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Development and Validation of an Instrument to Assess Nurse Practitioners Knowledge towards Use of High Risk/High Alert Medications

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Design: Prospective methodological program.

Methods: The instrument on HRM was developed in the form of videos compatible in both PC and mobile format. The five chapters were emphasised and modules was ensured to be important, relevance, reactions, appropriate with the help of content and face validations. Further, confirmed to be sensitive enough to distinguish the knowledge levels of nurses.

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Development and Validation of an Instrument to Assess Nurse Practitioners Knowledge towards Use of High Risk/High Alert Medications

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Results: The content validity included six experts involving senior consultants, nurse administrators and pharmacy heads whereas face validity was carried out with the involvement of forty five nurses practitioners. The five point Likert scale was carried out for all the five chapters to receive an average score above four points with Content Validity Index (CVI) = 0.83 and Item-level content validity index (S-CVI) = 0.83. Therefore, suggests the conciseness, appropriateness, and importance of the training materials. The face validity strongly highlighted the approval of the design of instrument and the importance of the issues to the nursing profession. The K-R 20 index consistently reached the score of 0.89 for introduction of HRM, 0.70 for inappropriate abbreviations, 0.85 for dose calculations, 0.79 for storage and labelling and 0.73 for LASA, indicated that the video materials prepared were effective, feasible and attractive.

Conclusions: The validated instrument was found to be appropriate, concise and important to improve the knowledge and handling of nurse practitioners on the HRM (s), thus helps to contribute to better patient care.

Keywords: high risk medications, medication error, content validity, reliability, instrument development, instrument validation.

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I. Introduction

High risk medications (HRM) or high alert medications (HAM) refers to medications which possess narrow therapeutic index or lesser margins of safety and stands a heightened risk of causing substantial harm to patient if used in error. Although, medication errors involving this type of medications are less common, but the consequences to the patient can be more devastating. So, the institute for safe medicinal practices (ISMP 2003) reports high risk medications as drugs which has been frequently involved in either injury, damage or even death of the patients (Engels and Ciarkowski, 2015). The medications such as heparin, warfarin, insulin, sedatives, and narcotics were repeatedly administered by the nurses are reflected as potential drug classes eligible for continuous monitoring. According to American Pharmaceutical Association, HRM or HAM were listed into eight categories such as anticoagulants drugs, chemotherapeutics agents, cardiovascular drugs, opiates, narcotics, benzodiazepines, electrolytes and neuromuscular blocking agents (Cohen, 2007).

According to US pharmacopeia (2001-2006), 60 % of errors have occurred because of anticoagulants and alarmingly, about 3 % of the errors had been associated with deaths. Interestingly, a study done from January 1997 to December 2007 reported 446 medication errors. Among drug classes contributing to this error, anticoagulants consisted of 7 % in which two-thirds of the patients received heparin. Unfortunately, this study reported 28 deaths and 6 patients being suffered from loss of function (Anderson and Townsend, 2015). The use of concentrated electrolyte solutions such as potassium chloride (KCL), along with anticoagulants and cardiovascular drug was reported with potentials adverse drug events (ADEs) as indicated by Bates et al., (1995). Subsequently, published literature by Sheu et al., (2009) highlighted 328 drug administration errors. Insulin, oxytocin and KCL, primarily termed as HRMs were considered as the major culprits for these errors. Another study, reported 469 serious medication errors by the researcher Phillips et al., (2001) which involved in largest number of deaths (54.9 %) because of antineoplastic drug, cardiovascular drug and central nervous system products.

Nurses play an important role in drug administration with an aim to deliver high quality care to the patients by minimizing the medication errors. The reduction in administration errors is a demanding challenge and it's hard to formulate appropriate and safer methods for administration of HRMs, particularly in intensive care units and emergency situations. However, an investigation by Greenglod et al., (2003) showed that administration errors was not reduced significantly by replacement of general nurses with qualified nurses. Hence, implementing an educational programme through the various processes can raise nurses' awareness about medication errors and other various medication-related safety issues regarding to HRMs as explicitly described by Elnour et al. (2008). The instrument in the form of teaching modules can enhance nurse's knowledge and attitude toward handling of HRMs, thus influence the quality of patient care they provide.

Several studies have explained that validation and reliability are always been an important factors in social, health and science research for measurement of accuracy and consistency of an instrument. However, the process for validation of instruments is not frequently carried out in developing countries. This has been associated with the shortage of information on these assessments of validation which should have been carried out in the research field. A Nigerian researcher highlighted the significance of both literary and technical meaning through the process of validation and reliability tests and making them as an important procedure in research works. For improving the knowledge and skill of tests among researchers, various measures and approaches of examining validation and reliability of an instrument remained deliberated in this study (Anderson and Townsend, 2015).

The various international literatures mentioned about the evaluation of nurses knowledge on HRM by using valid and reliable instruments of measurement. To strengthen the above statement, the Taiwanese researcher in 2006 concluded that the learning module prepared by them was proven to be reliable and was validated through Kuder-Richardson Formula 20 (KR-20) for the assessments of nurse's knowledge on HRMs. In the same way, our educative materials plays an important role in assessing the nurse's knowledge in HRM management, hence the educative materials, has been deeply and vigorously developed and validated from various experts. Instruments in clinical research are required to go through the process of validation and reliability (Priscila and Roberta, 2015). Finally, the instrument was developed and validated with measurement of reliability with Kuder-Richardson reliability 20 for its internal consistency (Hsaio and Chen, 2010). This study was aimed on prepare and valid the teaching materials (as video format) to measure the nurse's knowledge regarding HRM or HAM so as to increase the increment in nurses knowledge.

II. Methods

The study involved prospective methodological program. The summarized study methodology is represented in Figure 1.

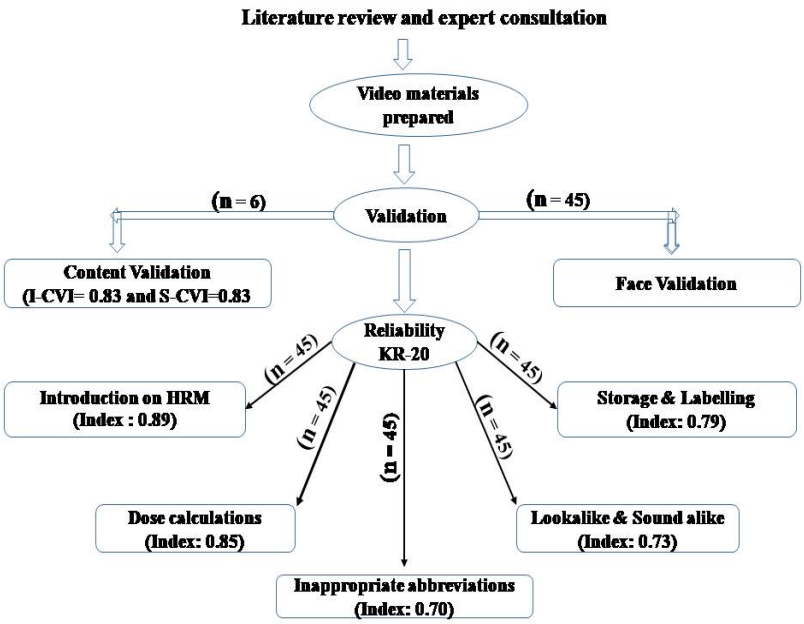

Figure 1: The overall study procedure along with reliability scores

a) *Preliminary preparations for the development of an instrument*

This study mainly includes preparation of educative video materials with rigorous analysis of the collected information, the main purpose of which was to create and validate research instrument and procedures. With respect to Indian nursing practice environment, information required for making educative and training materials were appropriately prepared from global guidelines and HRM management practice. Considering the fact of under stability and comprehensiveness, the materials on high alert medications were prepared. From various sources and literatures articles, five informative and educative chapters viz introduction to HRM, dose calculations, inappropriate abbreviations, look alike and sound alike (LASA) and storage and labelling was prepared. The information was collated and formatted in the form of Microsoft office power point presentation (PPT). The same was validated (out of this study scope) and used for the development of video materials required for this study. A compressed mobile formats, and high resolution personal computer (PC) format materials were made accessible, which would highly favoured and accepted by the participants. The researcher was fully believed that the informative and educative teaching materials made would play an important role for increasing knowledge in nurse practitioners. The materials were prepared for the assembly of data from the participant's responses regarding the training material.

b) *Development of an instrument in the form of video materials*

For the purpose of this study, the information in the training materials was transformed to scripts in the form of narrations in an intention to prepare suitable and appropriate video materials. For easy understandability, language of the scripts was then ascertained for easiest way. By considering various factors like voice of artiste, clarity in tone for pronunciation, rate of speech flow and delivery of speech timing, a suitable voice of female artiste was chosen for recording the well prepared scripts into an audible voice. Under the guidance of supervision of a technical team bearing hands on both recording and editing experience, the whole process was performed in a controlled environment.

The following six crucial processing steps were involved during the development of video materials viz: (i) Recording the scripts into voice in the form of individual sound track (ii) joining of individual sound track to make one single audio file. (iii) Adjust time gap of each slides of PPT with audio files. (iv) Mixing the audio files to each PPT slides. (v) Addition of suitable background sound or tracks to the collaborated files. (vi) Finally, compressing the complete file into suitable PC format as well as mobile format. The software such as; (i) Audio recorder by Green Apple Studio (Version 1.9.45), (ii) Audacity, The free, Cross-Platform Sound Editor by Audacity Development Team (Version 2.1.3), (iii) Corel Video Studio Ultimate X10 was utilized for the purpose of recording the scripts and collaborating with each slides of ppt. The video was finally ensured to be checked for synchronization and clarity. The prepared video materials were further subjected for validations to ensure its accuracy and reliability.

c) *Instrument validation by using various parameters*

The validation process has its important to research because it's a measurement which measures what it importance to measure. It has estimated through every single element of a construct. The content validity, face validity and reliability are more frequently used as indicators in the process of validation of any training materials. A customized documentation form for the instrument validation was prepared (Annexure 1). The Likert scoring system (1-4) was adopted for rating the each video slide of a chapter and also was used to score overall chapter. The scoring columns for teaching materials in various aspects such as content of the video, clarity of the video and audio as well as various diagrammatic illustrations was assessed. Additionally, the size and duration of the video for each chapter was also validated. The prepared learning modules was ensured to be exposed for the important, relevance, reactions, and appropriateness through the content and face validation, and sensitive enough to distinguish the levels of knowledge of registered nurses.

Forty five nurse practitioners actively involved in the process of the instrument validations. Among them, three were clinical nurses who held positions as head nurses, three of them were from nursing faculty members specialized in clinical teaching on medical and surgical wards, and rest had at least five years of experience as nurse practitioners. The three head nurses and three nursing faculties were utilized as special services for content validity. However, all of them examined the entire instrument, offered their expert opinions and rated the parameters as provided in the documentation form. The final scoring and feedbacks were evaluated and the appropriateness and reliability of the material was finally measured with KR 20. Finally, the validated video materials were distributed among all the station of nurse practioners to improve their knowledge on HRM.

i. *Content Validity*

Content validity was applied to examine the correctness and suitability of the teaching material (video file). Content validity index (CVI) remains a major concern for the validation of learning modules. Thus, the percentage agreement among specialists for assessing its instrument and its item was obtained by means of CVI calculation. This index permits for the analysis of

each item individually, and subsequently, the instrument as a whole. As mentioned by Lynn (1986), the instrument prepared to be valid follows two types of CVI viz content validity of individual items (I-CVI) and content validity of the overall scale (S-CVI). For I-CVI, the settlement between reviewers concerning on each item of the learning modules as an instrument was measured through the process of Likert scale, with scores that range from one to four (where, 1-irrelevent, 2- slightly relevant, 3- fairly relevant, and 4- completely relevant). Item having the scores of one or two were reviewed or excluded from the test. The results obtained from the I-CVI calculation for each item contained were fairly and completely relevant. So, Lynn (1986) recommends that for the items to be valid an I-CVI should be greater than 0.78 for analyses of instrument by six or more experts.

ii. *Face validity*

Face validity was conducted to test the effectiveness of the intervention as well as to validate video material. Face validity is defined as a process which includes the expert to be observing the modules of items in the instrument and assenting that the test is a valid for measure of the concept which is being measured just on the face of it. This means researcher are assessing whether each of the measuring items matches any given conceptual domain of the concept. The face validity revealed tough endorsement of the strategy and highlighted the important issues of nurse's profession. The respondents agreed to all training material provided by researcher secure a great atmosphere.

iii. *Reliability*

The instrument was also subjected to examine whether it had internal consistency. By KR-20 formula, an index score for reliability was calculated as shown in the Formula 1. And appeal about the internal consistency index of reliability to avoid the problems associated over multiple periods of time.

$$r_{KR\,20} = \left(\frac{K}{K-1}\right)\left(1 - \frac{\sum pq}{\sigma^2}\right) \qquad (1)$$

Where, $r_{KR\,20}$ is the Kuder-Richardson formula 20; k is the total number of test items; $\sum$ indicates to sum; p is the proportion of the test takers who pass an item; q is the proportion of test takers who fail an item; σ^2 is the variation of the entire test.

III. Results and Discussion

Many suggested strategies have been implemented to describe the errors caused by HRM, so among healthcare professional's high alert medications remains a major concern (Cohen, 2007). In the year 2009, Joint Commission has made a suggestion to avoid the use of misreads, abbreviations and also listed some special precautions which are needed for LASA. Gladstone (1995) reported that about more than half of life threatening hazard was happened because of rapid proportion of infusion of HRM. The North American system (2006-2008), used a software for reporting medication errors which nearly shows about 7 % of the 443,683 errors occurred by HRM. They also found that higher frequency of medication error occurred at intensive care units (ICUs) compared to clinical or surgical units of hospital. The primary reason being one as ICUs a complex units linked with different severity levels, and different drug groups including HRM. Additionally, the nurse's insufficient knowledge also significantly contributed for the errors (Hsaio and Chen, 2010). The overall reliability of all the chapters in the study is shown in Table 1.

a) Content Validity

The content validity index was reported only in methodological studies because it has focus only for explaining the process of content validations.

i. *Item-level content validity Index (I-CVI)*

The content validity index was obtained through the process where experts involve in giving a rating of either 3 or 4 (thus represent the main scale into "relevant" and "not relevant"), divided by the total number of experts involved. As shown in Table 2, the mean I-CVI was figured out to be 0.83. As per standard recommendations made by Lynn (1986), the standard can be relaxed when there are six or more than six raters, and also suggest about content validity should not be less than 0.78. The rating could be one ''not relevant'' rating (I-CVI = 0.83) with six raters or two "not relevant" ratings with nine raters (I-CVI = 0.78). Thus, the mean I-CVI obtained in this study could be considered as an ideal value. Lynn (1986) also suggested that when there is five or fewer experts as participants, there should be an agreement on the content validity for their rating which will be reflected as an equitable. From many published literatures it has been observed that researchers use content validity index information to guide them in reviewing, erasing, otherwise replacing items.

ii. *Scale-level content validity Index (S-CVI)*

The S- CVI/ave is the combination of number of items of test rated either as extremely or fairly relevant by all experts (x) combined divide by the total number of ratings (i.e 25 divided by 30) from Table 2 and calculated as 0.83. Many researchers (Davis, 1992; Grant & Davis, 1997; Polit & Beck, 2004).) suggest that the value of S-CVI should be of 0.80 or higher, which is consistent in this study. Waltz et al., (2005) mentioned about the average congruency percentage (ACP) which should not be 0.80 (because 0.80 is recommended as standard criterion for acceptability for the S-CVI. Rubio, Berg-Weger, et. al., (2003) mentioned about the development of Caregiver Well-Being Scale through process of content validation, in which they calculated

their S-CVI value based on ratings of relevance given by six judges. They specifically adopted this method because of their concern that with more than six raters, the content validity would be depressed if they used universal approach that demanded all expert agreement. Table 2 shows about the relevance rating of six experts for a five-item scale where all six experts rated 4 out of 5 items as relevant.

The calculation of the S-CVI/Ave involved three ways of methods, which was shown in Table 2. The first as average proportion of items rated relevant by all experts {i.e; S-CVI/Ave as (.8+.8+.8+.8+.8+1.0)/6 = .83}, another way is by summing them and dividing by the number of items: {i.e I-CVIs as (.83+.83+.83+.83+.83)/5 = .83}, a third way is to count the total number of xs in the table (i.e; the number of items rated relevant by all experts combined, which in this case is 25 and to then divide by the total number of ratings: 25/30 = .83. All three computations will always yield the same results.

They all agreed that the information, rationale, examples and diagrams on the video were vital on managing HRM by nurses and that the whole content was well organized, correct, precise and attractive.

b) Face validity

The face validity was conducted to determine the various aspects of study design which includes whether the instrument as learning materials was applicable, whether the audio and video clarity was clear and audible, whether the diagrammatic representations was clearly visible. Continuing medical education (CME) form of learning modules of HRM were distributed to 45 registered nurses practioners showing strong approval of the research design, its applicability, clear and comprehensive and the importance of the issue to the nursing profession.

c) Reliability

The process of validity and reliability concepts could be easily misunderstood. A validity symbolises about the accuracy of test whereas reliability denotes a test is reliable when it produces same results under the identical conditions. So that under the same conditions exactly the same experiment can be perform by other researchers, and can generate the same results which strengthen the outcomes and provide guarantee about the inclusive controlled public will consent the premise. Deprived of this repetition of statistically important results, the research has not satisfied almost all of the necessities of testability. The Kuder-Richardson formula 20 (KR20) was always involved as most commonly used formula for estimating the reliability of a test based on internal consistency, also called as reliability coefficient which requires only single test administration.

KR-20 always estimate the internal consistency of test materials (or reliability coefficient) based on the number of items involved in the test, proportion of correct answers given by candidates and the standard deviation of the total score. The values could range from 0 to 1. The closer the score is to 1, the more reliable the test. The overall test observations used for the reliability (n= 45) was documented in an excel sheet and the correct score per slide for the chapters introduction, dose calculations, inappropriate abbreviations, LASA and storage and labelling was obtained as shown in Tables 3, 4, 5, 6 and 7 respectively. The mean sum of product of proportion passed and proportion failed was calculated to apply standard deviation for each individual chapter. The validation was then done by applying KR-20 reliability formulae. When individual chapters were considered for their reliability, the index was obtained as 0.8994, 0.8587, 0.7077, 0.73736 and 0.7962 for chapters 1 to five, respectively. The reliability score is always expected to be above 0.50.

Similarly, Lin et al., (1999) showed the analysis of internal consistency for KR-20 value was reported in range of 0.86 to 0.94 for multiple choice test items in the registered nurse licensure exam. Also, Hsaio and Chen, 2010 used KR reliability for their true and false tests in development of valid instrument to assess nurse's knowledge of HRM in a tertiary care hospital, and got a value of 0.74, which indicated acceptable reliability. While, Priscila and Roberta, 2015 did the Brazilian transformation of the work done by Taiwanese researchers. Hsaio and Chen, 2010 computed KR 20 formulae for their instrument to assess nurse's knowledge and obtained a value of 0.74 respectively. Shafizan S. et al., (2013) designed an instrument test for students, to examine whether the test items made by researcher ensemble course for university music students and therefore for examining its reliability, they used KR 20 formula, the value of which was obtained as 0.717. Stephen, H., et al., (2017), developed an instructor-mediated performance assessment test, for which they did reliability and obtained an index of 0.95.

IV. Conclusion

Errors that occur due to high risk medication can significantly lead to patient harm. Hence, effective strategies are required for the safe use of HAM/HRM. This paper was designed to explain about the development and instrument process of the teaching materials through validity and reliability process that would benefit the nursing practitioners on their prospective about HRM and its management. Thus, the instrument made plays an important role in for making decision and recommendations for those nurses with insufficient knowledge of HRM. As the researcher proven that the training materials be able to promote the nurse's alertness about medication errors and other medication related safety issues. With this concern, instrument in the form of training materials consisting of demanding information on various aspects of HRM

management was prepared and finally validated. The applicability of such instrument in modern world practice effectively transforms the information to health care professionals on real time and in an easier way. Such practices will certainly help in reducing HRM related medication errors through better patient care.

Declarations

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Availability of Data and Materials

Data are available from the corresponding author upon request.

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Table 1: Representation of Index Value and Reliability for the five learning video modules.

Chapter No.	Chapter Name	Index Value	Reliability
1.	Introduction to High Risk Medication	0.8994*	Good
2.	Dose Calculation	0.8587*	Good
3.	Inappropriate abbreviation's	0.7077*	Good
4.	Look-alike Sound-alike drugs	0.7373*	Good
5.	Storage and Labelling	0.7963*	Good
Average		0.79988*	Good

*if the index value is >0.50 the sample is having good reliability

Table 2: Fabricated Ratings on a 5-Item Scale by Six Experts expressed in terms of item-level and scale-level content validity index values.

Item (Chapter)	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Number in Agreement	I-CVI
Introduction on HRM	-	x	x	x	x	x	5	0.83
Dose Calculation	x	-	x	x	x	x	5	0.83
Inappropriate Abbreviations	x	x	-	x	x	x	5	0.83
LASA Drugs	x	x	x	-	x	x	5	0.83
Storage and Labelling	x	x	x	x	-	x	5	0.83
Proportion Relevant:	0.8	0.8	0.8	0.8	0.8	1.0		
Mean I-CVI= 0.83						Mean S-CVI = 0.83		

*x: Agreements on content by expert, *I-CVI: item-level content validity index
*S-CVI: scale-level content validity index

Table 3: Reliability table for the chapter 'introduction to high risk medication' by KR 20 formula.

Slide Number	Correct Score	Proportion passed	Proportion failed	p*q
1	33	0.73	0.27	0.1971
2	17	0.37	0.63	0.2331
3	13	0.28	0.72	0.2016
4	33	0.73	0.27	0.1971
5	35	0.77	0.23	0.1771
6	34	0.75	0.25	0.1875
7	33	0.73	0.27	0.1971
8	33	0.73	0.27	0.1971
9	32	0.71	0.29	0.2059
10	30	0.64	0.36	0.2304
11	34	0.75	0.25	0.1875
12	28	0.62	0.38	0.2356
13	31	0.68	0.32	0.2176
14	27	0.60	0.40	0.2400
15	26	0.57	0.43	0.2451
16	29	0.64	0.36	0.2304
17	33	0.73	0.27	0.1971
18	35	0.77	0.23	0.1771
19	20	0.44	0.56	0.2464
20	22	0.48	0.52	0.2496
21	33	0.77	0.23	0.1771
22	32	0.71	0.29	0.2059
23	34	0.75	0.25	0.1875
24	35	0.77	0.23	0.1771

Table 4: Reliability table for the chapter "dose calculation" by KR 20 formula.

Slide Number	Correct Score	Proportion passed	Proportion failed	p*q
1	35	0.77	0.23	0.1771
2	26	0.57	0.43	0.2059
3	33	0.73	0.27	0.1971
4	34	0.75	0.25	0.1875
5	26	0.57	0.43	0.2451
6	29	0.64	0.36	0.2304
7	24	0.53	0.47	0.2491
8	35	0.77	0.23	0.1771
9	32	0.71	0.29	0.2059
10	33	0.73	0.27	0.1971
11	34	0.75	0.25	0.1875
12	28	0.62	0.38	0.2356
13	22	0.48	0.52	0.2496
14	29	0.64	0.36	0.2304
15	26	0.57	0.43	0.2451
16	29	0.64	0.36	0.2304
17	33	0.73	0.27	0.1971
18	19	0.42	0.58	0.2436
19	20	0.44	0.56	0.2464
20	22	0.48	0.52	0.2496
Mean Sum of p*q: 4.8962; Standard deviation squared: 26.5763 Index value $\mathbf{r_{KR20}} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum pq}{\sigma^2}\right)$: 0.8587				

Table 5: Reliability table for the chapter "inappropriate abbreviations" by KR 20 formula.

Slide Number	Correct Score	Proportion passed	Proportion failed	p*q
1	25	0.55	0.45	0.2475
2	26	0.57	0.43	0.2451
3	29	0.66	0.34	0.2244
4	25	0.55	0.45	0.2475
5	26	0.57	0.43	0.2451
6	29	0.64	0.36	0.2304
7	24	0.53	0.47	0.2491
8	26	0.57	0.43	0.2451
9	22	0.48	0.52	0.2496
10	30	0.66	0.34	0.2240
11	25	0.55	0.45	0.2475
12	28	0.62	0.38	0.2356
13	26	0.57	0.43	0.2451
14	29	0.64	0.36	0.2304
15	29	0.64	0.36	0.2304
16	26	0.57	0.43	0.2451
17	30	0.66	0.34	0.2240
Mean Sum of p*q: 3.9488; Standard deviation squared: 13.5073 Index value $\mathbf{r_{KR20}} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum pq}{\sigma^2}\right)$: 0.7077				

Table 6: Reliability table for the chapter "lookalike and sound-alike medications" by KR 20 formula.

Slide Number	Correct Score	Proportion passed	Proportion failed	p*q
1	35	0.77	0.23	0.1771
2	20	0.44	0.56	0.2464
3	22	0.48	0.52	0.2496
4	33	0.77	0.23	0.1771
5	32	0.71	0.29	0.2059
6	34	0.75	0.25	0.1875
7	35	0.77	0.23	0.1771
8	33	0.73	0.27	0.1971
9	25	0.55	0.45	0.2475
10	28	0.62	0.38	0.2356
11	24	0.53	0.47	0.2491
12	35	0.77	0.33	0.1771
13	32	0.71	0.29	0.2059
14	33	0.73	0.27	0.1971
15	31	0.68	0.32	0.2176
16	25	0.55	0.45	0.2475
17	28	0.62	0.38	0.2356
18	29	0.64	0.36	0.2304
19	24	0.53	0.47	0.2491
20	35	0.77	0.33	0.2541
21	26	0.57	0.43	0.2451
22	29	0.64	0.36	0.2304
23	24	0.53	0.47	0.2491
24	29	0.64	0.36	0.2304
25	32	0.71	0.29	0.2059
26	30	0.66	0.34	0.2240
Mean Sum of p*q: 5.7493; Standard deviation squared: 19.7553 Index value $\mathbf{r_{KR20}} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum pq}{\sigma^2}\right)$: 0.73736				

Table 7: Reliability table for the chapter "storage and labelling of medications" by KR 20 formula.

Slide Number	Correct Score	Proportion passed	Proportion failed	p*q
1	33	0.73	0.27	0.1971
2	32	0.71	0.29	0.2059
3	34	0.75	0.25	0.1875
4	35	0.77	0.23	0.1771
5	26	0.57	0.43	0.2451
6	29	0.64	0.36	0.2304
7	33	0.73	0.27	0.1971
8	35	0.77	0.23	0.1771
9	20	0.44	0.56	0.2464
10	22	0.48	0.52	0.2496
11	34	0.75	0.25	0.1875
12	33	0.73	0.27	0.1971
13	33	0.73	0.27	0.1971
14	32	0.71	0.29	0.2059
15	30	0.64	0.36	0.2304
16	34	0.75	0.25	0.1875
17	28	0.62	0.38	0.2356
18	31	0.68	0.32	0.2176
19	27	0.60	0.40	0.2400
20	30	0.64	0.36	0.2304
Mean Sum of p*q: 4.2224; Standard deviation squared: 17.4184 Index value $\mathbf{r_{KR20}} = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum pq}{\sigma^2}\right)$: 0.7962				