Developing A Validated Instrument To Assess Paediatric Interns In South Africa

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Research article

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Abstract

Background: Recently graduated South African medical practitioners (interns) are expected to be efficient and resilient in limited resource contexts that face multiple disease burdens. Work-based assessment in SA internship focuses on clinical skills and neglects the evaluation of non-clinical skills. This sub-optimal assessment process creates a daunting task for clinician supervisors who are expected to certify these interns for independent practice.

Methods: Using a mixed methodological approach, the study sampled a cross section of 411 interns in seven hospitals in KwaZulu-Natal and their intern supervisors . Data collection methods included focus groups discussions and surveys. A 4-round modified Delphi-process was followed to reach consensus on the set of core competencies required. The assessment tool that resulted in the process included a variety of competencies and the tool was validated through factor analysis and internal consistency was measured with Cronbach's alpha.

Results : A competency-based assessment tool was developed that allows for the assessment of both clinical and non-clinical skills. This tool was found to be very reliable, with an overall Cronbach alpha of 0.927. Factor analysis for the instrument revealed 61 observable clinical activities aggregated into entrustable professional activities and these measured four major factors. The factors correspond with procedural clinical skills; holistic-care skills; and emotional skills related to social competence and self-management.

Conclusion: A locally relevant competency-based assessment tool was developed in SA to assess local paediatric interns. The validated tool's function as a multidimensional instrument to assess both clinical and non-clinical skills included the assessment of emotional skills which are largely neglected. Validated work-based assessment instruments can be developed that are responsive to local needs and support the development of holistic clinicians in high disease-burdened contexts.

Background

Recently graduated medical practitioners (interns) in South Africa (SA) are expected to manage excessive clinical service loads in the limited resource settings where they work and learn (1, 2). This introduction to independent medical practice is termed internship and plays itself out within the context of South Africa's multiple disease burdens, including its high childhood disease burden (3, 4). Interns in SA are expected to be highly skilled and resilient from early on in their careers, including when caring for children (2,5,6). Growing concerns over patient safety and litigation increase stress over this period for both SA interns and their clinician supervisors (6,7,8). The 24 month period of internship, consists of various specialities including a compulsory Paediatric rotation and this period offers the last formal opportunity to assess the competence of medical practitioners before their entry into independent practice.

While both undergraduate and postgraduate medical education programmes in SA are monitored and endorsed at higher education institutions (HEI), the internship period is sandwiched between these

programmes and regarded as a service-learning programme. The assessment of the intern is the responsibility of the Health Professions Council of South Africa (HPCSA), the professional accreditation body in SA (9).

Assessment practices during the internship period have a strong clinical focus and do not reflect the competency-based framework of other training programmes offered in SA's HEIs. The focus of assessment during the internship phase is predominantly based on assessing the interns' ability to master several procedural clinical skills while most other competencies are not being as closely monitored (8). The use of non-validated assessment instruments and the lack of formative holistic assessment strategies during SA's internship period have also been a cause for concern (8).

Competency-based Medical Education (CBME) is an important pedagogical framework which has greatly influenced the course of medical education over the past two decades (10). In this context, work-based assessment (WBA) serves as a critical component to operationalise CBME as it lends itself to the assessment of interns' readiness for independent practice. (11). Discipline-specific postgraduate programmes are thus increasingly developing more appropriate assessment instruments that use tangible and intuitive 'professional clinical activities' for assessment (12–14). Not only does the 'observable clinical activities' form the core of clinical work, but they also resonate with clinical supervisors due to the authenticity of the activities as required in the workplace (15). The activities such as 'taking a history from the parent of a sick child' or 'doing a lumbar puncture on a baby' are viewed as substantial and measurable professional activities. The significance attached to such an activity rests on the premise that evidence of successful completion at a particular point during the internship period will allow the supervisor to certify the trainee as "ready for independent practice".

This decision to 'entrust' a trainee with professional tasks can occur ad-hoc or on a formal basis and forms the basis of the workplace-based assessment process. A significant paradigm shift in workplace assessment has been this concept of 'entrustment" as it signifies that the trainee has reached a level of appropriate accountability and responsibility (15). Patient safety and quality improvement in health care settings ultimately rely on the practice of valid assessment opportunities and processes to support decisions of "entrustability"(15). The use of 'observable clinical activities' and their formulation into 'entrustable professional activities' (EPA) thus underpins current trends in WBA practices (13,15). The use of EPAs has helped to concretise assessments within the competency-based frameworks and its practice within authentic clinical environments.

Certifying interns for independent practice in SA rests on many entrustment decisions that need to be completed within busy, high disease-burdened hospital settings. There is a paucity of research on the use of EPAs while assessing newly graduated health professionals, in high disease-burdened and resource-limited health contexts (16,17). A holistic approach to assessment that is framed within a competency-based system is currently further lacking in the internship period in SA (2,8). There is thus a need for a locally developed, clearly defined, assessment instrument that is responsive to the specific needs of this high disease burdened context.

Aim

This study was thus conducted to develop an instrument to evaluate interns during the Paediatric rotation at hospitals, in the KwaZulu-Natal province of SA. The study set out to develop a set of ‘observable clinical activities’ as a basis for making entrustment decisions for certification of interns for independent practice. The development of the instrument included investigating the validity of the instrument for use with a representative group of interns in the local context.

Method

Research Design

This cross-sectional study used a mixed-methods approach that combined a modified Delphi process to reach consensus on a list of ‘observable clinical activities’ for the assessment instrument. Thereafter, the instrument was validated for use in the setting.

Setting

The study was conducted at the seven major hospitals that train interns in Durban and Pietermaritzburg in the KZN province of SA. The catchment population of these hospitals is approximately 6 million and serves communities with the highest HIV disease burden rates globally with high rates of Tuberculosis (TB) as well as common childhood diseases (3,18,19).

Subjects

Paediatricians, intern clinician supervisors and interns working within the seven major hospitals were sampled to develop a locally validated assessment instrument for the study. Specific criteria were used to ensure participants were experienced in both paediatric clinical care and intern supervision within this high disease burdened context.

Procedure

Ethical approval for the study was obtained from the Biomedical Research Ethics Committee of the Higher Education institution and permission was obtained from the various institutions and the Health Research & Knowledge Management Subcomponent of the KwaZulu-Natal Department of Health (KZNDoH). Written informed consent was obtained from all participants before each step of the study. Table 1 describes the three major steps in the methods used, the sample population and the process followed at each step.

Table 1: Steps in the development of the Paediatric Internship assessment instrument

Step	1 Modified Delphi consultation	2 Content Expert Focus group	3 Survey
Sample size (n)	**15**	**12**	**411**
Sample population	Senior intern supervisors	Heads of paediatric units in SA served as content experts	Interns at various stages of their Paediatric internship
Process followed in each step	3 round iterative process to develop a set of detailed of observable clinical activities	Content validation process of the final set of observable clinical activities	Psychometric analyses of the final instrument using intern self-assessment scores of competency levels

Process followed and statistical analyses in each step

Step 1: Modified Delphi process to create the list of items for the assessment instrument

A modified Delphi approach was used In step 1with multistep iterations between the authors and a panel of the experienced intern supervisor's. The modified Delphi methodology allowed for a process to establish and confirm a locally determined consensual list of observable clinical activities as required for independent clinical practice in paediatrics (20-22).

Sixteen senior paediatric intern supervisors, all from the sampled hospitals in Durban and Pietermaritzburg, were invited to participate in the modified Delphi consultation. All the expert participants who were sampled were actively involved in intern paediatric training and had more than ten years of clinical experience in the SA public health system.

Prior to obtaining informed consent, clarity was reached between the main investigator and participants regarding the principles of the Modified Delphi process being used, specifically the anonymised consultation and the steps required to ensure consensus building(20). An initial list of suggested 'observable clinical activities' that had previously been validated with junior medical practitioners was used in the first round of the modified Delphi consultation to create a template for building the new instrument (23). *(Appendix A lists the 41 items from the original Hill et al., 1998 questionnaire)*

Figure 1 provides the details of the steps in each round of the Modified Delphi process

Step 2: Content validation process

A focus group consultation was held in step 2 with 12 content experts who had been invited to participate in this study. All content experts were invited, based on being a paediatric department head in a KZN hospital (including the sampled hospitals) as well as district and provincial heads of paediatrics. All content experts had more than ten years of clinical experience in paediatrics in SA and were additionally involved with programmes to improve paediatric care at either an international, national or provincial level.

After a formal introduction to the study and informed consent was obtained, all content experts in the focus group were provided with the final list of 'observable clinical activities' as determined by the Modified Delphi process. The participants in the focus group were tasked with evaluating the relevance of all the 'observable clinical activities'. A Likert four scale based rubric was developed and used for scoring each item in the overall construct of paediatric intern competency in SA (24).

A content validity index (CVI) using this four-point Likert rating scale (Not relevant =1; somewhat relevant =2; relevant =3 and very relevant =4) was done for each item and dichotomised to either relevant or not relevant. The content validity for each item was then computed and items were accepted for inclusion in the assessment instrument-based on a CVI of >0.9 (25). The main investigators then collated a final list of Items into an assessment instrument for use in the survey amongst interns in step 3.

Step 3: Survey

In step 3, interns representing all the seven regional intern training hospitals were invited to participate in a survey using the developed instrument from step 2. Using a five-point Likert scale, each intern was asked to self-assess their level of competency. The five-point Likert scale is based on the five-stage entrustment scale as developed by ten Cate et al. (13). After obtaining informed consent, the survey was group administered to interns at all sampled hospitals. Demographic data on gender, age, university origin and year of internship per participant was also solicited.

Descriptive statistics were calculated based on the overall score for each of the items. For each 'clinical item' means were computed based on available data provided. Missing data did not exceed 20% of the items. The mean summarised continuous variables with standard deviations and medians.

Factor analysis

The newly developed assessment instrument was validated for the use in our local context by studying its psychometric characteristics and internal consistency. The sample had to exceed 100 for the factor analysis purposes to be representative of the general intern population in the province. The achieved sample size for this step was 415. The required observation to item ratio of 5 to 10 observations per item equated to 5.5 observations per item for a 75 item scale.

We investigated the internal structure, especially the construct validity, by applying factor analysis with varix (orthogonal) rotation to determine the underlying dimensions of the data. The Kaiser-Guttmann Eigenvalue criterion of >1, the Cattell criterion of accepting factors above the point of flexion on the

screen plot and the proportion of the total variance explained (60%) was used to determine the underlying factors. Factor loadings of >0.4 were interpreted. Cronbach's alpha coefficient was used to assess the reliability and internal consistency. Data analysis was carried out using SAS version 9.4 for Windows (26).

Results

In the Modified Delphi process, 11 of the 15 invited experts participated and contributed to all three rounds of the consultation. These participants represented the sampled hospitals in both the Durban (n=6) and Pietermaritzburg (n=5) regions. In the content validation phase, 12 content experts participated in the process.

Step 1: Modified Delphi consultation results.

The stipulated periods were four weeks for each round of the modified Delphi consultation. Figure 2 summarises the findings from each round of this process.

Step 2 Content validity analysis

Eleven content experts ranked the 75 'observable clinical items' individually as determined through step 1. All items in the developed instrument reached a CVI Index of >0.9 with most deemed relevant or very relevant to be achieved in SA paediatric internship. Some changes to wording and categorisation were suggested in the focus group and these were incorporated into the final instrument before final survey administration.

Appendix B includes the list of all 75 'observable clinical items. '

Survey results and Psychometric analysis results

Four hundred and fifteen interns across seven regional hospitals participated in the survey. The interns were at various stages of their two-year internship programme with 36.3% year 1 participants and 63.7% year 2 participants. The mean age of the interns was 25.4 years (standard deviation =2.1 years; range 20-37 years). The participants were predominantly female (59.6%). Interns who participated graduated from various medical schools both in and outside SA. Figure 3 illustrates the distribution of the undergraduate medical schools attended by all the intern participants of the survey.

Factor analysis results

Factor analysis (FA) was performed on the data obtained from participants (n=415) of the survey. The initial FA suggested 14 factors (eigenvalue criterion) or 13 (60 % variance explained) or six factors (scree plot). Items with loading >0.5 were accepted only, and this resulted in eight items being removed for the re-running of the factor analysis. The scree plot following this FA indicated four factors only with a further six items which did not have loadings >0.5. Removing these items the final FA was done on 61 items.

Table 2 presents this final factor solution. The final FA suggested ten factors (eigenvalue criterion) or ten factors (% variance explained) or four factors (scree plot). The first two factors corresponded to constructs relating to specific skills that focus on the performance of clinical procedures (this was termed 'Procedural clinical skills') and providing holistic care (this was termed 'Holistic-care skills'). Factors 3 and 4 corresponded to constructs and activities relating to emotional skills. The items to assess emotional intelligence skills were grouped based on their focus either on the patient or environment of the patient(this was termed 'Social competency skills') and those skills related to self-care of the clinician while caring for children (this was termed 'Self-management skills').

Appendix B provides the results of the factor analysis in full and Table 2 lists the final factor analysis.

Insert Table 2

Internal consistency

The Cronbach's alpha to assess internal consistency was 0.927 for the overall scale**.** The main investigators collated the final list of observable clinical activities from the final round of factor analysis and clustered these 61 items into entrustable professional activities'(EPAs) based on the framework of ten Cate et al. (13). This then formed the final developed instrument.

Table 3 includes the final assessment instrument developed with the final 61 validated 'observable clinical activities' listed as individual items and also clustered into 'entrustable professional activities'. The instrument is arranged to reflect the four major internal constructs as indicted by the FA.

Insert Table 3

Discussion

This study developed a validated instrument to assess interns' competencies when working in paediatrics in a high disease-burdened context. It used local expertise to identify and define relevant, measurable clinical activities that are grounded in SA's workplace context.

Entrustment decisions that indicate the safe transfer of responsibility for clinical personnel use clinical activities relevant to each discipline and context (21). These activities form the basis of summative entrustment decisions relevant to certification for practice. The instrument reflects a paradigm shift using entrustment decisions to frame the assessment of interns in SA for independent practice. The findings of this study revealed three fundamentals principles:

1. The need for assessment instruments responsive to priority health needs of the local context (27).
2. The need for a formalised competency-based framework on which to base assessment development (28).

3.
The importance of the holistic assessment of multiple competencies including those competencies associated with the development of emotional skills (29,30).

The principle that health professionals need to be responsive to current societal needs was identified as a major driver for determining criteria for assessment in the design of this study. Observable clinical activities that relate to the major health challenges facing children predominated the core assessment criteria. This contextual responsiveness reflects a patient-centred and responsive health care system (27). Clinical activities selected for assessment by experts reflected the major child health challenges in SA viz. Acute emergency care of sick children with acute gastroenteritis, lower respiratory tract infections, HIV and Tuberculosis. There was also a clear mandate to ensure generic skills in all competencies were assessed holistically.

Poor buy-in to CBE due to perceptions of the additional bureaucratic burdens posed with assessing vague concepts or behaviours have been documented (10, 31). Implementation of CBE frameworks can thus be problematic in resource-poor contexts where inadequate supervision during internship was noted (2). In this study, experts reaffirmed the need to assess interns across multiple competencies. It also became clear that there is a need for a framework to house these ‘granular‘ observable clinical activities. The use of the CanMEDS framework for teaching, learning and assessment both in the undergraduate and postgraduate sectors in SA possibly influenced this trend amongst intern supervisors. This augurs well for its uptake within internship as most intern’s supervisors have exposure to the use of these frameworks from experiences in undergraduate training programmes. The recognition that multiple facets require assessment within the clinical experience is gratifying. It reflects acceptance and understanding of the competency-based education context in SA and the growing a need to assess more holistically. The operationalising of a resource-poor framework through the use of ‘entrustable professional activities’ helps to demystify CBE. The use of locally constructed EPA’s as a focus of assessment allows for a more integrated, relevant and holistic evaluation (13).

Whilst the need to respond to crucial priority health challenges in paediatrics was noted, the study also revealed a shift to assess interns on their abilities to develop skills beyond priority diseases. The major constructs determined in the final FA include clinical procedural skills and holistic care skills that are fundamental in the provision of quality health care. These holistic care skills encompass clear communication, accurate documentation and inter-professional collaboration when managing children. Not only does this reflect the increased complexity of modern medical care but also responds to the need for greater accountability and entrustment in the context of increasing concerns for patient safety (32).

A significant finding of the final FA is the constructs related to activities associated with the development of emotional skills (33). These are viewed as social competency skills and self-management skills and reflect a growing trend in medical education to respond to and develop an awareness of and the ability to respond to emotions (33). Leadership, advocacy and teamwork while recognised as vital competencies are notoriously difficult to assess within the clinical context of busy, hospital-centric acute clinical care.

The identification of concrete activities that encompass these non-clinical competencies assists in the holistic assessment and adds to the strength of this instrument.

The focus on time management, professional and ethical standards related to clinical care reflects a holistic assessment paradigm by including the assessment of self-management skills. The ability to manage stress and balance personal and work life have generally not been included in EPA's as their measurement remain poorly defined (13). These were identified as important skills that needed to be assessed and reflects concerns with increasing rates of burnout, depersonalisation and poor accountability reported amongst interns and other medical practitioners (34).

The finding that emotional skills variously defined as emotional intelligence (EI) reflect a growing trend to develop this aspect of health professional education (33). While clear definitions of what constitutes EI are lacking and the debate on the positioning of EI either as a trait, or ability is still confounding, the findings in this study emphasise the importance of these skills and their value in making important entrustment decisions in the assessment of interns (33,35).

Study Limitations

This study focused only on the skills pertaining to paediatrics and within the context of one geographical area. The findings may, therefore, reflect a strong local perspective. Further multi-centre studies are required to corroborate how well the instrument resonates with the national perspective. The participants in both the Modified Delphi and the Content validation steps were drawn from one province and are affiliated to one university milieu. This would indicate a potential bias in opinion and may not reflect the experiences across the country. The massive HIV and poverty burden specific to this context could potentially cloud decision making on priorities and this may not reflect other sites where interns train.

Conclusion

Locally relevant and responsive assessment instruments can be developed with a systematic and robust approach to disease-burdened contexts. The use of 'entrustable professional activities' enables the operationalisation of competency-based frameworks within clinical environments. A locally developed instrument to assess KZN interns in a high childhood disease-burdened context was validated and proved reliable in use. Multiple competencies were being assessed that corresponded to the major needs required of interns within busy clinical contexts. The emphasis on the instrument was placed on clinical skills related to procedural activities, generic holistic care, as well as the important emotional skills to ensure the development of self-management and social competence for junior doctors.

Declarations

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Authors and do not necessarily represent the official views of the government”.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Authors’ contributions

KLN was responsible for study design, data collection, data analysis, and drafting the manuscript. JVW was responsible for the supervision of the entire work, study design and manuscript review.

All authors read and approved the final manuscript.

Authors’ information

Dr KL Naidoo is a Paediatrician involved with the training of undergraduate students, medical interns, and postgraduate registrars. His research interests include Paediatric HIV disease as well as work-based learning of Paediatric doctors.

Professor J M Van Wyk has a PhD in Education and is involved with developing pedagogical capacity among health professions faculty. Her research interests relate to advancing health professions education in the sub-Saharan African region.

Ethics approval and consent to participate

The Biomedical Research Ethics Committee (BREC) of the University of KwaZulu Natal approved the research (BE177/15). All participants provided written, informed consent to participate in this

Study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

WBA
work based assessments
CBME
Competency based medical education ‘
EPA
‘entrustable professional activities ‘
SA
South Africa
HIV
Human Immunodeficiency Virus
CVI
Content Validity Index
FA
factor analysis
EI
emotional intelligence

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Figures

Figure 1: Detail of the steps in each round of the Modified Delphi process

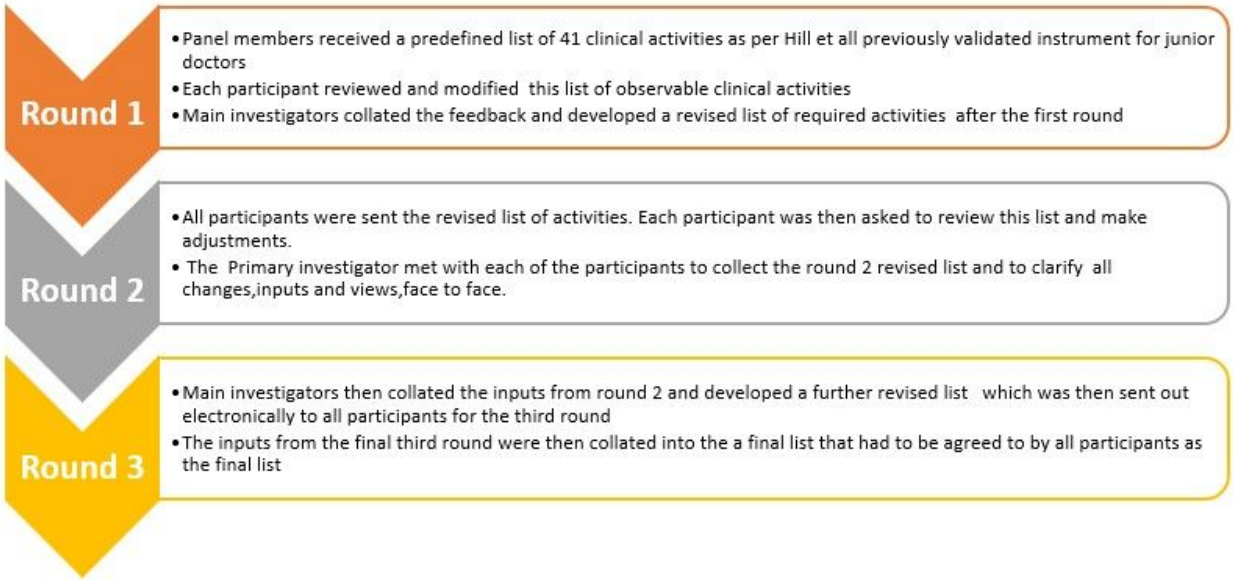


Figure 1

provides the details of the steps in each round of the Modified Delphi process

Figure 2: Major results of each round of the Modified Delphi consultation.

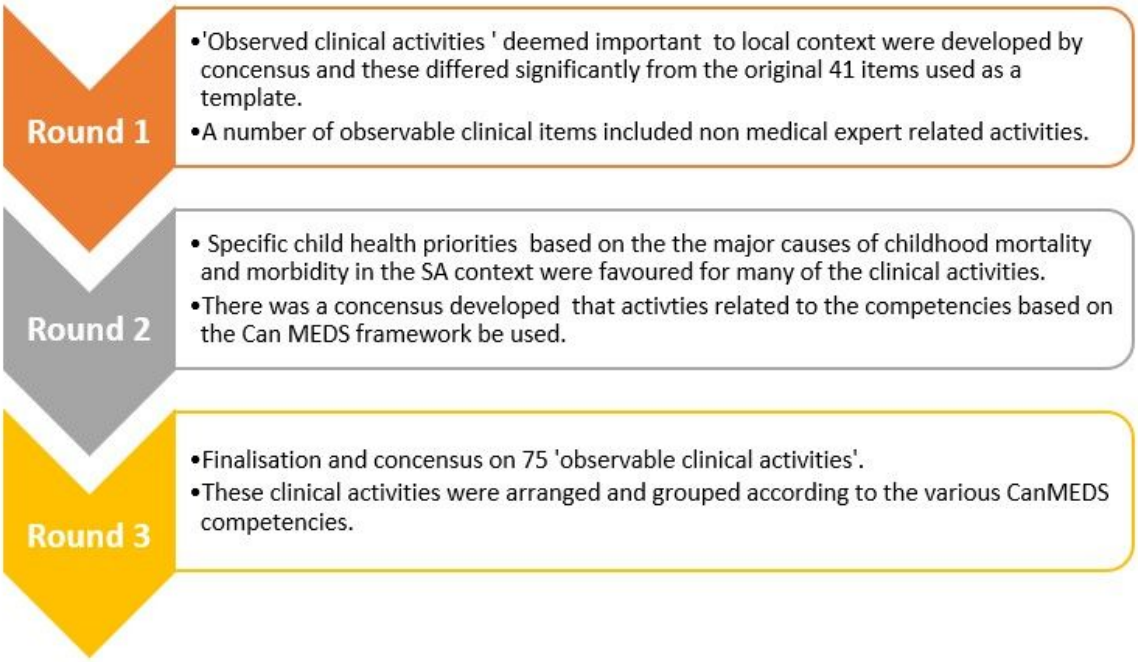
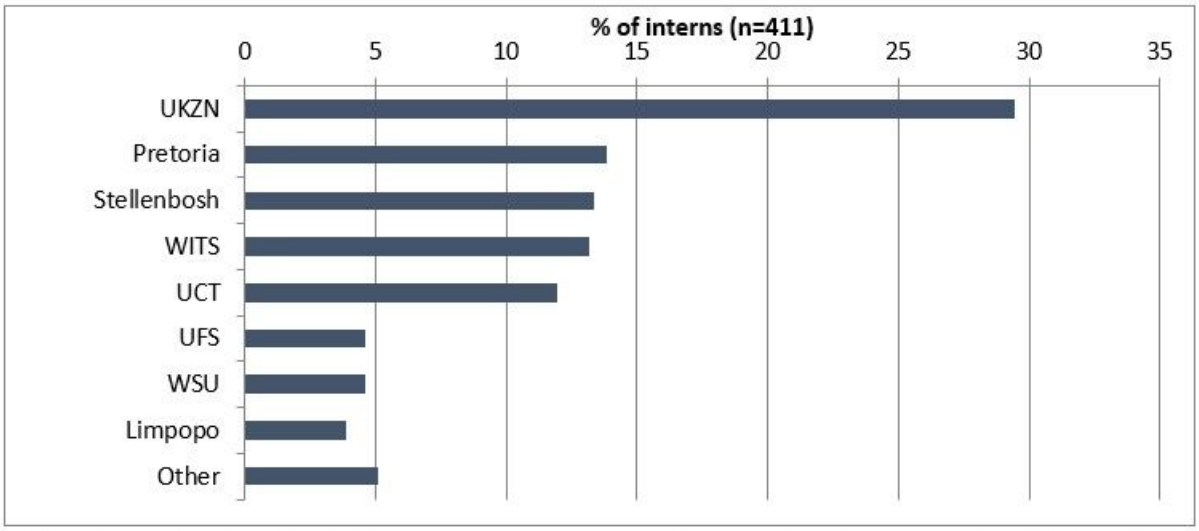


Figure 2

Major results of each round of the Modified Delphi consultation.



UKZN: University of KwaZulu-Natal; WITS: University of the Witwatersrand; UCT: University of Cape Town; UFS: University of the Free State; WSU: Walter Sisulu University; Limpopo: Sefako Makgothu health Sciences University

Figure 3

Distribution of undergraduate universities attended by interns who participated in the survey.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AppendixA.docx
- AdditonalFile1Table2Finalfactorsolution.docx
- STROBEchecklistcrosssectional.doc
- Table3FinalAssessmentInstrument.docx
- AppendixB.xlsx