

Design and Validation of Questionnaires Investigating Access and Utilization of Cervical Cancer Treatment and Palliative Care

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Abstract

Background: Standardized tools to evaluate access and utilization of cervical cancer treatment and care remain scarce in developing countries. The objective of this study was to validate questionnaires to investigate access and uptake of cervical cancer treatment and palliative care.

Materials and Methods: We designed and validated two questionnaires for patient and community and health worker surveys to determine the main constructs of each of the draft questionnaires. Pilot data was collected randomly amongst 50 patient and community participants and 14 health workers respectively in Chitungwiza, Zimbabwe. Content and face validity were assessed qualitatively from expert evaluations. Construct validity, reliability and internal consistency testing were conducted using exploratory factor analysis and Cronbach's alpha correlation coefficient respectively.

Results: Twelve (12) experienced researchers, based on convenience, reviewed the questionnaires and validated their draft constructs based on experience and literature. Each of the questionnaires was sub-divided into 4 separate mini-questionnaires respectively. All the eight mini-questionnaires were analyzed independently and Kaiser-Meyer-Olkin coefficients ranged from 0.5-0.9 and Bartlett's sphericity tests were all significant, $p < 0.001$, showing promising good constructs. Patient and community questionnaire had 15 meaningful constructs while the health worker questionnaire had 13. Cronbach's alpha (α) coefficients for internal consistency reliability testing of all the final constructs were greater than the minimum acceptable threshold of 0.70.

Conclusion: This analysis revealed the validity and reliability of questionnaires that could be used to evaluate access and utilization of cervical cancer treatment and palliative care in countries affected by the disease.

Keywords: cervical cancer, access, utilization, construct, questionnaire, validity, reliability, exploratory factor analysis, Cronbach's alpha

1. Background

Cervical cancer is the fourth most commonly diagnosed cancer amongst women worldwide and the most prevalent cancer in Zimbabwe's female population (Bruni et al., 2016). About five million (60%) of the 15–49 year-old Zimbabwean female population is at risk of cervical cancer. (Nyakabau, 2014). Despite the increasing availability of prevention and screening programmes, morbidity and mortality rates remain very high due to limited, centralized treatment services (Nyakabau, 2014; Kuguyo et al., 2017). While access and utilization of treatment and care for cervical cancer remains a huge challenge predominantly due to limited resources (Kuguyo et al., 2017), standardized tools to measure them remain limited in Africa. Understanding service access and utilization patterns is the first step towards evidence-based programme improvement and formulation of relevant national policies. Generally, access to healthcare is a complex and multidimensional concept which has three dimensions namely: affordability, physical accessibility and acceptability of services (Sundaresan et al., 2016). Margolis et al. (1995) defined access to health care as the timely use of personal health services to achieve the best health outcomes. The

difficulties in measuring access and utilization of health services are largely due to complexity of the concepts, subjectivity and contextual differences in understanding (Sundaresan et al., 2016). Assessment of access and utilization of health care services are also further complicated by the need to integrate evidence from both the supply (health system) and demand sides (patients/community).

Some standardized tools have been developed to evaluate access and uptake of other health services such as malaria prevention interventions, HIV/AIDS, family planning and other sexual reproductive health services (ZDHS, 2015). These tools have been used to assess access and utilization of health services or interventions from the demand side with little attempt to integrate the supply side. Furthermore, these tools have failed to capture full breadth of the ideas enshrined in access and utilization concepts and their psychometric attributes remain unknown. Another weakness of the tools used in population-level surveys is that some proxies are used to measure access and utilization with no data on items and scorings available publicly. No studies have been conducted to test and validate tools that may be used to evaluate access and utilization of cervical cancer treatment and care in Zimbabwe.

We conducted this study to address the identified gaps by developing and validating some of the constructs that may be used to measure access and utilization of cervical cancer treatment and care in developing countries. Demographic and socioeconomic variables were adopted from Zimbabwe Demographic and Health Surveys (ZDHS) of 2015 for the patient and community survey questionnaire (ZDHS, 2015). This tool was validated and used for several rounds of the DHS surveys in the country. The ZDHS wealth quintile asset variables were simplified by adopting the approach from previous work by Chakraborty et al. (2016) to shorten the questionnaire for ease of administration. Variables to measure access and utilization of cervical cancer treatment and care were adopted from ZDHS and literature (Bruni et al., 2016; Nyakabau, 2014; Kuguyo et al., 2017; Sundaresan et al., 2016; Margolis et al., 1995; ZDHS, 2015; Andersen & Newman, 2005).

Several approaches have been developed and used to design and validate psychometrically sound questionnaires (Parsian & Dunning, 2009; Atkinson et al., 2011; Osborne et al., 2013; de JagerMeezenbroek et al., 2012; Yu & Richardson, 2015; Besnoy et al., 2016). In Australia, Parsian et al. (2009) reported the development and validation of a questionnaire to measure spirituality using content, face validity, construct validity using factor analysis, reliability and internal consistency testing using test-retest and Cronbach's alpha correlation coefficient. In another Australian study development of a tool to measure health literacy was done through consultative process involving workshops. The resultant tool was then validated using confirmatory factor analysis and item response theory (Osborne et al., 2013). In Netherlands, a questionnaire to measure spirituality was validated using Cronbach's alpha testing, factorial and convergent validity testing approaches (de JagerMeezenbroek et al., 2012). A four factor, 20 item questionnaire used to measure student online readiness in university freshmen was confirmed to be valid after exploratory factor analysis and Cronbach's alpha correlation coefficient approaches in USA (Yu & Richardson, 2015). A three factor brief pain assessment was validated to be superior to a one-factor model using confirmatory factor analysis by Atkinson et al. (2011) in New York, USA. A one factor model; traits, aptitudes, and behaviors score (TABS) tool was validated in southeastern USA for use by teachers to refer or nominate gifted students without bias using exploratory and confirmatory factor analyses (Besnoy et al., 2016).

This paper describes the conceptualization, psychometric development and validation of the new questionnaires based on approaches in literature. We endeavored to develop tools that could be used for the assessment of access and utilization of cervical cancer treatment and palliative care from population-level surveys through to programme improvement and policy formulation.

2. Methods

The methods used in the development and validation of the two study questionnaires included:

- Translational validity: content validity and face validity.
- Construct validity: exploratory factor analysis (EFA)
- Reliability test: internal consistency (Cronbach's alpha)

The process of validating the questionnaires is illustrated in Figure 1. The initial phase of the tool development involved extensive literature review of relevant publications to identify important domains related to the measurement of access and utilization of cervical cancer treatment and palliative care. A consultative process followed with cancer specialists, public health experts, policy makers and some patients to develop draft constructs. Validated tools used in recent surveys in Zimbabwe were also used to guide the development of draft constructs for both questionnaires (ZDHS, 2015). The ideas from literature, consultations and existing tools were used to develop the constructs and items for the drafts questionnaires. The draft tools were then tested after obtaining written

consent from patients, community members and health workers in Chitungwiza, Zimbabwe in cross sectional surveys to identify meaningful and psychometrically valid constructs. The draft patient and community survey questionnaire consisted of four mini-questionnaires, 13 constructs and a total of 140 items (excluding participant socioeconomic and demographic characteristics. Health worker survey questionnaire consisted of four mini-questionnaires, 6 constructs and 116 items (excluding health facility characteristics).

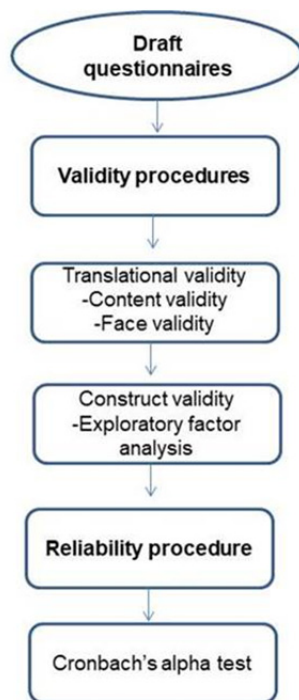


Figure 1. A flow chart depicting the process used to validate patient, community and health worker questionnaires (Parsian & Dunning, 2009)

2.1 Translation Validity

2.1.1 Content Validity

Content validity was conducted to examine if the content of the two study questionnaires were appropriate and relevant to the study purpose. Content validity shows a complete range of attributes under study and it is usually carried out by at least seven (7) experts (Parsian & Dunning, 2009). To estimate the content validity of the two questionnaires, we defined the conceptual framework for access and utilization of cervical cancer treatment and palliative care using literature and seeking expert opinions. For this study the health utilization model (Andersen & Newman, 2005), was used as the conceptual framework. At least 12 purposively selected experts in the areas of research, public health, oncology, health policy, gynaecology and biostatistics were chosen to review the two questionnaires with 140 and 116 items, respectively. The experts reviewed the appropriateness and relevance of questions to answer the research questions for the study. The validity of each questionnaire was based on the qualitative comments or suggestions for improvements from the reviewers.

2.1.2 Face Validity

Face validity shows the appropriateness of a questionnaire to the purpose of the study and content area. Though this is the easiest validation process, it is the weakest as it measures the appearance of questionnaire in terms of feasibility, readability, consistency of style and formatting, and the clarity of the language used (Parsian and Dunning, 2009; DeVon et al.,2007). In order to assess the face validity of each of the two draft questionnaires in terms of readability, translations, contextual appropriateness of questions, length of questionnaire, formatting and flow of the tools, at least 12 purposively selected experts (oncologist, gynaecologist, public health specialists, social scientist and researchers) provided their evaluations through comments and suggestions for improvements. Secondly, a five member team of trained research assistants also reviewed and pre-tested the questionnaires through mock interviews and validity was determined by their qualitative evaluations.

2.1.3 Construct Validity

Construct validity refers to the degree to which an item on a questionnaire or data collection tool relates to the theoretical construct. It is used to determine how independent variable (construct) relates to the proxy dependent variable (indicator) (Parsian & Dunning, 2009). Cognitive interviewing, after obtaining consent, was conducted by administering questionnaires, eliciting responses to questions, and collecting additional information from respondents about how they understood the questions and how they selected their responses. The approach helps the researcher to be able to elicit the right data from the questions being asked (O'Sullivan & Rasmussen, 2017). This was done amongst 13 randomly selected participants in Harare until no more modification of the tools was required. When an indicator has multiple items, factor analysis is imperative (Parsian & Dunning, 2009) and for this study, exploratory factor analysis was applied to validate the draft constructs in the two questionnaires. The sample sizes for the exploratory analysis of n the patient and community questionnaire and the health worker tool were 50 and 12 respectively based on literature (Parsian & Dunning, 2009; DeVon et al., 2007).

Factor analysis is broadly used to summarize data so that relationships and patterns can be better understood (Yong & Pearce, 2013). It is a useful technique during questionnaire development and validation as it groups up items into common factors; interpret each factor on the basis of item loading and summarizing items into smaller items. Therefore, a factor is a list of items that can be clustered together (Bryman & Cramer, 1991). Loadings measure the relationship between an item and its factor and are used to identify items that could be lumped into a factor based on their magnitude. Unrelated items, those with low factor loadings, do not define a construct and should be deleted from the tool (Parsian & Dunning, 2009). Exploratory factor analysis (EFA) is applied to explore complex patterns within datasets and testing predictions. There are some conditions that need to be satisfied for EFA to be valid and these include:

- I. data must be normally distributed;
- II. no outliers;
- III. factor should have at least 3 items, though this depends on the design of the study;
- IV. variables under factor analysis should have at least 5-10 observations

In the analysis factors, we extracted factors based on two criteria; Kaiser's criteria and scree plots made in *STATA* version 14 (StataCorp LLC, Texas). Orthogonal varimax rotations were also conducted to produce factor structures that are uncorrelated to provide easier interpretation of results, and more parsimonious solutions (Brett et al., 2010). Factor analysis, like any other scientific method has its limitations which include: challenges in naming factors, some factors may be loaded onto others making interpretation difficult, need for large sample sizes and using singular datasets collected at specific time points, and if collected at different points datasets cannot be combined for factor analysis (Yong & Pearce, 2013).

Sample size adequacy for the questionnaires for factor analysis was assessed using KMO statistic and the estimates ranged from 0.5-0.9 (see Tables 1-4). The KMO statistic values lie between 0 and 1, with values closer to 1 showing that factor analysis is appropriate. Zero value indicates that the sum of partial correlations is larger than the sum of the correlations, indicating dispersion in the pattern of correlations, thus rendering factor analysis inappropriate for analysis (Chakraborty et al., 2016). KMO estimates ≥ 0.5 are acceptable, 0.5-0.7 are mediocre, 0.8-0.9 are great and ≥ 0.9 are superb (Kaiser, 1974). On running factor analysis, factor extraction was conducted based on Kaiser's criterion of eigenvalues ≥ 1 and scree plots (see Figure 2) to determine the number of factors to be retained for each questionnaire. Items with communalities < 0.5 were deleted from the factor solutions (Parsian & Dunning, 2009). Some researchers recommended that a factor is reliable if it has at least three items (Castello & Parsian, 2005).

We conducted EFA on data collected randomly during pilot testing using each of the two draft questionnaires based on the approaches above. Given the complexities of measuring access and utilization of health services in general and the several hypotheses under investigation in the study, the two draft questionnaires had many variables to fully understand demand (patients/communities) and supply side issues (health workers) based on literature and the theoretical framework (Andersen-Newman health model). This necessitated us to analyze the data in mini-questionnaire formats based on the draft constructs to avoid Heywood case in factor analysis (Castello & Parsian, 2005). Heywood case or negative variance estimates are common errors in factor analysis and given their impossibility their causes need to be understood. Some of the causes of Heywood case include outliers, non-convergence, empirical underidentification, structurally misspecified models or sampling fluctuations (Castello & Parsian, 2005; Kolenikov & Bollen, 2012). Furthermore, our approach made interpretation of outputs easier and resulted in meaningful factor models.

2.2 Reliability Testing

Upon completion of the validity procedures, internal consistency reliability testing was conducted on each of the meaningful constructs derived from the two questionnaires. Reliability is defined as the ability of a tool to measure an attribute and how well the items fit together conceptually (Parsian & Dunning, 2009). In tool design and validation, reliability is important but it is not sufficient to validate the tool and it is possible to have a reliable but invalid tool. Some researchers have recommended that reliability testing be conducted on validated tools. Two estimators are reported in literature to measure reliability: test-retest reliability and internal consistency reliability (Parsian & Dunning, 2009; DeVon et al., 2007). The most commonly used method is the internal consistency reliability and this was used to test the two questionnaires in this present study.

Internal consistency is a measure of inter-item correlation within a tool and how well the item fit together within that instrument. The total score of the items is also determined to measure the overall internal consistency of the questionnaire. Split-half reliability and Cronbach's alpha correlation are the two approaches that can be used in determining internal consistency. However, Cronbach's alpha correlation is the most commonly used method as it also averages all the possible split-half estimates (Parsian & Dunning, 2009; DeVon et al., 2007).

Cronbach's alpha was estimated for each of the meaningful constructs in the mini-questionnaires of both tools designed to measure access and utilization of cervical cancer treatment and palliative care. The total scores for each mini-questionnaire were also computed to obtain overall internal consistency alpha coefficient estimates (Parsian & Dunning, 2009; DeVon et al., 2007).

3. Results

3.1 Content Validity

Experts reviewed the two questionnaires and evaluated them as clear and appropriate to the subject under investigation. Based on their qualitative evaluations, the tools were determined validity in terms of their content.

3.2 Face Validity

Experts, research assistants and participants who evaluated the questionnaires reported that they were understandable and acceptable for the intended target audience.

3.3 Factor Analysis

After excluding binary and string variables and applying Kaiser's criterion, all the questionnaires were acceptable for factor analysis (Brett et al., 2010), see Tables 1–4. Using the guidance of Hair et al. (1998) who reported that factor loadings ≥ 0.4 were important, we applied the same criteria to retain items in factor solutions. Meaningful factors were ultimately retained for each questionnaire based on literature and the subject under investigation.

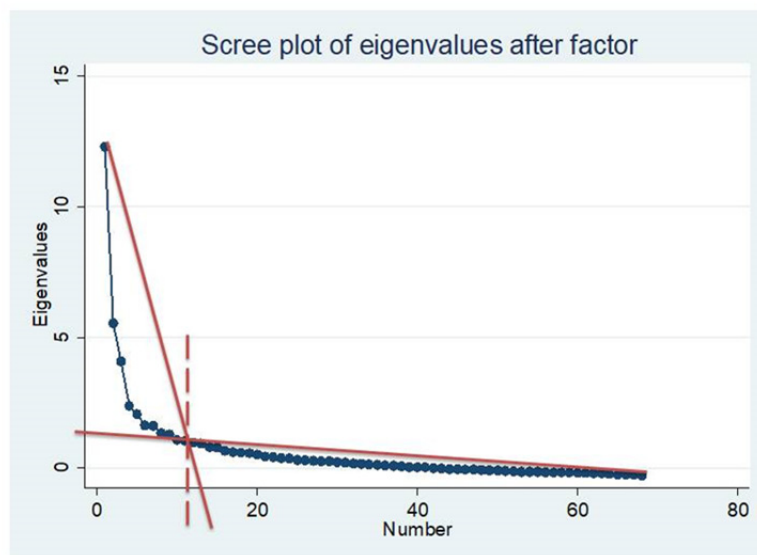


Figure 2. Scree plot retaining 11 factors in a questionnaire

Figure 2 shows a scree plot of questionnaire with 11 meaningful factors based on eigenvalues (Parsian & Dunning, 2009).

3.4 Internal Consistency Reliability Testing

Finally, once all the meaningful factors and items had been selected for each mini-questionnaire, we applied Cronbach's alpha correlation for internal consistency testing and all questionnaires had estimates ≥ 0.7 . The estimates showed that the questionnaires had high correlations amongst items and were consistently reliable. Some researchers have recommended alpha estimates ≥ 0.9 , though others suggested that alpha ≥ 0.7 is acceptable for new instruments (Parsian & Dunning, 2009; DeVon et al., 2007). We used 0.7 as our threshold in this study given that we were testing newly developed tools.

Table 1. Summary results from 15 factor solution of the final *Patient and Community* questionnaire from factor analysis and internal consistency testing for each factor

Items	KMO	Bartlett's test (p value)	Alpha (α)
1. Knowledge of cervical cancer	0.7607	<0.001	0.75
a. Knowledge about cervical cancer causes and treatment			0.80
b. Sources of information			0.70
c. Knowledge of palliative care			0.80
d. Knowledge of cervical cancer treatment			0.70
2. Access to cervical cancer treatment and palliative care	0.7150	<0.001	0.79
a. Access to treatment and palliative care			0.94
b. Health facilities that provide treatment and palliative care			0.70
c. Health facilities that treat cervical cancer in Harare			0.73
3. Utilization of cervical cancer treatment and palliative care	0.9016	<0.001	0.84
a. Utilization of cervical cancer treatment and palliative care			0.89
b. Challenges faced in accessing health services			0.75
c. Access to cervical cancer screening			0.89
4. Perceptions, attitudes and beliefs about cervical cancer treatment and palliative care	0.8132	<0.001	0.78
a. Attitudes			0.88
b. Availability of treatment and palliative care services			0.82
c. Quality of care			0.70
d. Perceptions about treatment services abroad			0.86
e. Beliefs			0.70

The table above shows the questionnaire items from factor analysis and their KMO statistic and Cronbach's alpha coefficients which were acceptable based on literature- also see Table 3 (Appendix) (Parsian & Dunning, 2009; DeVon et al., 2007).

Table 2. Summary results from 13 factor solution of the final *Health Worker* questionnaire from factor analysis and internal consistency testing for each factor.

Items	KMO	Bartlett's test (p value)	Alpha (α)
1. Health worker characteristics	0.532	<0.001	0.72
a. Professional development			0.72
b. Profession training			0.71
c. Quality of care			0.70
d. Working conditions			0.78
e. Perception of cervical cancer strategies and policies			0.71
2. Health facility characteristics	0.639	<0.001	0.79
a. Characteristics of cervical cancer service providers			0.87
b. Perceptions about provider quality of services			0.71
3. Service characteristics	0.5	<0.001	0.70
a. Cervical cancer services			0.70
b. Cervical cancer service referrals			0.70
4. Infrastructure, equipment and drugs capacity	0.538	<0.001	0.79
a. Availability of basic services, equipment and drugs.			0.84
b. Hygiene, sanitation and waste management capacity			0.70
c. Supply of basic services, equipment and drugs.			0.70
d. Availability drugs for treatment of cervical cancer.			0.91

Table 2 shows the questionnaire factor analysis items together with KMO statistic and Cronbach's alpha coefficient which were all within acceptable limits -also see Table 4 (Appendix) (Parsian & Dunning, 2009; DeVon et al., 2007).

4. Discussion

The integrity of any research data collection tool depends on accuracy of the measure being used particularly in the context of assessing complex phenomena such as access and utilization of cervical cancer treatment and palliative care services. This study demonstrated the validity and reliability of the patient and community and health worker questionnaires to conduct both demand and supply side evaluations in the context of cervical cancer treatment and care services. The scientific approaches used in this study were rigorous and appropriate for the intended purposes. Face validity, while being the lowest form of validity was crucial in the administration of the tools amongst cervical cancer patients, healthy women in communities and health care workers. Content validity, which was measured qualitatively in this study, assisted in determining the relevance of content of both questionnaires to the concepts of access and utilization of cervical cancer treatment and palliative care. Exploratory factor analysis helped in assessing the theoretical constructs of the two questionnaires and meaningful factors were the ultimate outcomes of this analysis based on recommended best practices (Parsian and Dunning, 2009; Castello and Parsian, 2005). Cronbach's alpha (α) internal consistency reliability reached the acceptable threshold for both questionnaires. This demonstrates that the two questionnaires could be used confidently in clinical and public health practice to determine access and utilization of cervical cancer treatment and palliative care. These tools could also be used for programme improvement and policy formulation. The tools may be used to understand cervical cancer treatment and care gaps in order to design packages of interventions to address the limitations.

Understanding access and utilization of health care services is a fundamental public health priority though these concepts are difficult to measure given their complexities. However, this study provided psychometrically valid questionnaires to specifically measure access and utilization of cervical cancer treatment and palliative care. While it is plausible to extrapolate these tools to other cancers or disease areas, care must be taken to ensure their appropriateness given the differences in disease specific issues.

However, to strengthen scientific rigor, the researchers recommend further research using a bigger sample. Furthermore, the researchers endeavor to conduct extended analysis using structural equation modelling and

confirmatory factor analysis on a larger sample with diverse population that includes healthy women, cervical cancer patients and health care workers to support wider generalizability of the tools.

5. Conclusion

This study showed that patient and community and health worker survey questionnaires were valid and reliable and could be used to evaluate access and utilization of cervical cancer treatment and palliative care in countries affected by the disease. While a plethora of approaches have been developed and used in validating questionnaires in different fields of research, this present study presents a systematic and simplified approach that can be adopted by researchers investigating complex concepts.

5.1 Ethics Approval and Consent to Participate

This study was carried out as part of a PhD degree at the University of Pretoria and was approved by several ethics committees/bodies:

- 1) University of Pretoria, Faculty of Health Sciences Research Ethics Committee (**REC 487/17**)
- 2) Harare Hospital Ethics Committee (**HCHC 271017/77**)
- 3) Joint Parirenyatwa and University of Zimbabwe Research Ethics committee (**JREC 33A/18**)
- 4) Medical Research Council of Zimbabwe (**MRCZ/A/ 2271**)

All participants in this study were consented in writing before interviews. Consent forms were administered by the researchers in the language of the participant's preference i.e English or Shona (local language spoken by majority of people in Zimbabwe).

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Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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Appendix

Table 1. Full results from 15 factor solution of the final *Patient and Community* questionnaire from factor analysis and internal consistency testing for each factor

Items	KMO	Bartlett's test (p value)	Alpha (α)	Factor loadings															
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
5. Knowledge of cervical cancer	0.7607	<0.001	0.75																
e. Knowledge about cervical cancer causes and treatment			0.80																
What are the causes of cervical cancer that you know or have heard about?				0.64															
How is cervical cancer prevented?				0.63															
How do you think cervical cancer may be treated?				0.51															
f. Sources of information			0.70																
*Where did you hear/see about messages on cervical cancer?				0.63															
*Where did you hear about palliative care?				0.57															
g. Knowledge of palliative care			0.80																
Have you ever heard about palliative care that is given to cancer patients including those suffering from cervical cancer?				0.71															
Where did you hear about palliative care?				0.79															
Where are palliative care services given in Harare?				0.70															
h. Knowledge of cervical cancer treatment			0.70																
Do you think that cervical cancer can be treated?				0.55															
*How do you think it may be treated?				0.54															

6. Access to cervical cancer treatment and palliative care	0.7150	<0.001	0.79
d. Access to treatment and palliative care			0.94
If you were to be diagnosed of cervical cancer today do you think you would have access to treatment and palliative care services in Harare?			0.91
Where would you go to seek treatment?			0.57
Where would you go to seek for palliative care services?			0.85
Are you currently accessing cervical cancer treatment or palliative care?			0.97
What made you go for cervical cancer screening just before your diagnosis?			0.96
Where you were first screened and suspected of cervical cancer?			0.85
Do you have access to treatment for your condition?			0.98
How much have you paid or are you paying on average for your treatment in one month?			0.69
e. Health facilities that provide treatment and palliative care			0.70
Generally, where would you go or refer someone for cervical cancer palliative care services?			0.54
Where do you think people can be treated of cervical cancer in Harare?			0.50
Where would you go to seek treatment?			0.50
Where would you go to seek for palliative care services?			0.66
f. Health facilities that treat cervical			0.73

cancer in Harare			
Where do you think people can be treated of cervical cancer in Harare?			0.64
Where would you go to seek treatment?			0.49
Where were you referred for further investigations (histological tests) to confirm your diagnosis?			0.47
Where were you commenced on treatment?			0.45
7. Utilization of cervical cancer treatment and palliative care	0.9016	<0.001	0.84
d. Utilization of cervical cancer treatment and palliative care			0.89
Do you have a regular doctor whom you see when you require health services			0.92
If you are not feeling well where would you go first?			0.64
If you were to be given some medication or treatment for a disease would adhere to it			0.98
Have you ever been screened for cervical cancer?			0.91
Who do you believe can manage cervical cancer better?			0.85
What challenges do you usually face in using health services?			0.65
How many times have you visited your health facility or doctor for treatment/check up in the last 6 months?			0.51
Do you have a regular doctor whom you see when you require health services?			0.98
What treatment are you on or have you received for your condition?			0.93

Are (Were) these fees affordable to you or your household?				0.98
Who do you believe can manage cervical cancer better?				0.93
What challenges do you usually face in using				0.72
e. Challenges faced in accessing health services			0.75	
*What challenges do you usually face in using health services?				0.72
f. Access to cervical cancer screening			0.89	
Where were you screened?				0.78
Were the charges [for screening] affordable to you or your household?				0.79
8. Perceptions, attitudes and beliefs about cervical cancer treatment and palliative care				
	0.8132	<0.001		0.78
f. Attitudes			0.88	
I can discuss experiences of cervical cancer with my family members.				0.59
I can discuss experiences of cervical cancer with my friends.				0.51
Awareness of cervical cancer is done in my community				0.52
The local hospital offers cervical cancer screening to women.				0.54
The local hospital offers cervical cancer vaccination to young girls.				0.50
My partner/husband [would] supports me to go for cervical				0.64
My partner/husband [would] support me to go				0.58

for cervical cancer treatment.		
My friends support me to go for cervical cancer treatment.		0.57
My family supports me to go forcervical cancer treatment.		0.59
I encourage others to be screened and treated for cervical cancer		0.67
I am too busy to go for cervical cancer treatment [R]		0.60
I do not have time to go for cervical cancer treatment [R].		0.57
Cervical cancer treatment procedure is embarrassing [R].		0.51
Screening is important for early treatment of cervical cancer.		0.60
Cervical cancer treatment saves lives		0.64
Cervical cancer treatment gives a woman and their family peace of mind.		0.56
Cervical cancer treatment gives a woman control over her health.		0.52
HIV testing is optional when being screened for cervical cancer.		0.50
Cervical cancer treatment is for all women regardless of background		0.56
I am responsible for my health.		0.51
Test results for cervical cancer screening are immediate		0.53
Cervical cancer screening does not take too long.		0.52

g. Availability of treatment and palliative care services	0.82	
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The local hospital offers treatment to women with		0.62
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cervical cancer.		
The local hospital offers laboratory investigations for women suspected of cervical cancer.		0.68
The local hospital has adequate trained staff to provide cervical cancer treatment.		0.60
The local hospital offers treatment to ALL cervical cancer patients in this community.		0.57
Hospitals/clinics in my community offer cervical cancer treatment services for free		0.56
Hospitals/clinics in my community offer free treatment services for cervical cancer patients who cannot afford to pay.		0.64
h. Quality of care		0.70
<hr/>		
The hospital/clinic in my community offers timely services for people with cervical cancer.		0.49
The local hospital offers counselling to cervical cancer patients and their partners/families.		0.47
Cervical cancer patients do not survive long even when treated [R].		0.49
Health care workers who perform cervical cancer treatment are well trained.		0.49
Health care workers who perform cervical cancer treatment are very helpful.		0.48
i. Perceptions about treatment services abroad		0.86
<hr/>		

I get better value for money for cervical cancer treatment abroad than in my local hospital/clinic.	0.41
Cervical cancer treatment is best done abroad.	0.47
Health professionals abroad provide better care for cervical cancer patients.	0.57
Cervical cancer patients treated abroad have better survival chances	0.53

j. Beliefs	0.70
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	0.42
Cervical cancer patients should not be stigmatized.	0.45
I encourage others to be screened and treated for cervical cancer.	0.47
I am afraid of cervical cancer treatment [R].	0.46
Getting results of cervical cancer screening is scary [R].	0.45
Women should go for cervical cancer screening only when they experience serious health problems [R].	0.47
Cervical cancer treatment is for people with money [R].	0.46
Cervical cancer screening is for promiscuous people [R].	0.48
I am too busy to go for cervical cancer treatment [R].	0.49
I do not have time to go for cervical cancer treatment [R].	0.43
Cervical cancer treatment procedure is embarrassing [R].	0.43

Table 2. Full results from 13 factor solution of the final *Health Worker* questionnaire from factor analysis and internal consistency testing for each factor.

Items	KMO	Bartlett's test (p value)	Alpha (α)	Factor loadings													
				1	2	3	4	5	6	7	8	9	10	11	12	13	
5. Health worker characteristics	0.532	<0.001	0.72														
d. Professional development			0.72														
Have you ever received any on-the job training on cervical cancer treatment and palliative care?				0.74													
Do you feel that you have received adequate training to provide cervical cancer treatment and palliative care services?				0.55													
Does your employer support your continuous professional development (CPD) in cervical cancer treatment and palliative care?				0.51													
Have you read or heard about the Zimbabwe Cervical Cancer Prevention and Control Strategy (2016-2020)?				0.54													
What are the general perceptions of cervical cancer patients and their families on the services you provide in this facility?				0.65													
e. Profession training			0.71														
What is your profession?					0.49												
Where did you receive your basic professional training?					0.66												
Where did you receive your specialist training?					0.40												
f. Quality of care			0.70														
Do most of your cervical cancer patients adhere to prescribed treatments?						0.53											
Are you motivated to provide your services to cervical cancer patients in this facility?						0.47											
d. Working conditions			0.78														
How many hours do you work in a week?							0.46										
Do you think the benefits (salaries and allowances) you are receiving are commensurate with the services you provide to cervical								0.49									

cancer patients?

e. Perception of cervical cancer strategies and policies 0.71

Does your facility have clinical guidelines for the treatment and palliation of cervical cancer patients? 0.44

0.49

Have you read or heard about The National Cancer Prevention and Control Strategy for Zimbabwe (2013-2017)? 0.51

Have you read or heard about the Zimbabwe Cervical Cancer Prevention and Control Strategy (2016-2020)? 0.46

Do you think Zimbabwe has adequate policies and strategies for the treatment and management of cervical cancer? 0.46

Do you think that the cervical cancer surveillance system is adequate in the Zimbabwe to account for every case?

6. Health facility characteristics 0.639 <0.001 0.79

a. Characteristics of cervical cancer service providers 0.87

Who owns this facility 0.92

Who mainly pays the salaries of staff at this facility? 0.96

Who mainly pays for running costs for this facility? 0.66

What is the type of the health facility? 0.90

b. Perceptions about provider quality of services 0.71

Besides health services where else are cervical cancer patients seeking help for their conditions? 0.60

Do you think cervical cancer patients are better off seeking treatment abroad than in Zimbabwe if they have the resources? 0.81

Would you recommend your cervical cancer patients to seek treatment abroad if they have the resources? 0.80

Are the available health professionals adequate to serve all 0.47

the patients (all disease areas) you receive?				
Do you have a specific number of beds reserved for cervical cancer patients in this health facility?				0.56
7. Service characteristics	0.5	<0.001	0.70	
c. Cervical cancer services				0.70
Does this facility offer cervical cancer screening?				0.87
Does this facility offer treatment of pre-cervical cancer lesions?				0.67
What treatment options for pre-cervical cancer lesions are available in this facility?				0.71
What cervical cancer treatment services are available in your facility?				0.84
d. Cervical cancer service referrals				0.70
Where do you refer patients for histological investigations?				0.61
Where do you usually transfer/refer cervical cancer patients for other services?				0.46
What services do you usually transfer/refer cervical cancer patients for?				0.78
8. Infrastructure, equipment and drugs capacity	0.538	<0.001	0.79	
a. Availability of basic services, equipment and drugs.				0.84
What is the main source of water for this facility?				0.89
Over the last 3 months have you experienced water supply interruptions of this source of more than 2 hour?				0.54
Are there functional (soap and water) hand washing facilities for patients or in the toilets?				0.55
Does the facility have access to ambulance facility for emergency transport?				0.87
If the facility owns an ambulance is fuel available for use in cases of emergency?				0.75
Does the health facility have adequate basic equipment?				0.72
Is most equipment in this facility				0.66

in functional order?		
Does the facility have adequate analgesics and other medication for palliative care patients today?		0.50
b. Hygiene, sanitation and waste management capacity	0.70	
What back-up water supply does this health facility has?		0.55
Are there functional (soap and water) hand washing facilities for patients or in the toilets?		0.50
What method does this facility use in the final disposal of sharps?		0.58
Is the incinerator functional today?		0.65
Is the power source for the incinerator available today?		0.67
Have you or any staff member received training in health care waste management practices in the past 2 years?		0.72
c. Supply of basic services, equipment and drugs.	0.70	
Over the past 3 months have you experienced any power interruptions of this source of more than 2 hours?		0.50
Has the facility faced challenges in transporting patients in emergency situations in the last 3 months?		0.43
Does the facility have modern equipment for treating cervical cancer		0.41
Did the facility experience stock outs of analgesics and other medication for palliative care patients in the last 3 months?		0.70
Does the facility have adequate analgesics and other medication for palliative care patients today?		0.55
d. Availability drugs for treatment of cervical cancer.	0.91	
Does the facility have adequate stocks of drugs such as cisplatin for treatment of cervical cancer today?		0.70
Did the facility experience stock-outs of cisplatin in the last 3 months?		0.64

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