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A Comparative Analysis of Costs and Outcomes of a Model Teach-Back and Regular Educational Intervention for Enhancing Health Literacy in Nigeria

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Abstract

Introduction: Health literacy describes patient-provider interactions, involvement in the healthcare system, rights and duties, and health information-seeking habits. Its resultant impact on illness prevention, individual and social competency, and health outcomes make it relevant for patients and health authorities. This study aimed to model the costs and outcomes associated with a teach-back educational intervention compared to a regular educational intervention to improve health literacy in Nigeria.

Method: A decision tree analysis was designed to capture the progression of participants through a teach back educational intervention, a regular educational intervention and no intervention (control). The decision tree model was built in Microsoft excel, and the various input were obtained from literature and best estimates where applicable.

Result: Baseline results from the model estimated a cost of ₦765,000 and ₦670,000 for the teach- back & regular educational intervention respectively, while cumulative outcomes include Quality of life gain (228.36 vs 140.96), In-Patient hospital costs reduction (-₦ 462,137.40 vs -₦ 285,270.00), Increased adherence rates (145.80 vs 90.00), Gain in self-care ability (31.21 vs 19.26) for the teach -back & regular educational intervention respectively. Scenario analysis showed the same trends.

Conclusion: Education remains the major channel for improving health literacy, and implementing a teach-back intervention will substantially yield more benefits and costs compared to a regular education method. By prioritising health literacy, Nigerian health authorities can empower individuals to take an active role in their healthcare, leading to improved health outcomes and overall well-being.

Keywords: Health literacy, cost impact analysis, teach-back intervention, Nigeria



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Introduction

Health literacy (HL) as a construct cuts across healthcare, psychology, public health, applied linguistics, nursing, media and social sciences.¹ Massey et al.'s² concept of health literacy captures patient-provider encounter, interactions with the healthcare system, rights and responsibilities and health information-seeking behaviours as important items in understanding and quantifying health literacy. Physician-patient encounter describes empowering patients to communicate preferences, assess whether they have received enough care, and communicating understanding; Interacting with the healthcare system covers the need to give high-quality care, patient's ability to schedule appointments, understand health issues in the system such as confidentiality, prescriptions etc.; Rights and responsibilities explain the individual understanding of health benefits available to them, insurance options, confidentiality, self-care practices and attitudes; Health information seeking assesses the individual's ability to seek and understand health information sourced from various points.

The impact of health literacy can be seen across different domains. Parnell³ explains that a common shortcoming of many health literacy research frameworks is focused on the role it plays in healthcare at the primary, secondary and tertiary levels and consistently overlooks the role in disease prevention in the first place. Mancuso⁴ identifies the impact of health literacy as changing through the course of an individual's life. As a result, there is a net impact on society and individuals through enhanced autonomous, interactive, cultural, informational, contextual and operational competence via communication, increased capacity and comprehension. It may be better to factor the stage of life, health system, and culture in designing interventions to improve health literacy. A roundtable on health literacy recommendations highlighted the need for health literacy intervention and its resultant benefits across health systems, the education system, culture and society, and health outcomes and costs.⁵

The consistent association of health literacy with health outcomes is a common ground for many health researchers. Lower health literacy can be shown as a poor ability to demonstrate taking medications as prescribed, a poorer ability to interpret labels and health messages, and, among elderly individuals, worse overall health status and higher mortality rates.⁶ It also includes more hospitalisations, greater use of emergency care, and lower receipt of mammography screening and influenza vaccination. Building on these, it is anticipated

that improving health literacy would have a resultant effect on individuals and society by resulting in different health practices, improved health outcomes, better health choices, as an example increased uptake in social health initiatives and the capacity to persuade people to make healthy decisions like giving up smoking or enrolling in preventative screening programs.⁷ In presenting a health literacy brief, the clinical excellence commission in Australia describes overwhelming evidence that shows the impact of health literacy on morbidity and mortality, disease and information-seeking knowledge, use of preventive services and healthcare, medication adherence, chronic disease management, patient-practitioner outcome, patient-practitioner relationship, and decision-making involvement where individuals with lower health literacy consistently have worse outcomes.⁸

Studies on health literacy in Africa consistently show fairly high levels of health literacy. It could be pointed out that the constructs and meanings vary, and there seems to be various measures and an inconsistent approach to health literacy measurement or a definitive operational framework. A case could also be made for a high level of health literacy and self-care, especially in relation to unorthodox medicine, as this is more common on the African continent. There is a dearth of centrally coordinated health literacy research and evidence-based policies. Strategies proposed to improve health literacy in Nigeria include the development of a national action plan on health literacy, promotion of established effective strategies to improve health literacy such as education, media, drama etc.⁹

This study aimed to model the costs and outcomes associated with potentially implementing a teach-back educational intervention compared to a regular educational intervention to improve health literacy in Nigeria. The specific research questions are:

1. What are the costs associated with implementing a regular and teach back educational interventions to improve health literacy in Nigeria?
2. How do these interventions benefit the participants and the health system?

Method

A decision tree model was built in Microsoft Excel based on two randomized controlled trial to improve health literacy. The decision tree analysis was designed to show the impact of the teach-back and regular educational intervention methods on the health literacy of healthy adults with inadequate/poor health literacy, compared to no intervention in the same population. The

intervention is proposed to enrol 450 individuals, with 150 participants per arm.

Population

The 150 people proposed are a simulation, and this population is not fixed or specific. This model is proposed as a decision making or estimation tool and can cater to many people or locations with adjustments to the model parameters, especially relating to the population and administrative capacity.

Setting

The model setting is proposed to be in Nigeria from the health system perspective. The intervention is expected to be completed over a 4-week period. The effects are anticipated to be seen over a 12-month horizon.

- Patient population – individuals older than 18 with poor health literacy
- Intervention – Teach back education method, Regular education intervention
- Comparator – No intervention (standard)
- Outcomes
 - Primary Outcome: Number of individuals who move to an adequate health state.
 - Secondary outcomes: Impact on self-care ability, adherence rates, patient healthcare costs, and quality of life)

The Interventions

The model is based on the randomised controlled teach-back method implanted by Sotoudeh et al.,¹⁰ and the regular education method randomised controlled trial implemented by Bayati et al.¹¹

Model structure

This model anticipates individuals with poor literacy are identified after an initial screening. After the interventions, the participants could either remain in the inadequate health literacy state or an adequate health literacy state. These outcomes are derived from the health literacy instrument for Iranian adults (HELIA).¹² The HELIA has been validated and shown to be reliable in assessing general health literacy in different populations and has been able to show differences in several individual variables such as age, sex, education etc.¹³

Individuals with adequate health literacy have advanced scores across the reading, access, understanding, appraisal and decision-making/intention to behave domains, while those with inadequate health literacy have shown scores below average in total. Inadequate health literacy state is defined as those who have scores

≤ 66 on the HELIA scale, while those with score > 66 were ascribed adequate health literacy state. The structure of the model is shown in figure 1.

Implementing the Teach-Back Intervention

1. Baseline Health literacy (HL) is measured at the start of the intervention to identify individuals in a poor health literacy state.
2. The educational program was run in 4 sessions (each 45 minutes long) to teach health literacy (25 minutes of education, 20 minutes of teach back).
3. The educational content of each session was taught face to face to health ambassadors through the teach-back method along with training using reliable sources, then the ambassadors were asked to recite the educational content in their own language. If the content showed not to be correctly understood by the health ambassador, the content was taught again.
4. Questionnaires for both (intervention and control) groups are to be completed again after 3 months.

Implementing the Regular Education intervention

- a. Baseline HL is measured at the start of the intervention to identify individuals in a poor health literacy state.
- b. A book called “Self-care in minor morbidities” was designed by the Ministry of Health for the purpose of the training and was given to participants in the intervention arm for self-study. An equivalent book with similar content may be designed in place of the book. At the end of this self-study, an in-person training session was held.
- c. The levels of health literacy using the HELIA questionnaire is then re-assessed four weeks after the intervention.

Transition probabilities for the model

The transition probabilities were calculated from the previously stated randomized controlled trials^{10,11} by dividing the number of individuals in the inadequate state at the end of the intervention divided by the number of total individuals in the inadequate state at the start of the intervention. This value was subtracted from 1 to obtain the values for individuals who move to the adequate state. In the regular education intervention method, the inadequate and marginal categories were grouped together as inadequate. The transition probabilities are shown in table 1.

Model Parameters and Outcomes

An assumption is also made to ensure that the staff-to-participant ratio is 1 to 30 participants in the teach-back

intervention, allowing for more personalised feedback, while the regular intervention method training session is delivered by one health promotion staff assisted by two administrative personnel. The primary outcomes expected are the costs of the intervention and the number of participants who move to an adequate health literacy state. The secondary outcomes, quantifying the impact of the interventions, include quality of life, in-patient hospital costs, adherence rates and self-care behaviour. The estimated baseline data for these outcomes, the specific reported outcome measures, and the estimated changes due to a shift in health literacy state are estimated based on the input parameters and

sources shown in Table 2. The changes in health-related quality-of-life data are estimated to be 15% in elderly patients with chronic conditions after a health literacy intervention¹⁴. An estimate of 3.75% (1/4) of the calculated 15% improvement is estimated from the base case since the model population is a younger and relatively healthy population. The baseline quality of life for Nigeria was adapted from the average health-related quality of life measured in the Indian population because there is a lack of health-related quality of life data in the general population in Nigeria. The Indian average for healthy individuals was used due to the similarities in both countries' cultures and health systems.

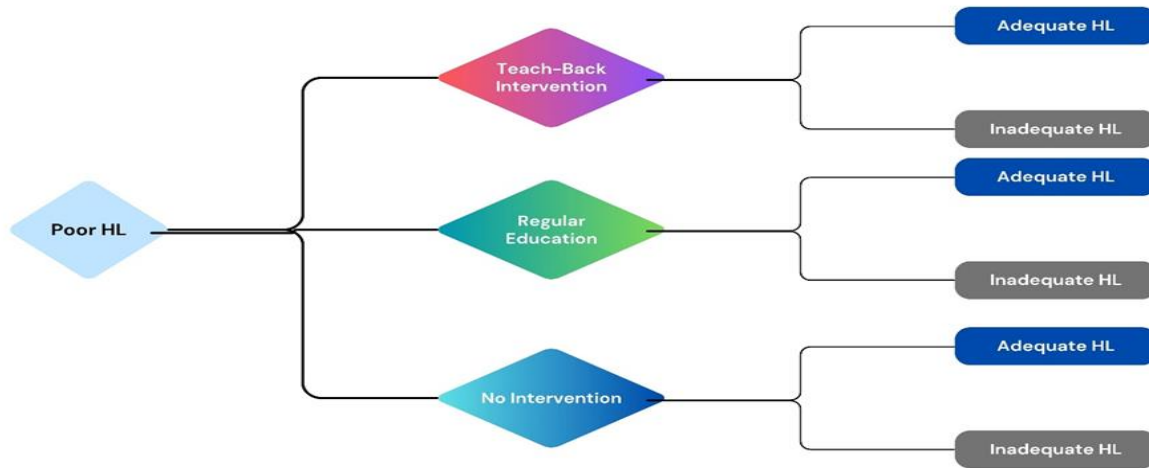


Figure 1: The Decision Tree Model

Table 1: Transition probabilities for the model

Intervention	Probability of remaining in inadequate state	Probability of moving to the adequate state
Teach-Back method	0.46	0.54
Regular education intervention	0.67	0.33
Standard of care (No Intervention)	0.92	0.08

Table 2: Baseline parameters estimated in the Nigerian population

Outcomes	Nigeria	Estimated Change after intervention
Quality of Life (EQ VAS)	75.18 ¹⁵	+ 3.75% ¹⁴
Hospital costs per in-patient case	₦ 38, 036 ¹⁶	-15% ¹⁹
Adherence rates (MMAS-8)	6.2 ¹⁷	+ 29.03% to a maximum of 8
Self-care ability (Consumer and patient empowerment index)	1.72 ¹⁸	+ 22.40% ²⁰

Results

Primary and Secondary Outcomes

The primary outcomes were the costs of intervention and the number of individuals who move into the adequate health literacy state per intervention. The

model was simulated based on a proposed walk-through of implementing these interventions in a population of 450 people, with 150 people in each arm. The implementation of both interventions is expected to take the same process, but the costs were estimated based on local currencies. There were no costs associated with ‘No Intervention’.

The regular education intervention method is estimated to cost ₦670,000 and this is likely to be most affected by the costs of printing materials, renting or using hall rooms/venues and associated wages. The teach-back intervention method is estimated to cost ₦765,000. In this intervention, the costs are likely to be most affected by the associated costs of designing the health literacy material and sessions, the use of varied staff numbers (this model anticipated the use of 1 staff to 30 participants), wages payable to staff, and costs of printing the training materials. A breakdown of the associated costs in both interventions is summarised in Table 3.

Of the 150 participants in a state of poor health literacy in each arm, at the end of the interventions, it is estimated that 81, 50 and 12 participants will move to a state of adequate literacy in the teach-back method, regular education intervention, and no intervention states respectively.

Consequently, in estimating the secondary outcomes cumulatively for participants in the adequate health literacy states, the expected gain in quality of life over 12 months was 228.36, 140.96 and 33.83 in teach-back, regular education intervention, and no intervention, respectively. The annual in-patient hospital costs that could be saved after the interventions are estimated to be up to ₦462,137, ₦285,000 and ₦68,464 for teach back, regular education intervention, and no intervention respectively. Significant gains in adherence rates are expected where we see 145.8 for teach back, 90 for regular education intervention, 21.6 for no intervention; the self-care ability, expressed in patient adoption and empowerment is expected to increase by 31.21 in the teach back intervention, 19.26 for regular education method, and 4.62 in no intervention. A summary of these outcomes is shown in Table 4.

Scenario Analysis

A scenario analysis conducted by removing the pre-screen filter and reducing/increasing key parameters to accommodate differences yielded results consistent with the base case analysis. The same pattern held significantly in the scenario analysis of an increase in status change estimates by +2.5%, 5%, and 10%, and a decrease in status change estimates even as far as 50 % still showed consistent positive benefits.

Table 3: Costs associated with implementing the two interventions

Regular Education Intervention		Teach-Back Intervention	
Questionnaire printing	₦ 30,000	Questionnaire printing	₦ 30,000
Administrative costs (ethical consent approval, routine costs)	₦ 40,000	Administrative costs (ethical consent approval, routine costs)	₦ 40,000
Health Literacy and Promotion book/manual	₦ 150,000	Self-study journal or notes	₦ 30,000
Self-study journal or notes	₦ 30,000	Refreshments for in-person training sessions	₦ 150,000
2 hours In-person training (staff allowance)	₦ 50,000	4 45 min in-person training session	₦ 200,000
Refreshments for in-person training sessions	₦ 150,000	Staff Wages	
Hall rooms	₦ 200,000	Admin Personnel	₦ 20,000
2 admin personnel (one off allowance)	₦ 20,000	Hall rooms	₦ 200,000
		Training material	₦ 45,000
		Training material Set up (One time)	₦ 50,000
Total Costs	₦ 670,000		₦ 765,000

Table 4: Estimated primary and secondary outcomes of the health literacy interventions (With & Without Screening)

	WITH PRE-SCREENING	WITHOUT PRE-SCREENING
Primary Outcome	Number of Individuals in a state of adequate health literacy	
Teach-back method	81	117
Regular Education Intervention	50	81



No intervention	12	75
Secondary Outcomes		
1. Gain in Quality of Life over 12 months		
Teach-back method	228.36	329.85
Regular Education Intervention	140.96	228.35
No intervention	33.83	211.44
2. Reduction in In-Patient hospital costs Life over 12 months		
Teach-back method	- ₦ 462,137.40	- ₦ 667,531.80
Regular Education Intervention	- ₦ 285,270.00	- ₦ 462,137.40
No intervention	- ₦ 68,464.80	- ₦ 427,905.00
3. Gain in Adherence rates over 12 months		
Teach-back method	145.8	210.6
Regular Education Intervention	90	145.8
No intervention	21.6	135
4. Gain in Self-care ability over 12 months		
Teach-back method	31.21	45.07
Regular Education Intervention	19.26	31.2
No intervention	4.62	28.89

Discussion

The teach-back method has been shown to allow for improved comprehension and retention,²¹ encourages superior student engagement compared to regular education and other one-way methods,²² and allows for individualised assessment and tailored feedback.²³ The teach-back method is the most dominant strategy compared to regular education intervention and no intervention. The outcome gains observed in the teach-back method were consistently higher than that in the regular education.

The interventions are to be carried out on individuals in a state of poor health literacy. This identification can be done with an initial pre-test. A scenario without pre-screening is explored in the sensitivity analysis, and there seemed to be slightly higher benefits. These estimated higher benefits are however questionable because a randomised population going through the interventions would likely have more than at least half of the sample population in adequate health literacy as previous literature estimated decent levels of health literacy in the Nigerian population.²⁴ While it may be useful to reinforce the knowledge, it is not necessarily encouraged, considering the estimated associated costs of implementing these interventions, and the intended efficiency of the health literacy interventions. It is also important to highlight the potentially variable cost estimates because this model does not directly focus on a specific state. Implementing these interventions in smaller states or with reduced associated wages may be associated with significantly reduced cost estimates, and some cost items may also be higher in some parts of the country.

The use of the interventions is no doubt very effective as it improves health literacy, improves associated outcomes and encourages self-care. However, it remains to be seen how sustainable this intervention is for the rest of the population, as it may not be feasible to teach the entire population in a country. This shows the need for complementary policies in education and schools at all levels, use of media, use of public platforms and consistent use of evidence-based policies to coordinate the decentralised health literacy approaches. These interventions are however useful in specific populations and can be used to improve health literacy in specific cases or as short-term measures.

The findings estimated from this cost and impact model suggest that healthcare systems should incorporate either the Teach-back method or regular education method as a standard practice to enhance health literacy and improve patient care improve health outcomes, reduce healthcare costs, and promote patient adherence. The intervention content could be adapted to fit multiple scenarios, diverse populations, healthcare settings, public and community interventions.

Model strength

The model is able to compare multiple interventions and randomised controlled trials estimated and quantified with the same health literacy measures. The estimated differences in poor and adequate health literacy states were based on published studies and can be easily adopted in comparing more interventions or adapted for sourcing input in different populations.



Model weakness

The model did not differentiate between the four different states of health literacy but instead compressed them into two. As a result, it may not be used to estimate differences in more complex health literacy considerations. The model also does not estimate the impact of the interventions beyond one year. It remains to be seen how the effect will be affected over time. Since the skills gained are essential and would be used constantly, the impact and knowledge of participants may be even higher than it is in the first year, thus sustaining and possibly increasing the effect of a single intervention for a longer period, potentially improving its cost-effectiveness. To account for education, the model runs on the assumption that the participants have had high school education and are generally healthy, but the model does not consider the impact of age or socioeconomic factors. The relationship between these socioeconomic factors and other outcomes are not explored in this paper and would be an important direction for future research. The model also only considered only 4 secondary outcomes. More secondary outcomes may be explored based on the specific interests and contexts of the interested population. Some of these could be mortality, hospitalisation rates, patient satisfaction, health visits, health insurance enrolment rates, quality of healthcare, mental health outcomes, etc.

Conclusion

The use of the teach-back education and regular education interventions in small populations are very effective. These methods have been shown to lead to positive health outcomes. While the teach-back method may be more expensive, the associated outcomes are significantly higher compared to the regular education method. Education remains the major channel for improving health literacy, and implementing a teach-back intervention will substantially yield more benefits and costs compared to a regular education method. By prioritising health literacy, Nigerian health authorities can empower individuals to take an active role in their healthcare, leading to improved health outcomes and overall well-being.

Declarations

Ethical Consideration: Ethical approval was not required for this study

Conflict of interest: The author declares no conflict of interest.

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