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Development and psychometric evaluation of the patient knowledge of, and attitudes and behaviours towards pressure ulcer prevention instrument (KPUP)

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Abstract

The Patient Knowledge of, and Attitude and Behaviour towards Pressure Ulcer Prevention Instrument (KPUP) was developed and validated using a two-stage prospective psychometric instrument validation study design. In Stage 1, the instrument was designed, and it is psychometrically evaluated in Stage 2. To establish content validity, two expert panels independently reviewed each item for appropriateness and relevance. Psychometric evaluation included construct validity and stability testing of the instrument. The questionnaire was administered to a convenience sample of 200 people aged more than 65 years, living independently in the community; reliability and stability were assessed by test/retest procedures, with a 1-week interval. Mean knowledge scores at 'test' were 11.54/20 (95% CI = 11.10-11.99, SD: 3.07), and 'retest' was 12.24 (95% CI = 11.81-12.66, SD: 2.93). For knowledge, correlation between the test/retest score was positive (r=. 60), attitude section-inter-item correlations ranged from $r = -.31$ to $r = .57$ (mean intraclass correlation coefficient of $r = .42$), and internal consistency for the retest was the same as the test ($\alpha = .41$ for the eight items). For health behaviours, individual inter-item correlations for test items ranged from $r = -.21$ to $r = .41$ for the 13 standardised items. Psychometric testing of the KPUP in a sample of older persons in the community provided moderate internal consistency and general high test-retest stability.

KEYWORDS

knowledge instrument, patient knowledge, pressure ulcers, prevention, psychometric

1 | INTRODUCTION

Pressure ulcers have a significant impact on patients' lives, with quality of life studies demonstrating that compared with similarly matched people, patients living with these wounds have a lower quality of life.[1] The prevalence of pressure ulcers in an Irish acute setting is in keeping with international studies which record prevalence at between 12% and 38%.[2] Prevalence in the non-acute sector is difficult to gauge due to the myriad of care settings; however, McDermott Scales et al[3] reported that pressure ulcers were the wounds most commonly managed by community nurses, with prevalence rates of 4%,[4] and also reported a 4% crude prevalence rate across nursing disciplines with a point prevalence of 0.056% for the community. In 2015, Guest et al[5] estimated that the annual cost of wounds in the National Health Service is between £4.5 and £5.1 billion per year with two thirds of these costs incurred in the community. Furthermore, between 2000 and 2010, global mortality due to pressure ulcers has increased by 32.7%.[6]

Pressure ulcer prevention strategies are varied and include risk assessment, pressure relieving devices, and collaborative approaches such as the Pressure Ulcer to Zero campaign.[7] However, with the shift in emphasis from acute services to community-based services, it is important that patients are educated in prevention strategies to enable them to continue to live independently in the community. As many older people have multiple comorbidities and therefore more complex health needs, this is a challenge for health professionals.[8] In order to support patients to self-manage their risk of pressure ulceration, education programmes need to enable patients to engage in self-management strategies aimed at optimal treatment management and encouraging adherence to prevention strategies.

Prevalence rates increase significantly with age, with 75% of pressure ulcers occurring in the over 60-year age group.[9,10] The Irish 2011 census showed the highest rate of growth in age groups were that of older people, indeed between 2002 and 2011 the older population grew by 23% (Irish Census 2011). These findings are reflected within many international population statistics. It is reasonable to assume that there is a potential for increase in the incidence of pressure ulceration in this age group. This is based on the fact that in 2008, Gefen et al[11] have shown that pressure ulcers occur due to prolonged unrelieved exposure to externally applied mechanical forces, with immobile people more vulnerable to exposure to pressure. Reduced mobility is more common in the older person,[12] and therefore, this was the patient cohort of interest for this study.

This research was conducted as part of a larger study to develop, implement, and evaluate a patient pressure

Key Messages

- The KPUP tool provides an instrument with adequate psychometric properties to assess patient's knowledge of, and attitudes and behaviours towards pressure ulcer prevention
- KPUP has potential applications for use in clinical practice, education, and research. It is designed as a reasonably short tool for ease of administration and scoring and could be used to evaluate the efficacy of educational interventions
- KPUP could be used for research purposes and for the design of outcome measures of quality improvement projects in the community setting

ulcer prevention education programme – the Shanley Pressure Ulcer Prevention Programme (SPUPP).[13] In order to assess the outcome of the programme, a validated tool was required to assess patient's knowledge of, attitudes, and behaviours towards, pressure ulcer prevention. Following an extensive literature search, no validated tool to measure patients' knowledge of pressure ulcer prevention was located; thus, the development and psychometric evaluation of the Patient Knowledge of, and Attitude and Behaviour towards Pressure Ulcer Prevention Instrument (KPUP)[14] instrument was required.

As described by Kesänen, Leino-Kilpi[15] in their systematic review, a good quality questionnaire consists of many important elements. The authors suggest that development should begin with identifying the content of the knowledge domain and then ensuring that items are pertinent to that domain with no unnecessary additions.[15] Moule and Goodman[16] stress that questionnaires pertain to the measurement of knowledge, and in research should contribute to answering the research question. The target population for the tool in development should also be considered and the validation process outlined.[17] Terwee, Bot[18] developed criteria for determining the quality of knowledge tests, which was referred to during the development, and psychometric testing of the current instrument. These include criteria such as content validity, internal consistency, criterion validity, and construct validity, among others. Behavioural theory, such as self-efficacy[19] and belief constructs, such as locus of control[20] was also consulted, and helped inform the rationale for the inclusion of each construct/question in the questionnaire.

Throughout the literature, there are inconsistencies in the available definitions for measurement properties in relation to reliability and validity, but for the purpose of

the development of the KPUP tool, the definitions outlined by COSMIN, Consensus based Standards for the Selection of Health Measurement Instruments taxonomy,[21] were referred to. COSMIN is a set of standards developed by a multi-disciplinary team of researchers with the aim of providing a tool to enable researchers to select appropriate outcome measurement instruments for both research and clinical practice. The tools include the COSMIN taxonomy and the definition of measurement properties, and the COSMIN checklist, which is designed to assist researchers to assess the methodological quality of studies on measurement properties. COSMIN also provides a database of systematic reviews of outcome measurement instruments and guidelines for selecting outcome measurement instruments.[22]

Within the literature, there are knowledge assessment tools available to assess nurses' knowledge.[23,24] Beeckman et al[23,24] developed and evaluated the Pressure Ulcer Knowledge Assessment Tool (PUKAT) and an Attitude towards Pressure Ulcer Prevention (APUP) tool for nurses. Manderlier and Van Damme[25] updated and revised the knowledge tool (PUKAT)[24] tool and demonstrated that the PUKAT 2.0 tool had good psychometric properties and thus can be used to assess nurses' knowledge regarding preventing pressure ulceration. These tools, while psychometrically sound, are focused on health professionals and therefore were deemed unsuitable for adaptation for use with patients; thus, the development of the KPUP[14] was considered necessary (see Figure 1).

Knowledge is a pre-requisite for individuals at risk of pressure ulceration in order to facilitate self-management. Therefore, it is imperative that in tandem with providing an education programme such as SPUPP,[13] patients knowledge levels are assessed to determine the efficacy of such an intervention.[15] Measuring knowledge requires learning achievement tests, which can either be objective tests or essay tests. McDonald[26] describe essay tests as a format which allows the participant to present personal knowledge of a subject in an organised personal form, while objective tests are short, and presented with a set of answers or open-ended responses which are easy to score. The objective test was selected as the most appropriate format for the KPUP,[14] due to ease of administration, participation by the subjects, and scoring of results.

1.1 | Aims and objectives

The aim of this study was to develop and evaluate the psychometric characteristics of the Patient Knowledge of, and Attitude and Behaviour towards Pressure Ulcer Prevention Instrument (KPUP).[14] The tool was evaluated for the following:

- Content validity
- Construct validity
- Stability
- Reliability

1.2 | Method

1.2.1 | Design

The design comprised of a prospective psychometric instrument validation.

Instrument development
The development and validation of the KPUP[14] involved multiple steps (see Figure 1).

Step 1
Step 1 of the instrument development began with defining the construct to be measured. Within the KPUP knowledge section, the construct to be measured was defined as *'Knowledge of concepts and processes related to pressure ulcer development and prevention, including knowledge of the key tenets of pressure ulcer prevention, which are skin, keep moving, incontinence and nutrition'*. The sub-sections were the content of the individual sessions of the SPUPP.[13] Health behaviours section included 17 questions relating to participant health behaviours and attitude section included impact of PU, priority of PU prevention, confidence in the effectiveness, and responsibility in PU prevention and personal competency to prevent PU's.

Step 2
The next step was to generate the item pool, a pool of items generated to represent each sub-section (SPUPP sessions).[13] Current pressure ulcer prevention guidelines[27,28] were consulted to ensure that the content of the KPUP[14] addressed key recommendation from these guidelines based on most recent evidence. Expert opinion was obtained from within the Royal College of Surgeons. Health literacy was also considered with careful attention given to use of appropriate language and readability of the tool.

Step 3
Step 3 was carried out simultaneously to step 2; the goal was to ensure the ideal response format while remaining cognisant of the fact that all response formats have pros and cons associated with them. Pre-selected responses in a variety of formats were selected for the tool. The knowledge section contained both multiple-choice responses with four possible answers and one correct response, and
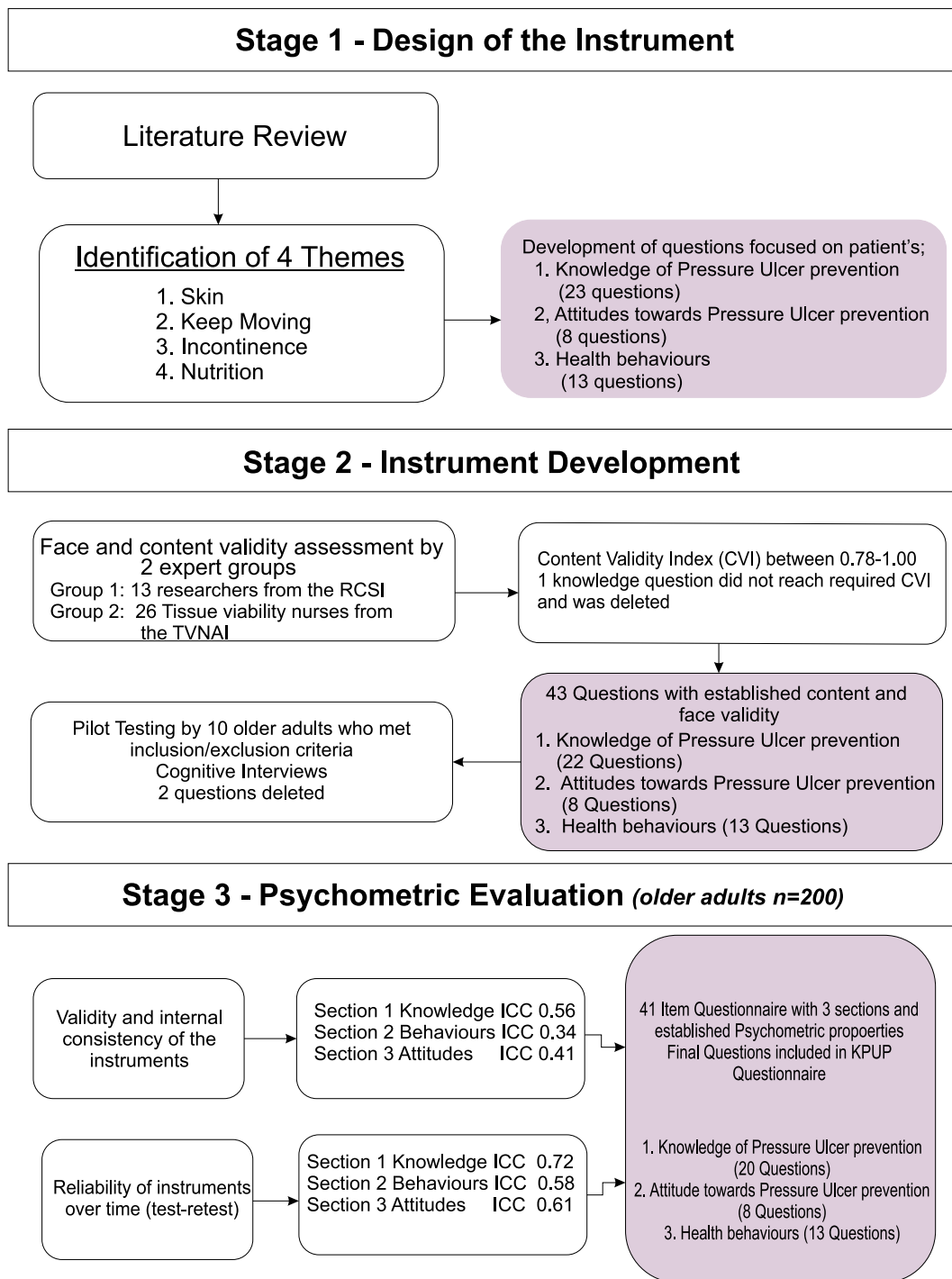
Stage 1 - Design of the Instrument

Literature Review

↓

Identification of 4 Themes
1. Skin
2. Keep Moving
3. Incontinence
4. Nutrition

→

Development of questions focused on patient's;
1. Knowledge of Pressure Ulcer prevention
   (23 questions)
2, Attitudes towards Pressure Ulcer prevention
   (8 questions)
3. Health behaviours
   (13 questions)

Stage 2 - Instrument Development

Face and content validity assessment by 2 expert groups
Group 1: 13 researchers from the RCSI
Group 2: 26 Tissue viability nurses from the TVNAI

→

Content Validity Index (CVI) between 0.78-1.00
1 knowledge question did not reach required CVI and was deleted

↓

43 Questions with established content and face validity
1. Knowledge of Pressure Ulcer prevention
   (22 Questions)
2. Attitudes towards Pressure Ulcer prevention
   (8 Questions)
3. Health behaviours (13 Questions)

←

Pilot Testing by 10 older adults who met inclusion/exclusion criteria
Cognitive Interviews
2 questions deleted

Stage 3 - Psychometric Evaluation *(older adults n=200)*

Validity and internal consistency of the instruments

→

Section 1 Knowledge ICC 0.56
Section 2 Behaviours ICC 0.34
Section 3 Attitudes   ICC 0.41

→

41 Item Questionnaire with 3 sections and established Psychometric propoerties
Final Questions included in KPUP Questionnaire

1. Knowledge of Pressure Ulcer prevention
   (20 Questions)
2. Attitude towards Pressure Ulcer prevention
   (8 Questions)
3. Health behaviours (13 Questions)

Reliability of instruments over time (test-retest)

→

Section 1 Knowledge ICC 0.72
Section 2 Behaviours ICC 0.58
Section 3 Attitudes   ICC 0.61

FIGURE 1   Development of the KPUP tool

some simple true/false responses. The use of 'don't know/not sure' response option was excluded to reduce the potential for a response set which respondents may use when they are not confident in their response.[29] For ease of scoring within the knowledge questionnaire, there was only one correct response, which scored '1'. The incorrect responses were scored as '0'. Within the health behaviours there was a combination of Yes/No and multiple-choice responses, which had four possible options. The response format for the attitude section was a Likert scale (five options from strongly agree to strongly disagree). Within the attitude section, agree/disagree response formats were used to reduce the potential for participants to feel they were being judged.[29]

Step 4
Once the questions were developed and appropriate response formats were determined, members of the

general public were surveyed to ascertain appropriate incorrect responses for the knowledge questions with four potential responses. This survey of members of the general public presented the proposed questions and noted the incorrect responses for use as potential response options. Experts within the university then reviewed the questionnaire and changes were made. Finally, the questionnaire was sent to two expert panels to establish content validity.

Step 5

Step 5 involved pre-testing and assessment of face validity. The KPUP was pilot tested with a sample of 10 participants. Four of these participants also completed cognitive interviewing.

1.2.2 | Content of the KPUP tool

The tool consists of three sections to be used separately or interchangeably. While the tool was designed with the intention of assessing the knowledge, attitudes, and behaviours of participants of the SPUPP,[13] this tool is intended for use independently of the programme so that it can contribute to the body of knowledge of pressure ulcer prevention (see Table 1).

1.2.3 | Readability of the KPUP tool

Readability of the written questions in the KPUP[14] was calculated using the Flesch-Kincaid Grade Level.[30] The Flesch-Kincaid Grade Level average was computed to be 4.6 which equates to reading age of 9 to 10 years, while the Flesch-Kincaid reading ease was 78.3, assessed to be fairly easy to read. Overall, the Flesch-Kincaid readability rating for the KPUP was Grade A, meaning that the questionnaire is deemed to be very easy to read for the general public. The report is outlined in Figure 2.

1.2.4 | Expert survey results

As per the study protocol, a document was sent to two expert groups to assess face/content validity of the questionnaire. Group 1 (n = *13*) comprised researchers from the Royal College of Surgeons in Ireland. This group had extensive expertise in pressure ulcers from a clinical and a research perspective. The second group (n = *26*) comprised tissue viability nurses from the Tissue Viability Nurses Association of Ireland who are expert in the field of wound care. The experts independently reviewed each question for appropriateness and relevance in assessing

TABLE 1 Content of the KPUP tool

Section 1 of KPUP – Knowledge	The themes of the knowledge section of the KPUP[14] were developed in accordance with the themes of the SPUPP programme.[13]
	As stated previously, the SPUPP[13] was based on evidence-based guidelines from NPUAP[28] and the Health Service Executive (HSE), Ireland,[1] and addressed the key tenets of pressure ulcer prevention, including risk assessment, support surfaces, repositioning, skin care, and nutrition. This was in keeping with the HSE Pressure Ulcer to Zero[7] campaign.
	The knowledge section is an objective test consisting of multiple choice and true/false questions.
	The intent was to have 20 knowledge questions included in the final tool, which would address each aspect of prevention.
	The themes and topics were discussed within the research team to ensure that they were measuring the domains of pressure ulcer prevention.
	At the first stage of development, 23 questions were designed, and of these, 14 were designed with four answer options.
	The remaining nine questions had true or false answer options.
	A total of 23 questions were included in the knowledge section, which was circulated to two expert groups.
Section 2 of KPUP – Health behaviours	This section originally contained 17 questions relating to participant health behaviours. Following discussion within the research team, the number of questions was reduced. This 13-question (Q21-Q33) section was then sent to the expert groups.
Section 3 of KPUP – Attitude towards pressure ulcer prevention	This section consists of eight questions (Q34-Q41).
	These questions were rated on a Likert scale.
	The questions were developed to measure five subscales: impact of pressure ulcers, priority of pressure ulcer prevention, confidence in the effectiveness, and responsibility in pressure ulcer prevention and personal competency to prevent pressure ulcers.

Abbreviation: NPUAP, National Pressure Ulcer Advisory Panel.

patient's knowledge of, and attitudes towards pressure ulcer prevention. In order to ensure the rigour of the validation process, an open-ended question was inserted for each item to allow the expert groups an opportunity to add in any suggestions or include missing content. The experts included individuals who have presented, published and are well known in their field both nationally and internationally. Furthermore, the groups were drawn from different workplaces and settings. Participants were encouraged to fully critique each item. The participants did not know the selection of the other individuals involved in this aspect of the study, and the responses were anonymous in order to enhance unbiased ratings and comments.

Relevance of each item under study was rated using a Likert scale as follows:

1 = Strongly disagree.
2 = Disagree.
3 = Neither agree nor disagree.
4 = Agree.
5 = Strongly agree.

Data were stored, analysed, and presented using Predictive Analytics Software (PASW) Statistics for Macintosh Release 20.0 (SPSS Inc. Chicago, IL). Content validity is defined as *'the degree to which an instrument has an appropriate sample of items for the construct being measured'*.[31] The item content validity index (I-CVI) was computed using the proportion of experts who agreed regarding the item relevance, divided by the total amount of experts. Polit and Beck suggest that items with an I-CVI of 0.78 or higher, for three or more experts, can be considered to display good content validity.[32] Within the questionnaire, three sections were assessed for face/content validity (see Table 2).

1.3 | Methods for psychometric evaluation

1.3.1 | Population and sample

The population was older persons living in the community who attended either a day care centre, or retirement group. The rationale for this was to access large groups of older persons who were living independently and were not currently under the care of public health nursing services. The sample was based on Polit[34] who recommended 10 respondents per item on a questionnaire as a minimum to support factor analysis and therefore 200 participants were required.

1.3.2 | Inclusion/exclusion criteria

The inclusion criteria were individuals:

- Living independently in the community
- Aged 65 years and older
- Who provided written consent

The exclusion criteria were individuals:

- Living in a long-term facility or a nursing home
- Who had cognitive impairment and/or unable to understand the nature of the study, or provide written informed consent?
- Who were already involved in another research project?
- Who did not provide consent?

1.3.3 | Recruitment

The lead researcher met with the day care coordinators and group leaders of the retirement groups in advance of recruitment to discuss the research and inform them of the study protocol. The day care coordinators and group leaders agreed to allow access by the lead researcher to the attendees and agreed to act as gatekeepers for the study. They applied the inclusion and exclusion criteria and gave information leaflets to people who met the

Readability Scoring Report	
Item Type	Text
Date	2018-05-24 11:34

Readability Rating

Readability Grade Levels

READABILITY FORMULA	GRADE
Flesch-Kincaid Grade Level	3.9
Gunning Fog Index	5.3
Coleman-Liau Index	4.6
SMOG Index	7.2
Automated Readability Index	1.9
Average Grade Level	4.6

Readability Scores

READABILITY FORMULA	SCORE
Flesch Reading Ease	78.3
Spache Score	3.0
New Dale-Chall Score	4.3

FIGURE 2 Flesch-Kincaid report KPUP

inclusion criteria, one week in advance of the lead researcher attending to gain consent.

1.3.4 | Data collection

Ethical approval for this study was granted and consent was sought from the participants (Reference Number; REC 1273). The gatekeeper gave the appropriate information leaflet to all eligible people. At the next visit to the day care centre, informed consent was obtained. Data collection began immediately once consent had been given and included:

- Baseline demographic data
- The Patient Knowledge of, and Attitude and Behaviour towards Pressure Ulcer Prevention Instrument (KPUP).

In order to study the stability of the Instrument over a time period, data were collected at two different points in time, with a one-week interval between time point one and time point two. The 1-week period between the test and the retest was used to reduce confounding factors during the intervening time interval.[34] The questionnaire took approximately 15 minutes to complete.

1.3.5 | Data analysis

Data were stored, analysed and presented using PASW Statistics for Macintosh Release 23.0 (SPSS Inc. Chicago, IL). The completed test and retest questionnaires were numerically recoded, tabulated, and entered into the SPSS Programme. Data analysis was blinded. An alpha level of .05 was applied for all statistical tests. Descriptive statistics, comparison of means, and paired/independent-samples *t*-tests were used for data exploration and between-group comparisons. The stability reliability of the questionnaire over time (test-retest) was assessed by computing Pearson's correlation between test-retest computed scores and the split-half coefficient for all individual items in a section. Calculating the inter-item correlations assessed the internal consistency. For the intraclass correlation coefficient (ICC) value, average measures were used with a two-way mixed effects model. The ICC was calculated for each section as well as for the overall instrument. Cronbach's alpha was also computed in parallel to the ICC values.

1.3.6 | Pilot study

A pilot study was undertaken of the KPUP,[14] and included completion of the data collection instrument and evaluation of:

- Clarity and ambiguity of the questions
- Format and layout of the questionnaire
- Time needed to complete the questionnaire

The pilot group consisted of 10 participants, six males and four females. The age of the participants ranged from 70 to 88 years (Mean age 77.7 years, SD: 6.03). The majority took 10 to 15 minutes to complete the questionnaire and commented that it was straightforward and clear. Two participants took longer (20 and 45 minutes) due to chatting about their health in general, as they were completing the questionnaire. One participant commented that the attitude section might be a little confusing for older people, but all other participants expressed satisfaction with the attitude section. Knowledge scores for the pilot study ranged from 8 to 19 out of a maximum of 20 points. The mean score was 13, and the median score was 14 (SD: 3.58). The pilot group included four retired professionals, and two of the participants had previously cared for relatives and had good knowledge of preventing pressure ulcers, which may account for the high knowledge scores achieved.

1.3.7 | Cognitive interview

Drennan[35] proposes that in questionnaire survey non-response, or non-completion of questionnaires leads to difficulty in collecting data or can result in incomplete data, which can preclude the generalisibility of findings. Furthermore, difficulties can arise for participants when completing questionnaires in relation to how they understand and interpret the questions and how much information they are willing to impart.[36,37] In order to enhance the readability of the KPUP and to facilitate optimal completion, cognitive interviews were conducted to ascertain the views of the participants. Drennan[35] recognises cognitive interviewing as a tool to determine if questions are not straightforward and may potentially generate response error. Cognitive interviewing is defined by Beatty and Willis[38] as a technique used in the development of questionnaires which can take the form of 'think aloud' or 'probing'. Four of the 10 participants of the pilot study were interviewed using the 'think aloud' technique. The participants were encouraged to articulate their thoughts as they responded to the questions, which is consistent with the principles of cognitive interviewing as described by Drennan[35] and Dillman.[39]

The goal of the interviews was to concentrate on organisational aspects of the KPUP, in addition to face and content validity. The interviews took place at a time and venue that suited the participant. Drennan[35] suggests that one of the shortcomings in cognitive interviewing is

TABLE 2 Content validity index KPUP tool

Section 1 of the questionnaire – Knowledge	Section 1 contained 23 items relating to knowledge, of which, the team planned to include 20 questions in the final questionnaire.
	Questions 1 to 14 were multiple-choice questions with four possible answers, of which only one is correct. The content validity index was calculated for each of the 14 questions using the proportion of experts who agreed/strongly agreed that the questions were:
	Appropriate
	Relevant
	Answers were appropriate
	One question (Q10) failed to reach an I-CVI of 0.78 or higher (I-CV1 = 0.71) for appropriateness, even though the I-CVI for relevance and answer appropriateness were I-CVI 0.97 and I-CVI 0.94, respectively; thus, this question was excluded.
	Question 10: 'when lying in bed, what can I do to prevent a pressure ulcer?'
	Stay in the same position,
	Use a hot water bottle or electric blanket,
	Change position regularly,
	Massage any red areas.
	All other items had an I-CVI index for each of the three subscales (appropriateness I-CVI 0.89-0.97, relevance I-CVI 0.88-0.97, and answer appropriateness I-CVI 0.81-0.94) of higher than I-CVI 0.78.
	A total of 20 knowledge questions pertaining to pressure ulcers and their prevention were considered the requisite amount by the research team.
	This was based on a previous study evaluating the impact that a structured education programme had on patients' knowledge of leg ulcer prevention and healing behaviour.[33]
	Furthermore, a mean baseline knowledge score of 11 and an SD of 3 were assumed. In order to demonstrate a 30% relative increase in the mean score (equivalent to a mean score of 14.3), with 90% power and a statistical significance of 5% (two-sided), between the randomised groups, 20 questions were required.[32]
	Twenty-two of the original 23 questions reached the I-CVI greater than 0.78 as recommended by Polit and Beck (2007) and all of these were included for pilot testing.
Section 2 of the questionnaire – Health behaviours	This section included 13 questions, which measured health behaviours. The I-CVI was calculated for agreement on the following:
	Is the question appropriate?
	Is the question relevant?
	For appropriateness, the I-CVI results for each item were between 0.86-0.97, which indicated that each item was considered appropriate.
	For relevance the I-CVI results were between 0.86 and 0.97 indicating relevance of each item in this section.
	Thus, all items in this section were included for pilot testing.
Section 3 of the questionnaire – Attitudes	This section contained eight questions designed to measure attitudes of participants towards pressure ulcer prevention. The I-CVI was calculated for agreement on the following:
	Is the question appropriate?
	Is the question relevant?
	For appropriateness, the I-CVI results for each item were between 0.94 and 1.00, which indicated that each item was considered appropriate.
	For relevance, the I-CVI was results were between 0.92 and 1.00 indicating relevance of each item in this section.
	Thus, all items in this section were included for pilot testing.

that the analysis of the participant's views is subjective, so to address this, the lead researcher took rough notes during the interviews. On analysis of the feedback provided by the participants that mostly consisted of expression of difficulty with some of the language used in some questions, the lead researcher reviewed the questionnaire. The process identified areas for modification including language, format and legibility of questions. The layout of the questionnaire and other minor adjustments were made including the removal of two questions in the knowledge section.

Instruments – KPUP

The knowledge questionnaire consists of three sections:

Section 1 consists of 20 knowledge questions – 13 multiple-choice questions and 7 true/false questions. Section 2 consists of 13 questions recording health

behaviours towards pressure ulcer prevention. These questions focus on nutrition, activity levels and skin care Section 3 consists of eight questions focusing on attitudes towards pressure ulcer prevention. These questions were rated on a five-point Likert rating scale as follows:

- 1 = Strongly Agree; 2 = Agree; 3 = Neither agree nor disagree; 4 = Disagree; 5 = Strongly Disagree.

1.4 | Results

1.4.1 | Demographic findings

The KPUP was administered to 200 older adults living independently in the community, attending either day care centres, or retirement groups. The group consisted of 72% female (n = 144) and 28% male (n = 56) participants. The mean age was 79 years (range = 65-98, SD: 6.918). Of the 200 participants, one (0.5%) had a previous pressure ulcer. During the retest period, 15 respondents did not attend the day care centre/retirement group, or did not answer the questionnaire, reducing the effective sample size to n = 185.

1.4.2 | Knowledge scores

The mean knowledge score for all participants at test was 11.54, from a potential maximum score of 20 (95% CI = 11.10-11.99, SD: 3.07). The mean score for the participants at retest was 12.24 (95% CI = 11.81-12.66, SD: 2.93) (Table 3).

1.4.3 | Validity and internal consistency of the instruments

Cronbach's alpha is used to estimate the proportion of variance that is structured or consistent in a set of scores.[40] The reliability coefficient ranges from 0.0 to 1.0 to provide the estimate of proportion of variance in the test scores that can be assigned to the true score variance. If there is no relationship or correlation between the scales, then α = 0, whereas if there is high correlation then α will be nearer to 1. Therefore, the higher the Cronbach's alpha, the higher the correlation between items.[40] However, it is important to note that Cronbach's alpha decreases the higher the number of items, regardless of actual correlations. For the ICC value, average measures were used with a two-way mixed effects model.

Section 1 KPUP – Knowledge

Questions for Section 1 of the instrument were recoded in SPSS, to a dichotomous profile (true/false). A score for the section was then computed for test and retest events. Both scores approximated a normal distribution profile. When interpreting 'r', the value is always between +1 and −1 with .50 indicating a moderate positive linear relationship and .70 indicating a strong positive linear relationship.[41]

The correlation between the test/retest computed score was positive as expected, $r = .60$. Using the split-half method, consistency for individual items over time was also high, with α = .75 and an ICC of $r = .72$.

Cronbach's alpha for the instrument was relatively stable; α = .58 for test, and α = .54 for retest. Individual inter-item correlations ranged from $r = −.19$ to $r = .34$ (test) and from $r = −.28$ to $r = .34$ (retest). The ICC value was $r = .56$ for the test subjects, and $r = .53$ for the retest subjects.

Section 2 KPUP – Health Behaviours

For Section 2 (Health Behaviours), individual inter-item correlations for test items ranged from $r = −.21$ to $r = .41$. The ICC was $r = .34$, while Cronbach's alpha was α = .35 for the 13 standardised items. For the retest data, the ICC was $r = .29$ with α = .29. This indicates lower internal consistency for this section of the instrument.

Section 3 KPUP – Attitudes

For Section 3 (Attitudes), internally, Cronbach's alpha was α = .41 for eight items for the test items. Inter-item correlations ranged from $r = −.31$ to $r = .57$, with a mean ICC of $r = .42$. Internal consistency for the retest questionnaires was the same as the test questionnaires as α = .41 for the eight items. Inter-item correlations ranged from $r = −16$ to $r = .59$, with a mean ICC of $r = .41$.

Table 4 provides a summary of the internal consistency statistics.

1.5 | Reliability of instruments over time (test-retest)

Reliability of the instrument over time was computed using two main measures, Pearson's correlation between test-retest computed scores, and the split-half coefficient for all individual items in a section.

Reliability Section 1 (knowledge)

The correlation between the test/retest computed score was positive as expected, $r = .60$ (α = .75). Using the split-half method, consistency for individual items over time was also high, with α = .75 and an ICC of $r = .72$.

	Mean	Median	SD	Min	Max	Skewness	Kurtosis
Test	11.55	11.0	3.07	4	19	0.053	−0.520
Retest	12.24	12.0	2.93	4	18	−0.148	−0.383

TABLE 3 Knowledge scores – Measures of central tendency (N = 185)

Note: Validity and internal consistency of the instruments.

Reliability Section 2 (health behaviours)

Individual variables were recoded into standardised dichotomous variables (0, 1). Variables of an ordinal character (for example, nutrition standard) were recoded into standardised ordinal variables (0, 0.33, 0.66, and 1.0). This was to enable equal weighting of all variables in generating the final section score.

For the test dataset, the final scores for Section 2 were $M = 8.74$ (SD: 1.41; range: 5.32-12.32). For the retest dataset, the final scores were $M = 9.03$ (SD: 1.32), with score range identical to the test questionnaires. According to the paired-samples t-test procedure, this difference in scores was statistically significant, as $t = 3.57$, $P < .001$. However, correlation between the test-retest scores was strong, with $r = .59$ using Pearson's correlation coefficient, and $\alpha = .74$ using Cronbach's alpha. Using Cronbach's alpha, as well as other methods (such as Split-Half and Guttmann coefficients), consistency between individual items over time was good, where $\alpha = .74$ between the two datasets. ICC was somewhat lower for individual items between the two datasets, as $r = .58$.

Reliability Section 3 (attitudes)

Individual variables of this section were computed to form a final summed score of the relevant Likert scores, reflecting the theoretical factor attempting to be measured by this part of the instrument (active concern). Where required, variables were reversed for consistency. The score was assumed to reflect higher values indicating more patient concern about the value of active prevention and management of pressure ulcers. For the test data, the final scores for Section 3 were $M = 26.22$ (SD: 3.76; range: 13-36). For the retest data, the final scores were, respectively, $M = 26.26$ (SD: 3.45; range: 17-34). Unlike Section 2, no significant difference was found between the test-retest scores, as $t = .08$, $P = .936$.

Correlation between the paired samples sub-score was, as expected, significant, where $r = .48$; using Cronbach's alpha, the standardised coefficient was $\alpha = .65$. The ICC value was very similar, as $r = .64$. As with the combined scores, correlation of individual items between the two datasets was positive, with $r = .48$. Using Cronbach's alpha, as well as other methods (such as Split-Half and Guttmann coefficients), consistency was good, albeit lower than Section 3, $\alpha = .65$ between the two datasets. The ICC values for the

TABLE 4 Internal consistency statistics for KPUP questionnaire (test)

	Section 1	Section 2	Section 3
Cronbach's alpha	.58	.35	.41
Inter-item correlations: min	−.19	−.21	−.31
Inter-item correlations: max	.34	.41	.57
Intraclass correlation coefficient (ICC)	0.56	0.34	0.41

individual items between the two datasets were slightly lower, as $r = .61$.

Table 5 provides a summary of the test-retest statistics.

2 | DISCUSSION

This study set out with the aim of developing a valid and reliable instrument to assess older adults' knowledge of, and attitudes and behaviours towards, pressure ulcer prevention. Psychometric testing of the KPUP in a sample of older persons in the community provided moderate internal consistency and general high test-retest stability.

Overall, Section 1 (Knowledge) was found to have the highest internal consistency as well as better test-retest stability. Section 2 (Health Behaviours) had lower internal consistency overall. However, test-retest reliability was relatively high and similar to Section 1. There was an increase in scores recorded between the test and retest events, which may indicate a learning effect. Section 3 (Attitudes) had better internal consistency than Section 2, but the lowest test-retest stability of all scores. Overall, however, all sections of the instrument enjoyed at least moderate internal consistency and general high test-retest stability.

An extensive literature search failed to identify a reliable instrument to evaluate patient's knowledge, attitudes and behaviour towards pressure ulcer prevention. In order to design and evaluate this tool the authors used sound rigorous processes to develop and evaluate the psychometric properties of the KPUP tool. The results presented in this paper suggest that this tool has acceptable psychometric properties. The content of the tool provides broad information for clinicians regarding the knowledge base of patients and therefore a good base upon which to

TABLE 5 Summary test-retest statistics for KPUP questionnaire

Section				
	1	2	3	All
Cronbach's alpha (sub-scores)	.75	.74	.65	.60[a]
Pearson's *r* (Sub-scores)	0.60	0.59	0.48	0.43[a]
Intraclass correlation coefficient (ICC) (individual items)	0.72	0.58	0.61	0.51

[a]Score computed for individual items only.

implement educational strategies. Within the older population the relationship between ageing and reduced mobility leads to an assumption that there is potential for an increase in the prevalence of pressure ulceration in older adults (Aul, 2018). Prevention of pressure ulcers is a key issue for enhancing health in the older population, and education is a means to empower people to take an active role in health promotion, however, interventions must be evaluated and valid reliable tools such as the KPUP are essential. Ideally, the results of this review would support policy and decision-makers, management and staff members of health care organisations to emphasise the importance of valid reliable tools such as the KPUP. Such tools also enable the identification of educational needs and priorities for this at risk cohort of people, while also evaluating the efficacy of educational interventions.

3 | CONCLUSION

This study was designed to develop a valid and reliable instrument to assess older adults' knowledge of, and attitudes and behaviours towards, pressure ulcer prevention. Psychometric testing of the KPUP in a sample of older persons in the community provided moderate internal consistency and general high test-retest stability. The established validity of the tool ensures that the use of KPUP tool to evaluate educational interventions designed to improve patient knowledge can be relied upon and are generalisable to the targeted population. Furthermore, an additional strength is that the design of the tool is such that it can be used either separately, that is to measure knowledge, or attitudes, or behaviours, or interchangeably where either all, or some of the above can be measured. The tool can also be used in various health care settings, providing an invaluable resource to clinicians working in pressure ulcer prevention.

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