitable for Thai-speaking subjects with brachial plexus injuries. However, responsiveness of the questionnaire should be performed in a future study.

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### Potential conflict of interest

None.

### Ethical Consideration

The present study was reviewed and approved by the Khon Kaen University Ethics Committee for Human Research, based on the declaration of Helsinki and the ICH Good Clinical Practice Guideline HE500938.

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**ความเที่ยงตรงของแบบทดสอบความด้อยสามารถของแขน, ไหล่ และมือฉบับภาษาไทยในผู้ป่วยที่เส้นประสาทแมงคอคได้รับบาดเจ็บ**

สุรัตน์ เจียรณมงคล, วีระชัย ไควสุวรรณ, ธรา ธรรมโรจน์, มนุศักดิ์ บุญอาจ

**วัตถุประสงค์:** เพื่อศึกษาความน่าเชื่อถือ และความเที่ยงตรงของแบบทดสอบความด้อยสามารถของแขน, ไหล่ และมือฉบับภาษาไทยในผู้ป่วยที่เส้นประสาทแมงคอคได้รับบาดเจ็บ

**วัสดุและวิธีการ:** ผู้ป่วยที่เส้นประสาทแมงคอคได้รับบาดเจ็บจำนวน 34 คน ถูกทดสอบด้วยแบบทดสอบความด้อยสามารถของแขน, ไหล่ และมือฉบับภาษาไทยที่ถูกสร้างขึ้นโดยวิธีการแปลและแปลกลับโดยผู้เชี่ยวชาญด้านภาษาอังกฤษและผู้ใช้ภาษาไทยตามมาตรฐานของการสร้างแปลแบบทดสอบต่างภาษา (KKU-DASH) และแบบทดสอบ SF-36 2 ครั้ง ห่างกันไม่น้อยกว่า 2 เดือน เพื่อทดสอบความน่าเชื่อถือจากการวิเคราะห์ด้าน reproducibility และ internal consistency ส่วนความเที่ยงตรงของแบบทดสอบวิเคราะห์โดย correlations coefficients ระหว่าง KKU-DASH และ SF-36

**ผลการศึกษา:** ค่า internal consistency ของความลำบากในการทำงาน ความเจ็บปวด และกิจกรรมสังคม ของ KKU-DASH ดีถึงดีมาก (Cronbach's alpha 1.00, 0.75 และ 1.00) ค่า intraclass correlation coefficient ของความน่าเชื่อถือในการทำแบบทดสอบซ้ำ มีค่าเท่ากับ 0.52 ค่าความลำบากในการทำงาน ความเจ็บปวด กิจกรรมสังคม และผลกระทบต่อภาพลักษณ์ของตนเอง มีค่าเท่ากับ 0.5, 0.45, 0.57 และ 0.53 ค่า convergent validity ระหว่าง KKU-DASH และ SF-36 มีค่าเท่ากับ 0.76 ค่า convergent validity ของแต่ละหมวดการทดสอบ อยู่ในช่วงระหว่าง 0.46 ถึง 0.69 และมีความสัมพันธ์มากที่สุดหมวดของกิจกรรมทางสังคม

**สรุป:** จากการวิเคราะห์ค่าความน่าเชื่อถือและความเที่ยงตรงของแบบทดสอบความด้อยสามารถของแขน, ไหล่ และมือฉบับภาษาไทย (KKU-DASH) เหมาะสมและสามารถนำไปใช้ได้กับผู้ป่วยที่พูดภาษาไทย

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