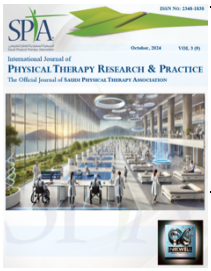


INTERNATIONAL JOURNAL OF
PHYSICAL THERAPY RESEARCH & PRACTICE
AN OFFICIAL JOURNAL OF SAUDI PHYSICAL THERAPY ASSOCIATION

Original Article

# Assessing the Validity and Reliability of the Arabic Version of the Locomotor Capabilities Index in Adults with Lower Limb Amputation: Cross-cultural Adaptation Study

Eman Alnamankany[1]; Wesam Qurban[2]; Marwa Eid[3]

1. Rehabilitation Department, Al Noor special hospital, Mecca, Saudi Arabia.
2. Occupational Therapy Department, King Abdulaziz University Hospital, Jeddah, Saudi Arabia.
3. Department Of Physical Therapy College of Applied Medical Sciences, Taif University, Taif, Saudi Arabia.

*Corresponding Authors: emo-2009-@hotmail.com

**Article info**

Received : **Oct. 31, 2024**
Accepted : **Nov. 18, 2024**
Published : **Nov. 30, 2024**

**To Cite:** Alnamankany, E., Wesam Qurban, & Eid, M. Assessing the Validity and Reliability of the Arabic Version of the Locomotor Capabilities Index in Adults with Lower Limb Amputation: Cross-cultural Adaptation Study. International Journal of Physical Therapy Research & Practice, 3(10), 407–415. https://doi.org/10.62464/ijoprp.v3i10.56



**Abstract**

**Background:** Amputations can significantly negatively impact an individual's economic status, psychological health, and social life. The Locomotor Capabilities Index (LCI) measures how well people with lower-limb amputation can use prostheses to carry out activities. The validity and reliability of the Arabic version of the LCI were assessed in this study. **Methods:** The English Locomotor Capabilities Index had been translated forward and backward for cross-cultural adaptation to Arabic (LCI). The subsequent Arabic (SAUDI) LCI was then administered to fifty-seven patients with amputation; thirteen of them were women with a mean age of 53 years (ranging from 29 to 71), while forty-four were men with a mean age of 55 years (ranging between 20 and 85 years). All patients were trained in Al Nour Rehabilitation training centre – in Mecca - KSA. The validity and reliability of the Arabic LCI were evaluated through several measures. In two different subgroups of 20 and 30 amputation patients, the Arabic LCI was compared to the Time Up-and-Go test (TUG) and the Index of EQ-5D Health Utility to assess its structural validity. Scores from various age groups were compared to determine the discrimination value. Thirty individuals with amputations underwent test-retest reliability (7–14 day) evaluations. **Results:** The Arabic LCI demonstrated good converging structure validity, exhibiting a strong correlation with TUG (r = 0.79 & 95%CI - 0.90- 0.60) and EQ-5D (r= 0.81,95%CI 0.61- 0.92), as well as discriminatory effect, with mean scores for older amputees significantly lower than for younger amputees ($p < 0.001$)) and high internal consistency (Cronbach alpha 0.93 ) (CI 95 % 0.91-0.94). Test-retest reliability for unilateral amputees had an intraclass correlation coefficient of 0.93 (95 % CI 0.83-0.92). 17.5 % of the cases involved the ceiling effect. The ceiling effect occurred in 17.5% of the cases. **Conclusion:** The Arabic version of the LCI has shown strong internal consistency and validity in adults with amputation.

**Keywords:** Locomotor Capabilities Index, Timed "Up-and-Go," EuroQol Instrument', EQ-5D, Validity, Reliability, Internal Consistency, Amputation.

## Introduction

Amputation is the surgical removal of a body part, such as an arm or leg. The prevalence of amputations globally has increased in recent

years, subsequently impacting an individual's economic status, psychological health, and social life. Reintegration of patients with lower limb amputations into their communities and the presence of the required support system is imperative to ensuring healthy adjustment for these patients (Abouammoh et al., 2021). Around one-third of all hospital beds in 2008 and 2009 in Saudi Arabia were occupied by road traffic accident (RTA) patients, with limb loss being the most common injury (Al Wahbi et al., 2016). In 2021, there were 1,008 amputations; 190 (19%) were caused by traffic accidents, and 521 (52%) by diabetes mellitus (Ministry of Health, Kingdom of Saudi Arabia, 2021).

Amputations due to traumatic causes affected 57.7 million people worldwide in 2017, most frequently caused by falls (36.2%), road injuries (15.7%), other transportation injuries (11.2%), and mechanical forces (10.4%) (McDonald et al., 2020). External circumstances in the Arab world, such as regional conflicts and crises, have directly escalated the frequency of amputations. A patient's use of the prosthesis depends on several factors, including the patient's mental and physical status, the quality of the prosthesis, the condition of the amputation (Gailey et al., 2008), diseases associated with the amputation, and the type of activity the patient practices with the prosthesis (Shankar et al., 2020). Furthermore, patients with amputation who successfully wear prostheses may use the prosthesis differently and perform varying activities with it (Ranker et al., 2021).

Numerous variables affect a patient's capacity to walk with a prosthesis. It is possible to predict how well these patients will do so through factors such as the patient's physical condition, the reason for and extent of the amputation (Kahle et al., 2016), the patient's diet and weight, the use of analgesics and sedatives (Bäck-Pettersson & Björkelund, 2005), the techniques used in providing rehabilitation services, the methods used to install the prosthesis (Fleury et al., 2013), and the psychological and mental condition (Roşca et al., 2021). In addition, the type and methodology of the surgery used in amputation are critical factors (Tisi & Callam, 2002). Lower limb amputation, due to peripheral arterial diseases or diabetes, is often conducted on elderly patients suffering from other medical conditions, which could hinder the progress of rehabilitation. The risks of strokes, heart failure, and vascular problems in the contralateral side are notable impediments. As a result, an instrument that assesses walking capacity after amputation may be used to track changes in function in the context of comorbidity.

A simple and appropriate outcome measure for prosthetic limb motion is critical for monitoring the outcomes of treatment intervention in patients with lower limb amputations. Outcome measures must be valid and reliable to obtain accurate results in clinical and academic studies (Miller et al., 2001). The LCI was initially developed in 1993 in Canada as part of the Prosthetic Profile of an Amputee questionnaire. It was designed to evaluate the ambulatory skills of lower-limb amputees using prosthetics and assessed their level of independence when performing the tasks in the questionnaire (Gauthier-Gagnon & Grisé, 2006).

Based on fourteen tasks typically encountered in daily life, the LCI is a self-report measure of ambulatory skills (Grisé et al., 1993). In contrast to Russek's classification for people with lower limb amputation, Treweek and Condie recommended LCI as more suitable (Miller et al., 2001). Compared to other measures, the LCI was found to have a somewhat higher reliability and validity

rating. Among three evaluations, the LCI (ICC = 0.88) had the highest test–retest reliability, followed by the Houghton Scale (ICC = 0.85) and the Prosthetic Evaluation Questionnaire (ICC = 0.77). The LCI has been subsequently translated from its original English source into numerous other languages (Ferriero et al., 2005). Evaluating the validity and reliability of assessment tools is crucial for ensuring accurate clinical decision-making in prosthesis users. For instance, recent studies on inertial measurement units (IMUs) have shown their reliability in measuring joint kinematics (Rattanakoch et al., 2023).

This study aims to provide healthcare professionals in Saudi Arabia with a reliable assessment tool for Arabic-speaking individuals who have undergone lower limb amputation. By establishing the validity and reliability of the Arabic LCI, the study seeks to help professionals better understand the functional abilities of amputees in the Saudi Arabian context. This will improve the rehabilitation and overall quality of life for those affected.

## Methods

### Translation Process

The Locomotor Capabilities Index (LCI) was culturally adapted from English to Arabic through a systematic translation process. First, three translators, including one with no medical experience, conducted a forward translation of the English version into Arabic. A consensus meeting produced the initial Arabic draft. In the reverse translation phase, two bilingual translators, both with English as their first language and one without medical training, translated the Arabic version back into English. The translations were reviewed by a cohort comprising two translators, a backward translator, and a supervisor, ensuring conceptual equivalence with the original version. This process culminated in a penultimate Arabic draft, which was tested on two amputees at the Al Nour Rehabilitation Training Centre. The field test confirmed the clarity and relevance of the translated items, resulting in a finalized Arabic version of the LCI.

The study recruited 61 participants from the Rehabilitation Unit at Al Nour Hospital in Mecca, of whom 57 completed the study. The sample included 44 male participants (mean age = 55 years, range = 20–85) and 13 female participants (mean age = 53 years, range = 29–71). All participants had undergone lower limb amputation (LLA) and were receiving prosthetic rehabilitation. The training program aimed to enhance their mobility post-rehabilitation. Participation was voluntary, and inclusion criteria required participants to: Have undergone lower limb amputation up to the trans-femoral level, have used a prosthesis for at least six months, with or without a walking aid, be aged 20 years or older, be able to understand, speak, and preferably read Arabic.

Exclusion criteria included psychological disorders, upper limb amputations, systemic inflammatory rheumatic illnesses, and neurological or cardiac abnormalities. Data collection occurred between December 2022 and March 2023.

The study adhered to the ethical principles outlined in the Declaration of Helsinki and International Conference on Harmonization Good Clinical Practice (ICH-GCP) guidelines. Ethical approval was obtained from the Local Ethics Committee of the Ministry of Health, Makkah Region, Saudi Arabia (IRB Number: H-02-K-076-1122-841; Date: 13 December 2022). Participants

provided written informed consent, ensuring confidentiality and anonymity. Regular progress reports were submitted to the Institutional Review Board for continued ethical compliance.

This cross-cultural adaptation study assessed participants using the Arabic version of the LCI, the Timed Up and Go (TUG) test, and the EuroQol instrument (EQ-5D). The EQ-5D-5L evaluates health status across mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, using a 5-level severity scale. Test-retest reliability was evaluated through two sessions conducted 7–14 days apart. Participants whose health or prosthetic status remained stable completed both sessions.

Data Collection and Statistical Analysis

Demographic and amputation-related data were collected at admission. The Arabic LCI scores, including basic and advanced subscale scores, were calculated and summarized using descriptive statistics (mean, median, standard deviation). The correlation between LCI scores and TUG/EQ-5D scores was assessed using Spearman's correlation coefficient to determine convergent validity. Internal consistency was evaluated with Cronbach's alpha, while test-retest reliability was analyzed using the intra-class correlation coefficient (ICC) for absolute agreement. Ceiling and floor effects were examined to ensure the instrument's validity and reliability. Statistical analysis was performed using JASP (version 0.17, 2023), with a p-value of <0.05 considered significant.

## Results

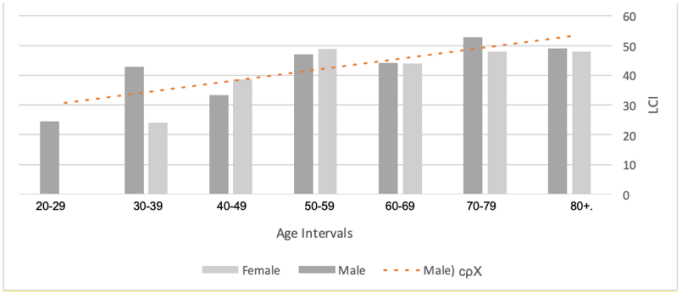
Score distribution

All fifty-seven participants provided answers for all items. Basic items 1, "Get up from a chair," and four, "Walk in the house," witnessed the highest mean scores (3.6 and 3.7, respectively). In contrast, the lowest mean scores were registered for advanced item 6 and basic item 7, "Go down a few steps (stairs) without a handrail" and "Walk outside in inclement weather (e.g., snow, rain, ice).", which had mean scores of 2.3 and 1.9, respectively (Table 2). The mean total score was 41.6 (standard deviation 12.3, median 46), the mean basic score was 22.5 (standard deviation 5.1, median 24), and the mean advanced score was 19.1 (standard deviation eight, median 21).

Convergent validity

The mean LCI in the TUG test subgroup was 40.27 (range 11-56), and the mean TUG result was 62.3 (range 13.28-230) seconds. The LCI and TUG strongly correlated (Pearson's r = 0.79, 95%CI -0.90- 0.60, p < 0.001). The mean EQ-5D index was 0.94 (standard deviation: 0.04; range: 0.95-0.81). The LCI and EQ-5D index strongly correlated (Pearson's r = 0.81, 95% CI 0.61-0.92, p < 0.001).

Figure 2: Age Interval Distribution with Sex

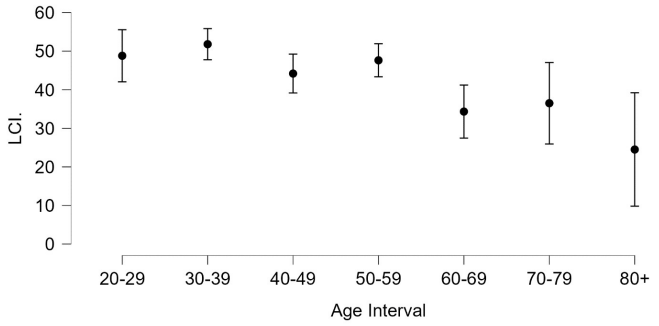



Discriminative validity

Data collected from younger amputees showed that the mean LCI score was significantly higher than that of the older age group (Figure 3). The former group (20-29) constructed a mean of 48.8 (SD 7.70), whereas the oldest group (80+) saw a mean of 24.5 (SD 10.61). The mean total score for women was 41.39 (SD 11.96, median 46) and for

men 41.73 (SD 12.51, median 44.5), where the difference was insignificant (p = 0.9) (Figure 2).

Figure 3 LCI distribution with age intervals




Internal consistency

Cronbach's alpha was calculated for three categories: the total LCI, basic, and advanced activities. The values obtained were 0.93 (95% CI 0.91-0.94) for the total LCI, 0.83 (95% CI 0.79-0.87) for basic activities, and 0.92 (95% CI 0.90-0.94) for advanced activities. These values indicate strong internal consistency within each category, as Cronbach's alpha coefficients are relatively high.

Test-retest reliability

The ICC values for the total LCI were 0.93, 0.96 for the basic LCI, and 0.89 for the advanced LCI, following the completion of the test-retest. Additionally, all 95% confidence intervals were more significant than 0.70 (Table 3). The mean difference in the LCI scores between the two testing times was four for the total LCI, 0.9 for the basic LCI, and 3 for the advanced LCI. However, it is essential to note that all these differences were statistically insignificant. These findings indicate that the LCI has good reliability, as evidenced by high ICC values, and the testretest results suggest that the LCI scores are consistent over time. The 95% confidence interval being more significant than 0.70 further support the reliability of the LCI measurements.

Table 3: Test-retest reliability of LCI

| LCI | | Median | Mean+SD | Range |
|---|---|---|---|---|
| Pre | Basic | 22.5 | 22 5.5 | 9-28 |
| | Advance | 20 | 18.3 8.5 | 1-28 |
| | Total | 44.5 | 40.3 13.3 | 11-56 |
| Post | Basic | 23.5 | 22.9 4.6 | 13-28 |
| | Advance | 22.5 | 21.3 6.6 | 5-28 |
| | Total | 46 | 44.3 10.6 | 19-56 |

Ceiling and floor effects

Twelve patients out of the fifty-seven participants with amputation scored fifty-three or above, and 10 (17.5%) obtained the highest possible score (ceiling effect). Men scored higher more frequently than women did. Only one patient with amputation (1.75%) achieved the lowest viable count, scoring below 14 (Table 4).

Table 4: Table 4: Characteristics of the Study Population for Validity and Internal Consistency.

| Characteristics | Discriminative Validity I & Internal Consistency (N-57) | Convergent Validity I (N-20) | Discriminative Validity II & Test-Retest Reliability (N-20) |
|---|---|---|---|
| Age, mean (SD, range) years | 52.21 (15.14, 20–85) | 51.9 (17.23, 20–85) | 52.1 (14.33, 20–80) |
| Women, n (%) | 13 (23%) | 7 (35%) | 5 (17%) |
| Above Knee Amputation, n (%) | 21 (36.84%) | 7 (35%) | 12 (40%) |
| Below Knee Amputation, n (%) | 36 (63.16%) | 13 (65%) | 18 (60%) |

| | | | |
|---|---|---|---|
| Time from prosthetic fitting to LCI testing, mean (range) years | 7.40 (0.7–17) | 4.2 (1–36) | 9.1 (1–36) |

## Discussion

The results of this study show that the Arabic LCI is a valid measure. The LCI showed strong correlations with the EQ-5D and the TUG test, indicating that it can effectively differentiate between groups with different physical abilities. The study demonstrated that the test-retest reliability was satisfactory in a small group of participants. Furthermore, the reliability tests demonstrated good internal consistency. The Arabic LCI's characteristic measurements are similar to those in the original English version (Gauthier-Gagnon & Grisé, 2006). Similar to the adaptation process of the Waterloo Footedness Questionnaire-Revised, our study followed established guidelines to ensure the validity and reliability of the Arabic version of the LCI (Aldaihan, 2023).

Studies assessing the original LCI's validity in English have indicated a strong correlation with the River Mead Mobility Index (Spearman coefficient of 0.75) and the Functional Independence Measure (FIM) (Spearman coefficient of 0.62). These findings are consistent with related studies that have used the TUG test. In addition, the LCI reliability assessment showed high internal consistency (Cronbach's alpha = 0.95 for total LCI and >0.90 for both subscales) and good test-retest reliability (ICC = 0.80), which aligns with the reliability results of related studies (Franchignoni et al., 2004). On the other hand, if Cronbach's alpha is very high, it may suggest that some of the elements could be redundant (Larsson et al., 2009). Our study's findings are consistent with the reliability results of other LCI studies. Studies indicate that the LCI score for younger amputees with transtibial amputations is 31.6 and for transfemoral amputations is 29.2. A study of 50 unilateral amputees found a mean LCI score of 41 after recovery. Population characteristics should be considered when comparing LCI results to past research (Gauthier-Gagnon et al., 1999).

According to our study, "getting up from a chair" and "walking indoors" were the most successful LCI items, while "climbing and descending stairs without a railing" were the least successful. This aligns with earlier research. The Arabic LCI clearly demonstrates that younger and older amputees exhibit varying degrees of independence in locomotor activities. These findings provide conclusive evidence that the LCI effectively identifies disparities in mobility (Miller et al., 2001). Men had higher ceiling LCI values than women, but mean scores were not significantly different. Hermodsson et al. (1998) found that men were three times more likely to achieve good function after major lower limb amputation.

The research on the Arabic version of the LCI showed a strong correlation with the TUG test (Pearson's r = -0.79, 95% CI [-0.90, -0.60], $p < 0.001$). In comparison, Miller et al. (2001) reported a lower correlation of -0.64 in their study of 55 amputees. The TUG test is an objective measure, while the LCI is subjective. The TUG test evaluates patients' safety reasoning and functional performance under pressure, including tasks like locking the wheels of a walking frame. Patients with amputations are prone to falls, which can lead to decreased function (Pauley et al., 2006). Our study revealed a significant relationship between the LCI and the EQ-5D-5L in measuring

perceived health. Walking is a basic human ability and is therefore featured in health assessments (Whynes, 2008).

People with amputations or vascular disease face various challenges, including limited movement, social isolation, fatigue, pain, insomnia, and emotional problems. Incorporating wheelchair mobility into rehabilitation programs can benefit amputee patients who primarily use a wheelchair but can transfer and walk short distances with a prosthesis. However, it is important to note that the EQ-5D assessment tool is not specifically designed to measure the functional abilities of amputees with a prosthesis and has not been validated for monitoring changes in function over time for this group (Pell et al., 1993).

A study conducted in Saudi Arabia that included patients similar to those in our study used the EQ-5D to investigate amputation patients who also suffered from diabetes and foot ulcers. The study found that patients who underwent major amputations had a lower EQ-5D index than those who achieved primary healing or underwent minor amputations. According to the study, the average EQ-5D index for 26 amputees was 0.31, while the patients in our study had a higher index of 0.94 (Ragnarson Tennvall & Apelqvist, 2000).

Recent research indicates that there are no established guidelines for the necessary sample size in studies evaluating measurement qualities. However, to determine the reliability of a parameter, a minimum ICC of 0.70 is recommended for a sample size of at least 50 patients (Terwee et al., 2007). There are varying opinions on acceptable ICC values, with clinical measures typically requiring ICCs over 0.90 and research purposes accepting ICCs of 0.70 or higher. In this study, all three LCI components (overall, basic, and advanced) had ICCs greater than 0.70. The overall and basic LCI had an ICC of 0.96, while the advanced LCI had an ICC of 0.89 (Koo & Li, 2016).

Using a higher ICC in data sets for bilateral amputees can inflate reliability and create variability. This can cause issues with test-retest samples, especially for basic LCI. Lower ICC values were found in the subsample of unilaterally amputated patients. To ensure adequate clinical usage, a larger sample of unilateral transtibial amputees should be studied. The LCI may also result in a ceiling effect, where a high proportion of patients achieve the best score. For example, 46% of 50 amputees achieved the best score in one study, while 40% of 329 amputees did so in another study (Miller et al., 2001).

**Limitations**

This study has several limitations that should be considered when interpreting the findings. First, the sample size (n=57) was relatively small, which may limit the generalizability of the results to the broader population of Arabic-speaking individuals with lower limb amputation. Future studies with larger and more diverse samples are recommended to further validate these findings. Second, the study identified a ceiling effect in 17.5% of the cases, which may have impacted the sensitivity of the locomotor capacity index (LCI) in differentiating between participants with higher functional abilities. This suggests a need to refine the tool to better capture variability in performance among individuals at the upper end of the functional spectrum. Lastly, the study was conducted in a single rehabilitation center, which could introduce bias related to site-specific practices and patient demographics. Expanding the study to include multiple centers and regions would enhance the applicability of the findings. Despite these limitations, the study provides

valuable information on the validity and reliability of the Arabic LCI.

## Conclusion

The Arabic version of the LCI has proven to be a trustworthy and advantageous method for assessing adult amputee patients. The results obtained indicates a high degree of consistency between multiple tests.

## Recommendation

To accurately measure differences in mobility over time, it would be helpful to create a comprehensive scale with a broad range of measurements. Additionally, it would be beneficial to conduct further research on amputations not included in the current study and to increase the sample size for future data collection. To gain a comprehensive understanding of the ceiling effect's impact, it is crucial to include patients with varying functional abilities in our studies as we continue to employ this tool.

## Reference

Abouammoh, N., Aldebeya, W., & Abuzaid, R. (2021). Experiences and needs of patients with lower limb amputation in Saudi Arabia: A qualitative study. Eastern Mediterranean Health Journal, 27(4), 407–413. https://doi.org/10.26719/emhj.20.124

Aldaihan, M. M. (2023). Cross-cultural adaptation of the Arabic version of the Waterloo Footedness Questionnaire-Revised: WFQ-Ar. medRxiv.

Al Wahbi, A., Aldakhil, S., Al Turki, S., El Kayali, A., Al Kohlani, H., & Al Showmer, A. (2016). Risk factors for amputation in extremity vascular injuries in Saudi Arabia. Vascular Health and Risk Management, 12(2), 229–232. https://doi.org/10.2147/VHRM.S91452

Bäck-Pettersson, S., & Björkelund, C. (2005). Care of elderly lower limb amputees, as described in medical and nursing records. Scandinavian Journal of Caring Sciences, 19(4).

Ferriero, G., Dughi, D., Orlandini, D., Moscato, T., Nicita, D., & Franchignoni, F. (2005). Measuring long-term outcome in people with lower limb amputation: Cross-validation of the Italian versions of the Prosthetic Profile of the Amputee and Prosthesis Evaluation Questionnaire. Eura Medicophys, 41(1), 1–6. https://doi.org/10.1007/s10160-005-0040-2

Fleury, A. M., Salih, S. A., & Peel, N. M. (2013). Rehabilitation of the older vascular amputee: A review of the literature. Geriatrics and Gerontology International, 13(2), 264–273. https://doi.org/10.1111/ggi.12016

Franchignoni, F., Orlandini, D., Ferriero, G., & Moscato, T. A. (2004). Reliability, validity, and responsiveness of the Locomotor Capabilities Index in adults with lower-limb amputation undergoing prosthetic training. Archives of Physical Medicine and Rehabilitation, 85(5), 743–748. https://doi.org/10.1016/j.apmr.2003.06.010

Gailey, R., Allen, K., Castles, J., Kucharik, J., & Roeder, M. (2008). Review of secondary physical conditions associated with lower-limb amputation and long-term prosthesis use. Journal of Rehabilitation Research and Development, 45(1), 15–29. https://doi.org/10.1682/JRRD.2008.01.0002

Gauthier-Gagnon, C., & Grisé, M. C. (2006). Tools to measure outcomes of people with a lower limb amputation: Update on the PPA and LCI. Journal of Prosthetics and Orthotics, 18(6).

Gauthier-Gagnon, C., Grisé, M. C., & Potvin, D. (1999). Enabling factors related to prosthetic use by people with transtibial and transfemoral amputation. Archives of Physical Medicine and Rehabilitation, 80(6), 706–713. https://doi.org/10.1016/s0003-9993(99)90177-6

Grisé, M. C. L., Gauthier-Gagnon, C., & Martineau, G. G. (1993). Prosthetic profile of people with lower extremity amputation: Conception and design of a follow-up questionnaire. Archives of Physical Medicine and Rehabilitation, 74(8), 862–870. https://doi.org/10.1016/0003-9993(93)90014-2

Hermodsson, Y., Ekdahl, C., & Persson, B. M. (1998). Outcome after trans-tibial amputation for vascular disease: A follow-up after eight years. Scandinavian Journal of Caring Sciences, 12(2), 73–80. https://doi.org/10.1111/j.1471-6712.1998.tb00479.x

Kahle, J. T., Highsmith, M. J., Schaepper, H., Johannesson, A., Orendurff, M. S., & Kaufman, K. (2016). Predicting walking ability following lower limb amputation: An updated systematic literature

review. Technology and Innovation, 18(2–3), 125–137. https://doi.org/10.21300/18.2-3.2016.125

Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. Journal of Chiropractic Medicine, 15(2), 155–163. https://doi.org/10.1016/j.jcm.2016.02.012

Larsson, B., Johannesson, A., Andersson, I. H., & Atroshi, I. (2009). The Locomotor Capabilities Index: Validity and reliability of the Swedish version in adults with lower limb amputation. Health and Quality of Life Outcomes, 7(44), 1–12. https://doi.org/10.1186/1477-7525-7-44

McDonald, C. L., Westcott-McCoy, S., Weaver, M. R., Haagsma, J., & Kartin, D. (2020). Global prevalence of traumatic non-fatal limb amputation. Prosthetics and Orthotics International, 45(2), 105–114. https://doi.org/10.1177/0309364620972258

Miller, W. C., Deathe, A. B., & Speechley, M. (2001). Lower extremity prosthetic mobility: A comparison of 3 self-report scales. Archives of Physical Medicine and Rehabilitation, 82(10), 1432–1440. https://doi.org/10.1053/apmr.2002.33221

Ministry of Health, Kingdom of Saudi Arabia. (2021). GoR education statistical yearbook - 2021. UAE Statistical Yearbook. Retrieved from https://www.moh.gov.sa/en/Ministry/Statistics/Book/Pages/default.aspx

Pauley, T., Devlin, M., & Heslin, K. (2006). Falls sustained during inpatient rehabilitation after lower limb amputation: Prevalence and predictors. American Journal of Physical Medicine and Rehabilitation, 85(6), 521–532. https://doi.org/10.1097/01.phm.0000219119.58965.8

Ranker, A., Örgel, M., Schiller, J., Egen, C., Ranker, A. H., Greitemann, B., et al. (2021). Translation, adaptation, reliability, and validity of the German version of the Prosthesis Mobility Questionnaire 20 (PMQ) on patients with major lower limb amputation. Rehabilitation, 60(6), 605–613. https://doi.org/10.1055/a-2152-6723

Roșca, A. C., Baciu, C. C., Burtăverde, V., & Mateizer, A. (2021). Psychological consequences in patients with amputation of a limb: An interpretative-phenomenological analysis. Frontiers in Psychology, 12(537493), 1–12. https://doi.org/10.3389/fpsyg.2021.537493

Shankar, P., Grewal, V. S., Agrawal, S., & Nair, S. V. (2020). A study on quality of life among lower limb amputees at a tertiary prosthetic rehabilitation center. Medical Journal Armed Forces India, 76(1), 89–94. https://doi.org/10.1016/j.mjafi.2019.02.008

Tisi, P., & Callam, M. (2002). Type of skin incision for below knee amputation. Cochrane Database of Systematic Reviews, 4(4), CD004981. https://doi.org/10.1002/14651858.CD004981.pub4