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Original article

Development, translation, and validation of a bilingual questionnaire on unused medications in homes

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ABSTRACT

Background: Unused medications in homes pose significant health, economic, and environmental risks. Patients are the medications end users and their knowledge, attitude, and practices (KAP) play an important role towards medication use, unuse and wastage. Thus, a valid instrument to reliably measure patients' KAP towards unused medications in homes may help manage the associated risks.
Objective: To develop, translate, and validate a questionnaire for the assessment patients' KAP towards unused medications in Qatar homes (i.e., QUM-Qatar).
Setting: This cross-sectional validation study was conducted among randomly selected outpatients visiting various public and private pharmacies in Qatar between September 2019 and February 2020.
Method: Nine experts in the field of pharmacy practice with Qatar contextual background established the content validity of the instrument. The validity was quantified using content validity index (CVI). Furthermore, construct validity was performed using principal component analysis (PCA), whereas internal consistency reliability of items was determined using Cronbach's alpha. Statistical analyses were performed using STATA 15 statistical software.
Main outcome measure: The psychometric properties of the QUM-Qatar assessment instrument.
Results: An English/Arabic questionnaire was developed and validated. Content validity in the form of scale-level-CVI (S-CVI)/Average and S-CVI/UA was 0.88 and 0.84, respectively, suggesting adequate relevant content of the questionnaire. Variation explained by the multivariate model was 85.0% for knowledge, 94.8% for attitude, and 89.8% for practice. Cronbach's alpha coefficients were 0.68, 0.82, and 0.84, for knowledge, attitude, and practice domains, respectively. From the psychometric results obtained, the questionnaire's validity and reliability were attained.
Conclusion: The QUM-Qatar instrument has acceptable psychometric properties and has the potential for future use in research and practice to assess KAP towards unused medications in Qatar and elsewhere. It may consequently help in improving medication use and mitigating the negative health, economic, and environmental impacts of unused medications.

Impacts on practice.

- There is now a valid and reliable English/Arabic language questionnaire to assess patients' KAP towards unused medications.
- Policymakers can utilize this questionnaire to develop evidence-based policies and strategies for managing unused medications and their disposal.

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- To improve medication use review, rational use of medicines, and adherence, it is necessary to consider patient-reported outcomes that may eventually reflect on saving health, economic resources, and environment.

1. Introduction

Generally, knowledge may affect an individual's attitude, which may be reflected on behaviors and practice (Gumucio et al., 2011). Good behaviors toward medications use, storage, and disposal are linked to awareness (Akici et al., 2018). Among the main causes of medication disuse which could lead to medication wastage, are medication non-adherence, patient's death, and medications change (Abou-Auda, 2003; Persson et al., 2009). Unused medications in homes pose risks to householders, environment (Persson et al., 2009), economy (Kheir et al., 2011) and animals (Lucca et al., 2019).

Qatar relies mainly on imported medications, but restricts their importation to a minimum of two-thirds shelf-life which may lessen the propensity of disuse due to expiry. In regional studies conducted in Saudi Arabia, Qatar, Iraq, Kuwait, and Oman, rubbish disposal bins were the main disposal site of unwanted medicines (Alnahas et al., 2020; Abahussain and Ball, 2007). Similarly, in many countries, including Qatar, the public behaviors and practices of throwing unused medications in rubbish bins may be partly due to knowledge deficiency of proper disposal practices (Lucca et al., 2019; Persson et al., 2009). This of course is incompatible with United States (US) Food and Drug Administration (FDA)'s and Qatar's recommended policies for returning unused medications to a pharmacy for proper disposal or otherwise adhering to appropriate disposal practices through trash or toilet. Additionally, short contact time between pharmacist and patients, renders pharmacist educational role sub-optimal in Qatar (El Hajj et al., 2011), which may result in non-adherence to medications. Despite this, several prescription medications are dispensed under strict regulations in Qatar, which serves against the ease to their access and potentially minimizes wastage. However, selling certain prescription medications without a prescription is a common practice in many Arab countries (Hasan et al., 2019). This practice may lead to health risks and accumulation of unwanted medications in homes. For example, self-medication with antimicrobials was commonly reported (26%) in Iraq (Jassim, 2010). Unwanted medications were also shared within a family or friends as shown in some studies (Al-Shareef et al., 2016). Kheir et al.'s findings of improper storage of medications and environmental-unfriendly disposal of unwanted ones in Qatar, warranted a public outreach campaign to improve awareness (Kheir et al., 2011).

Many of the non-Arabic speaking consumers and patients working in Gulf Cooperation Countries (GCC) find difficulties comprehending healthcare providers' instructions and thus, may not use medications as prescribed, leading to unused medications and wastage. Multilingual health information materials were found useful in enhancing understanding of patients, many of whom preferred written health information in their native language (Mohammad et al., 2015). In addition, the use of over-the-counter (OTC) medicines and traditional (complimentary, and alternative medicines) without informing the prescriber or other healthcare professional is widely spread in Arab countries (Hasan et al., 2019; Naja et al., 2015). This could also result in accumulation of unused medications and render conventional prescription medicines unused. To investigate the status of unused medications in multi-ethnic Qatar homes, a valid, reliable, English/Arabic data collection instrument was deemed crucial. The authors, therefore, decided to develop, translate, and validate a questionnaire (QUM-Qatar i.e., Questionnaire on Unused Medications in Qatar) that suits such unique population.

2. Material and methods

2.1. Design, Setting and participants

This study was a cross-sectional quantitative survey using a questionnaire. Two hundred patients aged 18 years or older were randomly interviewed between September 2019 and February 2020 in randomly selected pharmacies within Hamad Medical Corporation (HMC) hospitals, Primary Health Care Corporation (PHCC) centers, and private sectors.

2.2. Questionnaire development and validation

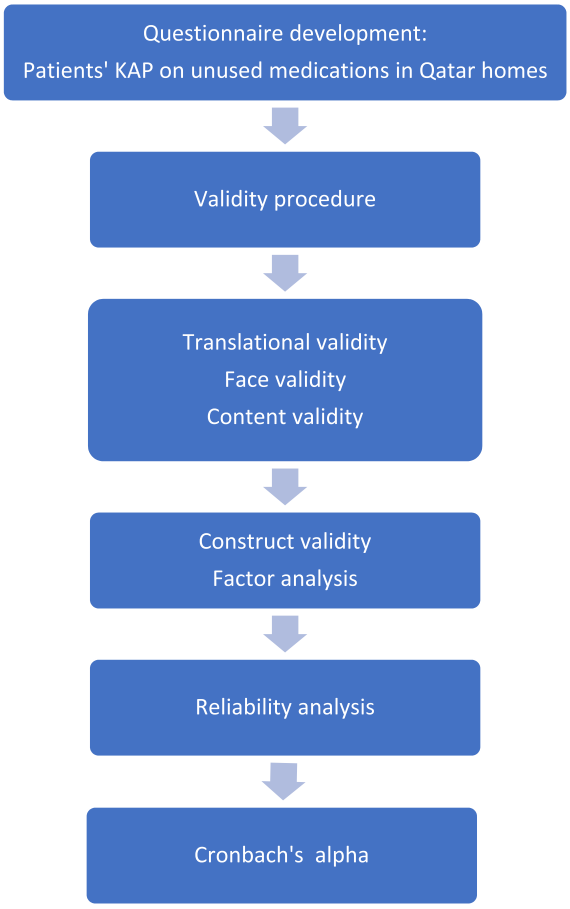
Ten steps for questionnaire development and validation that are classed in three phases were followed (Singh et al., 2018). In Phase 1, theoretical importance and existence of the questionnaire constructs were performed through three steps: content domain specification, item pool generation, and content validity evaluation. In Phase 2, representativeness and appropriateness of data collection were assessed by questionnaire development and evaluation, forward translation and back translation, pilot study, and data collection steps. Whereas, in Phase 3, statistical analysis and statistical evidence of the constructs were assessed by construct validity and reliability assessment of the questionnaire items (Scheme 1).

2.2.1. Items pool generation

A comprehensive literature review was conducted to identify studies on various aspects of unused medications such as reasons for disuse, sources, storage, and disposal methods (Abruquah et al., 2014; Ryan and Wagner, 2003). Publicly available items with similar ideas to this study's objective were adapted (Terzic-Supic et al., 2019; West, 2015). Some adapted items were modified to suit Qatar's context. The investigators generated additional items in the initial questionnaire to make a total of 58 statements. In the initial phase of designing the questionnaire, items were reduced to 55 following discussions with experts in the field. This was done by removing the items that were duplicated or lacked relevance to the country's law or due to other cultural reasons.

2.2.2. Coding of items in the questionnaire

The initially developed English/Arabic questionnaire had a demographic data section A, and 48 items under the KAP domains as follows: Section B: Awareness of unused medications in homes (10 items); Section C: Perception/attitude towards medication use and wastage (13 items); Section D: Current practices and behaviors related to medication use (25 items). Response options were mainly designed as five-point Likert-type scale. The knowledge/awareness and perception/attitude sections used five-point Likert scales, where perceived level of agreement was rated from 1 (strongly disagree) to 5 (strongly agree). In the practice section, level of frequency was scored from 1 (always) to 5 (never), except for the remaining items (17 to 24) which were multi-choice answers scored as 1 for chosen/Yes and 0 for unchosen/No



Scheme 1. A flowchart depicting the processes used for validating the QUM-Qatar.

answers. Statement number 25 was open for any comment regarding unused medications. Negatively worded items were given reverse codes. The average time to administer the questionnaire was between 10 and 15 minutes.

Scores for each of the knowledge, attitude, and practice constructs were generated by summing up items within each construct. Means and standard deviations were used to describe the variability in the different scores among patients based on their demographic characteristics. The association between patients' characteristics and the resulting scores was examined using linear regression. Betas and their associated 95% confidence intervals (CIs) and p-values were reported. Variables with p-value ≤ 0.1 qualified for inclusion in the multivariable models and, a p-value of ≤ 0.05 was deemed as showing strong evidence for an association with a score.

2.2.3. Translational validity

Arabic and English are the main spoken languages in Qatar. Therefore, the English survey questionnaire was initially forward translated into Arabic and backward translated to English by using a standardized forward-backward translation procedure (Tsang et al., 2017). Two independent bilingual translators translated the English version into their mother tongue (i.e., Arabic language). One translator was aware of the concepts the questionnaire intends to measure, to provide a translation that more closely resembles the original instrument. The other translator had no idea of the topic under study so as to detect any differences between the two translations. Discrepancies raised were discussed between the two translators in addition to a third bilingual translator who was not involved in the previous translations. Similarly, in the backward translation, the produced Arabic version was back translated into English by other two independent translators to ensure accuracy of the translation. A new harmonized translated version was prepared for face and content validity.

2.2.4. Face validity

First, and throughout the face validity study, nine bilingual experts who had good experience in the topic were invited to ascertain whether the content of the questionnaires (English and Arabic) was relevant to the study purpose and appropriate for the prevailing culture in a multi-ethnic country (i.e. Qatar). The experts were able to evaluate whether the items successfully capture the intended topic of the survey. They also assessed statement construction and common errors such as those leading and confusing. The questionnaire was assessed for clarity, accuracy, suitability within cultural and legal context and clarity of language used, appropriateness for a face-to-face interview survey, comprehensiveness for a readability and feasibility of the survey questionnaire, communication of right message, and consistency of style and formatting. Then, a pilot study among 30 participants was carried out to make sure of the feasibility of the research protocol and to measure the expected study response rates (In, 2017). They were requested to answer three open-ended questions regarding the clarity, potential ambiguity, and comprehensibility of each item and of the overall instrument. Their responses were recorded, analyzed, and discussed with the research team members and experts.

2.2.5. Content validity

A panel of nine experts including four pharmacists from the academia, two practicing pharmacists and three regulatory pharmacists evaluated the relevance of each item in the instrument by scoring on a four-point Likert scale, ranging from 1 = not relevant to 4 = very relevant. The guidelines proposed by Lynn were followed to calculate the Content Validity Index (CVI), both for each item (I-CVI) and for the scales (S-CVI) (Lynn, 1986). Changes were made in the questionnaire based on the suggestions of the experts and Qatar context to reach a final version.

2.2.6. Construct validity

We examined the correlation between items constituting the different constructs (knowledge, attitude, and practice) using a correlation matrix. In the practice construct, variables number 17–25 which had no interval level (i.e., non-Likert scale) were not considered for the factor analysis (Field and SPSS, 2009). A collinearity test was conducted for all constructs, and collinear items dropped from the questionnaire. We also conducted the Bartlett's test for sphericity to test whether items within each construct were sufficiently intercorrelated to warrant conduct of factor analysis. Significance of the test was determined at $p \leq 0.05$. Kaiser-Meyer-Olkin (KMO; a measure of sampling adequacy) was further calculated to assess suitability for factor analysis. KMO > 0.5 was deemed adequate for conduct of factor analysis.

2.2.7. Reliability

To determine the internal consistency reliability of items in the questionnaire, Cronbach's Alpha test was conducted. A Cronbach's Alpha coeffient above 0.65 was considered adequate for each domain (Sim et al., 2018; Taber, 2018).

2.3. Sample size and sampling

Guilford (1954) believed that the total sample size for conducting factor analysis regardless of the number of variables is 200 (Koo et al., 2016). For an appropriate sample size, Cattell (1978) recommended it to be three to six times the number of variables

(Mundfrom et al., 2005). Based on the aforementioned recommendations, 200 subjects were recruited for the validation study.

Multi-stage random sampling method was applied for the validation of the questionnaire to make the sampling process more practical and to render the sample representative of all patients in Qatar. The main pharmacies of HMC (n = 20), PHCC (n = 23) and private sectors (n = 397) were stratified. Researchers then, using computer software (Research Randomizer.org) selected equal share (i.e., 12 pharmacies from each stratum: total 36 pharmacies). To reach the required sample size of 200 patients, the researchers divided this number among the 36 pharmacies to get around 5–6 patients from each pharmacy. These patients were finally selected by systematic random sampling based on every consecutive tenth token number given while the patients were waitining to pick up their medications from the selected pharmacy.

2.4. Inclusion criteria

All patients who were found waiting to pick up their medications from the selected pharmacies at the time of data collection were considered for this study, regardless of nationality or gender. We included respondents 18 years or older, able to understand either Arabic or English, and willing to complete the questionnaire.

2.5. Exclusion criteria

Vulnerable populations including children, prisoners, or mentally disabled persons were excluded from the study. Individuals unable to answer the questionnaire due to language barrier were excluded from the study.

2.6 Informed consent

Prior to their participation in this research, selected participants were informed about the nature of the study and its aim, were reassured that their data will be kept confidential, their participation was voluntary, and that they can withdraw from participation at any stage. Any participant who agreed to take part in the study was requested to sign an informed consent form . This study mitigates non-response bias by: conducting a pretesting (pilot study), training of interviewers, random sampling of respondents (multistage sampling from various public and private healthcare facilities), and by face-to-face interviewing (mandatory sampling) (Cheung et al., 2017). Interviewees were reassured that their information was completely confidential and anonymous. In addition, the investigators confirmed that the questionnaire statements were not sensitive or intrusive.

2.7. Statistical analysis

Using STATA 15 analytic software, univariate descriptive analysis was initially performed for all items included in the questionnaire, and frequencies and percentages describing the 200 participants' characteristics were reported. Correlation between items constituting the different constructs (knowledge, attitude, and practice) was examined using a correlation matrix. As the items in the knowledge, attitude, and practices sections had mainly ordinal responses, these items were analyzed and treated as continuous data to allow evaluation of the dimensionality (number of factors) of the items (Zahiruddin et al., 2018). To determine the number of extracted factors, eigenvalue > 1, and scree plot inspection were performed. Factor loadings > 0.4 were considered acceptable (Zahiruddin et al., 2018). For internal consistency reliability, a Cronbach's alpha coefficient > 0.65 was considered acceptable (Zahiruddin et al., 2018; Taber, 2018). To evaluate data factorability, the Bartlett's test and KMO index were used. The Bartlett's test must be significant (i.e., $p \leq 0.05$). KMO > 0.5 was deemed adequate for conducting factor analysis.

2.8. Data availability

All data generated or analyzed during this study are included in this published article.

3. Results

3.1. Description of questionnaire items and constructs

A sample of 200 participants was enrolled in the study with a prevalent age between 30 and 49 years. Participants were mostly male (82.5%) and Indian nationals (34%). The average monthly income of the majority of the participants (73.5%) was between QR 1,000–9,999. Very few participants (1–2%) had a healthcare practitioner within their household. Univariate [Table 1], bivariate, and multivariate statistical analyses were conducted. Only items with p-value ≤ 0.1 in the univariate regression analysis were included in the multivariate regression model.

3.2. Content validity

Content validity was determined for comprehensiveness and representativeness of the content of the instrument. A four-point CVI based on the judgement of nine experts was evaluated in the form of S-CVI/Average and S-CVI/UA indices. The values of the S-CVI/Average and S-CVI/UA were 0.88 and 0.84, respectively. Thus, the questionnaire was considered for further analysis.

3.3. Factor analysis

Variation explained by multivariate model was 85.0% for knowledge, 94.8% for attitude, and 89.8% for practice domains.

3.3.1. Knowledge domain

Only items in the knowledge index fit the criteria for KMO. For this construct, principal component analysis (PCA; a feature extraction algorithmic technique which uses mathematical principles to transform a number of possibly correlated variables into a smaller number of variables) was conducted, and a scree plot (to find a smaller number of interpretable components that explain the maximum amount of variability in the data) generated, that is with eigenvalue > 1. Factor analysis was further conducted with oblique and orthogonal rotations to observe the correlation between the different items. Loadings > 0.4 were considered to pinpoint factors explaining the variability within the construct. Given that rotations generated totally different loading and after examining the uniqueness of items, we opted to keep the knowledge construct intact. The p-value for Bartlett's test for sphericity was ≤ 0.05, indicating that the 10 variables in the knowledge domain were sufficiently intercorrelated with Cronbach's alpha of 0.68. The KMO was 0.551, suggesting the suitability for the factor analysis. The value, however, is slightly above 0.5 suggesting that there could be overlap between the factors assessing the knowledge construct (i.e., not all factors are contributing unique information). The average interitem covariance was 0.1467563.

In multivariate statistics, a scree plot shows the eigenvalues on the y-axis, and the number of components on the x-axis. It always displays a downward curve. From the analyst's perspective, only variables with eigenvalues of 1 or higher are traditionally considered worth analyzing. In other words, the first 3 components to the left of the elbow joint have the highest total variance (i.e., eigenvalue above 1) and the rest have the least [Fig. 1]. The

Table 1
Univariate analysis.

A- Variables Demographic domain	N (%)
a_1 Age?	
18–29	6 (3.0)
30–39	109 (54.5)
40–49	66 (33.0)
50–59	10 (5.0)
60-above	9 (4.5)
a_2 Gender?	
Male	165 (82.5)
Female	35 (17.5)
a_3 Nationality?	
Qatari	9 (4.5)
Indian	68 (34.0)
Filipino	9 (4.5)
Nepali	36 (18.0)
Bengali	38 (19.0)
Pakistani	3 (1.5)
Egyptian	32 (16.0)
Other	5 (2.5)
a_4 Monthly Income?	
No income	2 (1.0)
Below QR 1,000	3 (1.5)
QR 1,000–9,999	147 (73.5)
QR 10,000–19,999	40 (20.0)
QR 20,000–29,999	7 (3.5)
QR 30,000 and above	1 (0.5)
a_5 Highest Education?	
Primary	87 (43.5)
Secondary	42 (21.0)
University	70 (35.0)
Post-graduate education	1 (0.5)
a_6 Occupation?	
No work	2 (1.0)
Laborer	127 (63.5)
Employee non-laborer	71 (35.5)
a_7 Healthcare practitioner at home?	
Pharmacist at home	
No	197 (98.5)
Yes	2 (1.0)
Missing	1 (0.5)
Doctor at home	
No	195 (97.5)
Yes	3 (1.5)
Missing	2 (1.0)
Nurse at home	
No	194 (97.0)
Yes	4 (2.0)
Missing	2 (1.0)
Dentist at home	
No	198 (99.0)
Yes	1 (0.5)
Missing	1 (0.5)
Other health care practitioner at home?	
No	197 (98.5)
Yes	3 (1.5)

variation explained by the three components is about 75% of the total (acceptable variance explained in factor analysis for a construct to be valid is at least 60% (Sarstedt, 2019). Component 1 includes questionnaire statements (b1, b2, b3, b4, b5, b8, and b10) which mainly focus on "Awareness of the issue of unused medications, its various impacts and return policy, and proper medication storage". Component 2 in the oblique rotation includes statement b1 "Awareness of what an unused medication is…". This item uniqueness is high, so is picked up by many other items in the scale and the relevance of this variable is low. Component 2 in the orthogonal rotation alternatively includes b6 and b7 statements concerning "environmental impact" and "awareness of possible different brand names for the same medication", respectively. Component 3 in the oblique rotation includes statement b2 "Awareness of the subject of unused medications in homes", and statements b9 "awareness of where to properly get rid of unused medications", and b10 concerning "awareness of the unwanted medication return policy in Qatar" with orthogonal rotation.

Overall, the uniqueness suggests that the scale is good with factors/components explaining different aspects of knowledge of unused medications.

3.3.2. Attitude domain

Initially, three variables (i.e., c10, c11, and c12) had to be removed due to collinearity, leading to a total of 10 items in attitude construct. The p-value for Bartlett's test for sphericity was ≤ 0.05, suggesting that the variables in the attitude were sufficiently intercorrelated to conduct factor analysis. However, the KMO was 0.262, suggesting that a factor analysis was not appropriate as factors seemed to contribute unique information. The scale reliability coefficient was found to be 0.8116.

In line to the procedure performed in the knowledge domain above, the PCA and scree plot [Fig. 2] suggest that four components with eigenvalue > 1 explain 98% of the variability. These factors e.g., factor 1: c3, c7, c2, and c6 (contribution of people, pharmacists, elderly persons, and free/co-paid medications in increasing medications accumulation and probable consequent wastage), and factor 2: c8 and c5 (wisdom of keeping unused medications in homes and capability of pharmacists to educate patients on unused medications and their impacts) seemed to contribute unique information and satisfactorily agreed in both oblique and orthogonal rotations.

3.3.3. Practice domain

Statement number d15 had to be removed based on correlation matrix as all 200 people answered that they "always check expiry dates before getting rid of their medicines". Cronbach's alpha for variables d1-d16 excluding d15 was 0.81. The scale reliability coefficient was 0.8869. A collinearity check identified that statements d8, d9, d10, d11, d12, d13, d14, d16 were collinear and had to be removed, too. The p-value for Bartlett's test for sphericity was ≤ 0.05, indicating that the variables in the practice domain were sufficiently intercorrelated to conduct factor analysis. However, the KMO measure of sampling adequacy was 0.242, suggesting that a factor analysis was not appropriate as factors seemed to contribute unique information. Four components explain all the variability. Based on the eigenvalues, if we remove collinear items d8 to d16, the scale still explained substantial variability. Cronbach's alpha for all variables, excluding d8-d16 was 0.79, while the average interitem covariance was 0.3784892. With seven Likert-scale items analyzed in this domain, the scale reliability coefficient was 0.7947.

After removing statements from d8 to d16, the PCA and the Scree plot [Fig. 3] pointed to three main factors that still explain 97% of the variability in the practice domain. The orthogonal and oblique solutions yielded the same results. These factors are: factor 1 including statements d4, d5, and d1 (receiving medications without checking availability from various sources); factor 2 including statements d3 and d6 (receiving more medications than my need based on different media propaganda), and factor 3: d2, and d7 (receiving medications in all cases even by putting pressure on doctors or pharmacists to supply).

3.4. Reliability

Cronbach's alpha coefficient of the new scales was 0.68 for knowledge, 0.82 for attitude, and 0.84 for practice. Cronbach's alpha near or above 0.7 confirms the internal consistency reliability of the items under these constructs.

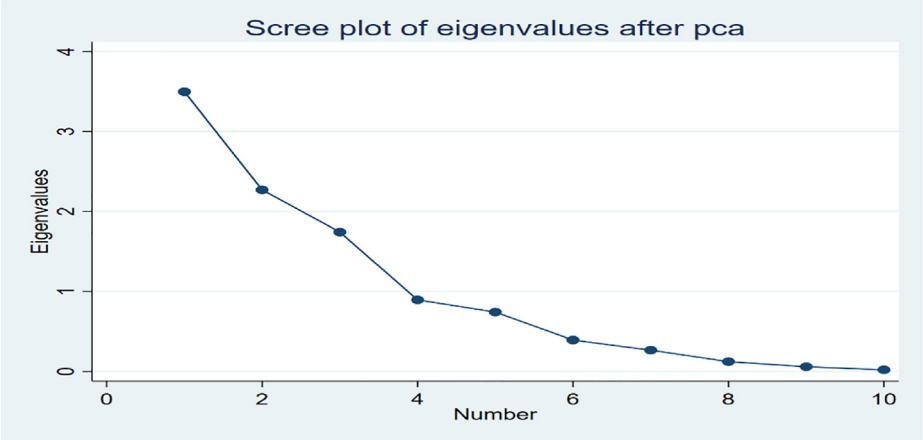


Fig. 1. Scree plot for the knowledge domain.

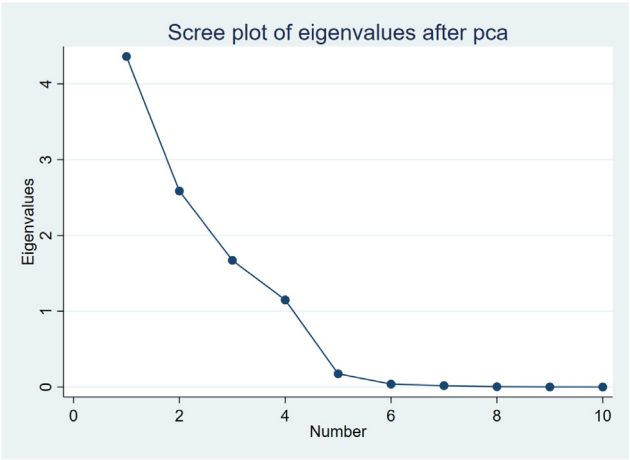


Fig. 2. Scree plot for the attitude domain.

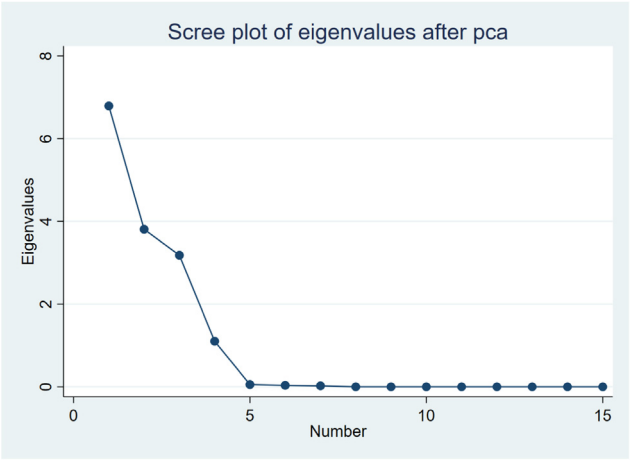


Fig. 3. Scree plot for practice domain.

3.5. Revising the survey

The questionnaire was revised based on the information gathered from the experts for contents, grammar, and spellings before collecting data.

4. Discussion

Unused medications have caused many adverse health, economic, and environmental impacts in many regions of the world (European Environment Agency, 2010; Stahl-Timmins et al., 2013). Patients, healthcare providers, and health regulators play different roles that lead to increase in the volume of unused medications and their associated consequences. With regard to patients, accumulation of medications, non-adherence, and patient's death are among the causes of medications being unused (Makki et al., 2019). In Romania, pharmacy staff were not enthusiastic to take back unwanted medications due to the lack of well-established policies and other bureaucratic processes (Bungau et al., 2018). On the other hand, the public showed weak knowledge towards proper disposal of unused medications ("Pharm Report_WEB.pdf," n.d.), and here emerges the role of healthcare providers in educating the public on unused medications and their right disposal to avoid adverse impacts. A study conducted in Saudi Arabia revealed that people were prone to return unwanted medications to pharmacies if they had good level of knowledge or taught about the appropriate disposal methods (Shaaban et al., 2018). At patients' level, we assume successful practice towards medication use, storage, and disposal is highly influenced by their knowledge and attitudes. Studying the patients' KAP towards various aspects of medications may help in developing strategies that curb the volume of unused medications and subsequently their waste. But such study may not be feasible without a valid and reliable instrument that assesses these aspects. A questionnaire may hence help in developing interventional strategies as well as determining the facilitators and barriers towards the right practice (Gumucio et al., 2011; Gumucio et al., 2014). To our knowledge, this study is the first to develop, translate and validate a questionnaire that assesses patients' KAP towards unused medications in Qatar homes, which may assist in developing effective intervention programs to manage unused medications and various consequent impacts. This is similar to a study done in Malaysia related to the return and disposal of unused medications (ReDiUM) (Sim et al., 2018), and another one to study various aspects of unused medications among patients and healthcare providers in Malta (West, 2015). KAP study was also found useful to seek status of disposal of unused and expired pharmaceuticals among community in Ethiopia (Ayele and Mamu, 2018). Such questionnaire was also used to compare KAP among doctors, nurses, and pharmacists regarding the use of expired and disposal of unused medicines in India (Bhayana et al., 2016). This type of evaluation tool was deemed necessary since unused medications have been associated with health, economic and environmental risks in many regions

(Makki et al., 2019; West et al., 2014). QUM-Qatar instrument is especially necessary as it was validated in both English and Arabic languages and it may suit contextual aspects of many countries in the MENA (Middle East and North Africa) region.

Following the same methodological approach in many validation studies (Lai et al., 2004; Lu, 1999; Oltedal and Wadsworth, 2010), this study selected PCA, factors with Eigen value > 1 (Kaiser Criterion) and Varimax rotation as the factor extraction, retention and rotation criteria. All the three KAP constructs showed good reliability by the resultant Cronbach's alpha coefficients of 0.68, 0.82, and 0.84, respectively. This was consistent with a Malaysian study where the overall Cronbach's alpha value was 0.727, indicating adequate internal consistency reliability (Sim et al., 2018). Cronbach's alpha coefficient of the new scale was 0.68 for knowledge, which is considered slightly low but acceptable for knowledge scale according to Berger and Hänze (Taber, 2018).

This study and its associated analyses have several applications as it may pave the way for future interventional strategies to minimize unused medications and hence, adverse health, economic, and environmental impacts. This is because the study captured the important information about patients' KAP on unused medications and the factors that influence it. Using such tool may potentially facilitate the identification and management of the problem of unused medications from its root. This questionnaire sought to understand various aspects of medications in Qatar homes including their use, storage, and destinies in case they were not used, in addition to reasons for disuse, and thus solutions tailored to these issues could be explored. Such instrument can also be used by researchers to assess KAP at community level. Furthermore, at individual level, this questionnaire will help practitioners to counsel their patients in a better way, by ensuring that the gaps in patients' KAP are addressed appropriately. Doctors and pharmacists can tailor their prescribing and dispensing practices, respectively, in the light of such findings. Another application of the instrument is in terms of quality assurance for detecting the weaknesses of medication use and monitoring improvement strategies.

Having been established among randomly sampled multicultural population, QUM-Qatar could be considered in different countries. In addition, it can also be used to analyze the association between KAP and socio-economic factors. The questionnaire was interviewer-administered; thus, adequate response rate was seen, and interviewees' understandability and items clarity were mostly maintained, which is contrary to self-administered mail surveys as seen in some of the previous studies (West, 2015). We recommend that pharmacy managers use our findings to allocate resources for improving patient adherence by looking into the dominant factors.

5. Limitations

Some participants felt that the questionnaire was lengthy, especially in answering the 25-item section of practice. The method of administration subject the tool to social desirability bias. Some participants may have been unlikely to admit to engaging in medication disuse or wastage behaviors due to a desire to please the researchers, leading to social desirability bias. Neverthless, we attempted to minimize this bias by assuring the participants aboutthe study's anonymity and the importance of their frankness to the study. For logistic reasons, the questionnaire distribution was performed among patients visiting different public and private healthcare facilities, but not at homes. Disabled and bedridden patients with unused medications at home do not approach these facilities, since according to Qatar health policy and practices, specialized home care teams reach these patients in their homes, and thus this faction of patients was not studied. Female participants were only 35 (17.5%) due to some logistical constraints and the conservative nature of female subjects in public area of Arab countries and that most of the data collectors were males.

6. Conclusion

Based on KAP model, we have developed QUM-Qatar, which is an easy to use, valid and reliable questionnaire that covers various aspects of unused medications in homes. It consists of 43 items (7 items for demographics, 10 items for knowledge, 10 items for attitude and 16 items for practice). The developed questionnaire assesses patients' knowledge, attitude, and practices towards unused medications in Qatar homes which may help in managing pharmaceutical resource and subsequently the health, economic, environmental, and ethical (Alnahas et al., 2020) impacts of unused medications. Arabic and English are widely spoken and among the World Health Organization's (WHO) six official languages ("WHO | Bridging the language divide in health," 2015). Therefore, we expect this study to contribute and facilitate future research addressing unused medications regionally and globally. Further research including confirmatory factor analysis on larger sample may be useful for more generalizability. Using self-administered QUM-Qatar and translating it into other languages may increase its applicability and serviceability in other populations.

It is worth to note that the annual cost of unused medications reached USD 150 million in GCC (Gulf Cooperation Council) countries (Abou-Auda, 2003) and>150 tons of general medical waste is daily formed (Zafar, 2019). Unfortunately, most of the solid waste is inappropriately treated causing harm to the ecosystem. Israel deviated from that irregularity by introducing advanced waste management policies and system since 1990s (Abumoghli and Goncalves, 2020).

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Ethical Approval

Ethics approvals were obtained in Qatar from; Ministry of Public Health, Hamad Medical Corporation (01–18-237), and Primary Healthcare Corporation (PHCC/IEC/19/01/001). The research was performed in accordance with relevant ethical guidelines/regulations, and informed consent was obtained from all participants and/or their legal guardians.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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