International Journal of Medicine and Medical Research
2021, Volume 7, Issue 1, p. 51-67

DOI 10.11603/ijmmr.2413-6077.2021.1.12120

SYSTEMATIC REVIEW ON THE PSYCHOMETRIC, RELIABILITY AND VALIDITY PROPERTIES OF TRANSLATED NEUROPATHIC PAIN SCREENING TOOLS (DN4, LANSS AND PDQ) 1 JANUARY 2005 – 19 JULY 2019

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Background. *Different neuropathic pain screening tools (DN4, LANSS and PDQ) have been developed, translated into several local languages, and validated. To determine the reliability of these tools and their ability to differentiate between diagnosing neuropathic pain quality from nociceptive pain, a systematic review was conducted to synchronize properties and suggest the reliability of the translated version of these neuropathic pain-screening tools.*

Objective. *To conduct an evidence-based systematic review to assess the psychometric, reliability and validity of the translated version of DN4, LANSS and PDQ between January 2005 and 2019.*

Methods. *Two independent reviewers adopted the use of online (Internet) search machine (Pubmed, Scopus and Web of Science) to search for the relevant articles based on JBI (Joanna Briggs Institute) inclusion criteria. Data extracted from the articles were synthesis in tabular form.*

Results. *Twenty-six articles were included from DN4 (n=11), LANSS (n=8) and PDQ (n=4) translated from English language to eight local languages. The sensitivity and specificity of the DN4 studies ranged from 75% to 98% and 37.3% to 96%, respectively. The internal reliability (α) of the translated version of the DN4 ranged from 0.55-0.862. The sensitivity and specificity of the LANSS studies ranged from 75% to 98% and 37.3% to 96%, respectively. The internal reliability (α) of the translated version of the LANSS ranged 0.67-0.96. The sensitivity and specificity of the PDQ studies ranged from 75% to 98% and 37.3% to 96%, respectively. The internal reliability (α) of the translated version of the PDQ ranged 0.81-0.86.*

Conclusions. *All the translated instruments reviewed showed good internal consistency of the items, high sensitivity and Positive predictive value (PPV) but not to a suitable level compared with the original version. Therefore, these screening tools are suggested to be used in conjunction with the clinical testing for appropriate diagnosis of patients with neuropathic pain quality.*

KEYWORDS: neuropathic pain; positive likelihood; negative likelihood; positive predictive value; negative predictive value.

Introduction

Neuropathic pain (Np) is classified as one of the worse pains reported by chronic pain patients [1]. An estimated 1 out of 10 chronic pain patients develop neuropathic pain, depending on the population study [2]. The prevalence may be as high as 51.9 % in the patients being managed for chronic pain clinic [3]. Evidence indicates that neuropathic pain affects both physical and emotional state of the patients [4], thereby. This type of pain decreases the quality of life of patients [4, 5] and results in a negative interaction with society in general [6]. Neuropathic pain is associated with lesion or disease of the somatosensory pathway that leads to abnormality observed at the peripheral and central region of the system function (hyperalgesia or allodynia) [7]. The common symptoms associated with neuropathic pain are: sharp, burning, pins and needles, tingling, painful cold, numb and shooting [2].

Diagnosing standards among pain physicians and researchers of neuropathic pain in chronic pain patients have been a challenge [8]. The five Np screening tools are LANSS [9], Neuropathic Pain Questionnaire [10], Douleur Neuropathique 4 'DN4' [11], ID pain [12] and PainDETECT [13]. These instruments have been validated and adapted in different languages from different countries.

Among these instruments, DN4, LANSS and PainDETECT are the most commonly used tools in the assessment of the quality of neuropathic

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pain in chronic pain patients due to their high sensitivity and specificity, short duration of the assessment, easy understanding of the terms and application by the pain experts [14, 15]. Translation of these tools from the original language to local languages is essential for good communication and effective assessment of pain quality between the researcher or pain expert and the patients.

Critically appraising the data measurement of these instruments may be valuable for the clinician and researchers in decision making based on evidence from peer-reviewed articles that adopted these instruments in their studies. Therefore, the aim of this study was to conduct a systematic review on the translated version of the Douleur Neuropathique en 4 Questionnaire (DN4), Leeds Assessments of Neuropathic Symptoms and Signs (LANSS) and the PainDETECT Questionnaire (PD-Q) tools with the objective to evaluate their psychometric, reliability and validity properties.

Methods

Study design: systematic review of studies was conducted according to PRISMA guidelines [16]. The systematic review was conducted using a developed protocol registered on PROSPERO (CRD42015016752) by the authors. PICO method was adopted to define our study question:

P (Patient or population): Patients with chronic pain

I (Intervention): Diagnostic screening tool

C (Comparator): None

O (Outcome): Psychometric and diagnostic properties of neuropathic pain screening tools: DN4*, LANSS**, and PD-Q (* Includes the DN4-interview, ** Includes the self-complete (S)-LANSS)

Study Inclusion Criteria

The following article selection criteria were used:

- **Language of publication:** No restrictions;
- **Geographic location:** No restrictions;
- **Publication date:** 1 January 2005 to 31 July 2019;
- **Publication type**: Original articles and abstracts;

Search strategy

The search strategy was as follows:

Databases: PubMed, Scopus, Web of Science.

Secondary search: Reference lists of selected publications were checked.

Search terms: ("Douleur Neuropathique" OR DN4 OR DN-4 OR "Leeds Assessment of Neuropathic Signs and Symptoms" OR LANSS OR PainDetect OR "Pain Detect" OR PDQ or PD-Q) AND pain AND (neuropathy OR neuropathic OR neuralgia OR neuritis OR central OR stroke OR spinal) AND (translation OR adaptation OR validation OR reliability OR validity).

Data management

Search results were transferred to Mendeley Desktop Reference Manager (Elsevier), where all references retrieved were combined, and duplicates were removed.

Screening

Initial screening of the articles included was done by title and abstract and was performed by TF (Temitope Fagbohun) and checked by PK (Peter Kamerman). The excluded articles were removed, and the reason for their exclusion was recorded. The full text of all retained studies was then screened by TF and PK and a consensus list of studies was generated to include into the review.

Data extraction

The following data were extracted:

1. Bibliographic information;
2. Study characteristics:

a. Name of the translated questionnaire;

b. Language of translation;

c. Setting (study population;)

d. Study methods;

e. Measures of reliability (Reliability of the screening tools was determined by the following measures: Test-retest reliability (intraclass correlation coefficient, Pearson's or Spearman's correlation coefficient), inter-rater reliability (Cohen's Kappa lowest and highest score), and internal consistency (Cronbach's alpha));

f. Diagnostic properties (Measures of diagnostic performance: Diagnostic performance was assessed by measures of sensitivity, specificity, positive likelihood, negative likelihood, positive predictive value, and negative predictive value.

Results

A total of 1,493 articles were obtained from the initial electronic databases search and 27 articles were finally included in the final review. The details of the study identification and selection process in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement [16] are described in Fig. 1. One hundred and twenty-two articles were excluded due to duplications. The abstract and the title of 1,371 articles were screened, 1,337 articles were excluded due to not meeting the inclusion

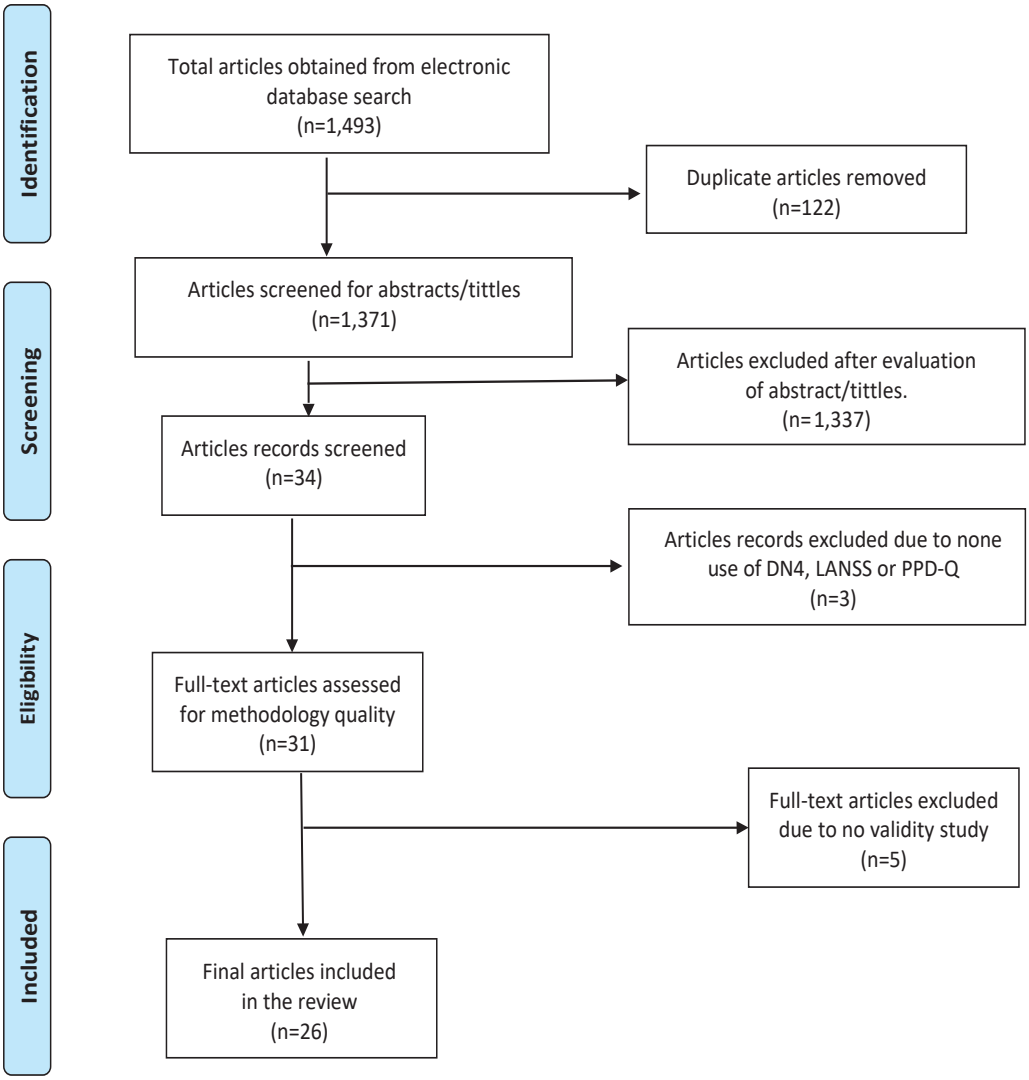

Fig. 1. *Flow chart of the final selected articles.*

criteria of this study. Thirty-four (34) articles were further screened for full-text inclusion, and three (3) articles were excluded for not applying DN4, LANSS or PainDETECT instrument neuropathic pain screening tools. Thirty (30) articles were further screened for check of validity test; five (5) articles were further excluded due to no validity test. Twenty-six (26) articles were included in this review for extraction.

Summary of the articles included

Twenty-six articles where included in this review – 11 DN4 articles [17-27], 8 LANSS articles [20, 24, 28-33], 4 PD-Q articles [15, 34-36] and 3 S-LANSS [28, 37, 38]. The total sample size reported was 2,075. Out of this, 1,056 were diagnosed with neuropathic pain, 874 – nociceptive pain and 55 were patients with mixed pain. Eighty-two (82) participants had mixed pain included in the neuropathic pain participants [24] (Table 1).

DN4

Description of the DN4 articles

Eleven (11) studies were included in the DN4 screening tool in this review (Table 2). Two (2) studies [17, 21] further evaluated the reliability and validity properties of the tools at different cut off. The DN4 was translated to eight different languages which includes: the Arabic language (n=2) [17, 21], Brazilian Portuguese (n=1) [26], Korean (n=2) [19, 20], Spanish (n=2) [24, 25], Farsi (n=1) [22], Greek (n=1) [23], Italian (n=1) [27] and Japanese (n=1) [18]. The total sample size reported n=1,756. Out of this, n=880 was diagnosed with neuropathic pain, n=731 – nociceptive pain and n=55 were patients with mixed pain. Eighty-two (82) participants had mixed pain included in the neuropathic pain

ISSN 2413-6077. IJMMR 2021 Vol. 7 Issue 1

Table 1. Description of the included studies

Author	Np Tool	Language	SAMPLE SIZE				Forward translation	No of forward translations	Backward translation	No of backward translations	Expert assessment	Pilot test
			Total	Neuropathic	Nociceptive	Mixed sample						
Matsuki et al. [18]	DN4	Japanese	187	100	87	0	Yes	1	Yes	1	Yes	No
Chatila et al. [17]	DN4	Arabic	195	99	96	0	Yes	3	Yes	NS	Yes	Yes
Terkawi et al. [21]	DN4	Arabic	124	77	47	0	Yes	5	Yes	2	Yes	Yes
Kim et al. [19]	DN4	Korean	83	43	40	0	Yes	-	Yes	-	-	-
Park et al. [20]	DN4	Korean	83	40	43	0	-	-	-	-	-	-
Sykioti et al. [23]	DN4	Greek	237	123	59	55	Yes	NS	Yes	NS	Yes	-
Madani et al. [22]	DN4	Farsi	175	86	89	0	Yes	5	Yes	3	Yes	Yes
Hamdan et al. [24]	DN4	Spanish	192	121	91	*See footnote	-	-	-	-	-	-
Spallone et al. [27]	DN4	Italian	221	50	61	0	NS	NS	NS	NS	NS	NS
Santos et al. [26]	DN4	Brazilian Portuguese	101	42	59	0	Yes	2	Yes	2	Yes	Yes
Perez et al. [25]	DN4	Spanish	158	99	59	0	Yes	2	Yes	2	Yes	NS
Batistaki et al. [28]	LANSS	Greek	100	58	42	0	Yes	2	Yes	2	Yes	Yes
Park et al. [20]	LANSS	Korean	213	113	100	0	Yes	2	Yes	2	Yes	Yes
Spanos et al. [30]	LANSS	Greek	70	35	35	0	NS	NS	NS	NS	NS	NS
Barbosa et al. [29]	LANSS	Portuguese	167	103	64	0	Yes	2	Yes	1	Yes	Yes
Hamdan et al. [24]	LANSS	Spanish	192	121	91	*See footnote	-	-	-	-	-	-
Türkel et al. [32]	LANSS	Turkish	148	99	49	0	Yes	NS	Yes	1	Yes	Yes
Schestatsky et al. [31]	LANSS	Brazilian Portuguese	90	34	44	12	Yes	2	Yes	1	Yes	NS
Yucel et al. [33]	LANSS	Turkish	101	49	52	0	Yes	1	Yes	1	Yes	No
Gudala et al. [15]	PainDETECT	Hindi	160	80	80	0	Yes	2	Yes	2	Yes	Yes
Matsubayashi et al. [36]	PainDETECT	Japanese	113	60	53	0	Yes	2	Yes	2	Yes	No
Alkan et al. [34]	PainDETECT	Turkish	240	80	80	80	Yes	2	Yes	2	Yes	No
De Andrés et al. [35]	PainDETECT	Spanish	221	71	71	79	Yes	2	Yes	2	Yes	NS
López-de-Uralde-Villanueva et al. [38]	S-LANSS	Spanish	182	71	111	0	Yes	2	Yes	2	Yes	Yes
Batistaki et al. [28]	S-LANSS	Greek	100	54	46	0	Yes	2	Yes	2	Yes	Yes
Koc and Erdemoglu [37]	S-LANSS	Turkish	154	137	107	0	Yes	2	Yes	NS	Yes	Yes

*Note. *82 (42%) had mixed pain, but were included in the neuropathic pain group*
NS – not specified

Table 2. Measures of validity for translated versions of the DN4

Author	Assessed Internal validity	Cronbach alpha	Assessed Test-retest reliability	ICC*	Correlation coefficient	Assessed Inter-rater reliability	Cohen's Kappa (lowest score)	Cohen's Kappa (Highest score)	Correlation Coefficient	ICC
Chatila et al. [17]	Yes	0.55 to 93	No	-	-	Yes	0.92 (brushing)	1.0 (hypoesthesia to brushing, hypo-esthesia to pinprick)	-	0.99
Chatila et al. [17]	Yes	0.86**	No	-	-	Yes	0.92 (brushing)	1.0 (hypoaesthesia for touch, hypoaesthesia for pinprick)	-	0.99
Terkawi et al. [21]	Yes	0.7	Yes	-	-	-	-	-	-	-
Terkawi et al. [21]	Yes	0.67	Yes	0.81	0.81 (Spearman)	No		-	-	-
Santos et al. [26]	Yes	0.76	No	-	-	Yes	0.92 (total score)	0.92 (total score)	-	-
Madani et al. [22]	Yes	0.862	Yes	0.957	-	Yes	0.416 (electric shocks)	0.826 (numbness)	-	0.957
Sykioti et al. [23]	Yes	0.65	Yes	0.956	-	Yes	0.818 (total score)	0.818 (total score)	-	-
Spallone et al. [27]	No	-	No	-	-	No	-	-	-	-
Matsuki et al. [18]	Yes	-	Yes	0.827	-	-	-	-	-	-
Park et al. [20]	Yes	0.819	Yes	0.813	-	Yes	0.823 (itching)	0.946 (numbness)	-	-
Kim et al. [19]	Yes	0.819	Yes	0.813	-	Yes	0.823 (itching)	0.946 (numbness)	-	-
Perez et al. [25]	Yes	0.7	Yes	0.949	-	Yes	0.68 (Not specified)	0.79 (Not specified)	-	0.926
Hamdan et al. [24]	No	-	-	-	-	No	-	-	-	-

***** *Intra-class correlation coefficient;**Only provided internal consistency for the entire questionnaire (by Kuder-Richdson formula).*

participants [24]. All the included articles that used DN4 instruments were published between 2007 and 2018 (Table 2).

Forward translation was reported in eight studies [17-19, 21-27] with the translation conducted in two studies in 5-times [21, 22], one study in 3-times [22], two studies in 2-times [25, 26], one study in 1-time [18]. Similarly, backward translation was reported in eight studies [17-19, 21-23, 25, 26]. One study conducted in 3-times [22], three studies conducted in 2-times [21, 25, 26], three studies were not specific on the number of times backward translation was done, and three studies did not report on the backward translation (Table 2). Expert assessment was involved in seven (7) studies [17, 18, 21-23, 25, 26] and four (4) studies conducted a pilot test [17, 21, 22, 26] (Table 2).

Validity and reliability of the DN4 instrument

Internal validity was reported in nine (9) studies [17-23, 25, 26] of the included eleven (11) studies (Table 2). Cronbach was reported in eight studies [17, 19-23, 25, 26]. Findings on test-retest validity were reported in seven (7) studies [18-23, 25] with ICC values between 0.81 and 0.96. One study reported the coefficients of correlation spearman value 0.81 [21]. The inter-rated reliability was conducted in seven (7) studies [17, 19, 20, 22, 23, 25, 26] in translated DN4, Cohen's kappa lowest scored values of 0.92 were reported for brushing in one (1) study [17], while total score values of 0.818 and 0.92 were reported in two (2) studies [23, 26], scored values of 0.823 was reported for itching in two studies [19, 20] (Table 2).

Cohens kappa high values of 1.0, 0.826-0.946 and 0.9 were reported for hypoesthesia to brushing and hypoesthesia to pinprick in two studies [17, 21] and numbness [19, 20, 22]. Also, total Cohens kappa highest score values of 0.818 and 0.92 (total score) were reported in two (2) studies [23, 26].

Sensitivity, specificity, negative and positive likelihood

Different cut offs were adopted to differentiate the neuropathic pain from nociceptive pain in this instrument (Table 3). Studies included at cut off of 3 showed sensitivity between 93.3-100%, specificity between 3-100%, Positive Likelihood between 5.2-5.5, Negative Likelihood between 0-3, PPV ranges between 84.3-85.6% and NPV of 72.1% – 97.5% in three studies.

At cut off 4, sensitivity reported ranges between 80-96%, while the specificity was between 6.8-95%, Positive likelihood 8.4-20.2 reported in three (3) studies, Negative Likelihood range between 0.1-0.2; PPV was between 63.9-95% and the NPV was between 69-95.5% reported in eight (8) studies. At cut off of 5, sensitivity reported ranges between 75-91% in four (4) studies, specificity was between 51-99%, Positive likelihood ranged between 5-150, Negative Likelihood was between 0.1-0.2, the PPV was between 84.3-93.7% and NPV was between 53.2-92.9%. Youden index values with cut off of three ranges between 0.46-0.92, cut off 4, was between 0.6-0.932 and cut off of 5 ranges between 0.6-0.89 (Table 2).

DN4-interview

Two studies were included in this review instrument [17, 27] conducted in the Arabic and Italian languages respectively (Table 1) and reported between 2012 and 2017 were participants in Arabic, and Italian population with a total sample size of 611. Patients with neuropathic pain (NP) were 248. The number of nociceptive pain patients' range was 253 patients, and none had mixed pain (MP). Forward translation was conducted in two studies thrice (3-times), and out of the three (3) studies that adopted this DN4-interview, one (1) study was not specific on the conduct and the number of times it was conducted. Similarly, backward translation was conducted in two (2) studies out of the three (3) studies adopted in DN4-interview, but the number of times conducted was not specific. Expert assessment involved, and a pilot study was conducted in two studies included.

Measurement of the validity of DN4-interview instrument

Internal validity was assessed in two studies with Cronbach alpha value between 0.55-93 and 0.86 (using Kuder-Richardson formula to assess the internal consistency of the whole questionnaire). In two studies Cohens Kappa lowest score value of 0.92 (brushing) and Cohen's Kappa Highest score values of 0.9 (electric shocks) and 1.0 (Hypoesthesia to brushing, hypoesthesia to pinprick).

Measurement of reliability of DN4-Interview

ROC was conducted in two studies included using this instrument (Table 6). At cut off of 2, the sensitivity was 99%, Specificity value of 58.3%, Positive Likelihood value 2.4, PPV of 71%, NPV of 98.2%. Two studies employ cut off 3 with sensitivity of 97%, Specificity value of between 82-82.3, Positive Likelihood value of 5.5., Negative Likelihood of 0, PPV of 85% and NPV of 96.3%. One study reported cut off value of 4 with sensitivity value of 84%, Specificity value

of 90%. Positive Likelihood value of 8.1, and Negative Likelihood of 0.2, PPV 89.2% and NPV of 84.3%. Youden index value at cut off of 2 was 0.56, cut off 3 was 0.79 and cut off 4 was 0.37.

LANSS

Description of the LANSS articles

Demographic characteristic of eight studies included using LANSS instrument in assessment of neuropathic pain (Table 1). Eight (8) studies [20, 24, 28-33] were included in this review. Two studies each were reported in the Greek [28, 30] and Turkish languages [32, 33]. Each of the following languages reported one study – Brazilian Portuguese [31], Korean [20], Spanish [24] and Portuguese [29]. Total sample size reported was 1,081. Out of this, 612 were diagnosed with neuropathic pain, while 477 were classified to have nociceptive pain. One study reported 42% of the neuropathic pain participants also had mixed pain [24]. Forward translation was conducted in four studies twice and one study once. Backward translation was conducted twice in two studies. Four studies conducted backward translation once. Six studies involved expert assessment while four studies conducted pilot studies.

LANSS measurement of validity

Internal validity assessment was conducted in six studies, with the Cronbach alpha ranging between 0.65-0.96 and the Test-retest reliability conducted in four studies (Table 4). One study reported the intra class coefficient value of 0.77 [28] with Pearson correlation coefficient reported in two studies (0.912-0.990 and 0.940). the inter-rated reliability was reported in two studies [28, 31] with Pearson value of 0.87 in one study [28].

Measure of reliability of LANSS instrument

Five studies conducted ROC at cut off of 12. Six (6) cut off values were reported to different neuropathic pain from nociceptive pain. Cut off 2, two (2) studies reported 80.2 and 89.8%, respectively. Specificity was 100% and 94.2%. One (1) study reported PPV of 93.6% and NPV of 90.74. While one (1) study reported Youden index value of 0.8. Two (2) studies reported cut off 2, sensitivity was 80.2 and 89.9, specificity was 94.2 and 100, NPV was 93.6. PPV was 90.74 with Youden index value 0.8. One (1) study reported cut off 7 with sensitivity of 91.2%, Specificity value of 83%, Positive Likelihood of 5.4, Negative Likelihood value of 0.1, PPV of 86% and NPV 89% with Youden index value of 0.74.

Cut off of 10.5 was reported in one (1) study with sensitivity of 88%, Specificity of 95%. One (1) study reported the use of Cut off 11 with sensitivity of 100%, specificity of 95.9%, PPV of 93.6 and NPV of 100. Four studies used cut off 12 with sensitivity ranging 72.6-98%, specificity range between 74-98%. Negative likelihood was reported in two (2) studies, NPV, at cut of 7 with value 5.4 and cut off 12 with value 36.3, Negative likelihood value 0.1 at cut off 7 and 0.3 at cut off 12, the sensitivity range between 72.6-98, specificity range between 74 98%. Positive likelihood was reported in a study with value of 36.3 and Negative Likelihood 0.3. Positive Predictive Value range between 85-99%, Negative Predictive Value of 76-96%. One study applied cut off 13, with sensitivity of 95%, specificity of 98%, PPV of 99 and Negative Predictive v=Value of 90.57. In addition, one (1) study reported the use of cut off 14 with Sensitivity 84, Specificity 82.8, PPV 88.7 and NPV 76.8.

Self-LANSS

Description

Three (3) included studies adopted LANSS-self between 2010-2016, one (1) study in the Greek language [28], one study in the Spanish language [38] and one study in the Turkish language [37] (Table 1). Internal validity was reported in three (3) studies with Cronbach alpha between 0.67-0.74. Test-retest validity was reported in two (2) studies with r-coefficient 964-Spearman, 0.97-Pearson, respectively. One (1) study reported inter-rater reliability and second r-coefficient. ROC was conducted in three (3) studies [28, 37, 38]. Three (3) different cut offs were used in this study labelled cut off 1, cut off 2, cut off 3, to distinguish neuropathic pain from nociceptive pain.

Reliability

ROC was conducted in three (3) studies (Table 7.3) with three different cuts off. One (1) study reported cut off 10 with sensitivity 78.8%, Specificity 76.6%, PPV 81.2%, NPV 73.9%. One (1) study adopted Cut off 10.5, Sensitivity 87%, Specificity 88%, Cut off 11, Sensitivity 90.1%, Specificity 72.1 %, Positive Likelihood value of 3.23, Negative Likelihood value of 0.2, PPV 67.4 and NPV 91.0% with Youden index value of 0.62. Three (3) studies adopted cut off 12 with sensitivity ranging between 72.3-88.7%, specificity ranging between 78.8-95.2%, Positive likelihood value of 3.8 and Positive likelihood value 0.2 was recorded in one (1) study (López-de-Uralde-Villanueva et al., 2018); PPV ranging between 70.8-96.2%, NPV between 69.4-91.4% with Youden index value 0.61 reported in one study. Cut off of 13 showed sensitivity of 81.7%, Specificity 79.3%, Positive likelihood value of 4,

Table 3. Measure of reliability for the DN4 instrument translated

Author	ROC*	Cut off used	Sensitivity (%)	Specificity (%)	Positive Likelihood	Negative Likelihood	PPV** (%)	NPV*** (%)	Youden Index
Chatila et al. [17]	Yes	3	98	81.3	5.2	0	84.3	97.5	0.79
		4	96	89	8.4	0.1	89.6	95.5	0.85
		5	93	96	22	0.1	85.8	92.8	0.89
Chatila et al. [17]	Yes	5	93	95.8	22	0.1	95.8	92.9	0.89
		4	96	89	8.4	0.1	98.5	95.5	0.85
Terkawi et al. [21]		-	-	-	-	-	-	-	-
Terkawi et al. [21]	Yes	4	88.3	75.4	-	-	-	-	-
Santos et al. [26]	Yes	3	1	37.3	-	-	85	80	0.627
		4	1	6.8	-	-	-	-	0.932
		5	91	5.1	-	-	-	-	0.854
Madani et al. [22]	Yes	3	95	88	8.5	0	89	95	83
		4	90	95	20.2	0.1	95	91	85
		5	83	99	150	0.2	99	86	82
Sykioti et al. [23]	Yes	3	93.3	52.5	-	-	85.6	72.1	0.46
		4	89	78	-	-	92.4	69.7	0.67
		5	75	85	-	-	93.7	53.2	0.6
Spallone et al. [27]	Yes	4	80	91.7	9.6	0.2	81.6	90.8	-
Matsuki et al. [18]		-	-	-	-	-	-	-	-
Park et al. [20]	Yes	3	100	88.2	-	-	-	-	0.882
		4	87	94	-	-	-	-	-
Kim et al. [19]	Yes	3	100	88.2	-	-	-	-	0.882
		4	87	94	-	-	-	-	0.812
Perez et al. [25]	Yes	4	79.8	78	-	-	85.9	69	0.58
		4	82	78	-	-	79	80.7	0.6
		4	82	78	-	-	63.9	90.2	0.6
Hamdan et al. [24]	Yes	4	95	97.2	-	-	-	-	0.92
	Yes	3	97	82.3	5.5	0	85	96.3	0.79

Table 4. Measures of validity for translated versions of the LANSS

Author	Assessed Internal validity	Cronbach alpha	Assessed Test-retest reliability	ICC	Correlation coefficient	Assessed Inter-rater reliability	Correlation coefficient	ICC
Schestatsky et al. [31]	Yes	0.67	No	-	-	Yes	-	0.97
Spanos et al. [30]	Yes	0.895	Yes	-	0.91 to 0.99* (Pearson)	No	-	-
Batistaki et al. [28]	Yes	0.65	Yes	-	0.940 (Pearson)	Yes	0.87 (Pearson)	-
Park et al. [20]	Yes	0.82	No	-	-	No	-	-
Barbosa et al. [29]	Yes	0.77	Yes	0.77	-	No	-	-
Hamdan et al. [24]	No	-	-	-	-	No	-	-
Yucel et al. [33]	No	-	No	-	-	No	-	-
Türkel et al. [32]	Yes	0.96	Yes	-	0.95 (Spearman)	#see footnotes	-	-

**range of r coefficients for each item: #Difficult to interpret test-retest, and inter-rater reliability because of the manner of reporting*

Table 5. Measures of reliability for translated versions of the LANSS

Author	*ROC*	Cut off used	Sensitivity (%)	Specificity (%)	Positive Likelihood	Negative Likelihood	PPV** (%)	NPV** (%)	Youden index
Schestatsky et al. [31]	No	-	-	-	-	-	-	-	-
Spanos et al. [30]	No	-	-	-	-	-	-	-	-
Batistaki et al. [28]	Yes	12	82.8	95.2	-	-	96	80	-
		10.5	88	95	-	-	-	-	-
Park et al. [20]	Yes	12	72.6	98	36.3	0.3	98	76	Not specified
		7	91.2	83	5.4	0.1	86	89	0.74
Barbosa et al. [29]		12	89	74	-	-	85	81	-
		14	84	82.8	-	-	88.7	76.8	-
Hamdan et al. [24]	Yes	2	80.2	100	-	-	-	-	0.8
Yucel et al. [33]	Yes	2	89.9	94.2	-	-	93.6	90.74	-
Türkel et al. [32]	Yes	11	100	95.9	-	-	98	100	-
		12	98	98	-	-	99	96	-
		13	95	98	-	-	99	90.57	-

Negative likelihood value of 0.2, PPV of 71.6%, Negative Predictive value 87.1 with Youden index value of 0.61.

PainDETECT

Description

Four (4) studies were included in the translated original using this instrument between 2012 to 2017 in population with local language Hindi [15], Japanese [36], Spanish [35] and Turkish [34]. Total sample size reported was 974, out of this, 371 participants had neuropathy, 364 and 239 participants were diagnosed with nociceptive and mixed pain respectively. Five (5) studies included reported forward translation, the translation was reported twice in five (5) studies. Backward translation was reported in five (5) studies conducted twice in five studies. Expert assessment was conducted in five studies. Pilot study was conducted in one (1) study [15].

PainDETECT validity characteristic

Internal validity of the terms was reported in the five (5) studies by Cronbach alpha reported ranges from 0.78-0.86. Test-retest validity was reported in five (5) studies and ICC reported ranges between 0.934-0.98 in five (5) studies included. Four (4) studies reported ROC [15, 34-36].

PainDETECT Reliability characteristic

Table 8.3: Four cut offs were reported in the studies included using PainDETECT instrument. Cut off 12, the sensitivity was between 84-93%, Specificity 66-68%, two studies reported PL 2.7 and 2.9; NL 0.1 and 0.2; PPV was reported by four (4) studies ranging between 73-87%, NPV 65-88% and Youden index value of 0.575 and 0.519 reported in two studies (Table 3).

Two (2) studies made use of cut off 17, Sensitivity 81%, Specificity 80 and 81%; Positive Likelihood 4.1 and 4.3; Negative predictive value 65 and 81 with Youden index values of 0.613 and 0.624. One (1) study reported cut off of 18, Sensitivity 83%, Specificity 91%, PPV 90% and NPV 84%. Three (3) studies adopted cut off of 19, specificity between 71-79%, Specificity 83-93 %, Positive likelihood reported in two (2) studies with values of 4 and 4.4, Negative likelihood 0.3 and 0.4, PPV reported in three (3) studies ranging between 82-90%, NPV between 55-79% with Youden index reported in two (2) studies of 0.531 and 0.613 (Table 3).

Discussion

The aim of the study was to conduct a qualitative systematic review to determine the psychometric property of translated, validation and reliability of neuropathic pain screening tools (LANSS, DN4 and PD-Q).

DN4 instrument

The participants' average sample size was above 30 in all the included studies, and this indicated that all the included studies had the sample size sufficient to represent the population and achieve the aim of the study, and the sample mean on normal distribution. Forward and backward translation were conducted in 90% of the included studies from local languages (Arabic, Brazillian-Portuguies, Farsi, Greek, Italian, Japanese, Korean and Spanish) into the English language and from English into local languages in the included studies. Tsang et al. [39] reported that this process is an important step in translation, the more times the translation the better chances of avoiding the error of bias. The reported Cronbach alpha value was higher than 0.6 that indicated an acceptable internal consistency among the items and accurate translation with exception of one study [17]. The involvement of expert assessment in over 80% of the included studies was in agreement with the set-out guidelines for the process of accurate translation [39]. Furthermore, a pilot study was conducted in most of the studies included which is an essential step in determination of the reliability of the items involved in the questionnaire and the validity of the test instrument. The value of Cohen's Kappa was low and high score reported by the pain expert was higher than normal values indicating a profound agreement among the pain experts. The average high sensitivity values and specificity values reported in the instrument pointed to a good validity of this instrument in differentiating neuropathic pain cohort from non-neuropathic pain groups.

The high average value of positive likelihood decreased as the cut off increases. The same pattern of decrease was observed in positive likelihood, however no obvious change in the negative likelihood was evidenced. Positive likelihood and negative likelihood were considered important factors in the measurement of sensitivity and specificity in test population. Considering the reports from the included studies, an optimum value sensitivity, specificity, positive predictive value was reported at cut off 4 at average value, which could make it a better cut off in agreement with Bouhassira et al. [11] in the original development of the DN4 instrument.

DN4-interview

The participants sample size in this review (n = 416) was greater than 30 in all the included

studies [17, 27] using DN4-interview instrument; this indicated that all the studies were statistically adequate, and the sample mean was on normal distribution. Forward and backward translation were conducted in 67% from local languages (Arabic and Italian) to the English language and from English to local languages at least (three times) which were reported as important steps in translation process, as mentioned previously, the more times the translation – the better chances of avoiding the error of bias. Tsang et al. [39] recommended a minimum of twice forward and backward translation for a good translation procedure. There was no specification on the number of times for backward translation that could lead to a possible limitation when using this instrument. The re_viewed Cronbach alpha value using this instrument (0.55-0.862) was averagely higher than 0.6 (the minimum Cronbach alpha value for a good internal consistency) that indicated an acceptable internal consistence among the items, a general internal consistency measured (dichotomized measurement of reliability) by the Kuder-Richardson formula (0.86) which is close to 1 as recommended for a good reliability [40] with exception of one study [17].

Moreover, expert assessment in over 80% of the included studies was also corroborating with the set-out guidelines for the process of adequate translation [39]. Inter-rated reliability review showed a close point (0.9) to 1 in bru_shing at low Cohen Kappa and 1 in hypoesthesia to brushing and pinprick. This indicates a high reliability in these two signs of measuring neuropathic pain and shows that this instrument is a good instrument and is consistent among the pain-expert. Therefore, this instrument could be used to distinguish neuropathic pain from non-neuropathic pain.

Pilot study was conducted in most of the studies (67%) included studies, this is an essential step in determination of the reliability of the items involved in the questionnaire and hence the validity of the test instrument. The optimum sensitivity (84-99%) and specificity (58-90%) reported in the instrument pointed to the fact that this instrument (DN4-interview) was a highly sensitive and valid in distinguishing neuropathic pain quality from non-neuropathic pain. Comparing the optimal test scores value of the translated DN4-interview instrument in the included studies with the original DN4-interview test score values, the performance of the translated was not as good as the original version.

LANSS

Our review on the psychometric translation properties using LANSS showed the sample size (n=90-213) indicating a good statistical sample. Forward and backward translation were conducted (80%) for the review [20, 28, 29, 31, 33] of the reviewed studies as compared with the original version of LANSS. Test-retest reliability was conducted in 55% of the studies within the pain experts. Only one study evaluated the intra-class correlation coefficient (0.77) [29]. This is contrary to the expectation from the original version, which showed that the included studies reported Cronbach alpha (0.67-0.9612) higher than 0.6, indicating a good internal consistency among the items. Forward and backward translation were conducted with the instrument good translation procedures in 75% of the included studies. Fifty percent (50%) complied with minimum of twice forward translation while twenty percent (20%) complied with minimum of twice backward translation. This shows that there were gaps in translation procedures in 70% of the included studies [24, 29, 31-33]. Inter-rated reliability was conducted in 20% of the included studies, which were considered as an important step in measurement of reliability in instrument testing and the validity of the instrument as compared with original LANSS translation procedure. This is in contrary to the setout procedure for a good neuropathic pain instrument.

The average sensitivity value (85%) and specificity values (92%) observed using this instrument indicated that LANSS was a very sensitive instrument and specific to measure the neuropathic components of a pain patient across all languages. Average Positive Predictive value (93.7%) showed that the instrument was an effective instrument in the determination of components of LANSS questionnaire that marked out neuropathic pain components. This agrees with the Bennett study on the development of LANSS neuropathic pain screening tool [9].

S-LANSS

The is a modification of the original LANSS instrument without the clinical examinations that was developed by Bennett et al. [41]. Our review indicated that the internal consistence measured by Cronbach alpha (0.67-0.74) showed high internal consistency among the items included in the instrument in a population sample size of average (n=145), which was statistically dependable sample size. Forward and backward translations were conducted in

Table 6: Measures of reliability for translated versions of the S-LANSS

Author	Assessed Internal validity	Cronbach alpha	Assessed Test-retest reliability	ICC	Correlation coefficient	Assessed Inter rater reliability	Cohens Kappa (lowest score)	Cohens Kappa (highest score)	Correlation coefficient	ICC
Batistaki et al. [28]	Yes	0.67	Yes	-	0.964 (Spearman)	Yes	-	-	0.54 (Pearson)	-
López-de-Uralde-Villanueva et al. [38]	Yes	0.71	No	-	-	No	-	--	-	-
Koc and Erdemoglu [37]	Yes	0.74	Yes	-	0.97 (Pearson)	No	-	-	-	-

Table 7. Measures of reliability for translated versions of the S-LANSS

Author	ROC*	Cut off used	Sensitivity (%)	Specificity (%)	Positive Likelihood	Negative Likelihood	PPV**(%)	NPV***(%)	Youden
Batistaki et al. [28]	Yes	12	86.2	95.2	-	-	96.2	83.33	-
		10.5	87	88		-	-	-	-
López-de-Uralde-Villanueva et al. [38]	Yes	11	90.1	72.1	3.23	0.1	67.4	91.9	0.62
		12	88.7	76.6	3.8	0.2	70.8	91.4	0.65
		13	81.7	79.3	4	0.2	71.6	87.1	0.61
Koc and Erdemoglu [37]	Yes	12	72.3	80.4	-	-	82.5	69.4	--
		10	78.8	76.6	-	-	81.2	73.9	-

*Receiver operating characteristic, ** – Positive predictive value, *** – Negative predictive value.*

Table 8. Measures of validity for translated versions of the PainDETECT

Author	Assessed Internal validity	Cronbach alpha	Assessed Test-retest reliability	ICC	Correlation coefficient	Assessed Inter-rater reliability	Cohens Kappa (Lowest score)	Cohen's Kappa (Highest score)	Correlation coefficient
Gudala et al. [15]	Yes	0.83	Yes	0.94	-	No	-	-	-
Matsubayashi et al. [36]	Yes	0.78	Yes	0.94	-	No	-	-	-
De Andrés et al. [35]	Yes	0.86	Yes	0.934	-	No	-	-	-
Alkan et al. [34]	Yes	0.81	Yes	0.98	-	-	-	-	-
Alkan et al. [34]	Yes	0.81	Yes	0.98	-	-	-	-	-

Table 9. Measures of reliability for translated versions of the PainDETECT

Author	ROC*	Cut off used	Sensitivity (%)	Specificity (%)	Positive Likelihood	Negative Likelihood	PPV**(%)	NPV***(%)	Youden
Gudala et al. [15]	Yes	19	79	93	-	-	91	81	-
		12	90	66	-	-	73	87	-
		18	83	91	-	-	90	84	-
Matsubayashi et al. [36]	-	-	-	-	-	-	-	-	-
De Andrés et al. [35]	Yes	12	93	68	2.9	0.1	87	80	0.609
		19	75	84	4.7	0.3	92	60	0.595
		17	81	81	4.3	0.2	91	65	0.624
Alkan et al. [34]	Yes	12	90	68	2.8	0.2	73	87	0.575
		19	78	83	4.4	0.3	82	79	0.6
		17	81	80	4.1	0.2	80	81	0.613
Alkan et al. [34]	Yes	12	84	68	2.7	0.2	86	65	0.519
		19	71	83	4	0.4	90	55	0.531

all the studies (two times) that was the minimum number of times it should be carried out; pilot study was conducted with involvement of expert assessment in all the included studies. This review proved Cronbach alpha (0.67-0.74 range) of above 0.6 recommended for a good internal consistency in translation research [42]. However, the Test – retest reliability was conducted (90%) of the included article, which is an important procedure to measure good translation procedure. Our review on this instrument showed an average sensitivity value (83.02%) and specificity (80.3%); these values indicated that the instrument was sensitive in determination of the neuropathic component of pain patients. The value of the sensitivity deceased as the cut off value increases from 12 to 13 in a population sample size of 154 [38] in association with decrease in the value of NPV as the cut off value deceased. This review showed an optimum value of sensitivity, specificity, and the positive predictive value at cut off 12, indicating a high performance of the instrument. This cut off 12 was also reported by the three studies, which could make it an acceptable cut off to distinguish neuropathic pain patients from non-neuropathic pain patients.

PD-Q

All the included studies conducted forward and backward translation twice (in agreement with the recommended standard). Most of the studies did not conduct any pilot study. This is contrary to the guideline for translation procedures, which is an important primary step. The internal consistency of the items measured by evaluating the Cronbach alpha values (0.78-0.86) showed a high internal consistency among the items listed on the instrument. Our review showed that Test-retest reliability was conducted in all the included studies with the average value of interclass correlation coefficient (0.95), suggesting a high validity of the instrument in all the translated versions of PD-Q reviewed in the diagnosis of neuropathic pain from non-neuropathic pain. The studies showed an average sensitivity value (82.3%) and specificity (80.5%) that indicated that PDQ was a sensitive instrument in the determination of neuropathic pain component, and the items were very specific in the determination of the symptoms of neuropathic pain.

Conclusions

The original DN4 and LANSS had the most evidence for their psychometric, reliability and validity properties in peer-reviewed articles. These tools were designed to assess the neuropathic pain quality in a test population through differentiating signs and symptoms between neuropathic and non-neuropathic pain patients. Furthermore, these screening questionnaires may provide an indication of the presence of neuropathic pain quality; however, they cannot replace a clinical assessment. It is clear from the studies that most of the instruments do not assess psychometric, reliability and validity properties effectively. For those that were assessed, not all of them were satisfactory, and most of the findings were supported by low or very low level of evidence. In conclusion, we recommend that both the clinical assessment and neuropathic pain-screening tool are pivotal in the diagnosis of neuropathic pain component in pain patients in clinical settings.

Recommendations

These three neuropathic pain screening tools (DN4, LANSS and PDQ) translated version as performed ultimately well in other local languages at their test population but none of these has been developed in the African Language, it will be a valuable interest also to evaluate the performance of this tool by determining the reliability and validity properties.

To increase the sensitivity, reliability and validity of these screening tools, efforts should be taken to carry out forward and backward translation more than twice from original version of the tools. Additionally, the use of language translation experts in both the original version and the translated local version of the original screening tool should be used for transcription and translation process. Moreover, translation into as many local languages as possible should be made to ensure consistency of the methodology and the properties should be measured by the tools.

This would be especially valuable in the sub-Saharan African region where most of the population might not be proficient in the lingua franca. We have just completed the translation of the DN4 screening tool into IsiZulu (a commonly spoken Nguni African language in South Africa) in our research group. In future studies, we will assess the sensitivity, reliability, and validity of this translated version and evaluate its feasibility in line with other previously translated versions.

Conflict of Interests

There are no conflicts of interest between the author and other researchers that contributed to data extraction.

Acknowledgements

My profound gratitude to Professor Peter Kamerman and Dr Antonia Wadley of pain laboratory, School of Physiology, Faculty of Health Sciences, University of Witwatersrand medical school for their intellectual contributions in screening of the articles. I also appreciate the funding support (FRC Funding) from the Faculty of Health Sciences and Professor William Daniels for funding this research through the NRF supervisor link funding, Wits University, Johannesburg, South Africa.

Autho's Contributions

Temitope Richard Fagbohun – Conceptualization, methodology, formal data collection and analysis, writing – original draft, writing – reviewing and editing.

СИСТЕМАТИЧНИЙ ОГЛЯД МЕТОДІВ ПСИХОМЕТРІЇ, НАДІЙНОСТІ ТА ВАЛІДНОСТІ ПЕРЕКЛАДЕНИХ ОПИТУВАЛЬНИКІВ ДЛЯ СПОСОБІВ СКРИНІНГУ НЕЙРОПАТИЧНОГО БОЛЮ (DN4, LANSS І PDQ) 1 СІЧНЯ 2005 – 19 ЛИПНЯ 2019

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Вступ. *Для скринінгу нейропатичного болю використовують різні опитувальники (DN4, LANSS та PDQ), які були перекладені на декілька локальних мов та валідовані. Щоб визначити надійність цих засобів та їх здатність відрізняти нейропатичний біль від ноцицептивного при діагностиці, було проведено систематичний огляд для синхронізації властивостей та припущення про надійність перекладеної версії цих засобів скринінгу нейропатичного болю.*

Мета. *Провести обґрунтований систематичний огляд для оцінки психометрії, надійності та валідності DN4, LANSS та PDQ у період з січня 2005 по 2019 рік.*

Методи. *Двоє незалежних рецензентів провели пошук відповідних статей у Pubmed, Scopus та Web of Science на основі критеріїв включення JBI (Інститут Джоани Бріггс). Дані, отримані зі статей, були синтезовані у вигляді таблиці.*

Результати. *В огляд були включені двадцять шість статей з DN4 (n=11), LANSS (n=8) та PDQ (n=4), перекладених з англійської мови на вісім місцевих мов. Чутливість та специфічність шкали DN4 коливалися від 75% до 98% та 37,3% до 96% відповідно. Внутрішня надійність (α) перекладеної версії DN4 коливалася в межах 0,55-0,862*

Чутливість та специфічність шкали LANSS коливалися від 75% до 98% та 37,3% до 96% відповідно. Внутрішня надійність (α) перекладеної версії LANSS перебувала в межах 0,67-0,96

Чутливість та специфічність шкали PDQ коливалися від 75% до 98% та 37,3% до 96% відповідно. Внутрішня надійність (α) перекладеної версії PDQ знаходилася в межах 0,81-0,86.

Висновки. *Усі перекладені інструменти продемонстрували хорошу внутрішню узгодженість елементів, високу чутливість та позитивне прогностичне значення, однак не досягали рівня оригіналів. Тому для належної діагностики пацієнтів з нейропатичним болем ці скринінгові інструменти пропонується використовувати разом з клінічним обстеженням.*

КЛЮЧОВІ СЛОВА: нейропатичний біль; позитивна ймовірність; негативна ймовірність; позитивне прогностичне значення; негативне прогностичне значення.

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Received 20 May 2021; revised 22 Jun 2021; accepted 23 Jun 2021.