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Adopting Logic Model to Predict Ovarian Cancer

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ABSTRACT

Background: The Logic model was primarily used in educational programs and then to evaluate tuberculosis control, cervical cancer prevention programs, and cardiovascular disease in health. Unlike cervical cancer, there is a gap in screening for ovarian cancer. However, clinical services exist. Thus, the Logic model has been used to evaluate the service standards for the secondary prevention of ovarian cancer.

Methods: This is the multi-centric service evaluation research adopted from the Logic Model. There are four domains namely utility, feasibility, propriety, and accuracy standards in the Logic model that includes 53 question items altogether for each participant. For each item, the participants responded on a Likert scale to assess their satisfaction with the service provided to the patients. There are 5-point satisfaction levels from strongly disagree to agree strongly. The internal consistency of items was calculated and the factor analysis was performed. Software used were Microsoft Excel, SPSS, SPSS Amos, and R.

Results: The agreement level of all specialist participants was satisfactory for the current prediction and management approach to ovarian cancer with a median value of 73.5% towards positive sentiment. Cronbach's alfa was at an acceptable level of more than 0.8 for utility, feasibility, and accuracy domains. The propriety domain had poor yield. Chi-squared test-based model fit is good (Baseline and Factor Models <0.001) and Barlott's test of sphericity is likely to work (X^2=5460.242, df=1378, and p<0.001). Other confirmatory factors were not at an acceptable level.

Conclusions: The logic model may work to predict ovarian cancer with an acceptable level of reliability, however for the perfect fit it requires a larger sample size.

Keywords: Factor analysis; logic model; ovarian cancer; satisfaction.

INTRODUCTION

There are diagnostic and therapeutic services for ovarian and uterine cancer at facility level. Uterine cancers may be symptomatic by menstrual problems but not ovarian cancer, so the diagnosis is delayed and there is no primary prevention measure yet. There are treatment guidelines but the predictive tools are not programmatically recommended or used uniformly for ovarian cancer.[1] Several approaches in the business and education sectors have evaluated programs and projects.[2] One of these is a Logic model that incorporates resources, activities, outputs, outcomes, and impact (RAOOI) to evaluate tuberculosis control, cervical cancer prevention, cardiovascular disease, smoking and pregnancy outcomes, and impact on rural community health to explain the service and the applicable measures for evaluations.[2-8] Symptoms self-appraisal, both conventional and novel approaches, and artificial intelligence may predict ovarian cancer.[9-13]

Thus, the Logic model has been used to evaluate the service standards for the secondary prevention of ovarian cancer.

METHODS

Service Evaluation Research design was used to test the service standards to predict and manage ovarian cancer at the facility level. It was a multi-centric study and the site selection was based on the availability of minimal service facility to diagnose and treat ovarian cancer. There were

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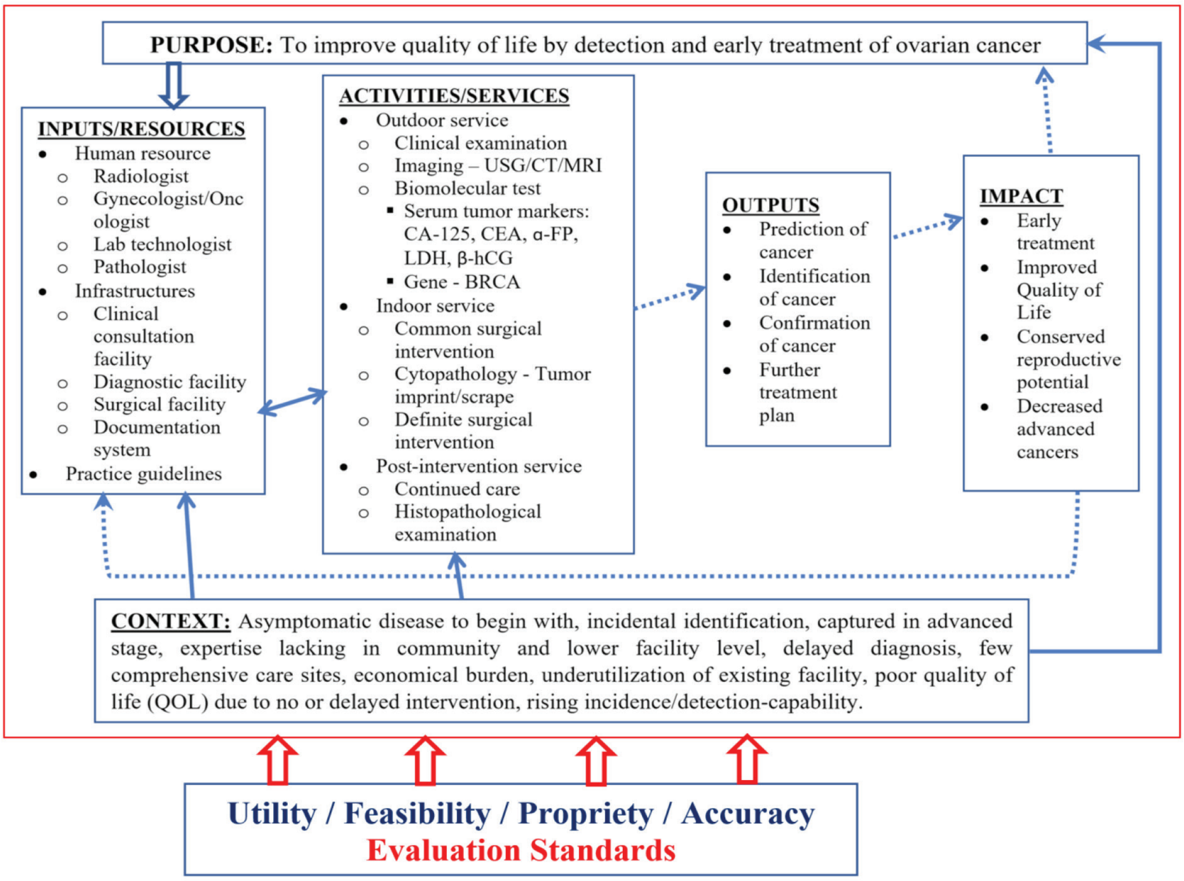
only four centers to fit in. The minimum facility was operationalized as the gynecologic oncology, surgical pathology, and radiology services in functional status. A logic model was adopted that was also used to evaluate the tuberculosis and cervical cancer prevention programs in the past. A conceptual framework was constructed on the shared relationships among the resources, activities, outputs, outcomes, and impact (RAOOI) for facility-level services.[14] (Figure.1)



Logic model for secondary prevention of ovarian cancer: A conceptual Framework

Figure 1. Logic model for secondary prevention of ovarian cancer: A conceptual framework (Illustration created by author).

The ideal participant size would be 10:1 per item for each evaluation standard for the factor analysis.[15] Thus, multiple of them (40:1) were taken for the interview to increase the power of the study.

The Likert Scale data were analyzed to calculate the internal consistency of various items to yield Cronbach's Alfa. Further, the Factor analysis was performed to see the good-fit of variables under different domains.

Service providers, gynecologists/gynecologic oncologists, radiologists, and pathologists were identified in each study site. The study procedure was explained and consent was taken. The set questionnaire was administered to each of them and at the end of the individual interview a focus group discussion was conducted in each department only for the professionally shared responsibilities like diagnostic reports correlating with other tests and clinical findings. The discussion was focused on the initial clinical diagnosis and surgical treatment given by the gynecologist and gynecologic oncologist; the radiological interpretation was focused on the radiologist; and intra-operative tumor cytology (frozen section biopsy where the facility was available at the study site), and final histopathological diagnosis was concentrated for the pathologist.

53 questions were administered to the 40 specialist participants each to respond in a sentiment level 5-point Likert scale variables on the existing services to predict and manage ovarian cancer. Those sentiment level responses were “strongly disagree”, moderately disagree”, “neutral”, moderately agree” and “strongly agree” represented by numbers from 1 to 5. 53 questions were grouped into four domains namely “Utility (U)”, “Feasibility (F)”, “Propriety (P)” and “Accuracy (A)” with 22, 11, 9, and 11 questions in each domain respectively. The internal consistency of items was calculated and the factor analysis was performed. Data analysis software used were Microsoft Excel, SPSS, SPSS Amos, and R. Ethical approval was taken from all study sites, and finally at the Nepal Health Research Council.

RESULTS

The median response was 73.5% toward a positive sentiment level as satisfied with the existing prediction and management system of ovarian cancer derived from the cumulative reaction of all four domains. The average sentiment level in the Accuracy domain was moderately satisfied with a number value of 4; and between Neutral and moderate satisfaction in other domains with a number value of 3.6-3.7 on the Likert scale. Thus, the agreement from all specialist participants is satisfactory in predicting ovarian cancer using the existing clinical management approach. [Fig 2]

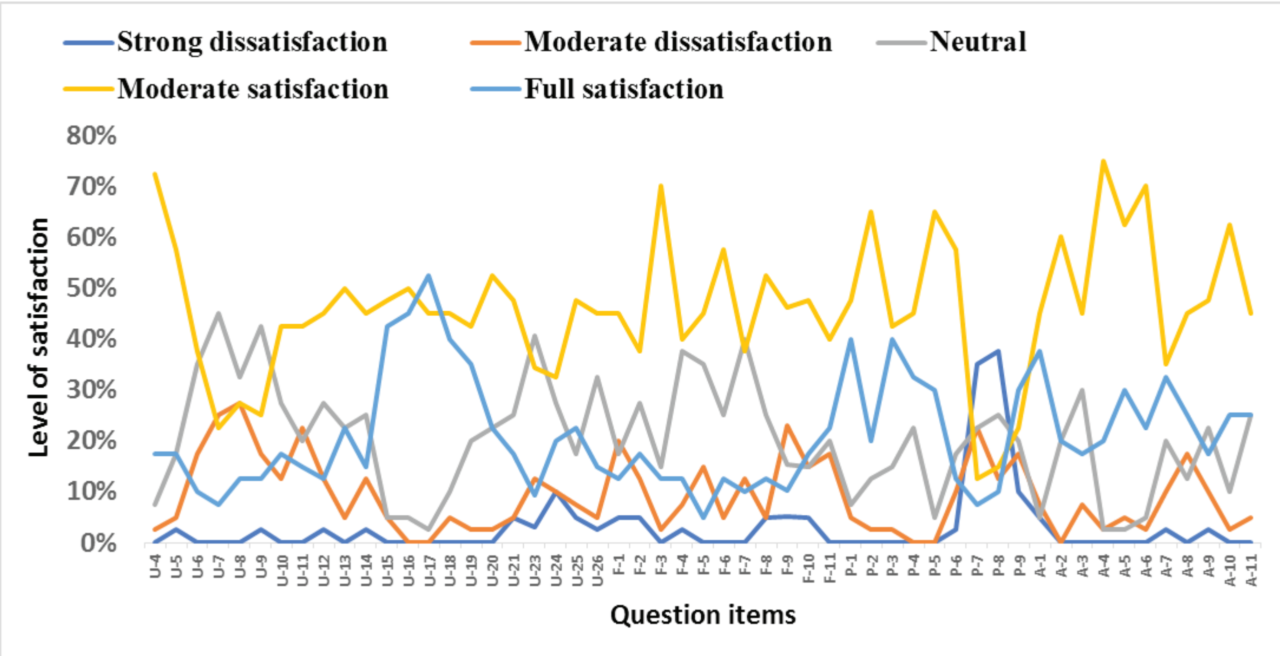


Figure 2. Level of satisfaction on the Likert Scale on the specified standards of measures.

Focused group discussions based on the same questionnaire revealed some limitations in all service areas. Non-representative sampling, cells obscured or replaced by bleeding or discharge, and inadequate sampling in tumor imprint may sometimes yield reports otherwise. Endometriosis and ovarian cancer share some similar signs to influence clinical diagnosis. Some imaging descriptions have similarities in both benign and malignant tumors of the ovary.

By excluding 8 out of 40 participants, 32 had all variables filled in scales to analyze for internal consistency using SPSS 20. The Cronbach’s alfa was 0.942 for 53 items. By including all 40 participants, the internal consistency of the 53 items using MS Excel the Cronbach’s Alfa was more than 0.8 combining all three domains the 22 items in Utility, 11 items in Feasibility, and 11 items in Accuracy domains signifying that the question items have a good internal consistency ie all questions tend to measure the same thing. However, the 9-item Propriety domain yields low internal consistency as fewer items (<10) to analyze and poorly considered items in clinical practice revealed from focused group discussion. It was calculate in Excel using formula [$\alpha = K/(K-1) \times (Sy^2 - \text{Sum } Si^2)/ Sy^2 \rightarrow 53/(52-1) \times (539.4-85.5)/ 539.4 = 0.858$] as well as from SPSS. [Table-1]

Table 1. Reliability test by Cronbach's alfa.				
Items→ Responder	U-22	F-11	P-9	A-11
G-10	0.85	0.93	0.71	0.83
P-11	0.91	0.85	-0.78	0.86
R-19	0.85	0.75	0.63	0.55
Item wise	0.88	0.85	0.54	0.80

Exploratory Factor Analysis

Factor analysis Scree Plot of 53 factors within four domains yields a steep curve followed by a bend, then a straight line suggesting the variables are a good-fit to apply in practice. [Fig 3]

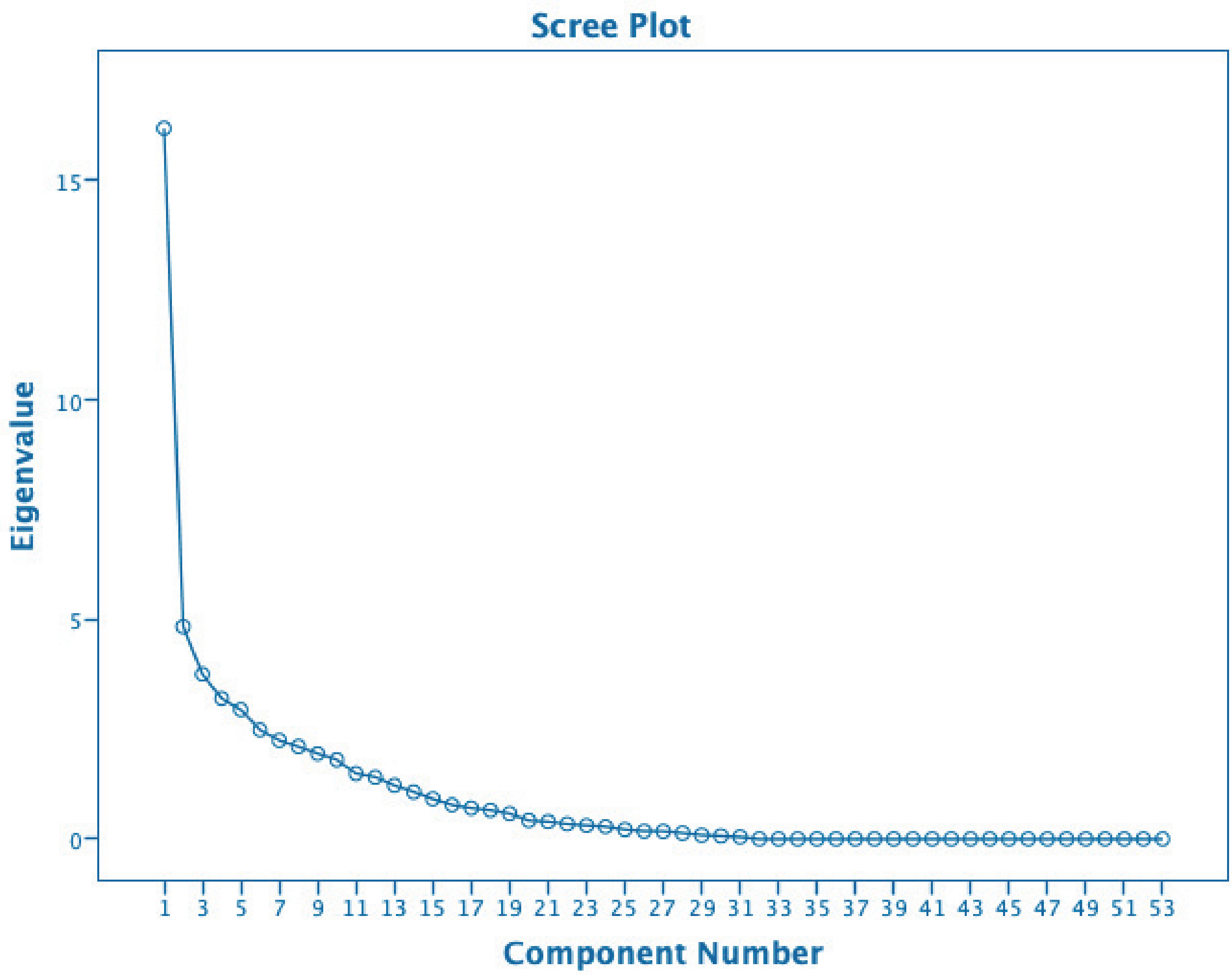


Figure 3. Scree plot of Eigenvalue by item numbers from exploratory factor analysis.

Confirmatory Factor Analysis

The coefficient alpha i.e. internal consistency reliability is acceptable for factors 1 (Utility domain), 2 (Feasibility domain), and 4 (Accuracy domain) but not for factor 3 (Propriety domain) as it is below 0.7. [Table 2]

Table 2. Reliability coefficients on confirmatory Factor Analysis.

	Coefficient ω	Coefficient α	Remarks
Factor 1 (Utility domain)	0.883	0.88	>0.8 (Acceptable)
Factor 2 (Feasibility domain)	0.855	0.85	>0.8 (Acceptable)
Factor 3 (Propriety domain)	0.486	0.55	<0.7 (Not acceptable)
Factor 4 (Accuracy domain)	0.812	0.80	>0.8 (Acceptable)
Total	0.895	0.93	

The model fit based on the chi-square test is good as it is statistically significant in confirmatory factor analysis. [Table 3]

Table 3. Model fit by Chi-squared test.

Model	$\square^2$	df	p-value
Baseline model	11112.682	1378	< .001
Factor model	10524.310	1319	

Bartlett's test of sphericity suggests that the model may work because the chi-squared value is highly significant ($\square^2$=5460.242, df=1378, and p<0.001).

The covariance estimates show the relationship between two factors, and the relationship is significant with minimal standard error. [Table 4]

Table 4. Factor covariances between any two factors or domains.

Factors or domains			Estimate	SE	z-value	p-value	95% Confidence Interval	
							Lower	Upper
1	□	2	0.775	0.093	8.308	< .001	0.592	0.958
1	□	3	0.719	0.108	6.658	< .001	0.507	0.930
1	□	4	0.622	0.123	5.074	< .001	0.382	0.863
2	□	3	0.627	0.128	4.905	< .001	0.376	0.877
2	□	4	0.665	0.118	5.662	< .001	0.435	0.896
3	□	4	0.790	0.101	7.793	< .001	0.591	0.989

However, the coefficient of determination or R-squared value for each factor concerning the construct i.e. satisfaction does not show good values in terms of variance explained. The average variance extracted for each factor from 1 through 4 are 0.282, 0.374, 0.179, and 0.287 respectively. The Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) are 0.054 and 0.012 respectively. These are below 0.90 to be a good fit. The Root Mean Square Error of Approximation (RMSEA) value is 0.418 (CI = 0.410 - 0.425). The RMSEA must be below 0.05 for good fit and below 0.08 for appropriate fit so the fitted model is a poor fit. Likewise, the Kaiser-Meyer-Olkin (KMO) sample adequacy test yields 0.576 (i.e., below 0.80). This indicates that the confirmatory factor analysis would have been better with a larger sample size of respondents.

DISCUSSION

With a reasonable degree of reliability coefficients in the logic model used in this study, the output targets can be set as in the Tuberculosis program and cervical cancer elimination strategy. Tuberculosis (TB) and cervical cancers have proven aetiological agents for the disease. This makes services to prevent or treat disease easier and more focused. Intervention programs can also be streamlined and their periodic evaluation can be planned. Outcome endpoints can also be set for the different levels of the evaluation process. A logic model was developed to evaluate the completion of treatment in the TB program. Completion of treatment in the TB program was evaluated by the Logic model. This model had set the output targets to achieve the set goal.[16]

The logic model would facilitate service providers to achieve overall quality of life.[5] Smoke-free legislation and other co-interventions for the identified risk factors analyzed in the logic model and the pregnancy outcome demonstrably improved in the German Federal States.[6] Input and impact were studied in rural community health by using a logic model and came to recommend it for a successful health impact.[7]

There are self-appraised symptoms only to seek care for the sickness and the directed diagnostics may reveal the cancer in an advanced stage.[9,10]

Conventional and novel methods like Imaging, biomolecular testing, and cell or tissue examination (cyto-histopathology) are being used by clinicians to predict the disease and intervene if it is to the suspicious end.[11] Even artificial intelligence is emerging as a new approach to predicting tools.[12] For diseases that have identifiable causative factors, there are programmatic interventions for prevention but for other diseases like ovarian cancer, there are services only to identify them and provide early treatment. Thus, there is a systematic gap in evaluating the services.

CDC has recommended this model for the comprehensive cancer control program as well.[17]

There is limited access to quality screening programs or services for cervical cancer in low-resource regions globally. However, the visual inspection method and cytology testing have been practiced in a 3:2 ratio.[18] A global strategy for cervical cancer prevention has also been set by WHO for the year 2030. This guides the scalable activities in the country's plan.[19]

The satisfaction level of service provided by specialist service providers at the facility level appears to be good for the available facility in this study. Training to health workforce and creating a checklist to identify the factors influencing specialized care for ovarian cancer enhances the satisfaction of both clients and providers.[20]

CONCLUSIONS

The overall satisfaction level of specialist service providers in managing ovarian cancer was good. However, all domains under study except the third domain (propriety) had a good fit in the Logic model. Internal consistency was at an acceptable level till exploratory analysis. Further research on a larger sample of responders would be better to yield a perfect fit in confirmatory analysis. This is possible if the functional service sites evolve further or cross-country sites are taken. The next step in adopting this logic model in predicting ovarian cancer requires setting targets for implementation.

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CONFLICT OF INTEREST

None.

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