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# Validity and Reliability of the Swedish Version of the Activities-specific Balance Confidence Scale in People with Chronic Stroke

*Anette Forsberg, PhD, RPT;* Ylva Nilsagård, PhD, RPT†‡*


## ABSTRACT

***Purpose:*** To evaluate the validity and reliability of the Swedish version of the Activities-specific Balance Confidence (ABC) scale in people >1 year after stroke. ***Method:*** In a multi-centre study design, using initial cross-sectional data collection with follow-up, the timed up-and-go (TUG) test, 10 m timed walk (10TW), and 6-Minute Walk Test (6MWT) were performed; ABC scale and Short Form 36 Health Survey (SF-36) were completed; and falls history data were collected during one session. One week later, the ABC scale was sent to participants for a second rating. Spearman correlation coefficients were calculated, and reliability was assessed via the intra-class correlation coefficient (ICC) and Cronbach alpha. ***Results:*** A convenience sample of 67 people was included (mean age 68 y). The median score for the ABC scale changed from 57 at the first rating to 43 at the second; 19 participants (28%) reported falls during the previous 3 months. Scores on the ABC scale were moderately correlated with the TUG ($r = -0.48$), 10TW ($r = -0.52$), 6MWT ($r = 0.45$), and SF-36 physical component summary score ($r = 0.43$). Internal consistency was high for the ABC scale at test and retest ($\alpha = 0.95–0.97$). The ICC was 0.82 (95% CI, 0.72–0.88). ***Conclusions:*** The Swedish version of the ABC scale is a valid and reliable measure for investigating balance confidence in people >1 year after stroke.


**Key Words:** postural balance; self-efficacy; stroke; validation studies; walking


## RÉSUMÉ

***Objectif :*** Évaluer la validité et la fiabilité de la version suédoise de l'échelle ABC (*Activities-specific Balance Confidence scale*) de confiance de la personne en son équilibre associé à des gestes de la vie quotidienne chez les personnes >1 an après un AVC. ***Concept :*** Collecte initiale de données transversales multicentres avec suivi à l'aide de l'échelle ABC en Suède. ***Méthode :*** Un test de locomotion TUG (*timed up-and-go*), 10 mètres de marche chronométrée (10MWT) et un test de marche de 6 minutes (6MWT) ont été effectués; une évaluation à l'échelle ABC et le questionnaire *Short Form 36 Health Survey* (SF-36) ont été réalisés; des données sur l'historique des chutes ont aussi été recueillies au cours d'une séance. Une semaine plus tard, l'échelle ABC a été envoyée aux participants pour une deuxième évaluation. Les coefficients de corrélation de Spearman ont été calculés, et la fiabilité a été évaluée à l'aide du coefficient de corrélation intraclasse (CCI) et du coefficient alpha de Cronbach. ***Résultats :*** Un échantillon de commodité de 67 personnes a été inclus (âge moyen: 68 ans). Le pointage moyen à l'échelle ABC est passé de 57 à la première évaluation à 43 lors de la seconde; 19 participants (28%) ont signalé des chutes au cours des trois mois précédents. Les pointages à l'échelle ABC affichaient une corrélation modérée avec le test TUG ($r = 0,48$), le 10 MWT ($r = 0,52$), avec le 6MWT ($r = 0,45$) et avec le pointage sommaire de la composante physique du questionnaire SF-36 ($r = 0,43$). La cohérence interne était élevée pour l'échelle ABC au test-retest ($\alpha = 0,95–0,97$). Le CCI était de 0,82 (I.C. de 95%, 0,72–0,88). ***Conclusions.*** La version suédoise de l'échelle ABC constitue un outil de mesure valable et fiable pour sonder la confiance en son équilibre chez les personnes >1 an après un AVC.


Reduced ambulatory activity levels are common in people after stroke, and balance deficits contribute to reduced ambulatory activity.[1] Walking capacity is often limited by physical limitations such as paresis, spasticity, and affected sensory functions that cause balance deficits. Actual walking performance can also be limited by mental functions, such as balance self-efficacy, regardless of physical capacity; this type of limitation can lead to reduced participation, and is therefore of interest to explore. Regaining walking capacity after stroke requires confidence in gait and balance as well as in handling near-fall events. Community-dwelling people with stroke

From the *Family Medicine Research Centre, Örebro County Council; †Centre for Health Care Sciences, Örebro University Hospital; and ‡School of Health and Medical Sciences, Örebro University, Örebro, Sweden.

**Correspondence to:** Anette Forsberg, Family Medicine Research Centre, P.O. Box 16 13, 701 16 Örebro, Sweden; anette.forsberg@orebroll.se.

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are at high risk of falling: reported fall incidence varies from 23% to 43%.[2–4] *Self-efficacy* is defined as a person's perception of his or her ability to perform a given task,[5] while *balance self-efficacy* corresponds to confidence in handling situations that may lead to a fall; in a prior study, decreased balance self-efficacy was found in people after stroke and partially explained the variation in physical function and perceived health status.[6] A commonly used measure of balance self-efficacy is the Activities-specific Balance Confidence (ABC) scale.[7]

The ABC scale, developed in Canada by Powell and Myers, consists of 16 items that present situation-specific tasks, both indoors and outdoors (e.g., standing on tiptoe and reaching for something above head level; walking on icy sidewalks).[7] Validated translations include Chinese,[8] French,[9] and British English.[10] A Swedish translation of the ABC scale was validated for persons in the acute and sub-acute phase of stroke[11] in a study that found moderate associations between the ABC scale and the timed up-and-go (TUG) test, the 10-metre timed walk (10TW), and the modified Rivermead Mobility Index (mRMI).[11]

Measures of self-rated balance confidence in performing indoor and outdoor tasks provide valuable information for clinicians involved in planning individual rehabilitation efforts. Such measures must have acceptable measurement properties and should be tested in the cultural and clinical setting in question. The ABC scale was first tested in older people,[12,13] and several studies have shown good psychometric properties for this group.[7,8,10,14] Both Botner and colleagues[15] and Salbach and colleagues[9] found the ABC scale to have acceptable measurement properties for people with stroke. Salbach and colleagues used the ABC scale with people living in the community in the first year after stroke and found high internal consistency ($\alpha = 0.94$) and moderate associations with the TUG, 6-Minute Walk Test (6MWT), and walking speed.[9] Botner and colleagues found the same high internal consistency for people >1 year after stroke onset,[15] as well as high test–retest reliability (ICC 0.85) and a moderate association with the Berg Balance Scale and walking speed.[15] However, the Swedish version of the ABC scale requires validation before it can be used in a clinical setting. In the present study, the focus was on people in the late phase of stroke, who are typically seen in primary health care.

Between-group differences, including gender differences, in scoring of the ABC scale have been described elsewhere.[9,10] Salbach and colleagues found significantly higher scores for men than for women;[6] in a study by Parry and colleagues, scores on the ABC scale distinguished between fallers and non-fallers.[10] We were interested in investigating both these differences in a Swedish sample. The overall aim of our study was to evaluate the validity and reliability of the Swedish version of the ABC scale in people >1 year after stroke onset. More specifically, our objectives were to investigate (1) cross-sectional convergent construct validity of the ABC scale; (2) known-groups validity (between fallers and non-fallers, and by gender and mobility status); (3) test–retest reliability of the ABC scale; and (4) internal consistency. Based on earlier studies,[9,15] our hypothesis was that correlations would be moderate between scores on the ABC scale and the TUG test,[16] the 10TW,[17] the 6MWT,[18,19] and subjective physical health status measured by the SF-36 physical component summary score.[20,21]

## METHODS

### Design

Multi-centre, cross-sectional data collection with follow-up for the Swedish version of the ABC scale was conducted at four primary health care centres in central Sweden from August 2009 to June 2010.

### Participants

A convenience sample of community-dwelling people with stroke was recruited at each primary health care centre. A research physiotherapist at each centre identified eligible patients through patient records. The research physiotherapists were not involved in the care of the patients they were recruiting. Eligibility criteria were as follows: diagnosis by a neurologist as first or recurrent stroke; >1 year since onset of most recent stroke; ability to walk 10 metres independently (consistent with at least Category 2 using the Functional Ambulation Classification);[22] and residence in the community. Exclusion criteria were dysphasia preventing understanding of the test procedure or difficulty understanding Swedish that prohibited the administration of the self-rating scales. Written information about the study was provided to potential participants.

The Regional Ethics Committee in Uppsala, Sweden, approved the study, and participants gave written informed consent. The study followed the principles of the Declaration of Helsinki.

### Procedure

All participants were assessed at one standardized test session by the research physiotherapist at each primary health care centre, who recorded data on demographic characteristics, other medical disorders, and self-reported number of falls during the previous 3 months. A fall was defined as an unexpected contact of any part of the body with the ground.[23] The physiotherapist was present and available for questions while participants filled in the rating scales at the test session. After 1 week, the Swedish version of the ABC scale was sent by mail to participants, who returned the questionnaire in an enclosed prepaid envelope. A reminder was sent to participants who had not returned the questionnaire within 2 weeks. Only one participant failed to return the questionnaire and was not included in the test–retest analysis; there were no missing items in any of the self-rating scales.

### Measures

Mobility status was classified according to the six grades (0 = cannot ambulate; 5 = independent) of the Functional Ambulation Classification (FAC).[22]

The mRMI was used to describe participants' walking ability and mobility status.[24] The mRMI consists of eight activities, scored from 0 (cannot perform) to 5 (independent) for a total score of 40: turning in bed, lying to sitting, sitting, sitting to standing, standing for 10 seconds, transfer from bed to chair, walking, and climbing stairs.

The TUG test was developed to assess functional mobility in elderly people.[16] In our study, the time taken to rise from a chair, walk quickly but safely 3 m, turn, walk back, and sit down was measured. Each participant performed one practice trial and then a second trial for which the time was recorded.

The 10TW is a recommended measure of walking ability after stroke.[17] Participants walked 10 metres quickly but safely, and the time was recorded from a standing start until participants had passed the 10-metre line with both feet. Two trials were performed, and the fastest time was recorded.

The 6MWT, a sub-maximal test of aerobic capacity, is a reliable and recommended test of walking endurance after stroke.[18,19] Participants walked a 30-metre pathway with turns at 0 and 30 metres; they were instructed to walk as far as possible during the 6 minutes, and no verbal encouragement was provided. The 6MWT was performed once, and distance walked was measured. Participants were allowed to rest and then continue walking; two participants had to rest during the test. For safety, heart rate was measured continuously during the test. The test was to be interrupted at a heart rate $>150$ beats/minute, but this was never necessary.

Self-rated balance confidence was assessed using the Swedish version of the ABC scale.[12,13] Participants were asked to rate their level of confidence in maintaining balance and remaining steady during 16 scenarios involving position changes, standing, and walking on an 11-point scale (0% = no confidence; 100% = complete confidence). Scores were summed and divided by 16, for a total score from 0% to 100%.

The Swedish version of the Short Form 36 Health Survey (SF-36) was used to investigate subjective mental and physical health status.[20,21] The SF-36 consists of 36 questions grouped into 8 health-domain scales. Answers to each question are scored, and the scores are summed to produce raw scale scores for each health concept, which are then transformed. Two aggregated summary scores can be calculated—the physical component (PCS) and the mental component (MCS)—using weighted scores from all eight health domain scales, but with different weights for each component score. In an earlier Swedish study on the general population, the range of scores was 8.8–73.7 for the PCS and 2.7–72.1 for the MCS[25] (a higher score indicates better subjective health status).

### Statistical analysis

Demographic characteristics are presented using means with standard deviations and percentages. Because of skewed data distribution, medians and inter-quartile ranges (IQR) are used to present the results. We calculated Spearman correlation coefficients to examine convergent validity between the ABC scale and scores on other measures; correlation coefficients $<0.30$ were interpreted as weak, 0.30–0.59 as moderate, and $\geq 0.6$ as strong.[26] Reliability analysis included calculating intraclass correlation coefficient (ICC) and internal consistency (Cronbach alpha); an acceptable ICC was a minimum score of 0.75, as suggested by Andresen.[26] Because of skewed distribution of ABC scale scores, the data were normalized before calculating the ICC. We used the Wilcoxon signed-rank test to investigate changes between scores on the ABC scale from test (A) to retest (B), and the Mann–Whitney U-test to analyze differences between groups (fallers vs. non-fallers; male vs. female; FAC category 5 [independent] vs. FAC categories 2–4 [dependent for support/supervision or requiring level surfaces]. Probability values $\leq 0.05$ were considered statistically significant. The Statistical Package for the Social Sciences, version 15.0 (SPSS Inc., Chicago, IL), was used to analyze the data.

## RESULTS

### Participants

The study included a total of 67 participants. Background characteristics and FAC categories are shown in Table 1. Ages ranged from 39 to 92 years; onset of stroke was 1 to 37 years before the time of the study. Of the 67 participants, 32 (48%) reported another medical disorder (e.g., diabetes, high blood pressure, arthritis); 13 (19%) reported 1 fall and 6 (9%) reported $\geq 2$ falls during the previous 3 months, so a total of 19 (28%) were classified as fallers.

### Validity and reliability of the ABC scale

Table 2 gives scores for individual items and total ABC scale scores at both test and retest sessions. Three items had notably low scores, representing situations in which participants experienced low balance confidence: standing on a chair and reaching for something; stepping onto escalators without holding onto the railing; and walking on icy sidewalks.

Scores for the ABC scale correlated significantly with results from the TUG test (Spearman's $\rho = -0.484$, $p < 0.001$), 10TW ($\rho = -0.52$ $p < 0.001$), 6MWT ($\rho = 0.45$, $p < 0.001$), and SF-36: PCS ($\rho = 0.43$, $p < 0.001$). The correlation coefficient between scores for the ABC scale and the SF-36: MCS was weak and non-significant ($\rho = 0.19$, $p = 0.12$).

At the first test session, there were no significant differences in ABC scale scores between fallers ($n = 19$)

**Table 1** Participant Characteristics, Descriptive Statistics for all Measures, and Functional Ambulation Classification Scores

| Variable | No (%) of participants* |
|---|---|
| Mean (SD) age, y | 68.1 (11.2) |
| Mean (SD) years since stroke | 4.6 (5.5) |
| Sex | |
| Male | 42 (63) |
| Female | 25 (37) |
| Other medical disorder | 32 (48) |
| Type of stroke | |
| Infarction | 45 (67) |
| Haemorrhage | 23 (33) |
| Paretic side | |
| Left | 36 (54) |
| Right | 31 (46) |
| Previous stroke | 10 (15) |
| FAC score | |
| 0: cannot ambulate | 0 |
| 1: Dependent, requires continuous support | 0 |
| 2: Dependent, requires intermittent support | 1 (1) |
| 3: Dependent for supervision | 1 (1) |
| 4: Independent level surfaces only | 35 (52) |
| 5: Independent | 30 (45) |
| mRMI | 37 (35–39)† |
| TUG test, s | 17.4 (12.6–26.8)† |
| 10TW, s | 13.4 (10.2–20.3)† |
| 6MWT, m | 247 (160–342)† |
| SF-36: PCS | 35.1 (29.4–42.3)† |
| SF-36: MCS | 48.4 (39.4–58.4)† |

*Unless otherwise specified.
†Median (IQR).
FAC = Functional Ambulation Classification; mRMI = Modified Rivermead Mobility Index; TUG = timed up-and-go; 10TW = 10-metre timed walk; 6MWT = 6-Minute Walk Test; SF-36 = Short Form 36 Health Survey; PCS = SF-36 physical component summary score; MCS = SF-36 mental component summary score.

and non-fallers ($n = 48$) ($p = 0.13$); the median (IQR) score was 42 (34–65) for participants reporting falls and 58 (38–72) for those reporting no falls. There were no significant gender differences in ABC scale scores ($p = 0.66$): the median (IQR) score was 56 (35–67) for men and 55 (37–72) for women. Participants in FAC categories 2–4 had significantly lower total ABC scores (median [IQR] 41 [27–65]) than participants in FAC category 5 (64 [48–77]) ($p = 0.001$).

When the ABC scale was retested, scores were significantly lower for 11 items as well as for the total score (see Table 2). Internal consistency was high at both test sessions ($\alpha = 0.95$ and 0.97, respectively). The ICC for total ABC scale score was 0.82 (95% CI, 0.72–0.88), which was judged to be acceptable.

## DISCUSSION

Our hypothesis that convergent validity of the Swedish version of the ABC scale would be moderate was fulfilled, in that correlation coefficients between ABC scale scores and measures of physical function were between 0.4 and 0.5. This finding confirms the moderate associations between the ABC scale and measures of physical capacity shown by Salbach and colleagues[9] and by Botner and colleagues.[15] We found low associations with scores for the SF-36 MCS, similar to findings by Talley and colleagues,[14] who presented low correlation coefficients between the mental subscales of the SF-36 and ABC scale scores in a study of older women.

The Swedish version of the ABC scale has acceptable psychometric properties when used with people following stroke, both in the acute and sub-acute phases[11] and, as shown in this study, in people >1 year after stroke onset. Our findings support those of several other studies that the ABC scale is a valid and reliable measure for investigating balance confidence in older people.[8–10,12,15] Published versions in languages other than English support the notion that the ABC scale is a culturally stable measure with acceptable psychometric properties.[8,9,27–30]

There were significant differences in scores on most individual items, as well as in the total ABC scale score, between the first and second test sessions. However, we found no significant differences for the more difficult items, on which participants overall rated their balance confidence as low. A plausible explanation for this is that participants were more aware of their limitations in performing difficult tasks, and therefore rated these items similarly during the two test sessions. Internal consistency of items was found to be good, as has also been reported for other versions of the ABC scale.[8–10,15] The high ICC for the normalized total ABC scale score was similar to findings reported elsewhere, indicating good stability of the ABC scale.[8,10,15]

We found no significant difference in scores between people who reported falls within the 3 months before the test sessions and those who did not report falls, even though fallers scored lower on the ABC scale. In contrast, Belgen and colleagues found that after a stroke, people with a history of falling had lower fall-related self-efficacy as well as greater fear of falling.[3] Parry and others found that in a group of older people, the ABC scale was able to distinguish fallers.[10] A fall analysis should include measures of fall-related self-efficacy, as well as measures of physical capacity. The ABC scale could be a suitable measure of fall-related self-efficacy, as it addresses both indoor and outdoor tasks.

Our investigation of known-groups validity found no significant differences in scoring on the ABC scale between men and women. Earlier findings on gender in scoring the ABC scale are conflicting: Myers and colleagues found no gender differences in their study of older

**Table 2** Median and Inter-quartile Range for the ABC Scale: Item and Total Scores, Test and Retest

| Items of the ABC | Median score (IQR) Test A (n = 67) | Test B (n = 66) | *p*-value |
|---|---|---|---|
| How confident are you that you will not lose your balance and become unsteady when you | | | |
| 1. Walk around the house? | 80 (60–90) | 70 (40–90)* | <0.001 |
| 2. Walk up and down stairs? | 70 (40–90) | 50 (30–70)* | <0.001 |
| 3. Bend over and pick up a slipper from the front of a closet floor? | 60 (30–90) | 50 (20–80) | 0.05 |
| 4. Reach for a small can off a shelf at eye level? | 90 (50–100) | 70 (40–90)* | 0.008 |
| 5. Stand on tiptoe and reach for something above your head? | 50 (20–70) | 30 (10–70)* | 0.033 |
| 6. Stand on a chair and reach for something? | 10 (0–40) | 10 (0–30) | 0.74 |
| 7. Sweep the floor? | 70 (40–90) | 60 (30–80)* | 0.030 |
| 8. Walk outside the house to a car parked in the driveway? | 80 (50–100) | 70 (40–90)* | 0.004 |
| 9. Get in and out of a car? | 80 (50–100) | 70 (40–90)* | 0.002 |
| 10. Walk across a parking lot to the mall? | 70 (40–90) | 60 (30–80)* | <0.001 |
| 11. Walk up and down a ramp? | 60 (30–80) | 50 (30–80) | 0.24 |
| 12. Walk in a crowded mall where people walk rapidly past you? | 50 (30–70) | 40 (20–70)* | 0.006 |
| 13. Are bumped into by people as you walk through the mall? | 50 (20–70) | 40 (10–70)* | <0.001 |
| 14. Step onto or off an escalator while you are holding onto the railing? | 50 (10–80) | 30 (10–70)* | 0.039 |
| 15. Step onto or off an escalator while holding onto parcels so that you cannot hold on to the railing? | 10 (0–40) | 10 (0–40) | 0.29 |
| 16. Walk on icy sidewalks? | 10 (1–30) | 10 (0–30) | 0.80 |
| Total ABC score | 57 (3–68) | 43 (29–65)* | <0.001 |

*Significant change in scores ($p < 0.05$) between tests A and B.
Test A = test session; Test B = retest session.

people,[13] while Salbach and colleagues found that men scored higher than women.[6] Further studies exploring the gender aspect of this measure are needed.

Further investigation of group validity showed significantly lower scores for participants in FAC 2–4 than for those in FAC 5, which suggests that the ABC scale can be used to differentiate between sub-groups of different mobility status. Myers and colleagues have suggested that ABC scale total scores >80 indicate high levels of physical function characteristics, 50–80 moderate levels, and <50 low levels.[12] In our sample, 12% of participants had high levels of physical function, 42% had moderate levels, and 46% had low levels at the test session. The ABC scale can thus provide information on balance confidence that may help in targeting rehabilitation services.

Other properties of the ABC scale, such as responsiveness in people in later phases after stroke, also need to be investigated; in people 0–3 months after stroke, the ABC scale has shown a moderate ability to capture changes.[31] We found the ABC scale easy to administer and score. Participants took an average of 5–10 minutes to fill in the scale. During the test session, some participants tended to reverse the scoring (i.e., "being totally confident that you will not lose your balance or become unsteady" was rated 0% instead of the correct 100%); this was corrected before analysis. We recommend that a therapist be available the first time a person fills in the ABC scale.

## LIMITATIONS

One limitation of our study is that the retest of the ABC Scale was distributed by mail, whereas the initial test was completed at the primary health centre, with a physiotherapist on hand to answer questions. We hypothesized that scores would be stable, since participants were already familiar with the scale, but the retest scores were significantly lower for 11 items as well as for the total. One reason for this could be that participants had not encountered the situations presented in these items for some time, and therefore were unsure of their confidence in their ability; in the time between test and retest, they may have attempted these tasks and thus had a better idea of their actual confidence level. The differences in scoring show that caution is required when comparing ABC scale scores obtained through different distribution channels.

The participants in our study represented a sample of people with stroke living in the community and typical of patients visiting a primary health care centre in Sweden. Performance on the TUG, 10TW, and 6MWT varied considerably, reflecting the heterogeneity of residual deficits seen in people after stroke. The range of ages was similar to other studies that included community-dwelling participants.[9,15] The ABC scale could therefore be considered a suitable measure for people who have some walking capacity and are able to participate in activities in the community. We did not screen

for cognitive impairments before including participants in the study; since a few participants had some difficulty in completing the self-rating scales, it may be that cognitive screening would have excluded these participants.

## CONCLUSION

In conclusion, the Swedish version of the ABC scale is a valid and reliable measure of balance confidence in people with stroke, not only in the acute phase but also in later phases after stroke.

## KEY MESSAGES

### What is already known on this topic

The Activities-specific Balance Confidence (ABC) scale is a measure of self-rated balance confidence. The Swedish version of the ABC scale has not been applied to people in the late phase of stroke. Only one study has investigated psychometric properties of the ABC scale in people in the late phase of stroke; this study found moderate associations with the Berg Balance Scale and with walking speed.

### What this study adds

The Swedish version of the ABC scale is a homogeneous and valid measure of self-rated balance confidence in people $>1$ year after stroke. Moderate convergent validity was shown between scores on the ABC scale and results on the timed up-and-go (TUG) test, 10-metre timed walk (10TW), 6-Minute Walk Test (6MWT), and the Short Form 36 Health Survey (SF-36) physical component summary score. Test–retest reliability was acceptable.

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