The American Journal of Physical Education and Health Science (AJPEHS)

ISSN: 2992-9679 (ONLINE)

VOLUME 4 ISSUE 2 (2026)



PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Physical Education and Health Science (AJPEHS)

Volume 4 Issue 2, Year 2026
ISSN: 2992-9679 (Online)
DOI: https://doi.org/10.54536/ajpehs.v4i2.8998
https://journals.e-palli.com/home/index.php/ajpehs

Economic Barriers to Preventive Healthcare Utilization among Rural Households and the Mediating Role of Perceived Healthcare Accessibility

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Article Information

Received: August 22 , 2026

Accepted: November 05, 2026

Published: November 24, 2026

Keywords

Domestic Healthcare Use, Indirect Relationship, Partial Least Squares, Perceived Access to Healthcare, Preventive Care, Rural Families, Socio-Economic Factors

ABSTRACT

Prevention healthcare demands the households to transform the accessible services into prompt and consistent involvement. This paper explores the relationships between the economic deterrents, perceived access to healthcare and preventive healthcare use in rural households. An analytical sample consisting of 380 respondents was given by a cross-sectional household survey. Economic barriers were defined as a formative composite inclusive of service fees, transport costs, lost income, accompaniment costs, and rival essential expenses. Four reflective indicators measured the perceived healthcare accessibility, and overall utilization measured the reported completion of preventive services in the last 12 months. The partial least squares composite modelling was supported by 10,000 bootstrap replications, repeated out-of-sample prediction and adjusted sensitivity analyses. The accessibility was negatively correlated with economic barriers (β = -0.403), and utilization given accessibility (β = 0.212). Utilization was positively related to accessibility conditional on economic barriers (β = 0.267). The indirect correlation by accessibility was negative (β == -0.108; 95% confidence interval = -0.158 -0.065), and the overall correlation was -0.320. The composite reliability of Accessibility was 0.909 and the average variance extracted was 0.713. Formative weights of lost earnings and service charges were statistically significant. The model explained about 16.2 % of overall utilization variation and held-out prediction accuracy compared to a training-mean benchmark. Principal directions of association were maintained with adjusted linear and ordinal analyses. The results justify a combined mindset toward rural prevention considering household spending, the economic price of time, and the feasible structure of services. Perceived accessibility is a statistically validated mediator between financial limitations and preventive engagement.

INTRODUCTION

Prevention healthcare is based on the capacity of individuals and family to access the right services when they are not desperate. Arrangements needed to compete with work, household spending, and the need to provide other family members with proper care include vaccination, screening, preventive health checks, antenatal preventive care, and professional preventive counselling (Rush *et al.*, 2022). The presence of a facility is hence just a single aspect of the terms of condition needed to participate. Households will also have to make decisions about the financial viability, practicality, and compatibility of getting care with their daily lives schedule. These are especially considered where the advantage of prevention is to be expected as opposed to being directly felt.

In the case of rural households, preventive participation may be a series of related choices. A member of the household has to realize that a service is required, where to get it, make travel arrangements, spend time, and meet the costs of the same. Where a service charge is affordable alone in a location, when transport payments and lost income are added to the cost of making the decision and costs of companies of accompaniment are to be met, it could modify the final decision (Coombs *et al.*, 2022). The cost of prevention is therefore a larger economic cost than the cost to a provider. It entails the resources needed to accomplish the whole visit and the strains that the visit creates on domestic livelihood arrangements.

This process can be investigated based on the difference between the economic barriers and perceived accessibility. Economic barriers relate to the challenge of financial expenditure of care (Acquah-Hagan *et al.*, 2022). Perceived accessibility addresses the issue of ease of access to services when the household perceives services as being accessible and easy to obtain when the need arises. These are distinct concepts related analytically. A family might spend a lot of money and still find it easy to make service arrangements or it can experience a practical challenge even though the resources are present (Williamson *et al.*, 2020). An analysis of both constructs enables the analysis to look at the financial conditions in which the utilization is being conducted and household evaluation on whether or not it is possible to receive care.

The current research examines a model that economic barriers relate to preventive use either directly or indirectly using the perceived access to healthcare (Kilchenstein *et al.*, 2022). The direct relationship shows the correlation that persists even with the inclusion of accessibility. The indirect association is the product of the correlation of the economic barriers and the accessibility and the correlation of utilization and accessibility. Collectively, all these relationships characterize whether accessibility

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offers a statistical avenue between financial constraints and preventive participation (Akhtar *et al.*, 2022). The discussion is of relationships in a cross-sectional household survey and explains mediation by that statistical meaning.

A household approach would be suitable since the prevalence of preventive needs and resources is frequently shared among multiple members. A parent who has organized a child to have a vaccination may be also on top of a job and taking care of an aged and also spending on necessities of a larger family. Likewise, during an antenatal visit, there might be a need to have more than one individual accompany you and transport you. Household level measurement of utilization acknowledges that household level determination to acquire prevention may reflect communal incomes and collective liability (Rasekaba *et al.*, 2022). It also renders eligibility significant as households vary on what services were suitable or owed at the reference time.

LITERATURE REVIEW

Economic Barriers as a Household Resource Constraint

Economic barriers are also conceptualized as the financial pressure in combination with financial strains of receiving preventive healthcare. The construct includes struggle in meeting service charges, spending on transport, foregone earnings, accompaniment costs, and preventive services of meeting the basic household spending (Ito *et al.*, 2022). The household resources are demanded by each component in a different way. A family may have one aspect that is highly felt and a second that is a weak one. The elements hence constitute the general barrier as opposed to being replaceable expressions of one underlying attitude (Conrad & Ronnenberg, 2022). This argument endorses a formative specification where the indicators collaboratively specify the economic-barriers composite.

The household resource approach brings out the expenditure and opportunity cost. Service fees and transportation costs must be paid and time out of work may cost an income or productive use. This can be transferred to a different member of the family with the aid of accompaniment (Moser & Beiruti, 2023). The necessity spending presents another allocation issue as there might be minimal budget grants to visit a doctor in the name of prevention due to funds required to cover food, housing, education and other essentials. Such pressures may influence the possibility of getting care in the situation when a household understands its necessity (Houghton *et al.*, 2023). Financial hardship should therefore not mean they do not care about prevention.

This is expected to have negative relationships with utilization since resources that need to be made available at the right time are required to complete the preventive services. Households facing a higher level of financial hardship can receive less of the services or delay a visit or do not follow a recommended sequence. The direct hypothesis relates to the relationship that occurs when one considers the perceived accessibility (Ibitoye, 2022). It thus realizes that financial limitations can be construed to do with participation in the form of allocation choices and spending pressures outside the route conducted by accessibility.

H1 There is a negative relationship between economic barriers and the use of preventive healthcare by rural households controlling for perceived access to healthcare.

Economic Barriers and Perceived Healthcare Accessibility

Perceived healthcare access is an indicator that describes the household judgment of the accessibility of preventive services, whether able to reach and acquire without significant practical challenge (Deng *et al.*, 2022). The four indicators deal with overall facilitability, preparedness to receive services when they are required, ease of visit scheduling, and the lack of significant practical barriers. These utterances are different formulations of a latent evaluation of access. It is specified reflectively and thus the indicators are supposed to have a large common element but still have their specific wording and focus (Coste & Bousmah, 2023).

This assessment can be influenced by financial pressure due to the fact that a service is experienced through the arrangements necessary to have it. A long trip can physically be feasible but hard to plan as far as spending of transport is more than free cash (Al-Zubayer *et al.*, 2023). Even when the loss of earnings is not able to be offset, there may be a clinic appointment available but hard to attend. Where this occurs, economic limitations come into the domestic assessment of utilitarian access (Sulku *et al.*, 2023). In the presence of real conditions of resources of the household, accessibility is a determination of the available care, not an abstract determination of the availability of a service.

The relationship proposed does not reduce accessibility to affordability. The questionnaire specifically instructs the respondents to take into account the location, availability of transport, opening hours, and service provision when assessing accessibility (Wright *et al.*, 2021). The economic barriers stand alone to tackling the financial challenge of engaging in prevention. This distinction should be maintained to enable the model to test the hypothesis of whether financial pressure is linked with a wider view of practical difficulty (Mulyanto *et al.*, 2020). The negative association is anticipated due to increased economic burden that the arrangements of preventive care present greater challenges to the households.

H2 There is a negative relationship between economic barriers and the perceived access of healthcare by rural households.

Accessibility and Preventive Healthcare Utilization

The utilization should also have a positive relationship with accessibility since those households that can potentially organize care are in a better position to fulfill services when they are due. Preventative involvement can often be coordinating and not a decision (Rush *et al.*, 2022). Appropriate times of appointment, manageable travel,

availability of services which can be anticipated, and easy arrangements can make the process of identifying a need and visiting a service more practical (Coombs *et al.*, 2022). The construct of accessibility synthesizes a household view on the doability of this practical process, and the construct of utilization reflects the self-reported carrying through.

H3 There are positive associations between perceived access to healthcare and preventive healthcare use among rural households using economic barriers after adjustment.

The Indirect Pathway Through Accessibility

The mediation hypothesis is a combination of the above relationships. It is expected that there will be increased barriers to the economy that accompany perceived inaccessibility and reduced perceived inaccessibility will accompany reduced preventive utilization (Acquah-Hagan *et al.*, 2022). The interaction of a negative coefficient in the first stage and positive coefficient in the second serves as negative. It is an indirect relationship which is the difference between the statistical correlation of the economic barriers on utilization and that which is mediated by accessibility in the given model. A first-order relationship is maintained since accessibility does not have to consider all of the resources considerations that go into prevention (Williamson *et al.*, 2020).

H4 Economic barriers are negatively indirectly linked to preventive healthcare usage by perceived access to healthcare.

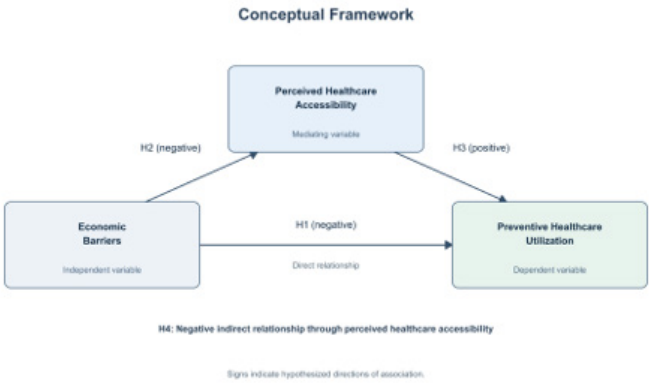


Figure 1: Conceptual framework linking economic barriers with preventive utilization through perceived healthcare accessibility

MATERIALS AND METHODS

Study Design and Analytical Unit

The analysis of economic barriers, perceived access to healthcare, and preventive healthcare use in the past 12 months are conducted using cross-sectional household survey. Substantive analysis is the household as a unit and the respondents are the adult with knowledge of household healthcare usage and costs. The survey instrument has eligibility criteria that include, being at least 18 years, a resident of the sampled rural study, a resident of the household during the reference period, and having adequate knowledge of its healthcare situation (Sahithi, 2021). The questionnaire indicates that each household should have one qualified adult respondent.

Preventive healthcare can be defined as the services that are designed to prevent or detect the problems beforehand. The tool contains vaccinations, screening in the absence of symptoms, preventive check-ups, planned antenatal preventive visits, and distinct preventive counselling. The visits made with an only purpose of diagnosing or treating the existent symptoms are excluded. Ongoing check-up of an existing disease cannot be defined as screening and the respondents are advised not to count the same service when it is respectively included in different categories. These limits ensure a steady difference between preventive involvement and care use associated with treatment.

Survey Instrument and Operational Measures

Five statements on five-point scale measure economic barriers on a five-point scale with strongly disagree, strongly agree as the two extreme ratings. EB1 evaluates the inability to afford preventive service costs, EB2 evaluates transportation costs, EB3 evaluates lost income through time out of work, EB4 evaluates costs incurred in the accompaniment and EB5 evaluates the inability to make ends meet after meeting the basic household expenses. The greater the answers, the greater the barriers. One more global object, EBG, measures the fact that the financial constraints, in general, rendered preventive healthcare hard to afford. This item is a distinct measure of redundancy as opposed to being a sixth element of the main composite (Bahishti, 2023).

Four statements assess perceptions of access to healthcare on the same agreement scale. PHA1 deals with general ease of access to preventive services. PHA2 is about accessing services at the right time. PHA3 evaluates the ease with which a preventive visit could be organized, and PHA4 is about access without a significant practical challenge. Perceived higher scores mean higher perceived accessibility. The common emphasis on pragmatic access affirms the reflective measurement model and the conceptual difference between two constructs is maintained by the distinct financial expression of the economic-barriers indicators.

The general preventive use is modeled by PHUG, a rated

item enquiring the number of the preventive services that were right or preventive and due to the household during the reference period. Ratings are none, a few, about half, most and all. Greater levels suggest a greater utilization compared to need. The questionnaire will also have a specific eligibility query to each type of preventive services to be followed and then a completion responds only where the service is due (Adaikkalam Zabihi *et al.*, 2025). This hierarchy separates lack of need and non-utilization and allows descriptive comparisons of service based on its purposes by the right denominators.

The instrument captures the age, sex, marital status, education and occupation of the respondents along with household set up, monthly earnings in BDT, predictability of income, chronic disease, access to healthcare, commuting time, customary facility, and pregnancy state during the reference period. These variables describe the circumstances in which preventive decisions occur. Adjusted sensitivity analysis has education, household size, chronic illness, coverage and travel time as well as the results are reported. They play a supplementary role to the three main constructs but not part of their measurement definitions.

Sample Screening and Descriptive Analysis

The screening of the analytical records was done to identify duplicate or missing identifiers, invalid coded values, negative values where inappropriate, and non-integer age or count responses. Additional checks were on household composition, service eligibility, and antenatal eligibility (Harwood, 2023). The outcome of the screening results includes 380 unique records, 0 duplicate identifiers, 0 missing identifiers and 0 invalid values of the screening results reported. There was no conflicting household and service eligibility. All households had received at least one preventive service and all the records included the core measurement data necessary to the primary model.

The ultimate main sample of analysis thus includes 380 households where no record has been left out. Categorical variables are summarized using frequencies and percentages and continuous variables using means, standard deviations, medians, and ranges, as appropriate (Andiappan & Wan, 2020). The percentages of elements of specific utilization apply to households with a measured completion answer between those whose time was due. Full analytical sample is used in overall utilization percentages. This denominator difference is maintained throughout the results since preventive eligibility varies across the types of services and should not be conflated with completion.

Measurement and Structural Model Assessment

The measurement and structural relationships are estimated by applying partial least squares composite modelling. Economic barriers are dealt with as a formative composite whereas accessibility is dealt with by Mode A composite scores reflective indicators. Formative assessment explores outer weights, bootstrap uncertainty, indicator variance inflation factors, and outer loadings. Accessibility analysis looks at the indicator loading, standardized Cronbach alpha, rho A, composite reliability, and the average variance extracted. The global economic-barriers item offers a distinct standardized regression criterion to measure convergence with the core barrier score.

The structural model includes economic barriers as a predictor of accessibility and both economic barriers and accessibility as predictors of overall utilization. The direct paths are reported to have standardized coefficients (Mimansha Patel & Nitin Patel, 2019). Before the calculation of the indirect association, the economic-barriers-to-accessibility coefficient is multiplied with the accessibility-to-utilization coefficient. The total association will be the sum of the indirect and direct association. Bootstrap estimation applies the number of successes (10,000) to the given primary estimates. Confidence intervals are shown and bootstrap standard errors, and the results of normal-approximation significance in the workbook are more standard probability notation.

Predictive Assessment and Sensitivity Analyses

Predictive assessment is applied on repeated held-out evaluation with ten folds and five repetitions, resulting in 1,900 held-out predictions to the utilization result. The score-regression prediction is compared with a training-mean benchmark and a manifest-indicator linear benchmark (Balwan *et al.*, 2022). Root mean squared error and mean absolute error summarize prediction error. A custom Q squared test is an evaluation of the improvement with respect to the training-mean prediction. This step complements the structural analysis to look at the performance of the fitted approach on the withheld observations during the model fitting process in the repeated evaluation scheme.

Sensitivity analyses will involve linear regression with the primary composite scores as fixed and an adjusted proportional-odds logistic model of the ordered utilization response. The adjusted ones comprise education, household size, chronic illness, coverage, and travel time. The results are given as linear coefficients and confidence intervals as compared to the primary conditional associations. Ordinal measurements are presented in the form of odds ratios and confidence intervals. These tests are viewed as verifying the direction and stability of the central relationships among the reported specifications, and the team of bootstrap models is the foundation of hypothesis tests.

RESULTS AND DISCUSSION

Respondent and Household Characteristics

The average age of the respondent population of 380 was 41.57 years with a standard deviation of 14.12 years and a range of 18 to 80 years. The average age was 41 years. There were 202 respondents of male gender, 115 of female and 63 of other gender identity, respectively, which equals 53.2 %, 30.3 %, and 16.6 %, respectively.

The sample was made up of married respondents (54.2%) and never married or widowed or divorced or separated (remaining) respondents. The characteristics define the analytical respondents and give background on the household-level explanations about healthcare use.

The education was spread on multiple levels. The proportion in which 113 respondents or 29.7% reported primary education and 100 or 26.3% reported secondary education was 1:2. Another 64 respondents had completed higher secondary and 55 had undergraduate education or higher which was 16.8% and 14.5% respectively. The number of respondents with no formal education was 48 or 12.6%. The two biggest occupational groups were agriculture and day labour with 21.1% and 17.6%. Others are also included in the sample: those who received salaried jobs, those who self-employed themselves, those who were in unpaid care, those who were students, those who were unemployed, those who were retired and other jobs.

Homes had a mean of 5.18 people with standard deviation of 1.41 and a median of five. The mean monthly household earnings stood at BDT 25,869.21 in comparison with a median of BDT 23,200. Income ranged from BDT 4,800 to BDT 84,900. The average round trip travel time to the common healthcare facility was 41.22 minutes and median of 40 minutes and 10-90 range. These distributions determine a significant dispersion in household resources and time of access to normal care.

The percentage of households with a diagnosed long-term illness in at least one household member was 160, or 42.1%. The 60 households (or 15.8%) reported healthcare insurance or another payment support scheme. Fifty-six households (or 14.7%) reported pregnancy in the previous year. There was a combined representation of 49.7% of usual preventive-care facilities by community clinics and government facilities. Other households cited the private facilities, nongovernmental facilities, outreach services or other providers. The table 1 presents the summary of the selected respondent and household characteristics in terms of interpreting preventive participation (Rush *et al.*, 2022).

Table 1: Selected respondent and household characteristics

Characteristic	**Value**
Analytical households	380
Respondent age mean and SD	41.57 and 14.12 years
Women and men	115 and 202
Another gender identity	63
Household size mean and SD	5.18 and 1.41
Monthly income mean and SD	BDT 25,869.21 and 12,516.30
Travel time mean and SD	41.22 and 24.52 minutes
Household chronic illness	160 (42.1%)
Healthcare payment coverage	60 (15.8%)
Household pregnancy	56 (14.7%)

Economic Barriers and Accessibility Responses

Mean responses to the economic-barriers indicators were close to the middle of the five-point agreement scale, and the significant differences were observed among components. The mean of competing essential expenditure was the greatest with a value of 3.174, then 3.095 in transport expenses. The mean of difficulty to afford service charges was 2.984. The means of lost earnings and accompaniment expenses were 2.805 and 2.792, respectively. The world financial-constraint element was with a mean of 3.032. The values suggest that the various constituents of economic hardship existed to different extents within households surveyed.

Means of the accessibility indicators were very close, with a difference of 2.958 when it comes to the ease of getting preventive care when it is due versus 3.005 when it comes to ease of access in general. Setting up of visits was mean 2.976 and access when there was no large amount of practical difficulty was mean 2.997. SDs were around one point of the scale. The trend maintains average accessibility close to a central point of the response and maintains a significant disparity among households. Descriptive averages show the commonness of specific response patterns; the structural analysis distinctively assesses the relationship between the constructs and utilization (Coombs *et al.*, 2022).

Preventive Service Eligibility and Completion

The households with a service due were also different in numbers in the preventive categories. The proportion of screening without current symptoms was 222 households, vaccination was 211, preventive check-ups were 197, separate preventive counselling was 134 and antenatal preventive care was 56. These counts correspond to 58.4%, 55.5%, 51.8%, 35.3%, and 14.7% of the analytical sample. All eligible households within each category were

found to have completion responses. The distribution thus explains the reported completion in those eligible households but not by including these households in the households to which service is not owed.

In the case of vaccination, 48 households eligible received most of the services and 21 received all services, resulting in a total percentage of 32.7%. The resulting composite percentages were 31.1% on screening, 34.5% on preventive check-ups, 25.0% on antenatal preventive care, and 34.3% on counselling. About half had a high response in all the categories, with a high of 26.9% in check-ups to 39.2% in screening. The results, service-specific, indicate that partial completion was typical of various types of prevention, and was not limited to a single service category.

Total use also was distributed similarly. Forty-five households or 11.8% stated that they received none of the services due, and 85 or 22.4% stated they received some. The biggest segment was approximately half with 124 households, or 32.6%. Most (89) and all (37) households contained 23.4% and 9.7 %, respectively. A combination of 33.2% mentioned the most or all services due. On the other hand, 34.2% had none or few. Table 2 shows the household denominators and service specific completion distribution.

Table 2: Preventive service completion among eligible households

Service	Due n	None %	A few %	Half %	Most %	All %
Vaccinations	211	15.6	17.5	34.1	22.7	10.0
Screening without current symptoms	222	9.0	20.7	39.2	24.8	6.3
Preventive check-ups	197	13.7	24.9	26.9	21.8	12.7
Antenatal preventive care	56	8.9	28.6	37.5	12.5	12.5
Separate preventive counselling	134	12.7	21.6	31.3	21.6	12.7

Percentages use observed eligible households within each service category. Half denotes about half.

Reflective Measurement of Accessibility

The weightings of all four accessibility indicators were high and positive. PHA1 loaded at 0.830, PHA2 at 0.860, PHA3 at 0.853, and PHA4 at 0.835. Their bootstrap confidence intervals were not covering zero and the lower bounds were between 0.788 and 0.831. The loadings that are closely clustered are a pointer that the statements acted as contributors to the common accessibility score. The outcome favors the desired expression of general convenience, preparedness, simple arrangements, and realistic access to perceived access to healthcare in the form of perceived ease and preparedness.

Standardized Cronach alpha was 0.866, rho A was 0.869 and composite reliability was 0.909. Average variance extracted was 0.713. These findings, when combined, suggest a high level of internal consistency and shared item variance of the accessibility construct. The results of measurement are used to study accessibility in the structural model as compared to the use of an isolated access statement. Table 3 indicates the individual loadings and confidence interval and the construct-level reliability and convergence statistics.

Table 3: Accessibility indicator loadings

Indicator	Loading	95% bootstrap CI
PHA1	0.830	0.788 to 0.863
PHA2	0.860	0.831 to 0.886
PHA3	0.853	0.819 to 0.879
PHA4	0.835	0.793 to 0.869

Standardized alpha = 0.866; rho A = 0.869; composite reliability = 0.909; average variance extracted = 0.713.

Formative Assessment of Economic Barriers

The indicators of economic-barriers had the variance inflation factors of 1.538 to 1.791. These values state that the formative components were not defined by a high level of linear redundancy. The maximum outer weight was the lost-earnings indicator (0.527) then the service charges (0.329). Their bootstrap confidence intervals were 0.274 0.751 and 0.081 0.557 respectively. Both ranges did not include zero. The respective normal-approximation (probabilities) of lost earnings and service charges were less than 0.001 and 0.007 respectively.

The weights of transport expenses, accompaniment expenses, and competing essential expenditure were 0.077, 0.194 and 0.110, respectively. They had zero in their confidence intervals. The five outer loadings were positive; the highest value of 0.893, to the lowest value of 0.648 and each measure had a significant contribution towards the definition of the dimensions of costs that

were contained in the composite. The dissimilarity between outer weights and item means is pertinent: the greatest average described difficulty was about essential spending, and the greatest conditional formative weight in the estimated composite was lost earnings (Williamson *et al.*, 2020).

A standardized coefficient of 0.636 between the primary economic-barriers score and the independent global financial-constraint criterion was obtained in the redundancy assessment. Its confidence interval was between 0.551 and 0.685 with the R squared of 0.404. This positive correlation demonstrates that the component-based score was related to the overall evaluation of households on financial difficulty. The global item was maintained as a criterion of this independent assessment, maintaining the five-component definition of the primary structural analysis. The formative estimates and their uncertainty are given in Table 4.

Table 4: Formative economic barrier indicators

Indicator	Weight	95% bootstrap CI	VIF	Loading
EB1 Service charges	0.329	0.081 to 0.557	1.723	0.800
EB2 Transport expenses	0.077	-0.196 to 0.342	1.715	0.667
EB3 Lost earnings	0.527	0.274 to 0.751	1.705	0.893
EB4 Accompaniment	0.194	-0.082 to 0.453	1.791	0.741
EB5 Essential expenditure	0.110	-0.160 to 0.366	1.538	0.648

Direct Associations and Hypothesis Testing

There were low structural collinearity results. The inner variance inflation factor of the accessibility equation was 1.000 of economic barriers whereas the utilization equation showed the value of 1.194 of economic barriers and accessibility. The model thus approximated the two associations of utilization without noticeable collinearity among the predictor scores. The estimated structural relationships, both in standardized coefficients and the explained variance of each endogenous variable, are shown in Figure 2.

Overall preventive utilization conditioning on accessibility had a negative economic barrier relationship. It had a coefficient of -0.212, bootstrap standard error = 0.053 and a 95% confidence interval between -0.321 and -0.113. This finding helps in supporting H1. Accessibility was also negatively correlated with economic barriers, the coefficient was also -0.403, standard error 0.041 and the confidence interval of -0.490 to -0.330, which gives support to H2. Among the three direct relationships, the absolute standardized coefficient of the barrier-to-accessibility relationship was the largest.

Utilization was positively related to accessibility subject to economic barriers. The coefficient was estimated to be 0.267, having a bootstrap standard error of 0.050 and a confidence interval of 0.165-0.359. This result supports H3. All three direct relationships had a probability of normal-approximation less than 0.001. The estimates interpreted together reveal that higher economic barriers were associated with lower utilization and lower accessibility, and with higher accessibility, they were associated with higher utilization (Kilchenstein *et al.*, 2022). These conditional relationships are consistent with the offered conceptual structure and are not confused with the indirect association that is considered subsequently.

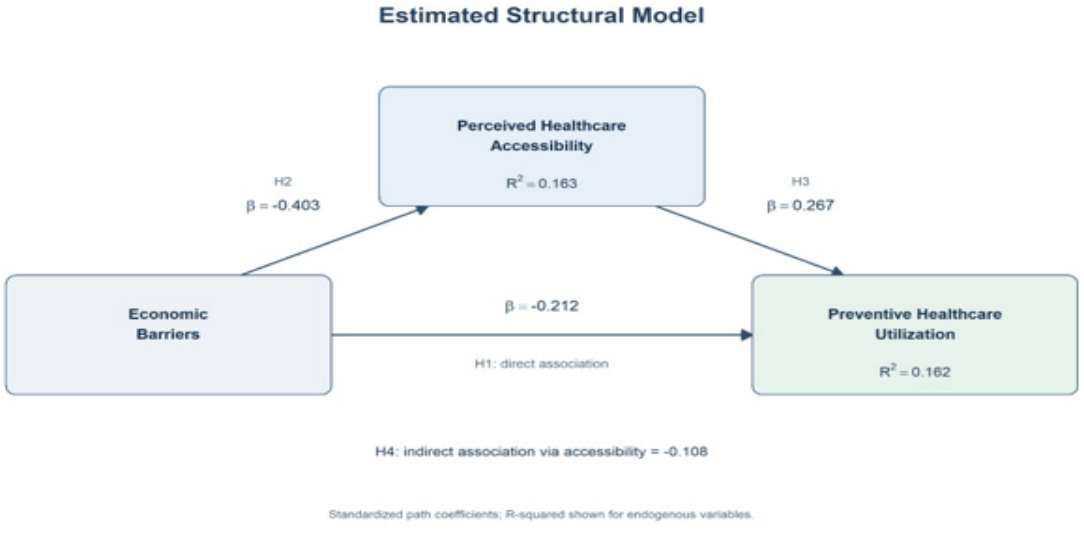


Figure 2: Estimated structural model with standardized path coefficients and explained variance

Table 5: Structural relationships and hypothesis decisions

Hypothesis	Relationship	β	95% bootstrap CI	p	Decision
H1	EB → Utilization, conditional on PHA	-0.212	-0.321 to -0.113	< 0.001	Supported
H2	EB → PHA	-0.403	-0.490 to -0.330	< 0.001	Supported
H3	PHA → Utilization, conditional on EB	0.267	0.165 to 0.359	< 0.001	Supported
H4	EB → PHA → Utilization	-0.108	-0.158 to -0.065	< 0.001	Supported

EB denotes economic barriers and PHA denotes perceived healthcare accessibility. Estimates use 10,000 successful bootstrap replications. Reported probabilities use the normal approximation.

Indirect Association and Explained Variance

The indirect relationship between economic barriers and utilization in terms of accessibility was -0.108. Its bootstrap standard error was 0.024 and the confidence interval was/or between/less than -0.158 and less than -0.065. The range on zero was omitted which favors H4. Associations were negative both directly and indirectly and the overall association was -0.320 with a confidence interval of -0.418 to -0. 235. The trend correlates with complementary partial statistical mediation: the availability explained an indirect route and a distinct conditional relationship between economic obstacles and use existed.

The indirect estimate was to a good part (almost 33.7 %) of the whole estimated association. This ratio is a description of decomposition in the fitted model and is not a share of preventable illness or expected benefit of an intervention. The accessibility has a R squared = 0.163, adjusted R squared = 0.160. The total use was with an R squared of 0.162 and adjusted value of 0.158. The model was thus able to explain about one sixth of the variance of each endogenous score.

Economic barriers had a score-regression effect size of 0.194 in the equation of accessibility. The effect sizes of economic barriers and accessibility were 0.045 and 0.071 respectively in the utilization equation, where the primary scores remained constant. These values solidify the differentiation between the relatively strong association between barrier-to-accessibility and independent contribution of both predictors to utilization. The overall outcome substantiates a hypothesis wherein financial limitations apply to preventive participation via multiple than one statistical path.

Prediction and Sensitivity Results

Recurring held-out assessment resulted in an RMSE of 1.064 and MAE of 0.870 of the score-regression forecast. Training-mean benchmark gave the RMSE of 1.152 and MAE of 0.902. The tradition Q squared compared to that benchmark was 0.146. The result of the manifest-indicator linear benchmark generated an RMSE of 1.067 and an MAE of 0.876. Therefore, the score-based method performed better than the training mean in prediction and a bit lesser errors than the manifest-

Table 6: Predictive assessment and adjusted sensitivity estimates

Assessment	Economic barriers or RMSE	Accessibility or MAE
PLS held-out prediction	1.064	0.870
Training-mean benchmark	1.152	0.902
Manifest-indicator benchmark	1.067	0.876
Adjusted linear coefficient	−0.217	0.262
Adjusted ordinal odds ratio	0.650	1.663

First three rows report RMSE and MAE. Last two rows report economic barriers and accessibility, respectively. Prediction used ten folds and five repeats; custom Q squared versus the training mean was 0.146. Adjusted models included education, household size, chronic illness, coverage, and travel time.

indicator in the reported repeated test.

Education, household size, chronic illness, coverage, and travel time were adjusted to conserve the key linear relationships. The adjusted coefficient of economic barriers was 0.217 and in the confidence interval 0.319-0.115. Interpreted value Accessibility was adjusted by 0.262 but the confidence interval was 0.158 to 0.366. They both were statistically different to zero. The extra covariates reported in the adjusted model were found to have confidence limits that crossed the zero. When they were included, they did not make much difference in the two associations that are at the heart of the conceptual

framework.

The directions of association were also maintained in the ordinal sensitivity analysis. The odds ratio of economic barriers was 0.650 with confidence interval ranging between 0.530 and 0.798 and accessibility odds ratio was 1.663 with 1.351 to 2.047 confidence interval. These findings characterize the given proportional-odds specification and are considered as the evidence of sensitivity. In the primary model, adjusted linear analysis, and ordinal specification, the higher the barriers, the less utilized and the higher the accessibility the higher the utilization. Table 6 is a summary of predictive and adjusted estimates.

Discussion

Economic Constraints and the Completion of Prevention

The findings provide a consistent correlation of economic barriers in the households and preventive healthcare use. Stronger barriers were associated with lower completion of services due even after perceived accessibility was included. This discovery puts the allocation of resources in households at the heart of the empirical explanation. Preventive care involves spending and time which has to be synchronized with other commitments (Akhtar *et al.*, 2022). The negative direct coefficient implies the score of the barrier had information on the utilization beyond the overall evaluation of the household of the feasibility of the access.

The specifications of the service elucidate the behavioural context of such a relationship. In the case of vaccinations, screening, check-ups, antenatal prevention, and counselling, most of the qualified families indicated that they had done parts (Rasekaba *et al.*, 2022). All in all, just a third of them cited receiving most or all preventive services as a result. Prevention in this sample was often therefore often a question of degree as opposed to a mere fact of distinction between any use and no use. A family might engage in certain services and fail to fulfill its complete preventive needs. This continuum is given in the ordered result and provides completeness to the analysis compared to need.

The outcome of the component results also differentiates between the prominence of a detailed hardship and its position in the predicted composite. The item means of essential expenditure and transport were the greatest, and the lost earnings and service charges were those with a clearest conditional formative contribution (Ito *et al.*, 2022). This trend indicates that a measurement which solely relies on average agreement will give a variation with the measurement model. The two approaches are complementary, the descriptive means describe the frequently reported pressures, and the formative weights show how the elements work together to form the estimated barrier score.

The aspect of lost earnings warrants extra consideration to the interpretation of the economic aspect of prevention. Absence of work is a resource allocation even in the absence of making payment to the health practitioner. A visit comes with a cost of economic burden in terms of interruption of productive activity (Conrad & Ronnenberg, 2022). The high importance of the lost-earnings weight is in line with the significance of considering household cost of time together with direct charges. It does not define an occupation-specific relation, yet it favours incorporation of livelihood compatibility in the organization of preventive services provision.

Accessibility as a Statistical Pathway

The direct correlation between economic barriers and accessibility was the strongest negative one in the model. This finding relates financial strain to the family thinking that preventive care is easy to acquire (Moser & Beiruti, 2023). Accessibility would be more informative on the understanding of the circumstances involved in attaining care, such as the arrangements of transport, when the visit will occur, and coordination of the visit. Financial difficulty and practical access were measured in a systematic relationship, although separately, as demonstrated in the model. Their association justifies a combined explanation of the state of affairs with regard to preventive participation.

Utilization also was positively conditionally correlated with accessibility. A family that felt that services were more readily available was more likely to report more complete prevention at a given level of the estimated barrier score. This discovery provides service organization with a distinct spot in the explanation (Houghton *et al.*, 2023). It proposes that pragmatic arrangements can have a role even where economic pressures are already factored in. The positive correlation can be aligned with the hypothesis that facilitating prevention need into completed services through simple scheduling, easy travel, and guaranteed availability is possible.

These findings are united with the help of the supported indirect association. Lower utilization was attributed to economic barriers that were associated with the low accessibility (Ibitoye, 2022). This pathway accounted around a third of the overall fitted association. Meanwhile, the direct correlation was still negative and statistically significant. The correct interpretation is thus of complementary rather than complete statistical mediation of the pathways (Deng *et al.*, 2022). The role of accessibility helps in explaining the relationship between the financial and barrier dimension and excludes an independent relationship that could depict the household allocation requirements implied by the indicators of the barriers.

This interpretation is useful in practice as various service alterations focus on different elements of the observed pattern. The visit arrangements that are easier to make are probably the ones that are most aligned with the accessibility aspect, whereas the dimension of expenditure and livelihood manifested by economic barriers is tackled by a financial support. The results indicate the need to take these measures into account in the development

of rural prevention programmes (Coste & Bousmah, 2023). The empirical coefficients are cross-sectional correlations; the suggested service reactions are policy suggestions based on the trend instead of quantifiable effects of actions executed in the surveyed households.

Measurement and Analytical Contributions

The difference between formative barriers to the economy and reflective accessibility augments the conceptual formation of the analysis. Financial stresses are associated with various causes, and they do not have to flow constantly in the same direction among households. Photographing them as elements preserves the substantive breadth of the barrier construct. In contrast, accessibility statements convey associated evaluations of perceived pragmatic ease and demonstrated significant common variance. By constructing the empirical model using varying measurement specifications to the constructs, the model is responsive to the meanings of the constructs instead of having unified measurement structure to similar concepts.

The measure of utilization contributes the aspect of service eligibility to the completion measure. A home which lacked antenatal care due should not be regarded as having failed to receive antenatal prevention. Similarly, a completed service due is not the same as partial completion of a series. These differences are maintained by the routing rules of the questionnaire and the overall item of completion (Al-Zubayer *et al.*, 2023). This method aids in considering utilization as achievement of pertinent preventive care and not merely the number of various types of services that a respondent indicated.

Implications for Rural Preventive Healthcare

Addressing the full household cost of a visit

The results help to evaluate the preventive affordability based on the full household price of accessing care. Possible resources are service fees, transportation fees, accompanying expenses, lost income and competing needs. This structure can be used by programme planning to determine areas that can be funded. Only provider-limited assistance can leave households with hefty bills in other areas of the visit. A home-based assessment must then inquire as to what needs to be paid, whose time is to be requested and what other duties should be restructured.

The high contribution of lost-earnings helps to take into consideration the timing of appointments, and the duration of the visit along with the financial assistance. Reduced or substituted working hours, scheduling, and predictable times can be the approaches to minimizing work-related conflict. Where multiple individuals in a household need preventive services, scheduled visits can help decrease the time and travel requirements (Sulku *et al.*, 2023). These are service design implications and not tested programme effect implications. Their applicability is due to the quantified elements of the economy and the validated correlation between the general barrier score and preventive finish.

Making Accessibility Operational

The concept of accessibility could be converted to concrete operational questions. Are households able to recognize when a service is available, access it with the help of available transport, make arrangements to attend, and get the service when it is time? The four items of accessibility offer a brief means of keeping track of these experiences. Service managers are able to measure changes in these responses in comparison to attendance records and completion indicators. The administrative access and the family experience of access to care to a facility can then be evaluated jointly when discussing preventive service provisions.

The outreach and local coordination are specifically applicable alternatives to the service mix as outlined by the respondents. The usual sources of prevention were represented by community clinics, government facilities, nongovernmental providers, and outreach services (Wright *et al.*, 2021). The cross-setting of the locations may assist the households with finding a proper service point and prevent the excessive trips. Arrangements can also be made with clear communication regarding service days, eligibility and preparation requirements. The main idea is to plan the prevention in terms of the chain of activities that households should accomplish, not the elements of consultation.

Monitoring Completion and Aligning Support

Prevention planning needs to consider the two aspects of planning, namely, financial support and enhancement of practical access. The negative direct and indirect relationships suggest that the two constructs do not completely replace each other in the estimated model. A systematic study can thus be used to look at whether or not households are getting the right financial help and whether the services arrangements in place are viable (Mulyanto *et al.*, 2020). This combined focus has been rationally explained in the study. Follow-up programme assessment can follow expenditure pressures, perceived accessibility and service completion jointly to determine whether the intended changes are linked with enhanced household involvement.

CONCLUSION

The consumption of preventive healthcare among 380 rural households, that were selected in this study, was negatively related with economic barriers. Perceived healthcare access was found to be negatively correlated with economic barriers, and positively associated with utilization. The undesired non-directional relationship via accessibility gave support to the assumed statistical mediation pathway, whereas the rest of the direct relationship was a complementary relationship between monetary constraints and preventive completion. The

reported bootstrap confidence intervals supported all of the four hypotheses.

The results recognize domestic financial capability, the price of time, and a sensible structure of services as interrelated in country prevention. Formative roles included substantial contributions of lost earnings and service charges, and the accessibility measure proved to be very reliable and agreed upon variance of indicators. The principal pattern was supported by predictive analysis and sensitivity analysis that was modified. Planning Rural preventive healthcare should then take care of the entire family expenditure of getting care and simplify service arrangements. The alignment of the financial support with the practical accessibility provides a logical answer to the relations reported in this research.

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