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RESEARCH ARTICLE

Development and Validation of a Questionnaire to Assess the Knowledge, Attitude, and Practices Regarding Adult Immunization amongst Resident Physicians at an Apex Tertiary Care Center in India

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Abstract:

Background:

The coverage of immunization amongst adults in India remains low; a lack of nationally endorsed guidelines and implementation policies is a contributing factor. There is a paucity of tools available to assess knowledge, attitude, and practices (KAP) regarding adult immunization. Hence, we attempted to develop a KAP questionnaire to evaluate the existing expertise regarding adult immunization among medicine and infectious diseases resident doctors in an apex medical institute in India.

Methods:

A two-stage scheme for the development and validation of the questionnaire was followed. The first step involved an exhaustive literature review, focused group discussion, and in-depth interviews. The prepared draft was reviewed by experts in the field of infectious diseases and adult immunization across the domains of necessity, relevance, and clarity. 'Item-level content validity indices' (I-CVI) and 'Scale-level content validity indices' (S-CVI) were then calculated. Brennan and Prediger's AC (Agreement Coefficient) and Gwet's AC (Agreement Coefficient) were used to establish inter-rater agreement on the obtained expert reviews.

Results:

A 57-item KAP questionnaire was developed and was reviewed by a total of 11 experts. The questionnaire had satisfactory I-CVI (>0.6 for all the items) and S-CVI Ave (>0.9 for each of the domains). The questionnaire had a strong inter-rater agreement as assessed by both Brennan and Prediger AC (> 0.6, p<0.001) and Gwet's AC (>0.8, p<0.001).

Conclusions:

The developed tool was scientifically validated following a staged process. We propose that this questionnaire can hence be used to evaluate the knowledge, attitude, and practices regarding adult immunization amongst medical practitioners across medical colleges and hospitals in India. This may be instrumental in developing programmatic interventions and major policy changes to enhance the practice of adult immunization amongst healthcare providers.

Keywords: Adult immunization, Attitude, Content validity, Development, Knowledge, Practices, Questionnaire.

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1. INTRODUCTION

Antimicrobial discovery has had a great impact on healthcare, but the emergence of antimicrobial resistance presents a challenge in the domain of infectious diseases. Vaccine-preventable diseases represent a significant proportion of the morbidity and mortality affecting adults [1]. More than

20 life-threatening diseases can now be prevented by immunization. Vaccination appears to be one of the most cost-effective interventions in public health, given the scenario, which was further highlighted by the COVID-19 pandemic and emerging diseases [2].

Since the eradication of smallpox in 1979, vaccination has been instrumental in the control of various infectious diseases, including the newly emerging diseases [3, 4]. The importance of adult immunization has been highlighted well throughout the literature. The aging population, the epidemiological shift of various infectious diseases from childhood to adult age group, and the waning of immunity with age are some of the important considerations in this regard [1].

The Indian UIP (Universal Immunization Programme) has been in place since 1985 and has been targeting around 2.7 crore newborns and 2.9 crore pregnant women annually [5]. The programme has been largely responsible for the reduction of under-5 vaccine-preventable mortality in India, which has proven to be one of the most cost-effective public health interventions [6]. The coverage of adult immunization in India remains poor, though no official data is available on this record, and no composite measure is available to evaluate the same [7, 8].

A number of barriers to adult immunization have been highlighted [1, 7 - 10]. Vaccine hesitancy and missed opportunities are some of the other factors. Highlighting the importance of vaccine hesitancy as an example, in a health survey conducted in Russia regarding (COVID-19) pandemic related health behavior, 38.7% of the surveyed individuals reported low trust in vaccination efficacy, and 57.5% were unwilling to take a vaccine [11]. Various reasons for vaccine hesitancy amongst healthcare workers have also been studied, which include concerns about safety and efficacy, mistrust of government and institutions, waiting for more data, and feelings of infringement of personal rights [12]. Vaccine literacy has been defined as people's and communities' knowledge, motivation, and competency in accessing, understanding, critically evaluating, and applying information about immunization, vaccines, vaccination programs, and organizational processes to access vaccination and make informed vaccine decisions for themselves, their family members, and the community [13]. The lack of vaccine literacy, especially amongst healthcare workers, needs to be explored further. Unlike its pediatric counterpart, India lacks nationally endorsed guidelines or a government-sponsored programme for adult immunization. Lack of knowledge regarding adult immunization amongst practicing physicians coupled with no definitive guidelines for adult immunization in our country has been recognized as a cause for poor vaccination coverage amongst adults.

We aimed to develop and validate a structured KAP questionnaire to assess the knowledge, attitude, and practices regarding adult immunization amongst medicine and infectious diseases residents at a tertiary care center in India. It is the first of its kind, and no such questionnaire has been used henceforth. We feel that with baseline trends of knowledge, attitudes, and practices regarding the topic of adult immunization, directed efforts could be made to further work upon this field at the institutional level and serve as a template for the national level. Likewise, programmatic interventions can be instituted to further improve the coverage of adult immunization in our country.

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2. MATERIAL AND METHODS

The process of making the KAP questionnaire and its validation was carried out in the following steps. We followed the two-staged scheme for the development and validation of the questionnaire as proposed by Lynn, 1986 [14]. The development of the questionnaire was divided into the initial two steps, and the judgement-quantification stage followed (Fig. **1**). All the statistical analysis was done using Stata 14 software. The study protocol was approved by the institute's ethics committee.

2.1. Step I: A thorough Literature Review to Generate 'etic' Items in the Questionnaire

A thorough literature review was conducted to generate 'etic' items in the questionnaire. A number of standard textbooks, journal articles, and international guidelines on the subject matter were reviewed to identify domains and sub-domains. Internet platforms, namely Google Scholar and Pub Med, were used to search for relevant articles. Questions were framed in a self-assessment format with a Likert scale of 0 to 4 for response to each question, making it suitable for quasi-interventional studies. A total of 110 questions were prepared in the initial draft after an exhaustive literature review and divided into various domains.

2.2. Step II: Focused Group Discussion (FGD) and In-depth Interviews to Generate 'emic' Items

We carried out an FGD with the faculty members from the Department of Medicine trained and practicing in the Infectious Diseases (ID) specialty and residents undergoing training in the same field. In- depth interviews were conducted with experts in the field from both the parent institute and elsewhere. The questions framed were evaluated for face validity at this stage, and requisite edits were made to the questionnaire. The feasibility of conducting the survey was considered, and the total number of questions was restricted to a total of 57 items. The final draft, hence prepared, was validated in the next step.

2.3. Step III: Content Validity and Inter-rater Agreement

With no such exhaustive and comprehensive questionnaire available to consider as the gold standard, we considered establishing judgement-based validity of this 'first-of-a-kind questionnaire'. Various measures have been proposed in this regard, namely face validity, content validity, and consensual validity [15]. Face validity was established in the earlier steps after thorough deliberation with experts. Content validity can be described as the extent to which the operational definition of the measured variable conforms with the conceptual definition

of the variable of interest [16]. We proposed to evaluate content validity at the item level for each of the 57 items. The questionnaire was mailed to 20 experts in the field of infectious diseases and adult immunization, including residents and physicians practicing both in the parent institute and elsewhere. Further, we classified content validity measure with respect to three variables, namely: 'necessity' (the necessity of the question to be included to assess knowledge, attitude, and practices regarding adult immunization), 'relevance' (the relevance of the question to the domain of adult immunization as far as the training of a resident physician is concerned), and 'clarity' (linguistic and scientific clarity of the statement contained in the question). This particular approach of decomposing the content validity measure has been used elsewhere including a similar study conducted on travel medicine [17 - 19]. This gives the raters more freedom and is proposed to increase the strength of the validation process.

The raters were asked to rate each item of the questionnaire against each of the content validity measures on a Likert scale from 0 to 3 as:

- Necessity: '0' (neither useful nor necessary), '1' (useful but not necessary), '2' (essential), '3' (very essential)
- Relevance: '0' (not relevant), '1' (slightly relevant/needs revision),'2' (relevant/needs minor revision), '3' (very relevant)
- Clarity: '0' (not clear), '1' (slightly clear/needs revision), '2' (clear/needs minor revision), '3' (very clear)

2.4. Measures

We chose various measures to establish the content validity of our developed tool.

2.4.1. Content Validity Indices

Item level content validity index (I-CVI) has been proposed in the literature as a useful measure for psychometric studies. Polit and Beck have reviewed the use of content validity indices and laid down recommendations for their use [16]. In our study, we used item-level content validity indices (I-CVIs) for the three domains of necessity, relevance, and clarity for each of the 57 items in the questionnaire. The Likert scale of 4 (0 to 3) was dichotomized into '0' (for a score of 0-1) and '1' (for a score of 2-3). Further, we calculated the scale level of content validity index- average (SCI-Ave) by taking the mean of the I-CVIs. Lynn's (1986) criteria propose a minimum I-CVI of 0.78 for 6-10 experts, which would be further lower for 11 experts, as was the case in our study [14]. The acceptable level of SCI-Ave has been derived from Polit *et al*. (2007), wherein a cut-off value of 0.9 has been taken to suggest excellent consensus on content validity [20].

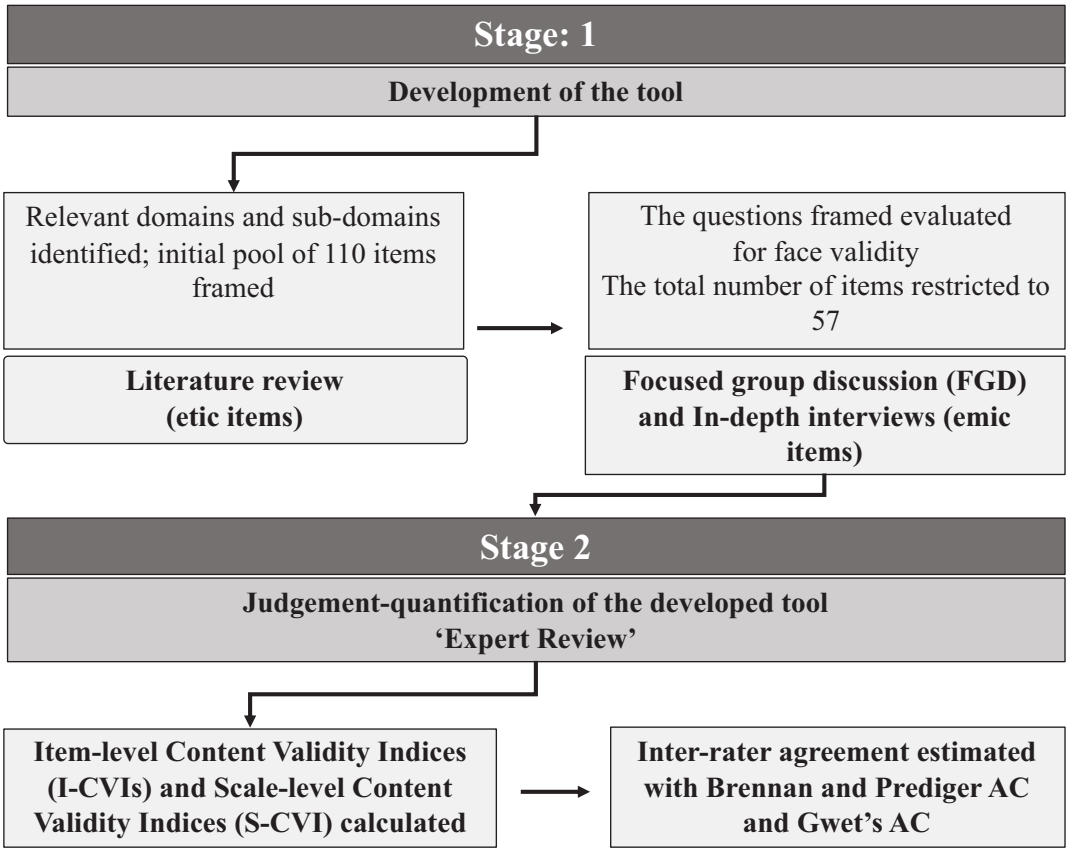

Fig. (1). Workflow of the development and validation of the KAP questionnaire.

2.4.2. Agreement Coefficients

Classically, Cohen's kappa has been used to study inter-rater agreements by adjusting for chance agreements [21]. Various problems and paradoxes have been recognized with the use of the 'kappa coefficient' [22, 23]. It is more subject to change with the prevalence of the trait and the very high level of agreement or disagreement. Another paradox highlighted is kappa's dependency on marginal distribution. To overcome these limitations, some other refined measures of agreement have been defined. These include Brennan and Prediger coefficient and Gwet's agreement coefficient [24, 25]. We used these two coefficients for the estimation of inter-rater agreement for our study. The crude ratings obtained on the Likert scale of 4 were used without dichotomization. Likewise, ordinal scale adjustment (weighting) was used for the calculation of these coefficients [26].

3. RESULTS

The final version of the questionnaire had 57 items divided between pre-defined domains, as depicted in Table **1**. The complete questionnaire is included in the supplementary appendix. The tool was reviewed by a total of 11 experts.

Table **2** lists the item-level content validity indices (I-CVIs) for each of the 57 items against necessity, relevance, and clarity. I-CVIs for necessity and relevance ranged from 0.636 to 1.000, while I-CVIs for clarity ranged from 0.727 to 1.000. The percentage of the I-CVIs equal to or more than 0.8 for each of the domains, namely necessity, relevance, and clarity, were respectively 94.7%, 91.2%, and 98.2%. The overall S-CVI-Ave for each of these domains was more than 0.9, as shown in Table **3**.

The inter-rater agreement was then estimated as detailed in the methods section. Brennan and Prediger AC and Gwet's AC for each of the domains are depicted in Table **4**, along with the confidence intervals. A benchmark scale, as described by Landis and Koch, is included in the supplementary appendix (Table **A.1**) [27]. We see that Gwet's AC ranged from 0.81 for clarity to 0.84 for relevance. Hence, the obtained coefficient demonstrates an 'almost perfect' agreement between experts for all the domains. Likewise, Brennan and Prediger AC ranged from 0.64 to 0.72 for the three specified domains and demonstrated 'substantial' agreement between the experts.

Table 1. The list of domains included in the final 57 item KAP questionnaire.

Knowledge	Attitude	Practices
• General Aspects (4) • Individual vaccines (36) • Vaccination by indication (4)	A total of 5 items	A total of 8 items

Table 2. Item level content validity indices for each of the 57 items across the three domains of necessity, relevance and clarity.

Items	I-CVI-necessity	I-CVI-relevance	I-CVI-clarity	Items	I-CVI-necessity	I-CVI-relevance	I-CVI-clarity
1	0.818	0.909	0.818	30	0.818	0.909	0.818
2	0.909	0.909	0.909	31	0.909	0.909	0.909
3	1	1	0.818	32	1	1	0.818
4	1	1	0.909	33	1	1	0.909
5	0.909	1	1	34	0.909	1	1
6	0.727	0.636	0.818	35	0.727	0.636	0.818
7	1	1	0.818	36	1	1	0.818
8	1	1	1	37	1	1	1
9	0.909	0.727	0.818	38	0.909	0.727	0.818
10	1	1	1	39	1	1	1
11	1	1	0.909	40	1	1	0.909
12	1	1	1	41	1	1	1
13	1	1	0.909	42	1	1	0.909
14	1	1	1	43	1	1	1
15	1	0.909	0.818	44	1	0.909	0.818
16	0.818	0.727	0.818	45	0.818	0.727	0.818
17	0.909	0.818	0.909	46	0.909	0.818	0.909
18	0.909	0.909	0.909	47	0.909	0.909	0.909
19	1	1	0.818	48	1	1	0.818
20	0.909	0.818	0.818	49	0.909	0.818	0.818
21	1	1	1	50	1	1	1
22	1	1	0.818	51	1	1	0.818
23	0.636	0.727	0.818	52	0.636	0.727	0.818

(Table 2) contd.....

Items	I-CVI-necessity	I-CVI-relevance	I-CVI-clarity	Items	I-CVI-necessity	I-CVI-relevance	I-CVI-clarity
24	1	1	0.909	53	1	1	0.909
25	0.818	1	0.909	54	0.818	1	0.909
26	0.727	0.909	0.818	55	0.727	0.909	0.818
27	1	1	1	56	1	1	1
28	1	1	0.727	57	1	1	0.727
29	1	1	0.909				

Table 3. Scale level content validity indices calculated by averaging the item-level content validity indices for each of the domains.

-	Necessity	Relevance	Clarity
Scale-level Content Validity Index (S-CVI Ave)	0.954	0.959	0.928

Table 4. Results of the inter-rater agreement coefficients for each of the domains for the 57-item questionnaire.

Agreement Coefficient	Necessity	Relevance	Clarity
Brennan and Prediger's AC	**0.697** (0.65 - 0.743)	**0.716** (0.667 - 0.766)	**0.639** (0.578 - 0.7)
Gwet's AC	**0.837** (0.802 - 0.871)	**0.840** (0.803 - 0.877)	**0.806** (0.760 - 0.852)

Note: (95% CIs)
*p values= <0.001.

4. DISCUSSION

A few studies assessing knowledge, attitudes, and practices amongst healthcare providers regarding adult immunization have been conducted across the globe [28 - 32]. Most of these have been restricted to a limited number of adult vaccines and do not assess broader domains like general principles of vaccination, including immunology and vaccination by indication. Moreover, none has been carried out amongst resident physicians in a training hospital, and to the best of our knowledge, there has been no comprehensive study assessing the knowledge, attitude, and practices regarding adult immunization amongst resident doctors or practicing physicians in India [33 - 50].

We developed a KAP questionnaire covering various domains in the field of adult immunization. The comprehensiveness of the questionnaire is one of its major strengths, making it the first of its kind. A scientifically established protocol was followed in the development and validation of the tool. The questionnaire was reviewed by experts in the field, and a strong consensus was reached on content validity. We can assert that this shows satisfactory content validity deriving from the recommendations proposed by Polit *et al*. [16, 20]. A strong inter-rater agreement across refined coefficient measures establishes the robustness of the tool.

A few limitations can be highlighted in our study. First, the questionnaire is a self-rated questionnaire, where the participants are required to rate their confidence in the knowledge, perceived attitudes, and routine practices of adult immunization. This leaves the responses subject to individual bias. The technique was used to make the questionnaire suitable for re-administration (pre and post-test) and evaluation in quasi-experimental studies. Second, adult immunization is an ever-expanding domain with the ongoing research and introduction of new vaccines [32, 50 - 77]. So, our developed tool might require updating over time with re-establishment of the validity. The questionnaire has been particularly designed and validated for use in India, so it might not be suitable for use at a global level. It needs to be highlighted that out of the 20 experts to whom the questionnaire was mailed to, only 11 replied with the review. Additionally, only a single round of validation process by the subject experts could be carried out. Further, such serial reviews leading to revisions in the questionnaire might have improved the robustness of the content validity of our tool.

CONCLUSION

The developed tool was scientifically validated following a staged process. We propose that this questionnaire can hence be used to evaluate knowledge, attitudes, and practices regarding adult immunization amongst medical practitioners across medical colleges and hospitals in India. This may be instrumental in developing programmatic interventions and major policy changes to enhance the practice of adult immunization among healthcare providers.

AUTHORS' CONTRIBUTIONS

All authors contributed equally to this work.

LIST OF ABBREVIATIONS

KAP = Knowledge, Attitude, and Practices

AC = Agreement Coefficient

S-CVI = Scale-level Content Validity Indices

ID = Infectious Diseases

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical clearance was taken from the AIIMS Ethics Committee (Ref. No.: IECPG-623/28/10.2021), AIIMS, New Delhi, India.

HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Written consent was taken from patients or their surrogates before recruiting patients.

STANDARDS OF REPORTING

COREQ guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

All data generated or analyzed during this study are included in this published article. All available raw data can be shared on reasonable request to the corresponding author [A.K].

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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SUPPLEMENTARY MATERIALS

Supplementary material is available on the Publisher's website.

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