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ARTICLES

Full Length Research Paper

Validation of tools for the evaluation of pharmaceutical services: A systematic review

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The objective of this study was to identify and evaluate studies that performed the validation of tools applied to health evaluation with a focus on pharmaceutical services. A systematic literature review was conducted to identify validation studies involving pharmaceutical services. The search for articles strategy was held in databases: EMBASE, PubMed/Medline, Scopus, and CINHAL. The descriptors used were: ("Pharmaceutical services" or "Pharmacy Services") and ("Validation Studies" or "Evaluation Studies"). The results showed that 18 community pharmacies (78%) were leading studies realization scenarios. Regarding the data extraction strategy, the questionnaire was the strategy most commonly used with 20 (86%). With regard to the objectives of the studies, 13 (56%) pointed to the development and validation of tools for verification of patient satisfaction with pharmaceutical services. 20 (86%) studies carried out the analyses of reliability and validity and only one realized (4%) singly the reliability analyses. The reviewed studies did not indicate the potential of their instruments in interventions to improve pharmaceutical services as well as the potential beneficial effects of these interventions. Thus, research is needed to develop and validate instruments directed at pharmaceutical services, especially in hospitals, in order to improve the quality of services provided to users, influence users' quality of life, and decrease the demand for health services.

Key words: Validation, systematic review, pharmaceutical services.

INTRODUCTION

The term "pharmaceutical service" is defined by a set of actions related to administration of medications that are intended to support the health needs of a community (Souza, 2011). With the changes that have occurred in recent years, the pharmaceutical practice has undergone several adaptations in their field. In this regard, the

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patient care services, a practice that takes up more space in the pharmaceutical assignments and requires professional expertise in the management of pharmacotherapy and therapeutic outcomes can be mentioned (Correr et al., 2009).

According to the health ministry pharmacies structuring guidelines, pharmaceutical services are divided into: the technical and managerial services (programming medicines, application process and storage, and activities related to the disposal of waste from health services) and pharmaceutical services technical assistance (dispensation, pharmaceutical care, pharmacotherapeutic follow-up, education actions in health and technical support for health staff) (Brasil, 2009). The purpose of pharmaceutical services is to achieve the best results possible (Health) and improve the quality of life of individuals, families and communities, contribute to the promotion of healthy habits for the population, and promote rationality of medicalization (OPS, 2013). These services are considered a key process as it relates to the direct provision of public service to the end and so contributes to the achievement of health outcomes.

Starting from the premise that the quality of a service must be related to the adequacy of their activities to the needs of the context in which it operates, health quality cannot be evaluated or judged only in technical terms by health professionals. It is necessary to recognize individual preferences and social, seeking to equate them in ensuring equity (Norman, 2012). Therefore, it becomes necessary to conduct ongoing assessments of services and develop tools to ensure the implementation of these services with quality. Therefore, it has become necessary to constantly evaluate health care services and develop tools to ensure that these services are implemented with quality (Vituri et al., 2009).

These sense health service assessment strategies have become an important tool to allow the rationalization of decisions and practices, as the results may be useful to facilitate decision making by managers and support necessary interventions. Currently, there are increasing numbers of questionnaires and scales available in health seeking to ascertain and assess the various research conducted (Alexandre et al., 2011). However, it is imperative that these tools have reliability and validity to minimize the possibility of subjective evaluation (Raymundo, 2009). Thus, the literature has alerted the investigators about the correct evaluation of the quality of the data collection instruments, for the recognition of the quality of the instruments is critical to the legitimacy and credibility of the results of a search (Medeiros et al., 2015).

In this scenery, the validity consists in analyzing whether an assessment instrument measures offered to him is a key determinant factor in the choice and/or application of a measuring instrument and is measured by the extent or degree to which represents the concept the instrument proposes to measure (Bittencourt et al.,

2011). Validity tests ask whether they measure actually the attributes behind it. The fact that there are no a health, the gold standard in which the results can be compared, validation methods normally use the criteria accepted by behavioural sciences (Lima et al., 2013).

The use of psychometric analysis performs the assessment of the quality of the instruments by middle of denominated psychometric properties of variables, among which the reliability and validity were highlighted (Pilatti et al., 2010). Therefore, validity is more than a statement of value of a measuring instrument is an extensive process of research. Consider this, Pasquali (2009) didactically divided the validation process into three parts: content validity, construct validity, and criterion validity.

The validation of content is determined by the trial judges also entitled to experts, the extent to which the rated instrument adequately represent all dimensions of the concept to be measured (Moura et al., 2008). Already, the construction and its validity tests are evaluated by the interrelationship of the studies, statistical tests and the correlation of the theory with the variables to be measured (Raymundo, 2009). The criterion validation process describes the relationship between a measure and an objectified criterion is related to a factor that can receive the influence of other factors not integrated into the main variable, which can alter the amplitude of the validity coefficient (Lima et al., 2013).

The other step of the analysis is the psychometric reliability. As regards the extent to which the instrument measures repetitions, evaluated relatively stable are located close to each other and may be verified by testing specific (Vituri et al., 2009). However, the search for quality in research reflects the concern in analyzing the results of different studies conducted with the aim of achieving excellence and quality required for the search of the best results in health (Medeiros et al., 2015). As mentioned earlier, this study aimed to identify and evaluate a systematic review of studies that performed the validation of tools applied to health evaluation with a focus on pharmaceutical services.

METHODOLOGY

A literature review was performed to identify validation studies of measures of various aspects of pharmaceutical services. A search of the following databases was performed: EMBASE, PubMed/Medline, Scopus, and CINHAL. To identify articles, the following descriptors: ("Pharmaceutical services" OR "Pharmacy services") and ("Validation Studies" OR "Evaluation Studies") were used. Searches were conducted from May to June, 2015. The articles published were included by May 2015, unrestricted by date of publication.

In order to meet the inclusion criteria, studies had to be original works published in English, Spanish, or Portuguese. Articles should address validation of pharmaceutical services assessment tools. Articles that did not have abstracts available were excluded from the review and articles referenced in two or more databases were considered only once. Differences in selection were resolved by

discussion with a third reviewer and decisions were made by consensus among the three reviewers.

A seven-step systematic review was performed according to the recommendations of the Cochrane Handbook: (1) formulating the questions (the kinds of services to be evaluated and validation tools, in other words, the psychometric constructs evaluated), (2) location and selection of studies (databases mentioned earlier), (3) critical review of the studies, (4) data collection, (5) analysis and presentation of data, (6) interpretation of results, and (7) refining of conclusions (Higgins et al., 2006). The methodological quality of the validation studies was analyzed by two independent reviewers, based on the Standards for Diagnostic Report Accuracy (Bossuyt et al., 2003); disagreements were resolved by consensus. The degree of agreement in the assessment of titles and abstracts was measured using the kappa coefficient, considering a confidence interval of 95% (Feinstein et al., 1990). The articles that met all inclusion criteria were assessed by the country of production, the scenario in which the study was performed, type of study, participants, duration of the study, key findings, and limitations pointed out by the authors. The type of instrument and psychometric characteristics used for validation in each review article were assessed.

RESULTS

The initial search identified 1830 studies. After exclusion of repeated articles, 1544 eligible titles were considered potentially relevant, and their abstracts were reviewed. After reviewing the abstracts, 105 articles were pre-selected for evaluation of the full text. Of these, 82 were excluded for the following reasons: the full-text version 45 was not available in the databases, 19 studies only evaluated pharmaceutical services and 18 had not presented data on content, construct, or criterion validity or internal consistency/test-retest reliability.

A substantial agreement was found among raters in the evaluation of abstracts ($\kappa = 0.786$) and full texts ($\kappa = 0.923$); this agreement was statistically significant (p < 0.001). Figure 1 shows the selection process and the number of articles in each stage.

At the end of the selection process, 23 studies met the inclusion criteria, of which 19 articles were written in English, two in Spanish, and two in Portuguese. Seven studies (26%) were conducted in Europe (Armando et al., 2008; Quispe et al., 2011; Tamargo et al., 2006; Delgado et al., 2009; Allenet et al., 2006; Horvat et al., 2010; Jocic et al., 2014), six (26%) in North America (Young et al., 2011; Martin et al., 2010; Skomo et al., 2009; Gourley et al., 2001; Desrochers et al., 2011; Sakharkar et al., 2014), three (13%) in Asia (Ngorsuraches et al., 2008; Fang et al., 2011; Al-jumah et al., 2014), and one (4%) in Oceania (Sriram et al., 2014). The main settings were community pharmacies (73%) (Armando et al., 2008; Quispe et al., 2011; Tamargo et al., 2006; Delgado et al., 2009; Horvat et al., 2010; Young et al., 2011; Martin et al., 2010; Skomo et al., 2009; Desrochers et al., 2011; Ngorsuraches et al., 2008; Fang et al., 2011; Feletto et al., 2011; Williams et al., 2012; Armando et al., 2009; Jocic et al., 2014; Sakharkar et al., 2014; Sriram et al., 2014; Al-jumah et al., 2014) and outpatient pharmacies

(8%) (Gourley et al., 2001).

Regarding the methodological design, 15 (60%) studies did not describe the methodology used (Armando et al., 2008; Tamargo et al., 2006; Delgado et al., 2009; Allenet et al., 2006; Horvat et al., 2010; Young et al., 2011; Martin et al., 2010; Skomo et al., 2009; Desrochers et al., 2011; Feletto et al., 2011; Njilele et al., 2012; Williams et al., 2012; Jocic et al., 2014; Sakharkar et al., 2014; Al-jumah et al., 2014) and only four studies (17%) were classified as cross-sectional descriptive studies (Fang et al., 2011; Azeredo et al., 2009; Armando et al., 2009; Sriram et al., 2014). Regarding the type of participants, 13 (57%) studies involved patients who used pharmaceutical services (Correr et al., 2009; Armando et al., 2008; Quispe et al., 2011; Delgado et al., 2009; Horvat et al., 2010; Gourley et al., 2001; Ngorsuraches et al., 2008; Njilele et al., 2012; Azeredo et al., 2009; Armando et al., 2009; Sakharkar et al., 2014; Sriram et al., 2014; Al-jumah et al., 2014) and 9 (36%) studies were conducted with the pharmaceutical community (Tamargo et al., 2006; Allenet et al., 2006; Young et al., 2011; Martin et al., 2010; Skomo et al., 2009; Desrochers et al., 2011; Fang et al., 2011; Williams et al., 2012; Jocic et al., 2014). Table 1 describes the general characteristics of the selected studies.

The development and validation of questionnaires for verification of patient satisfaction were the main objectives of ten studies (Armando et al., 2008; Quispe et al., 2011; Delgado et al., 2009; Horvat et al., 2010; Skomo et al., 2009; Gourley et al., 2001; Njilele et al., 2012; Azeredo et al., 2009; Armando et al., 2009; Sakharkar et al., 2014; Sriram et al., 2014; Al-jumah et al., 2014). Six studies (24%) were more diverse, evaluating topics from the ability of pharmacists to communicate, to the dispensing of medications (Tamargo et al., 2006; Young et al., 2011; Martin et al., 2010; Desrochers et al., 2011; Fang et al., 2011; Williams et al., 2012). As a questionnaire is a data collection tool that can be integrated with any methodology, it is the most common type of instrument used for the validation process (Correr et al., 2009; Armando et al., 2008; Quispe et al., 2011; Tamargo et al., 2006; Delgado et al., 2009; Allenet et al., 2006; Horvat et al., 2010; Young et al., 2011; Skomo et al., 2009; Gourley et al., 2001; Fang et al., 2011; Njilele et al., 2012; Azeredo et al., 2009; Armando et al., 2009; Jocic et al., 2014; Sakharkar et al., 2014; Sriram et al., 2014; Al-jumah et al., 2014), followed by the development and validation of measurement scales (Martin et al., 2010; Desrochers et al., 2011; Ngorsuraches et al., 2008; Feletto et al., 2011; Jocic et al., 2014; Sakharkar et al., 2014). Table 2 describes the methodologies of the articles included in the systematic review.

Regarding the characteristics of reliability analysis, 14 (61%) studies (Correr et al., 2009; Armando et al., 2008; Quispe et al., 2011; Horvat et al., 2010; Young et al., 2011; Martin et al., 2010; Skomo et al., 2009; Gourley et
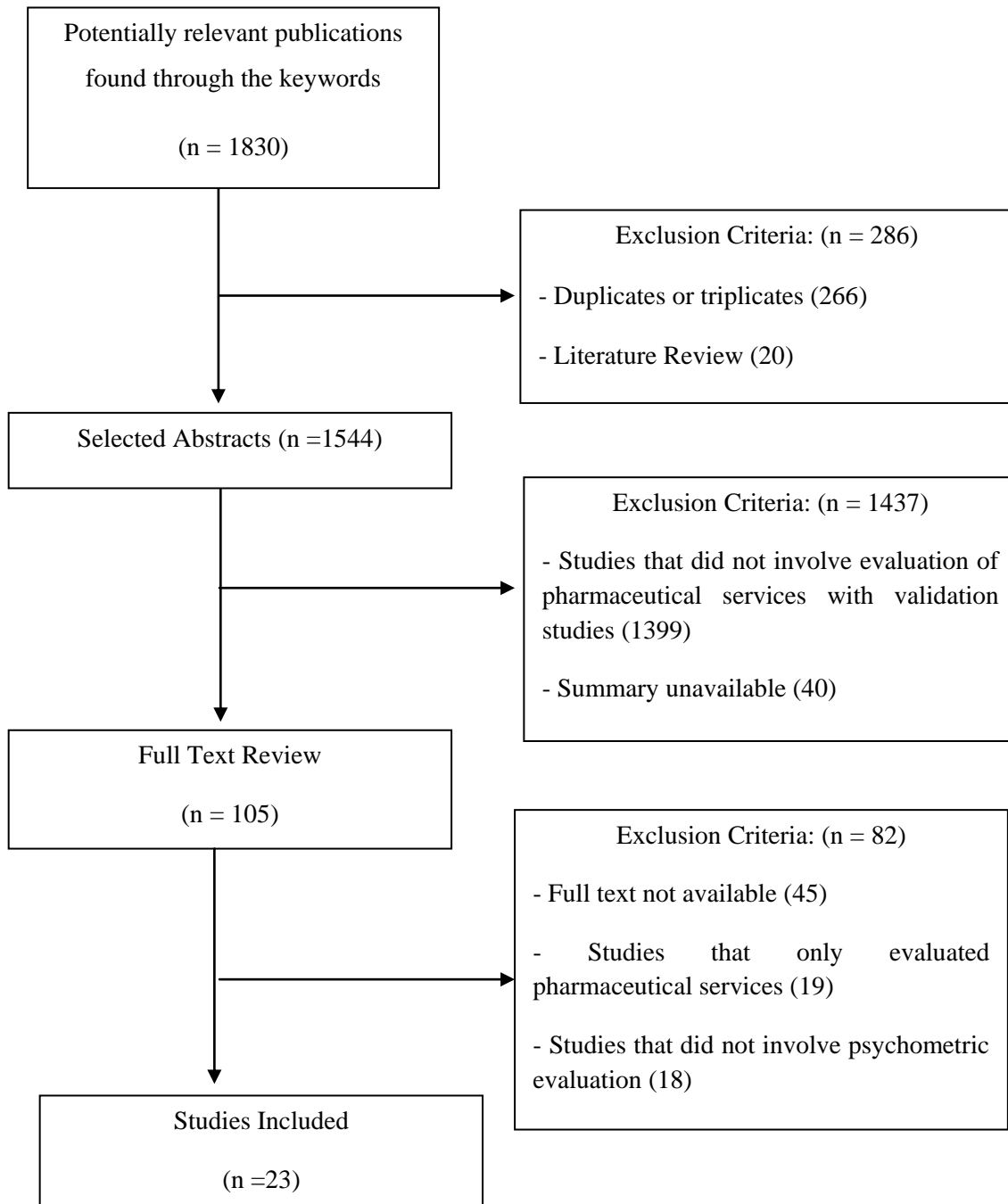
Figure 1. Selection process and the number of articles in each stage.

al., 2001; Ngorsuraches et al., 2008; Fang et al., 2011; Azeredo et al., 2009; Armando et al., 2009; Jocic et al., 2014; Sakharkar et al., 2014) used only one analysis of internal consistency (Cronbach's α), one study (4.7%) (Allenet et al., 2006) assessed inter-rater agreement using Cohen's kappa, and no study assessed only test-rest reliability. However, 28.5% of the studies examined several aspect of reliability simultaneously (internal consistency [Cronbach's α], test-retest, and inter-rater [Cohen's kappa] reliability).

Regarding validity, 13 (56%) studies (Correr et al., 2009; Armando et al., 2008; Quispe et al., 2011; Tamargo et al., 2006; Delgado et al., 2009; Allenet et al., 2006; Horvat et al., 2010; Desrochers et al., 2011; Ngorsuraches et al., 2008; Feletto et al., 2011; Njilele et al., 2012; Armando et al., 2009; Sriram et al., 2014)

Table 1. General characteristics of the studies included in the review. São Cristóvão - SE, 2015.

Study/Country	Scenery	Type of studies	Participants (n)	Duration of study	Results	Limitation
Al-Jumah et al. (2014) Arábia Saudita	Community Pharmacies	Exploratory research	Community Pharmacists (480)	One month	The Arabic version presented good internal consistency and a component structure identical to the original English version.	Limitations differences between the two languages made the translation and back-translation difficult.
Allenet et al. (2006) France	Hospital Pharmacy	NR	Pharmaceutical experts (12)	NR	The validation process using standard statistical methodology gave results support the external validity	Limitation of the method used
Armando et al. (2009) Argentina	Community Pharmacies	A descriptive cross-sectional	Patients or their caregivers (289)	Two months	The internal consistency were satisfactory	It was not possible to assess the retest, or the sensitivity of the questionnaires.
Armando et al. (2008) Spain	Spanish Community Pharmacies	NR	Patients received pharmaceutical services (NR)	Two months	The questionnaire showed evidence of validity and reliability to assess patient satisfaction	The data obtained cannot be generalized
Azeredo et al. (2009) Brazil	Dispensing Units	Cross-sectional study	With HIV on ARV therapy (1412)	One month	The instrument was suitable to be applied in similar populations	Representativeness of the sample
Correr et al. (2009) Brazil	Pharmacies of health facilities	NR*	Patients with diabetes II (154)	Six months	The Pharmacy Services Questionnaire (PSQ) has adequate reliability and validity for use	Absence of a prior assessment of patients
Delgado et al. (2009) Spain	Community Pharmacies	NR	Patients received pharmaceutical services (106)	Two months	For the use of the questionnaire is required monitoring of the assessment standards to prevent future bias classification	The management of data affected the assessment questionnaire
Desrochers et al. (2010) Canadá	Community Pharmacies	NR	Community pharmacists (90)	NR	O Pharmacotherapy Assessment in Chronic Renal Disease (PAIR) is a new research tool reliable	Insufficient information
Fang et al. (2011) China	Community Pharmacies	Cross-sectional study	Community pharmacists (110)	One month	Was perceived confusion of pharmacists regarding pharmaceutical care and its role in this process	Small sample size, selection bias
Feletto et al. (2011) Austrália	Community Pharmacies	NR	Owners (272), Pharmacy manager (83)	NR	Need to assess the implementation of pharmacy services	The sustainability of the service could not be measured in this study
Gourley et al. (2001) United States	Outpatient Pharmacy	Multicenter	Patients with hyperlipidemia (379)	NR	O Pharmaceutical Care Satisfaction Questionnaire (PCSQ) can be used to measure patient satisfaction	Needs further studies to enhance validity
Horvat et al. (2010) Slovenia	Community Pharmacies	NR	Outpatients (30)	NR	Analysis of reliability and construct validity and criterion yielded satisfactory results	Lack of response variability
Martin et al. (2011) United States	Community Pharmacies	NR	Community Pharmacists (106)	NR	More research would be needed to determine the self-efficacy instrument to perform services Medication therapy management (MTM)	Low generality

Table 1 Contd.

Ngorsuraches et al. (2008) Thailand	Community Pharmacies	NR	Patients received pharmaceutical services (400)	NR	It takes more study to refine the scale that measures the patient's confidence in the pharmacist	Low reproducibility, and selection bias
Njilele et al. (2011) Nigéria	University Hospital	NR	HIV-positive patients (400)	NR	The results indicate that the questionnaire is valid and reliable	Pharmacists helped in the administration of the instrument.
Quispe et al. (2011) Spain	Community Pharmacies	Cross-sectional study	Patients received pharmaceutical services (223)	NR	The patient satisfaction questionnaire (PSQ) is an effective tool for evaluating patient satisfaction	Selection bias, poor adherence to the study of pharmacy
Sakharkar et al. (2014) United States	Hospital Pharmacy	Observational study	Diabetic and psychiatric patients (149)	Two years and ten months	The PSPSQ 2.0, developed to measure patient satisfaction with the services provided by the pharmacist DM and clinical MTM	Some items of the questionnaire were invalidated by power have confused respondents
Skomo et al. (2009) United States	Community Pharmacies	NR	Community pharmacists (580)	One months	The creation of a reliable and valid tool can provide benchmarking intervention and improve care pharmacists to migraineurs	The low generalization low return rate of the instrument
Sriram et al. (2014) Austrália	Community pharmacies	NR	Patients at higher risk of bowel disease (118)	Twenty-two years and nine months	The JLT has high sensitivity for identifying patients with symptoms of serious bowel disease	The JLT instrument was compared to PCQ becoming a common practice and that the bias can be perpetuated
Strana et al. (2014) Sérvia	Community Pharmacies	Exploratory research	Community pharmacists (123)	A year and nine months	The initial PABS scale did not meet theoretical statistical criteria for reliability, but the findings indicated its potentially acceptable construct validity.	The initial PABS scale did not meet theoretical statistical criteria for reliability
Tamargo et al. (2006) Spain	Community Pharmacies	NR	Pharmacists holders of pharmacies (482)	NR	The questionnaire seems reasonably able to distinguish between phases in pharmaceutical change	Method postal survey
Young et al. (2011) United States	Community Pharmacies	NR	Community pharmacists (540)	Three months	We found evidence for the criterion validity of Spanish-Speaking Patients (PECS)	Low generality
Williams et al. (2011) Austrália	Community Pharmacies	NR	Community pharmacists (92)	NR	The system of classification of documents is a useful tool for clinical interventions made by pharmacists	NR

NR: Not reported.

assessed content validity and used other validation processes, and only 3(13%) of the studies (Horvat et al., 2010; Desrochers et al., 2011; Sriram et al., 2014) examined only content validity (expert panel and applicability of the instrument with target audience). Further, 19 (83%) studies (Correr et al., 2009; Armando et al., 2008; Quispe et al., 2011; Tamargo et al., 2006; Delgado et al., 2009; Horvat et al., 2010; Young et al., 2011; Martin et al., 2010; Skomo et al., 2009; Gourley et al., 2001; Ngorsuraches et al., 2008; Fang et al., 2011; Feletto et al., 2011; Njilele et al., 2012; Azeredo et al., 2009; Armando et al., 2009; Jocic et al., 2014; Sakharkar et al., 2014; Al-jumah et al., 2014) tested construct validity

Table 2. Methodological description of the articles included in the systematic review. São Cristóvão-SE, 2015.

| Study | Purpose of the study | Instrument type | Feature psychometric | | | | | |
| | | | Reliability | | | Validity | | |
			Stability and reproducibility	Uniformity of responses	Homogeneity of components or internal consistency	Content	Construct	Criterion
Al-Jumah et al. (2014) Arábia Saudita	Cross-culturally adapt the Armando Patient Satisfaction Questionnaire into Arabic and validate its use in the general population	Questionnaire	NR	NR	Cronbach's alpha Pearson correlation coefficient	NR	Factor analysis	NR
Allenet et al. (2006)	Assess the external validity of an instrument of French hospitals	Questionnaire; Likert Scale	NR	Cohen's kappa	NR	Expert Panel	NR	NR
Armando et al. (2009)	To evaluate the validity and reliability of the questionnaire of patient satisfaction in community pharmacies Argentina	Questionnaire; Likert Scale	NR	NR	Cronbach's alpha, Pearson correlation coefficient	Expert Panel; Applicability	Factor analysis (sphericity test Bartllet, Kmo)	NR
Armando et al. (2008)	Develop and validate a questionnaire on patient satisfaction with their medications in Spanish pharmacies.	Questionnaire; Likert Scale	NR	NR	Cronbach's alpha	Expert Panel; Applicability	Factor analysis (KMO)	NR
Azeredo et al. (2009)	Evaluate the reliability and construct validity of an instrument of patient satisfaction	Questionnaire	NR	NR	Cronbach's alpha, Pearson correlation	NR	Construct validation factor analysis (sphericity test Bartllet, Kmo)	NR
Correr et al. (2009)	Perform cross-cultural adaptation and validation of the questionnaire into Portuguese of Brazil.	Questionnaire; Likert Scale	NR	NR	Cronbach's alpha	Use of the target audience; Applicability	factor analysis (sphericity test Bartllet, Kmo)	NR
Delgado et al. (2009)	Develop and validate a questionnaire to measure the degree of patients' knowledge about drugs that they use	Questionnaire	Test-Retest	Cohen's kappa	Cronbach's alpha	Expert Panel; Applicability	Factor analysis	NR
Desrochers et al. (2010)	Develop an explicit set of criteria for the evaluation of pharmacotherapy in Chronic Kidney Disease.	Scale criteria	Test-Retest	Uniformity of responses, Correlation Coefficient Intra-class	Cronbach's alpha	Expert Panel	NR	NR

Table 2 Contd.

Fang et al. (2011)	Analyze the extent of the practice of pharmaceutical care and barriers to the provision of pharmaceutical services in community pharmacies in China.	Questionnaire; Likert Scale	NR	NR	Cronbach's alpha	NR	Factor analysis (sphericity test Bartllet, Kmo)	NR
Felleto et al. (2011).	Determine the actual needs of the pharmacy and the elements that require improvement in the performance of services.	Likert Scale	Stability used Test and Retest	NR	Cronbach's alpha	Expert Panel	Factor analysis	NR
Gourley et al. (2001)	Develop and validate a survey instrument to assess consumer satisfaction with pharmacy services	Questionnaire; Likert Scale	NR	NR	Cronbach's alpha	NR	Factor analysis	NR
Horvat et al. (2010)	Develop and validate a questionnaire of satisfaction, self-administered, to verify performance of the pharmacy with outpatients.	Questionnaire; Likert Scale	NR	NR	Cronbach's alpha	Expert Panel ; Delphi method	Factor analysis	Yes, but does not specify what type of validation.
Martin et al. (2011)	Develop and validate an instrument to measure "self-efficacy of pharmacists in performing these services Medication therapy management MTM"	Escala	NR	NR	Cronbach's alpha	NR	Factor analysis	NR
Ngorsuraches et al. (2008)	Develop and validate a scale to measure patient trust in community pharmacists	Scale	NR	NR	Cronbach's alpha	Expert Panel; Applicability	Factor analysis (sphericity test Bartllet, Kmo)	NR
Njilele et al. (2011)	Develop and validate a questionnaire of satisfaction of patients with HIV "with pharmaceutical care provided by the clinics' HIV / AIDS in Nigeria	Questionnaire; Likert Scale	Test pilot and pre-pilot	NR	Cronbach's alpha	Expert Panel	Factor analysis; Convergent and discriminant validity	NR
Quispe et al. (2011)	Describe and assess (validity and reliability) of a patient satisfaction questionnaire for services Pharmaceutical Assistance	Questionnaire, Likert Scale	NR	NR	Cronbach's alpha	Expert Panel	Factor analysis (sphericity test Bartllet, Kmo)	NR
Sakharkar et al. (2014)	To assess the psychometric properties of the PSPSQ 2.0, an instrument developed to measure patient satisfaction with clinical services provided by pharmacists.	Questionnaire; Likert Scale	NR	NR	Cronbach's alpha	NR	Factor analysis (Varimax, Kmo)	NR

Table 2 Contd.

Skomo et al. (2009)	Develop and evaluate the psychometric properties of an instrument on the pharmaceutical care of migraineurs	Questionnaire	NR	NR	Cronbach's alpha	NR	Factor analysis	NR
Sriram et al. (2014)	Develop and validate a questionnaire for use with adults presenting to community pharmacies with lower bowel symptoms	Questionnaire	NR	NR	NR	Expert Panel	RN	Yes, but does not specify what type of validation.
Strana et al. (2014)	Development and initial validation of a scale to measure attitudes and beliefs of pharmacists toward their work with patients	Questionnaire; Likert Scale	NR	NR	Cronbach's alpha	NR	Factor analysis	NR
Tamargo et al. (2006)	Validate the questionnaire to measure knowledge related to pharmaceutical services in Spanish community pharmacies	Questionnaire; Likert Scale	Test-Retest	NR	Cronbach's alpha	NR	Factor analysis (sphericity test Bartllet, Kmo)	NR
Young et al. (2011)	Develop and validate an instrument to measure the communication skills of pharmacists in Spanish patients (PECS)	Questionnaire; Likert Scale	NR	NR	Cronbach's alpha	NR	Factor analysis, (Test of sphericity Bartllet, Kmo, oblique rotation).	Yes, but does not specify what type of validation.
Williams et al. (2012)	Develop and validate a system for using documents to classify, record Drug-related problem (DRP), and investigate the frequency of clinical interventions	Documentation system	Test-Retest	Uniformity of responses, Kappa.	Cronbach's alpha (not reported in the results)	NR	NR	NR

NR: Not reported.

along with other kinds of validity, but only 10 (43%) (Tamargo et al., 2006; Martin et al., 2010; Skomo et al., 2009; Gourley et al., 2001; Fang et al., 2011; Azeredo et al., 2009; Jocic et al., 2014; Sakharkar et al., 2014; Sriram et al., 2014; Al-jumah et al., 2014) tested only construct validity. Criterion validity testing was not used as the sole methodology in any of the studies; two studies (8%) tested criterion validity in conjunction with

content and construct validity (Horvat et al., 2010; Young et al., 2011).

Studies appear to jointly evaluate reliability and validity, as it was found out that 22 (95%) studies performed complete analyses of reliability and validity (examining test-retest, inter-rater, internal consistency reliability and content, construct, and criterion validity) (Correr et al., 2009; Armando et al., 2008; Quispe et al., 2011; Tamargo et al.,

2006; Delgado et al., 2006; Allenet et al., 2006; Horvat et al., 2010; Young et al., 2011; Martin et al., 2010; Skomo et al., 2009; Gourley et al., 2001; Desrochers et al., 2011; Ngorsuraches et al., 2008; Fang et al., 2011; Feletto et al., 2011; Njilele et al., 2012; Azeredo et al., 2009; Armando et al., 2009; Jocic et al., 2014; Sakharkar et al., 2014; Sriram et al., 2014; Al-jumah et al., 2014). Only one study analyzed only reliability (Williams

et al., 2012).

DISCUSSION

Ever since the need for the use of valid instruments was identified, many countries are developing and implementing policies for dispensation of medications (Armando et al., 2008; Quispe et al., 2011). It was found in this review that countries in Europe and the U.S.A are working on strategies to improve the quality of pharmaceutical services (Armando et al., 2008; Quispe et al., 2011; Delgado et al., 2009; Allenet et al., 2006; Horvat et al., 2010; Njilele et al., 2012; Sakharkar et al., 2014). Cosendey (2003) states that the process of improving the quality of service still lacks a systematic approach to evaluating drug policies. Thus, there is a need for the development of tools that enable effective monitoring of the implementation of national and international policies of medication dispensation in order to evaluate performance and review priorities.

Regarding the setting of the studies, the community pharmacy was identified as the main venue for pharmaceutical services (Armando et al., 2008; Quispe et al., 2011; Tamargo et al., 2006; Delgado et al., 2009; Martin et al., 2010; Skomo et al., 2009; Ngorsuraches et al., 2008; Fang et al., 2011; Feletto et al., 2011; Armando et al., 2009; Jocic et al., 2014; Sriram et al., 2014). One of the strong pieces of evidence for the confirmation of this result can be linked to the structure of pharmacy. The community pharmacy is easily accessible and serves as an environment that allows good communication between the patient and pharmacist, leading to an increase in the level of trust between the professional and the patient (Quispe et al., 2011). However, this review found that few studies have addressed pharmaceutical services in hospitals (Allenet et al., 2006; Gourley et al., 2001; Njilele et al., 2012; Sakharkar et al., 2014; Al-jumah et al., 2014). There is a need to develop tools to evaluate hospital-based pharmaceutical services, as these tools can serve as a guide to improving the quality of service in daily practice. This recommendation is supported by Allenet (2006) and Gourley (2001), who reveal that the use of these evaluation tools enhances the aspirations of health professionals to improve care, and at the same time provide an idea of how this care is being perceived by the patient.

For the development of measures, the studies analyzed in this review used references to previous literature or adapted instruments already in use in other countries. However, the majority of the articles analyzed did not report the type of methodological design used in the study (Armando et al., 2008; Tamargo et al., 2006; Delgado et al., 2009; Allenet et al., 2006; Horvat et al., 2010; Young et al., 2011; Martin et al., 2010; Skomo et al., 2009; Desrochers et al., 2011; Ngorsuraches et al., 2008; Feletto et al. 2011; Njilele et al., 2012; Williams et

al., 2012). According to Rodrigues (2004) and Polit (2004), study design should be chosen in consideration of the human and material resources available and collected, the duration of the study, the representativeness of the population being studied, ethical issues, selection criteria, and possible biases. In this sense, the articles presented are limited in their reproducibility, as only studies using a cross-sectional design describing their methodologies (Quispe et al., 2011; Fang et al., 2011; Azeredo et al., 2009; Armando et al., 2009). As such, reproduction of these studies in other settings can become difficult to perform or be confusing for the researcher.

As for sample size, there was variation between studies, which may be explained by the diversity of sites where the research was performed, as well as different validation methodologies used by the authors. You can stand out negatively in the study (Armando, 2008) that failure to submit the sample size factor which limits the interpretation and even the majority of studies. According to Fontanella (2008), when it comes to psychosocial issues, the performance of an attribute should reveal functions or representative characteristics that context, perhaps, why the number of individuals appears to secondary way in some studies. Despite this secondary importance, the establishment of a sample size is inevitable as a methodological error in this final number of which the establishment may undermine the credibility of the findings and analyses.

Regarding research participants, patients and pharmacists were the most referenced. The participants indicated in the studies showed various characteristics, such as chronic degenerative diseases (diabetes, hypertension), infection with HIV, and experience of menopause. However, the studies do not clearly report their inclusion criteria. This failure may be related to the question of evaluating the service provided to these individuals. This is done once the patient has taken a starring role in the health system, that position has a direct impact on improving the relationship between him or her and the pharmacist (Ramos, 2003). On the other hand, Jocic (2014) in their study points out how the attitudes and beliefs of health professionals about their work with patients, can affect quality of health care showing improvement in clinical, humanistic and economic results. Thus, it is essential to know how users evaluating the service provided to them, for rethinking professional practices and intervene on the form of organization of services, to its improvement.

In relation to the objectives in the studies analyzed, was the development and validation of questionnaires for verification of patient satisfaction. In this sense, Armando (2008) and Larson (2002) state that user satisfaction is defined by observing the services provided. Azeredo (2009) suggests that it is the quality of the service itself that is responsible for determining satisfaction. However, Panvelkar (2009) showed that the result of the service is

not always included as the main criterion for the evaluation of services. Criteria for evaluating the pharmaceutical service should not be restricted to single assessment of how well the services are provided, but must also focus on how well the services meet the needs of patients. Therefore, it is necessary that the tools developed are validated to encourage research on patient satisfaction with pharmacy services, given that the focus of pharmacy services, including within the hospital setting, has expanded beyond dispensing drugs to providing other services (such as assessment of therapeutic regimens, development of monitoring plans, and assessments of physiological parameters).

The type of instrument most commonly used in the validation process of the studies was the questionnaire. With the expansion of services, it has become increasingly difficult for pharmacists to quantify the value of their services, so the use of a simple, practical, and useful questionnaire could easily reflect the level of patient satisfaction with professional services (Armando et al., 2008). The purpose of using questionnaires is to provide a voice to patients in order to assess and improve the services they are receiving.

In this respect, Collins (Rodrigues, 2004) states that questionnaires are useful for measuring patients' reactions to improvements or changes to the service. The reviewed articles did not make clear the duration of studies nor described the methodology used to arrive at consensus on the validation process, only mentioning the constitution of the panel of assessors (judges), changes in the questionnaire, and application to the target audience. According to Wright (2000), Giovinazzo (2001), and Cardoso (2005), the usual duration for the validation process using the Delphi technique, which is a systematic method of trial information, is four months to a year, depending on complexity of the subject and the instrument. In this sense, it is necessary to consider all specialties involved in consensus about content validity, because the opinion of experts (evaluators) brings to the researcher constructive feedback on the quality of the measure, as well as solid suggestions for its improvement.

In the reviewed articles, reliability was analyzed in terms of internal consistency; using Cronbach's α. Studies presented alpha values between 0.70 and 0.90, indicating that the items included were appropriate for the measurement instrument (Quispe et al., 2011). The articles did not measure the correlation between alpha and other parameters. Lee (2005) and Hair (2002) suggest that this may be linked to the fact that results obtained by the alpha coefficient are broad and based on the internal consistency; therefore, researchers did not doubt the reliability of a measure. However, the existence of redundant or unnecessary items that measure the same aspect of a concept cannot be ruled out, since this aspect is often not disclosed by the researcher in order to obtain high alpha values (Ladeira, 2010).

Most studies in this review used the parameters of internal consistency (Cronbach's α) and factor analysis. Based on the results of these analyses, the authors concluded that their instruments were valid and reliable, and that they were ready to be used in service (Correr et al., 2009; Armando et al., 2008; Quispe et al., 2011; Tamargo et al., 2006; Delgado et al., 2009; Allenet et al., 2006; Horvat et al., 2010; Young et al., 2011; Martin et al., 2010; Skomo et al., 2009; Gourley et al., 2001; Desrochers et al., 2011; Ngorsuraches et al., 2008; Fang et al., 2011; Feletto et al., 2011; Njilele et al., 2012; Azeredo et al., 2009; Armando et al., 2009; Jocic et al., 2014; Sakharkar et al., 2014; Al-jumah et al., 2014). However, the same studies reported that more research was needed to expand the robustness of the instruments (Vituri et al., 2009; Raymundo, 2009; Bittencourt et al., 2011; Higgins et al., 2006; Feinstein et al., 1990; Quispe et al., 2011; Delgado et al., 2009; Gourley et al., 2001; Jocic et al., 2014; Sakharkar et al., 2014). Armando (2008) emphasizes that these tools are useful when they are complemented with other methodologies, particularly those related to qualitative research tools such as focus groups, interviews, and field research. Thus, these articles recommend that future studies employ a combination of techniques because the use of multiple techniques (that is, triangulation) beyond mere survey research provides instruments that are not only reliable but also valid.

The articles also addresses the issue of statistical tests by presenting the results of concordance between raters on the items of the measurement instruments, mainly using factor analysis to test construct validity and calculating internal consistency (Cronbach's α) for reliability. According to Pasquali (2009), validity involves whether a test is a legitimate and its results are appropriate representation of the construct of interest. Reliability, in the view of the same author, is related to the test's ability to capture the variations in real measurements in a population through reproducibility of results and internal consistency. This view corroborates Pillati's (2010) opinions on the reliability, stability, and accuracy of the results of a test. In this sense, it appears that the studies conducted jointly psychometric characteristics, increasing its quality and providing strong evidence as to be the most appropriate form of survey data available for this purpose.

The articles studied in this review pointed to the lack of validated instruments in the area of pharmaceutical services. With respect to the testing of measures, the articles bring up the issue of the pilot test, which is conducted before the implementation of the final version of the tools developed (Norman, 2012; Vituri et al., 2009; Raymundo, 2009; Bittencourt et al., 2011; Higgins et al., 2006; Feinstein et al., 1990; Quispe et al., 2011; Young et al., 2011; Njilele et al., 2012; Sakharkar et al., 2014). The process of validation of an instrument defines the ability to measure the same observation in the study, so

this observation will affirm if the chosen variables and the theoretical concept being measured were adequate or not (Lima et al., 2013). The implementation of the pilot test can be highlighted positively in the articles included in the review, since this step allowed a prior assessment tool to be applied to a small sample of participants, and permitted evaluation of aspects of its administration and correction of any errors before its final deployment.

Conclusion

This review sought to contribute to addressing a topic relevant to improving the quality of studies related to public health: the development of the process of validation of instruments that evaluate pharmaceutical services. Although, there are different instruments that can be used to evaluate health services in general, there is not yet an instrument that can measure pharmaceutical services in all areas, and that suits all studies so that their results can be compared.

The analysis of variables of the studies demonstrated that the field of pharmaceutical services still needs to be explored, as they are still confounding these services with the actions already implemented in the daily example of the pharmacy dispensing drugs. The reviewed studies did not indicate the potential of their instruments in interventions to improve pharmaceutical services as well as the potential beneficial effects of these interventions.

The limitations of the types of features and study of the various methodologies proposed in the work should guide future studies in this field, helping them to adopt a more comprehensive approach for validating measures. Thus, research is needed to develop and validate instruments directed at pharmaceutical services, especially in hospitals, in order to improve the quality of services provided to users, influence users' quality of life, and decrease the demand for health services.

LIMITATIONS

The present study had some limitations. First, the number of keywords was limited due to the primary purpose of the review, and may restrict the data generated. Moreover, the selection strategy of databases and the restriction of the language of publication may have excluded some very important studies that were not published in the sources and languages used.

Conflict of interest

The authors have not declared any conflict of interest.

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Full Length Research Paper

Progress test: A review to motivate their use in pharmacy schools in Brazil

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Progress Test (PrT) is a longitudinal assessment strategy in which tests composed of contents from all the curriculum are periodically applied to all students of a course. Such strategy allows measurement of deep, long-lasting meaningful learning as well as early detection and remediation of underperforming students. It was introduced more than forty years ago, and it has been used in several health schools in the world, especially medicine. Assessment of students' knowledge gain and its application over the course is a challenge. PrT has become a relevant method to monitor the development of the student through graduation. There is no culture of using longitudinal assessments in Brazil's pharmacyschools. This scenario is an opportunity for use of PrT. The objective of this work is to make a literature review about how progress test has been used in context of education. The authors also discuss the possibilities of PrT's application in Pharmacy undergraduate courses in Brazil. PrT has a long history of use by various institutions in the world. Most user experiences come from medical schools, but there are articles showing the application of PrT in dentistry and psychology schools. PrT has been shown to be an effective assessment tool in a problem-based (PBL) and traditional curricula. PrT is recommended as a tool to longitudinal assesses growth in knowledge. Phamacy schools may develop their own framework for PrT collaborations, which could optimize the educational utility of student's assessment instruments as tools to enhance learning.

Key words: Progress test, assessment, knowledge.

INTRODUCTION

The Progress Test (PrT) is a longitudinal assessment strategy in which tests composed of contents from all the curriculum are periodically applied to all students of a course, with the expectancy that a progressive proportion of answers will be right (Vantini and Benini, 2008). Such strategy allows measurement of deep, long-lasting

meaningful learning as well as early detection of underperforming students. Information obtained from progress testing results also serve as a quality assurance tool for institutional stakeholders to help prioritize efforts on curricular governance and faculty development (Verhoeven et al., 2002). It has been introduced more than forty years ago, and it has been practiced in various health schools in the world, especially medicine (Vleuten et al., 1996; Verhoeven et al., 1999; Finucane et al., 2010; Freeman et al., 2010; Bennett et al., 2010). PrT was developed in the context of problem based learning (PBL), but its use was not restricted to PBL programmes (van der Vleuten et al., 2004; Verhoeven et al., 2005). The PrT values the knowledge acquired during the period of graduation, not individual curricula (Nouns et al., 2012).

It is expected that the curriculum of the faculty can produce a solid knowledge to the student. A well-developed curriculum should ensure the development of cognitive, psychomotor and affective skills (Al Alwan et al., 2011). The Ministry of Education published in Brazil the pharmacy courses curriculum guidelines in 2002. This guide has been published to meet the training needed in the face of increased pharmacist insertion in health services, especially public health. It is intended that the final objectives of a curriculum must relate to the reality of where the pharmacist works, after all, the quality of pharmaceutical services depend on the quality of learning to preparing individuals for the several changes and challenges (Ogaji et al., 2016). In addition to this, the amount of pharmacy courses has multiplied and this fact demands capable assessment tools to qualify learning and harmonize the knowledge taught in institutions. Currently most of the pharmacy courses in Brazil adopt assessment methodology focused on tests at the end of each module. This use promotes the short-term memorisation or unrelated facts rather than promotes deep learning. PrT has become a relevant method to monitor the development of the student through graduation (Langer and Swanson, 2010; Al Alwan et al., 2011; Gold et al., 2015).

The central question who guided this review was: What contribution can the progress test give for learning to the schools of pharmacy in Brazil?

The aim of this work is to make a literature review about how progress test has been used used in context of education. The authors also discuss the possibilities of PrT's application in Pharmacy courses in Brazil.

MATERIALS AND METHODS

To accomplish this literature review, the authors used the SCOPUS® database. It is one of the largest abstracts and citation database of peer-reviewed literature in the world. The keywords used for research in Scopus® were progress test delimited by inverted commas. This search was conducted in April of the year 2016.

In Scopus® database we select as inclusion criteria all the original articles and reviews on the progress test in higher education; articles or reviews written in *english or portuguese*, published between *1990 and 2015; subject area included was only* medicine, dentistry, social sciences, psychology and nursing. There were exclusion criteria: Notes, conference paper and book chapter. The search in database brought articles not relationed to progress test and was not considered to analysis. Some articles with terms "progress" or "test" isolated, appeared on search results and it was excluded as well.

RESULTS

The search finds 128 documents. After applied exclusion criteria, 65 articles were elegible to analysis. The main results are presented in Table 1. To make it easier to understand, it were analyzed considering the following criteria:

1. PrT as assessment tool through graduation
2. PrT as assessment tool through post-graduation
3. Investigation about standards to PrT
4. Practices to application of PrT
5. PrT used in collaboration
6. PrT as instrument to comparison

DISCUSSION

The number of pharmacy schools in Brazil is growing. This scenario demands instruments to ensure that the pharmacist is being well formed. For any course of university education, it is important to monitor how it develops the cognition of students. It is argued that the assessment of this growth needs to mix formative assessment elements to improve performance, or summative, for accountability purposes and making decision (Schauber and Nouns, 2010). The relationship between an educational program and the method of evaluation is vital because the tests and examinations lead student learning (Verhoeven et al., 1999). The PrT is a real possibility to assess gain of knowledge by students. Besides that, for students who have submitted to a PrT there were more consistent and significant progress in academic's results when compared to students without it. That is because students tested continuously tend to retain knowledge more effectively (Schaap et al., 2012).

The set of articles present the evidence that PrT is a valuable method to assess and monitor the student's advancement (Boshuizen et al., 1997; Verhoeven et al., 2002; Dijcks et al., 2003; Rodrigues and Catarina, 2007; Löwe et al., 2008; De Champlain et al., 2010; Nouns et al., 2012; Al Alwan et al., 2011). Most studies describe experiences of the use of PrT in medical schools, but it is also used in other courses such as psychology, dentistry or nursing (Finucane et al., 2010; Norman et al., 2010; Muijtjens et al., 2008; Schaap et al., 2012; Ravesloot et al., 2012; Sangestani et al., 2013; Postma and White,

Table 1. Main results of aplication of progress test.

Objective/Reference	Main results
PrT as assessment tool through graduation	
To understand the influence of PrT in students' behaviour and students' perceptions (Berkel et al., 1994)	PrT support learning processes meaning oriented in contrast to repetition oriented learning. When both progress tests and block tests are summative used, PrT is not seen by students as an effective method to develop a meaningful learning
To measure if there are differences in kinetics and acquisition of knowledge among students from three countries (Albano et al., 1996)	Perhaps Prt is not the most appropriate method for assessing students in international exchanges. Despite this, the authors consider that the PrT can be used to measure the gain of cognition in areas such as basic sciences.
To describe the experience of the Personal Progress Index as a PrT at the McMaster University (Blake et al., 1996)	PrT was well accepted by the students as a means of measuring growth of knowledge. The analysis of PPI scores allows us to identify students with learning problems.
To evaluate the impact of PrT on the scores on a Clinical Reasoning Test (CRT). To investigate how PrT scores contributes to the CRT scores through the years (Boshuizen et al., 1997)	PrT is a relevant instrument for monitoring the student's progression. It correlates with the CRT scores, specially in clinical sciences. Despite this, there are questions that depend on the school's aim and policy.
To evaluate the extension of study between academics of a medical school in first and later years (Hurk et al., 1999)	PrT was used as a parameter to evaluate the behavior of students relationed with dimension of learning.
To study the progression of knowledge in students over the course in a medical school's problem-based curriculum through PT scores (Verhoeven et al., 2002).	PrT scores of 21 years reveal a growth in knowledge related to training time.
To explore whether students are still gaining knowledge about basic sciences through the years (O'Neill, 2000)	PrT was used for summative assessment of knowledge. The researchers observed an advancement in the basic Science scores evaluated by PrT
To analyze relation to peer-rated competence of students with the relevance of written longitudinal tests, block tests and OSCEs (Dijcks et al., 2003)	Progress test is a valuable tool to predict a profile of functioning student
To confront the consistency of different dimension of self-directed clinical learning (Dornan et al., 2003)	There was no association between results on PrT with self-reported real patient learning instrument. Probably because PrT covers knowledge and seems less effective to this measure
To measure the quality of undergraduate education between medical students in psychiatry and behavioral sciences (van Diest R et al., 2004).	Conclusions after application of PrT point a significant increase in knowledge growth for psychiatry and behavioral sciences. The measurements were made between the 1st year and the end of the 6th year among academics
To plan and administer a competence test throughout the Sheffield undergraduate medical course related to musculoskeletal system knowledge gain (Basu et al., 2004)	An adaptation of PrT was used to measure gain of knowledge. Authors found an adequate knowledge about musculoskeletal medicine between students after application of PrT
To implement the PrT as periodic evaluation; assess whether the knowledge gain has continuity; to check for loss of knowledge in the area of basic sciences at the end of the course (Tomic et al., 2005)	The authors showed that it was possible the implementation of PrT; there was progressive knowledge gain from first to last year in all tests; the knowledge related to basic sciences were kept
To analyze models of learning, training and progress evaluation (Vantini and Benini, 2008)	The authors summarize questions about learning, progression of the students, competence, responsibility, continuity and assessing progression. PrT is discussed as a method that assesses the comprehensive knowledge and its progression.

Table 1. Cont'd.

To compare the level of knowledge of graduate students with a university degree with to the ones with college degree (Cohen-Schotanus et al., 2008).	Analysis of results from a PrT revealed that there were no differences between the groups of evaluated students
To discuss the implementation of PrT in medical schools in Germany (Nouns and Georg, 2010)	PrT was proposed by students, who looked for meaningful learning in undergraduate education. The study showed that it is possible to compare knowledge between schools within a context of cooperation. The longitudinal application of PrT contributed to the understanding of formative assessment and improved the quality of examinations
To study long-term effect of PrT on student learning (Norman et al., 2010)	The implementation of a formative PrT has a beneficial consequence for performance in a national licensing examination. The introduction of the PrT in an institution reduced failure rate by ¾
To evaluate the PrT as a predictive factor to identify behaviour of knowledge in medical students related to basic and clinical Science (Alwan et al., 2011)	Results of PrT have showed that students performed better in clinical sciences than the basics'. In this experiment the results were used to modify the curriculum
To analyze perceptions and preparations by medical students for the PrT (Wade et al., 2012)	Students elected three major factors around PrT: PrT's capacity to assess behavior of knowledge, to assist clinical learning and its importance for exam preparation
The objective of this study was characterized by the development of knowledge among first-year psychology students (Schaap et al., 2012)	PrT scores showed that the growth of knowledge was different among the students. Nevertheless, due to some limitations, researchers receive this result with caution
To compare the performance among students in development and retention of knowledge in the basic medical sciences (Nouns et al., 2012)	PrT allows understanding the advance of knowledge in both traditional and PBL reformed medical curriculum.
To investigate relations between student characteristics and academic achievement (de Koning et al., 2012).	Department of Psychology uses the PrT as a central method of assessment. Based on PrT results, authors concluded that three factors are strong predictors of academic development: students observed learning activities across the course, conquests in secondary education and during the first two bachelor years, as well as in their verbal abilities
To report the innovative use of the National Board of Medical Examiners Comprehensive Basic Science Examination as a PrT throughout the preclerkship medical curriculum (Johnson et al., 2014)	This work demonstrated the use of the CBSE as a PrT has an important role as an evaluation method
The objective of this study was to evaluate the stress and student learning by comparing the PrT with traditional forms of assessment (Chen et al., 2015)	A low sense of stress was achieved with the application of PrT. For the other hand this research found no evidence that PrT enhances learning.
To make a literature review investigating the result of different learning environments. (Schauber et al., 2015).	PrT was used as indicator of academic achievement. This work showed that there was a better performance of students through the time, but PT was not able to detect application of knowledge.
To share the experience of building PrT in an undergraduate dental programme (Ali et al., 2015)	PrT features: Being applied to students from all 4 years; also, realized twice a year; it is a formative assessment in years 1 and 2 and summative in subsequent years; each test adopts 100 single best answer multiple-choice items; among the options there is a 'don't know' option; it uses negative marking and 0 for 'don't know' answers. PrT has validity and reliability to assess growth in knowledge through the undergraduate program

Table 1. Cont'd.

PrT as assessment tool through post-graduation	
To evaluate extension of post-graduation training in general practice on the acquisition of knowledge of trainees (Kramer et al., 2003)	Application of PrT allowed showing that post-graduation training promotes an increase in knowledge between students. The gain of knowledge in a 3-year program is better than in a 2-year program
To investigate the behavior of the residents of anesthesia relating affective-motivational variables with study strategies (Rodrigues and Catarina, 2007)	The growth of the knowledge of the basic sciences among residents of anesthesia was associated with anxiety related to the activities of study, results, motivation to study, the individual improvement and to the ability in choosing main ideas from subject matters
To measure the effect of a 1-year resident training program in clinical research (Löwe et al., 2008)	Use of the PrT shows growth on research knowledge
To verify the validity and reliability of a national PrT in postgraduate Obstetrics and Gynecology training (Dijksterhuis et al., 2009)	The results of this study were not satisfactory. The PrT has not presented validity and reliability
To investigate the quality and validity of PrT in postgraduate radiology training (Ravesloot et al., 2012)	The study finds that PrT is a valuable method in medical specialty education. For the other hand, the study doesn´t allow to relation visual skills with knowledge. Reliability and construct of validity were found by researchers

Practice to application of PrT	
To review the application and some results of PrT after 15 years of experience (Vleuten et al., 1996)	PrT has a central role of PBL program. It magnifies the student-centered learning. Several universities in the Netherlands have been using the progress test. The domain of knowledge by students of Maastricht is equal to other institutions that do not have progress test. The multiple-choice questions are more reliable. Progress test was developed in the context of PBL, but it can be used in traditional educational programs
To inspect methods which have been used to assess the outcomes of single tests, and to advice best practices (McHarg et al., 2005)	Authors recommend that the norm referencing is better than criterion referencing; number-right marking is less recommended than negative marking; discontinuous scale is better than a continuous scale.
To evaluate the use of questions with short answers (Rademakers et al., 2005)	The authors consider that to adopt short answer questions is relevant to formulate and implement PrT. The time and costs of question plan and marking the answers are acceptable. The process will be simplified with adoption of computerizing
To describe a development of a web-based tool to give feedback to students (Muijtjens et al., 2010)	The study showed that the Progress Test Feedback (PRoF) system was developed in two years, it was tested in several schools and it has many features. Although the authors consider the system useful for teachers and students, they understand that it takes more evidence to prove the integration of summative and formative assessment
To discuss aspects of the development of the PrT (Ricketts et al., 2010).	This work raises questions about how best to apply the test. Two aspects are considered in the article: cost and reliability. The reliability increases with the size and the test frequency. On the other hand, discusses choose larger and less frequent testing as the best way forwards. This aspect can reduce the global costs for the test. However, the analysis did not link the issues of cost and reliability to educational impact and acceptability.

Table 1. Cont'd.

To investigate if multiple choice tests are fair to students in medical schools with specific learning disabilities (Rickets et al., 2010b)	The authors analyzed a series of PrT questions applied to a group of students including those with some disabilities. They concluded that when the test is adequately prepared, there are no problems to students with learning disabilities
To evaluate whether a variant of PrT could recognize poor performing students (Kerfoot et al., 2011)	According to the authors, PrT developed by e-mail together with a cycle of reviews with the materials of study seems to be an important tool to use for improving gain of knowledge
To evaluate acceptance of formative assessment comparing computer-based with paper-based assessment (Karay et al., 2012)	The PrT application in computed-based format was well accepted by the students.
Investigation about standards to PrT	
To investigate application of standards (relative or absolute) for approval or disapproval and check for a substantial increase of the variation in the failure rate per test (Muijtjens et al., 1998)	The use of fixed absolute standards in progress tests developed in a norm referenced setting is precarious because of the variations in difficulty of different tests. The authors recommend: constructing a test by selecting items from a bank of items of known difficulty, which enables measurement and control of the test difficulty, or 2) a more expressive standard setting procedure which is based on item judgment by a panel of experts
To investigate standards for the PrT (Verhoeven et al., 1999)	Graduated students as judges are a useful method for development of a progress test. However, viability was a problem detected in the search
To describe the steps and approaches necessary to achieve effective peer review and to produce tests of consistent high quality (Verhoeven et al., 1999b)	The authors explain the approach to produce highest possible quality items for progress test.
To characterize the reliability and credibility of Angoff procedure and do a comparison of the standards (Verhoeven et al., 2002b)	The use of a panel of writers as judges is not feasible to obtain a reliable passing score. The established passing score seems less credible. The political acceptability of a panel from recently graduated students seems doubtful. A better standard can be obtained from a mixed panel (item writers and graduates)
To demonstrate a statistical method used in context of PT, called the cumulative deviation method and which is intended to elicit trends in longitudinal knowledge growth across the undergraduate curriculum and that can be used for benchmarking (Muijtjens et al., 2008)	The findings support the feasibility of using the method of average cumulative deviation. This method compares schools' performance on student knowledge, reveal the impact of curricular changes on knowledge gain, and diagnose strengths and weaknesses of current or developing curricula
To purpose a new standard setting for PrT (Ricketts et al., 2009).	This study showed that the development of standards for the PrT represents a challenge. Authors demonstrated that successive evaluation of students' performance can produce a rich source of information. This action helps set standards setting for PrT
To study the basis of equating in context of PrT (Langer and Swanson, 2010).	Equating is a statistical process that controls differences in the difficulty among forms, so that, the scores can be used interchangeably. PrT must produce a true assessment of what you want to measure. Authors discuss a usage of a hybrid equating design as a potential solution for development of the PrT
To discuss the use of blueprint to enable increasing and new opportunities for feedback in context of PrT (Coombes et al., 2010)	The blueprint covers questions on the curriculum and gives possibilities to monitoring the quality of test. Associated to this fact, the PrT can provide a very important source of feedback to learners.

Table 1. Cont'd.

To investigate the use of PrT in clinical education through growth of knowledge and impact of recent training (De Champlain et al., 2010)	The study helps to show the importance of equated scores because of its capacity in promoting an assessment of growth without the confounding effects; and because it explains the mechanism how clinical knowledge grows
To analyze the use of procedure for cross-institutional benchmarking between institutions which use PrT (Schauber and Nouns, 2010)	Cross-institutional comparisons can be made using the cumulative deviation method. The model seeks to interpret standards and clarify the differences of the data obtained in the PrT. Nevertheless, the method has limitations, for example, it does not discriminate partly depending on the structure of the data
To analyze the reliability and credibility of several panels of judgement to PrT (Anderson et al., 2011).	This study found out that identifying the best judges for standard setting is paramount to successful implementation of a progress test. Alumni and mixed faculty-alumni judge panels had difficulty producing credible student outcomes. Judge panels should be preferred when established progress test criteria.
To investigate a Bayesian statistical approach used for reducing error in PrT (Ricketts and Moyeed, 2011)	The statistical approach from this study produced a best estimate of scores and smaller standard error of values. The simplicity of the method facilitates its use along the large cohorts of students and frequent tests

PrT used in collaboration

To report the progress test and its convenience for cross-institutional cooperation (Vleuten et al., 2004)	The economic benefit is one of the advantages of sharing materials among schools. This allows a construction of the PrT with more quality. Sharing achievement contributes to educational quality
To evaluate the potential of international sharing of PrT (Verhoeven et al., 2005).	The PrT is an important methodology to evaluate medical schools. Evidences show that sharing test material saves resources and seems to be a viable strategy
To investigate whether there is discrimination between items of PrT used for inter-curriculum comparison (Muijtjens et al., 2007).	The researcher found that it may not be appropriate to make comparisons between results on identical tests from students of different schools when tests are composed by staff of one of the schools only. The authors concluded that the source of the bias items has a propensity to compromise the reliability and fairness of comparison. The solution to this problem must involve the provision of equal number of items by the schools. Another proposal is to make a more rigorous review
To detail various stages of PrT development in collaboration to the National Board of Medical Examiners (NBME) (Swanson et al., 2010).	This work shows that it is feasible to develop the PrT in the UK on taken items from the United States Medical Licensing Examination (USMLE). The use of the same blueprint helps to improve the comparison over time. Furthermore, the use of multiple test forms and involving experts are also important considerations. The authors recommend caution when using materials from other countries due to cultural characteristics, laboratory units, terminologies, care protocols and drug formularies
To describe collaborative banks with questions for PrT, methods used to validate and adapt questions and to make comparisons among questions from different sources (Freeman et al., 2010).	This work shows that transferring questions from one institution to another is not a simple task. There are issues related to curricular and cultural differences. The effective use of questions from external banks needs an amount of work to adapt them to local conditions

Table 1. Cont'd.

To report advantages and disadvantages of the collaboration in PrT (Schuwirth et al., 2010)	The authors consider that collaboration in Netherlands in context of PrT is adequate, but there is some riskiness. The main advantages are: the possibilities for curricular comparisons, opportunities for conducting research, cost reduction and reach of many students by application of PrT. Some disadvantages are: conceptual differences about what items are good quality and regulatory issues of each institution.
Instrument to Comparison (between curricula, methods of learning…)	
To compare the academic performance of two medical schools with two different learning method (Verhoeven et al., 1998)	PrT was used to comparison between two curricula. There were no significant differences in cognitive performance for curricula.
To compare scores on knowledge of two cohorts of students from two curricula (old and new) in their final year (Peeraer et al., 2009)	This study evaluated the effect of curriculum change from a medical school. PrT was used as instrument to measure scores. No significant differences were found between two curricula (old and new)
To compare behavior of students between two curricula (Van Der Veken et al., 2009).	PrT was used to measure the learning between integrated medical curriculum (ICMC) and conventional medical curriculum (CMC). The differences obtained in ICMC medical students were attributed to the stronger emphasis on clinically relevant basic sciences in the first years and to the stronger integration of basic and clinical sciences in the ICMC.
To compare the increase of knowledge among students of a new and another long-established school using the PrT (Finucane et al., 2010)	The level of knowledge acquisition is similar between these groups of students. There is feasibility in inter-institutional and international collaboration in PrT. This type of collaboration can be offered as a useful quality assurance tool.
To study methods for educational evaluation between schools (Muijtjens et al., 2008b).	The study shows that single-point benchmarking, among three schools that used PrT produces questionable results. For the other hand, the better method seems to be benchmarking based on longitudinal data and cumulative deviations
To evaluate the results of a competency-based active learning curriculum (CBAL) compared to the existing active learning curriculum (AL) (Kerdijk et al., 2013)	Based on PrT results, this research could not prove that competency-based education is better than traditional form for students. Authors recommend further studies
To confront the influence of PBL and lecture-based learning (LBL) to the learning development of students (Sangestani et al., 2013)	Results of PrT showed that students in PBL group experiments more rapid progress of learning than the other lecture-based
To measure knowledge retention in schools with PBL curriculum and traditional curriculum (Heijne-Penninga et al., 2013)	PrT was used as an assessing method to evaluate performance of students in three medical schools. PBL curriculum is better than the traditional curriculum. The use of closed and open-book tests contribute to the long-term knowledge retention
To describe the progress of the clinical reasoning skills using PrT results (Postma et al., 2015).	PrT was used to compare case-based learning against lecture-based teaching. Case-based learning seems to contribute to accurate clinical decisions more than lecture-based teaching.

2015; Ali et al., 2015). Development of PrT in post-graduation training seems possible, but in this revision showed that there is a need for further studies (Kramer et al., 2003; Rodrigues and Catarina, 2007; Löwe et al., 2008; Dijksterhuis et al., 2009; Ravesloot et al., 2012).

The authors have discussed aspects of the practice of

PrT as the type of questions, reference criteria, use of internet-based tools and costs (Vleuten et al., 1996; McHarg et al., 2005; Rademakers et al., 2005; Muijtjens et al., 2010; Ricketts et al., 2010; Rickets et al., 2010b; Kerfoot et al., 2011; Karay et al., 2012).

Several articles present procedures for the achievement of standards for the PrT. Statistical methods, bank of items, better judges for the questions and quality of test are discussed (Verhoeven et al., 1999b; Muijtjens et al., 1998; Muijtjens et al., 2008b; Ricketts and Moyeed, 2011; Anderson et al., 2011; De Champlain et al., 2010; Langer and Swanson, 2010). Despite this development of standards for the PrT represents a challenge (Rickets et al., 2009).

Collaborative studies about PrT show mainly the economic benefit (Vleuten et al., 2004; Verhoeven et al., 2005). The PrT can be used for comparison purposes, but there are existing error sources that need to be considered (Swanson et al., 2010; Muijtjens et al., 2007; Freeman et al., 2010; Schuwirth et al., 2010).

For comparison purposes, PrT has several features. The studies show that PrT can be used for comparing types of curricula such as problem based versus traditional learning (Verhoeven et al., 1998; Nouns et al., 2012), problem versus lecture based learning (Sangestani et al., 2013), to evaluate effectiveness of curriculum change (Peeraer et al., 2009); to measure transition of a conventional to an integrated contextual medical curriculum (Van Der Veken et al., 2009), infer performance results among students from different schools (Muijtjens et al., 2007), and comparison of curricula (Muijtjens et al., 2008; Muijtjens et al., 2008b).

Although most studies have been conducted in developed countries, PrT has been applied in countries with few resources (Aarts et al., 2010; Mardiastuti and Werdhani, 2011). Some experiences involving the PrT has been carried out in Brazil, that is a developing country. Studies about application of PrT in Brazilian medicine schools (Tomic et al., 2005; Sakai et al., 2011) demonstrate the possibility of implementation and execution of it.

The use of continuous assessment has emerged as a proposal to improve student learning and develop educational programs in Pharmacy Schools (Plaza, 2007; Szilagyi, 2008; Begley et al., 2013). The Accreditation Council for Pharmacy Education recommends that pharmacy schools can use evaluations that can achieve desired educational objectives. In this context, progress test has been used as both formative assessment as summative (Duncan-Hewitt et al., 2007; Szilagyi, 2008; Anderson Jr and Nelson, 2011; UCL, 2014; Karimi et al., 2014).

The Pharmacy courses in Brazil are guided by a national curriculum guideline (Brazil, 2002). This guideline establishes the profile for formation of the pharmacist. Several institutions have discussed the improvement of the teaching of pharmacy in Brazil (ABERFABIO, 2013).

Despite these efforts, the pharmaceutical education still has been very influenced by memorization and repetition of content often disconnected from the reality. In addition, the absence of methodologies like problem based learning left a void for critical and reflexive constructions in the learning process (Almeida et al., 2014; Blouin et al., 2008).

The last Pan American Conference on Pharmaceutical Education in 2014 defended the adoption of a competency-based curriculum. Knowledge is an important cognitive component needed to develop competencies (OPAS, 2014). The PrT is a tool to assess knowledge and can fill this need. Pharmacy schools can adapt the PrT to provide assessment that measure the final objectives of their curricula and start an era of evaluation that guides learning and contributes to the quality of education.

Conclusion

There is much evidence about the use of the PrT as an evaluation method to enhace learning in graduation and even pos-graduation. The literature also records studies which seek to qualify the design and implementation of the PrT, presenting proposals for standards, common practices, experiences in collaboration and showing features of the PrT used as comparison tool between types of curricula, learning methods etc. Although most studies describe experiences in medical schools, there are descriptions of the application of the test in other courses in the health area. It was not detected in this review study the use of this test in pharmacy schools. However, we advocate that the PrT can be used by the schools of pharmacy in the same way as is already the case in other courses.

Conflicts of Interests

The authors have not declared any conflict of interests.

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Full Length Research Paper

Drug use and prescription pattern at the Usmanu Danfodiyo University Veterinary Teaching Hospital (UDUVTH), Sokoto; A ten-year retrospective study (2006-2015)

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A ten year (2006 – 2015) retrospective study was conducted using records from the case files of patients handled at the Usmanu Danfodiyo University Veterinary Teaching Hospital (UDUVTH) in order to ascertain the pattern and problems associated with drug prescriptions in the management of diseases presented to the hospital. The results obtained show that, a total number of 622 patients comprising cattle (4.80%), goats (16.9%), sheep (33%), birds (11.3%), horses (1.1%), dogs (28.6%), cats (2.9%), rabbits (0.8%) and others (0.3%) were presented. Of the total number of 622, 537 (86.2%) received various medicaments ranging from antibacterial drugs (39.1%), anthelmintics (18.1%), acaricides (4.4%), haemoparasiticides (1.3%), antidiarrhoic (2.5%) and analgesic (4.3%). Other drugs dispensed were dietary supplements/vitamins (17.7%), fluids/electrolytes (2,5%), anticoccidialsm (3.7%) and unspecific agents (5.8%) in retrospective study of drug use and prescription pattern at the UDUVTH, Sokoto. 20% of the drugs were given by oral route of administration while parenteral and topical routes constitute 74.2 and 10.3%, respectively. The route of administration of 4% of the medications was not specified. Multiple drug therapy overwhelmed the practice with 80.41% while inappropriate prescription and drug combination was 1.03% of all the drugs used over the study period. The study revealed that antibacterials and anthelmintics are the most widely used drugs and parenteral route of drug administration and polytherapy were the dominant practice in the hospital.

Key words: Retrospective study, prescription pattern, UDUVTH, Sokoto, North-western Nigeria.

INTRODUCTION

The primary purpose of veterinary drugs, biologics and pesticide chemicals is for the health and welfare of all animals (whether farm, pet, laboratory or zoo animals, safeguard cage birds, reptiles, fish or bees). They are

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Table 1. Species of animals presented to UDUVTH, Sokoto (2006 – 2015).

Animal species / Year	Bovine	Caprine	Ovine	Avian	Equine	Canine	Feline	Laprine	Others	(%)
2006	-	3	6	4	-	19	1	-	-	33(5.3)
2007	3	7	17	3	1	26	3	-	-	60(9.6)
2008	3	12	25	8	-	12	2	1	-	63(10.1)
2009	-	2	1	6	-	11	-	-	-	20(3.2)
2010	7	10	12	-	-	8	1	-	-	38(6.1)
2011	-	4	3	3	1	7	-	1	-	19(3.1)
2012	2	4	18	3	1	23	1	-	1	53(8.5)
2013	3	17	27	9	3	12	5	2	1	79(12.7)
2014	1	9	32	6	1	4	1	1	-	55(8.8)
2015	11	37	64	30	-	56	4	-	-	202(32.5)
Total	30	105	205	72	7	178	18	5	2	622
(%)	(4.8)	(16.9)	(33)	(11.6)	(1.1)	(28.6)	(2.9)	(0.8)	(0.3)	(100)

also used as therapeutics or for disease prevention, diagnosis, growth promotion in food animals, to increase feed conversion efficiency, and increase milk and egg yield (Aliu, 2001; Kabir et al., 2002). The provision of basic veterinary care is therefore to a large extent based on the rationale use of these products. However, choosing between a wide range of these products and using them judiciously to the best advantage of the patient and the client is not always straight forward (Anjum et al., 2003). In Nigeria, there are only a few registered veterinary medicinal products, with faulty distribution channels and a large number of unqualified persons participating in the animal health industry as medicinal product users.

The Usmanu Danfodiyo University Veterinary Teaching Hospital is one of the tertiary animal health institutions in the country. It was established in 1991 with the primary mandate of serving as a facility for training prospective doctors of veterinary medicine and to provide clinical as well as extension services to its immediate community. Although, studies abound in the literature on diseases encountered in veterinary hospitals and clinics in Nigeria including that of UDUVTH (Akinrinmade, 2014; Ebbo et al., 2003; Mbaya et al., 2008), only a few reports (Ramon-Yusuf, 1990; Agaie and Junaidu, 1997; Kabir et al., 2002) have been documented in Nigeria on veterinary drug use pattern. The dearth of this information has limited the development of true field based data for essential veterinary drug list, veterinary formulary, policies on use of veterinary medicinal products use and code of conducts for personal involved in their use for the optimal cost effectiveness and classification of veterinary medicinal products in the country.

It is in view of the foregoing that this study was designed to assess retrospectively veterinary drug use and prescription pattern at the Usmanu Danfodiyo University Veterinary Teaching Hospital between the years 2006 and 2015.

MATERIALS AND METHODS

Case files of animal patients treated at the large, small as well as ambulatory clinic of the hospital between January 2006 and December 2015 were examined. The species treated, clinical diagnosis made, drugs prescribed and dispensed, number of drugs per visit, routes of administration and pattern of prescription were noted and documented. Pattern of prescription in this write-up means the nature of the drug itself whether the drug is in tablets, suspensions et.c, the frequency and the route of administration, the age, sex and species of the animal and considering the drug combination and the dosage by which the drug is being prescribed. A prescription is termed standard when it considered all the above mentioned subjects on the prescription form and poor when it those not report them. The results obtained for the period were analyzed using descriptive statistics and expressed as percentages.

RESULTS

Species of animals presented to UDUVTH (2006 – 2015)

The result indicates that a total number of 622 patients were presented to the hospital during the period under review. Of this number, ovine, canine and caprine were the most presented with 33, 28.6 and 16.9%, respectively, while equine (1.1%) and lapine (0.8%) were the least presented during the study period (Table 1)

Types of drug prescribed/dispensed at UDUVTH Sokoto (2006 – 2015)

Antibacterial drugs were the most commonly used drug category (39.1%), followed by anthelmintics (18.1%), and dietary supplements/multivitamins (17.7%). Other drugs used during the period includes acaricides (4.4%), analgesic/anti-inflammatory agents (4.3%), topical dressing agents (3.7%), fluids therapeutic and antidiarrhoic agents (2.5%) each, haemoparasiticides (1.3%) anticoccidials

Table 2. Types of drug prescribed/dispensed at UDUVTH Sokoto (2006 – 2015).

Drug	Year										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total (%)
Antibacterials	28	62	62	17	38	11	48	60	19	149	495(39.1)
Oxytetracycline	8	12	13	8	12	5	22	37	12	57	186(37.6)
Penicillin	13	22	19	2	13	2	12	8	2	30	123(24.8)
Chloramphenicol	-	-	1	2	-	-	-	3	-	4	10(2.0)
Aminoglycosides	1	16	13	3	11	2	8	5	2	26	87(17.6)
Sulfonamides	1	5	7	1	--	-	3	2	2	17	38(7.8)
Others	5	7	10	1	2	2	3	5	1	15	51(10.0)
Anthelmintics	13	26	25	5	14	5	20	26	17	78	229(18.1)
Piperazine	-	-	-	-	2	1	2	-	-	3	8(3.5)
Benzimidazoles	2	5	5	-	3	1	7	13	10	37	83(36.2)
Imidazothiazole	2	2	5	4	1	1	4	3	1	6	29(12.7)
Avermectins	1	9	5	-	-	1	5	6	5	19	51(22.3)
Tetrhydropyrimidines	6	7	5	-	1	1	1	2	-	8	31(13.3)
Anticestodes	2	-	-	-	-	-	-	-	-	-	2(0.9)
Others	-	3	5	1	7	-	1	2	1	5	25(11)
Acaricides	6	11	7	3	2	2	5	7	1	11	55(4.4)
Systemic	-	5	-	-	-	-	-	-	-	2	7(12.7)
Topical	6	6	7	3	2	2	5	7	1	9	48(87.3)
Haemoparasiticides	1	2	-	2	1	-	-	1	-	10	17(1.3)
Antidiarrhoeals	6	4	6	-	1	-	4	5	-	6	32(2.5)
Antiinflammatory/Analgesics	1	4	9	4	4	2	5	10	4	11	54(4.3)
Dietary suppliments/ Vitamins	18	20	21	6	8	9	17	21	18	86	224(17.7)
Replacement fluids	5	3	-	1	1	-	5	5	2	10	32(2.5)
Topical dressing & ointments	1	6	2	3	-	1	8	7	1	18	47(3.7)
Anticoccidials	1	-	-	1	-	-	-	-	-	4	6(0.5)
Others	5	5	6	5	8	4	5	5	2	28	73(5.9)
Total (%)	85(6.7)	143(11.3)	139(11.0)	47(3.7)	77(6.1)	34(2.7)	117(9.3)	147(11.6)	64(5.1)	411(32.5)	1264

(0.5%) and other non-specific agents (5.9%) (Table 2). Of the antibacterials, oxytertracyclines were the most commonly used (37.6%). They were closely followed by penicillins (24%) and aminoglycosides (17.6%), which were predominately streptomycin (Table 2). With regards to anthelmintics, members of the benzimidazoles group particularly albendazole led in usage (32.7%) (Table 2). Other wormers used under the

Table 3. Frequency of polytherapy at UDUVTH, Sokoto (2006 – 2015).

Drug combination	Bovine	Ovine	Caprine	Equine	Poultry	Canine	Feline	Laprine	Total (%)
Single	9	32	16	1	20	21	2	-	33(5.3)
Double	9	70	42	3	33	51	6	2	217(40.5)
Triple	5	54	29	2	-	49	6	-	145(27.5)
4-drugs	4	11	10	-	1	24	6	-	56(10.4)
5-drugs	-	4	-	-	1	7	-	-	12(2.2)
6-drugs	-	-	-	-	-	1	-	-	1(0.2)
Total no. of Ani. (%)	27(5)	171(31.9)	97(18.1)	6(1.1)	5(10.3)	153(28.5)	20(3.7)	5(0.9)	538()
Total no. of Drugs (%)	58(4.6)	398(31.5)	227(17.9)	13(1.0)	95(7.5)	414(32.8)	56(4.4)	6(0.5)	1264(100)

Table 4. Route of administration of drugs dispensed at UDUVTH, Sokoto (2006 – 2015).

Route of drugs administration	Percentage (%)
Intramuscular	58
Oral	24.5
Topical	10.3
Subcutaneous	5.7
Intravenous	1.5
Total	100

period at the hospital included ivermectin (22.3%), tetrahydropyrimidines (Pyrantel and morantel) (13.3%), and levamisole (12.7%). Topical acaricides (87.3%) were preferred as compared to systemic application (12,7%) during the period of the study (Table 5).

Frequency of poly-therapy at UDUVTH, Sokoto (2006 – 2015)

It is clear from this study that poly-therapy was common in the treatment of animals presented to the hospital during the period under review. Patients treated with two or more drugs per presentation constituted 71.4% of all cases as compared to 19.6% that received single drug treatment. Two and three drug therapy per visit was the most predominant feature with 40.5 and 27.1% of cases, respectively. The frequency of poly-therapy per visit declined from 10.4 to 2.2 and 0.2%, respectively, for 4, 5 and 6 drugs combinations (Table 3).

Route of administration of drugs dispensed at UDUVTH, Sokoto (2006 – 2015)

Fifty eight percent (58%) of the drugs dispensed during this period were administered through the intramuscular injection while oral, topical, subcutaneous and intravenous routes were 24.5, 10.3, 5.7 and 1.5%, respectively. The study suggests that no drug was given by intraperitoneal

route during the 10 year study period (Table 4).

Prescription pattern at UDUVTH, Sokoto (2006 – 2015)

The results in Table 5 shows that 81.3% of the prescriptions on the case file of patients were not in line with standard practice.

Inappropriate drug use/combinations at UDUVTH (2006 – 2015)

Of the total of 1264 drugs used during the period of the study, 13 were inappropriately used based on clinical diagnosis made in each of the patient in which the drugs were dispensed (Table 6).

DISCUSSION

The results of this study show that ovine, canine and caprine were the most common species presented to the UDUVTH, Sokoto. This is not surprising as small ruminants play a very significant role in the socio-economic life subsistence families and small holder farmers in the study area. The high number of canine species could be due to increase awareness on desirability of attending to the health needs of all species

Table 5. Prescription pattern at UDUVTH (2006 – 2015).

Year	Standard*(%)	Poor (%)	Total Prescription
2006	10(11.8)	75(88.2)	85
2007	6(4.2)	137(95.8)	143
2008	5(3.6)	134(96.4)	139
2009	9(19.1)	38(80.9)	47
2010	3(3.9)	74(96.1)	77
2011	11(32.4)	23(67.6)	34
2012	14(12)	103(88)	117
2013	21(14.3)	126(85.7)	147
2014	7(11)	57(89)	64
2015	77(18.7)	334(81.3)	411
Total (%)	163(12.9)	1101(87.1)	1264(100)

Table 6. Inappropriate drug therapy/prescription/combinations at UDUVTH (2006 – 2015).

Year	Total prescription (%)	Diagnosis	Drugs prescription
2006	85(1.18)	Free gas bloat	Sulphathizole
2007	143(1.40)	Bloat	Penicillin+Sulphadimidine
2008	139(1.44)	Babesiosis	Ivermectin
2009	47(0)	Tetanus	Pethidine
2010	77(1.30)	Helminthosis	Sulphadimidine
2011	34(0)	Coccidiosis	Oxytetracycline + Ivax
2012	117(4.27)	PGE/Coccidiosis	Oxytetracycline + Ivax Oxytetracycline+ Penicillin (2 times)
2013	177(1.36)	Pregnancy Toxaemia	Oxytetracycline+Sulphadimidine
2014	54(0)	Helminthosis	Oxytetracycline+ Penicillin
2015	411(0.6)	Gastroenteritis	Carbacol+Oxytetracycline+Levermisole
Total	1264(1.03)		

of animals and increase urbanization of Sokoto city with persons of different faith and social status. There was however no clear yearly trend on the species presented except for year 2007 to 2009 when there was an increasing number of ovine been presented.

With regards to drug use, antibacterials and anthelmintics appear to be most widely prescribed/ dispensed drugs. This agrees with earlier reports by Ramon-Yusuf et al. (1990), Agaie and Junaidu (1997) and Kabir et al. (2002). Amongst the antibacterials, oxytetracycline, penicillin and streptomycin were the main agents used. The broad spectrum nature of oxytetracycline and availability and convenience of using long acting formulation might be responsible for its wide range use. This is in addition to its low cost, availability in market and various dosage forms that may likely suite different species and patients in various conditions. Anthelmintics were also one of the leading drugs used under the period under review and albendazole and ivermectin were the lead choices. Earlier report by Agaie and junaidu (1997) indicated that albendazole and

morantel tartate were the preferred veterinary anthelmintic by veterinarians and animal health workers in Sokoto. This study confirmed the faith of veterinarians/animal health workers in this area in albendazole while diminished role of morantel may be due to its unavailability in the market. Albendazole is a broad spectrum anthelmintic (ovicidal, larvicidal and effective against adult nematodes), has a wide safety margin (Aremu et al., 2012) as compared to agents like levamisole that are also commonly available and also cost effective in the management of helminthosis. Studies by Agaie et al. (2004) in the study area confirmed the superiority (efficacy) of albendazole over ivermectin and levamisole in the treatment of nematodiasis in sheep. Ivermectin however is an endectocide with very wide safety margin used against both endo and ectoparasites, and larval stages of filarial worms; this may be the reason for its high usage in the hospital.

Polytherapy is common in modern veterinary human and medical practice especially in cases with myriads of clinical signs and symptoms where a number of drugs

may be administered to ostensibly to alleviate the discomfort experienced by the patient (Ramon-Yusuf et al., 1990). This approach may be to exploit the benefits of the combination such as broadening the spectrum of activity of the drugs, preventing development of resistance in case of chemotherapeutic agents or reducing the possibility of toxic/side effects of a particular drug or the combination (Aliu, 2007; Aliu et al., 2007). However, in some instances, they could simply be due to inappropriate laboratory support for diagnosis and inexperience of the attending professional. The reason for frequency of polytherapy in UDUVTH may be due to the former than the later. It is however important for practitioners to always note that though polytherapy may benefit some patients, it could also result in some cases with undesirable consequences in patients or even non compliance to medication by the client (Ajuwon and Eghianruwa, 2004). Davies et al. (2007) reported that the frequency of such adverse reactions have been found to increase proportionately with an increasing number of drugs given to a particular patient.

The reason for having most prescriptions on the patient's case files not in tandem with the standard format could be due to the fact that prescription writing and prescription record keeping has not taken firm root in veterinary health care services in Nigeria but for this to occur in a tertiary health facility, cannot be justified. Prescriptions are important source of drug information on drug management history of the patient and drug use in a health facility and could provide needed guide for therapeutic strategies to be adopted by the professionals and policy making in the hospital and the country as a whole. It is really a professional and ethical burden that practitioner must discharge with utmost sense of responsibility where prescriptions should be written with every detail it requires (Broadhead, 2015; Lazarou et al., 1998).

Inappropriate drug use/combination of 1.03% over the ten-year period with the highest figure (4.27%) occurring in 1991 was quite negligible. However, there is need to put in place appropriate measures to review therapeutic measures undertaken in the hospital by senior personnel from time to time and institute continuous education programme on drug use and other aspects of improving services rendered by the hospital.

Conclusion

This study revealed that antibacterials (oxytetracycline, penicillin and streptomycin) and anthelmintics (albendazole and ivermectin) are the most widely used drugs and parenteral route of drug administration,

particularly intramuscular and polytherapy were the dominant practice in the hospital. Proper hospital based training programme on management (Adenike, 1998) is therefore recommended to be incorporated into the continuous education programme of the professionals while evidence based therapy should be the norm and encouraged in the hospital.

Conflict of interest

The authors have not declared any conflict of interest.

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