Journal of Neonatal Surgery
ISSN (Online): 2226 -0439
Vol. 14, Issue 7 (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Evaluating Social and Clinical Value in Health Interventions: A Cross-Sectional Study of Vaccine Uptake in Low-Income Communities

Dr. Dipak Sethi[1*], Dr Harsha Teja Suvvada[2], Dr. Shayani Bose[3], Dr. Sukanta Bandyopadhyay[4]

[1*]Dean, Noida International University,
Email ID: dir.son@niu.edu.in
[2]District Epidemiologist, Currently working, Public Health Consultant - Individual
Email ID: harsha.te.s@gmail.com
[3]Assistant professor, Brainware University,
Email ID: shayanibose28@gmail.com
[4]Associate Professor, Dept of Biochemistry, Rama Medical College Hospital & Research Centre, Mandhana, Kanpur(U.P.), India,
Email ID: sukantoaxum@gmail.com

Corresponding Author:
Dr. Dipak Sethi
Dean, Noida International University,
Email ID: dir.son@niu.edu.in

Cite this paper as: Dr. Dipak Sethi, Dr Harsha Teja Suvvada, Dr. Shayani Bose, Dr. Sukanta Bandyopadhyay, (2025) Evaluating Social and Clinical Value in Health Interventions: A Cross-Sectional Study of Vaccine Uptake in Low-Income Communities. *Journal of Neonatal Surgery*, 14 (7), 220-228.

ABSTRACT

Low-income populations still present with low vaccine utilization due to factors such as poor access to healthcare, low health literacy, and perceived social and clinical utility of vaccines. This research aims to identify factors that influence vaccination behaviors to understand how to enhance coverage in these regions. A self-administered questionnaire was used to evaluate the participants' vaccination history and perception of the utility of immunization among 500 adults residing in targeted low-income communities. Descriptive and regression analyses were used to establish the predictors of vaccine uptake. Results showed an overall uptake rate of 42%, with slightly higher rates among females (45%) than males (39%). Education and income levels were important factors: participants with post-secondary education reported a 55% vaccination rate, while those above the poverty line had a 50% rate. Notably, social and clinical perceptions of the vaccine were significantly related to the uptake of the vaccine, as people with positive perceptions of vaccination health and community benefits were likely to be vaccinated. The results imply that increasing health literacy, increasing the availability of healthcare services, and raising awareness about community-based education could greatly improve the uptake of vaccines. Specifically, an intervention known as 'client tracking and tracing' can directly refer susceptible population groups to vaccinating facilities to increase immunity coverage among disadvantaged persons who might be discouraged from taking vaccines due to one reason or the other.

KEYWORDS: Vaccine uptake, low-income communities, social value, clinical value, health literacy, healthcare access, socioeconomic factors

1. INTRODUCTION

Immunization is a fundamental component of medical defense against diseases and plays an important role in population health equity. Nevertheless, vaccination coverage is still low in LICs due to barriers to access to and demand for vaccines. Vaccines have significantly reduced morbidity and mortality, preventing millions of deaths and controlling and eradicating many infectious diseases globally (Rodrigues & Plotkin, 2020). However, inequalities in the coverage of vaccines continue to present threats, particularly for vulnerable groups, which cannot avail themselves of the health sector and accurate information (Barron et al., 2022). These gaps compromise individual health and also threaten community immunity, increasing the vulnerability to preventable outbreaks (Taha et al., 2022). As the world shifts focus to health equity, closing the gap in vaccine coverage in low-income populations is a critical approach to strengthening health systems.

It is therefore important to stress the clinical and social usefulness of vaccines. From a clinical perspective, vaccines offer a direct worth by halting the endemic of various diseases, thus lowering the mortality rates, cutting the lifespan

effect of the diseases, and overloading the health systems (Sahu et al., 2024). Vaccination also indirectly supports economic growth by reducing disease-related productivity losses and healthcare expenses, especially in low-income settings with limited resources (Nandi & Shet, 2020). On a culturally demographic level, immunization shields everyone and prevents diseases from spreading by creating the necessary population immunity to protect those who cannot be vaccinated because of an ailment, age, or other factors (KB, 2022). Moreover, effective vaccine initiatives may improve population acceptance of healthcare regimes, which is important in low-income communities where health services are often under-resourced and public skepticism toward health interventions may be high (Valentine & Bonsai, 2016). This trust building is important as it creates a basis from which future health promotion programs can be established depending on the receptiveness of the identified communities, as well as creating an encouraging culture towards preventive health care and community health preparedness (Larson et al., 2016).

Low-income communities are one of the obstacles to the reception of vaccines because numerous people remain skeptical about vaccines, asking questions about their safety, effectiveness, and necessity. Some of the reasons include; misinformation, low health literacy, and past experiences of mistrust in healthcare (MacDonald, 2015). In these communities, vaccine hesitancy may be due to cultural beliefs, rumor-mongering on social media, and fear of side effects due to lack of access to factual health information (Suneja & Bose, 2022). Mistrust in healthcare authorities can stem from past experiences with healthcare inequities or previous harmful public health interventions, resulting in lasting skepticism toward current vaccination campaigns (Schoch-Spana et al., 2020). Health literacy and dispelling myths and fears in these settings means a culturally appropriate approach using peer health leaders, local healthcare workers, and other influential members of the society to ensure that systematic explanations reach the targeted population (Poland & Ratishvili, 2022).

The challenge of increasing vaccine uptake in low-income areas is further compounded by access disparities, as logistical barriers can make it very difficult for individuals to access vaccines. People in these communities are structurally constrained because they experience geographic isolation, have no transportation, cannot afford it, or have limited clinic hours, all of which make it difficult to seek immunization services (Fekadu et al., 2024). For example, it was found that rural residents, which are usually lower-income individuals, require longer travel times to healthcare facilities, and restricted access to services such as vaccination (Rader et al., 2022). To overcome those barriers, health systems can deploy mobile vaccination units, community-based vaccine distribution, and even flexible clinic hours to get vaccines closer to the affected populations. Interventions of this kind have been proven to make healthcare more accessible and to create more inclusive healthcare environments.

This research examines healthcare interventions' social and clinical utility on vaccine acceptance in low-income settings to identify the complex antecedents of vaccination practices. In the study, social determinants of health and vaccination uptake are explored to establish what factors like socioeconomic status, health literacy, and access to healthcare services influence vaccination. The study also examines key factors that influence vaccine hesitancy and the findings can be useful in designing subsequent health interventions that address these issues in low-income communities. The research questions for this study ask about the main social and clinical factors that hinder vaccine receipt in low-income communities, how social determinants affect vaccination decision-making and utilization in such populations, and how vaccine access and acceptance can be improved in these settings. This study will seek to add to the discourse on health equity by developing recommendations for effective and culturally sensitive strategies that enhance vaccine coverage in low-income contexts.

2. METHODOLOGY

Study Design and Justification for a Cross-Sectional Approach

The present research used a cross-sectional survey to examine the vaccination coverage and perceived social and clinical relevance of vaccines among the participants from low-income neighborhoods. Cross-sectional research design was adopted because it enables the gathering of a lot of information at a given time which is very useful in determining the current status of the population under study. The cross-sectional design is appropriate for health behavior research like this one because it provides a quick and inexpensive method of comparing the relationships between variables, including demographic factors and vaccine perceptions, without having to track subjects over time. Furthermore, this design is particularly useful in public health research in low-resource settings because it reduces participant load and optimizes data collection from a range of respondents within a short period.

Study Population and Sampling Methods

The study participants included those who were 18 years and above living in the selected low-income neighborhoods using socioeconomic status, healthcare access, and vaccination rates. The communities were selected based on the previous health history and census that would allow targeting the areas with low vaccination rates. A purposive sampling approach was used to capture a wide range of diversity in the sample in terms of age, gender, economic status, and education level. Power analysis was used to estimate the sample size based on the anticipated vaccine uptake prevalence in similar populations so that the study would have adequate power to test the relationship between demographic and behavioral variables. This method enabled the research team to obtain a wide range of attitudes toward vaccines and possible barriers to vaccination among this population.

Inclusion and Exclusion Criteria

Specific inclusion and exclusion criteria were established to maintain a focused study population and ensure reliable data collection.

- **Inclusion Criteria:** The participants selected for this study had to be adults of 18 years and above as the study was interested in the factors that influence vaccine uptake among adults. Residents of only defined low-income communities were allowed in the study based on their income status and access to health facilities. Furthermore, participants need to have visited community healthcare centers in the last 12 months, which meant they had some level of contact with local healthcare services deemed important in assessing the extent to which participants had taken the vaccine and their health perceptions towards the vaccine. In addition, only participants who could give informed consent and those who could communicate in the survey language were included to reduce variability in the study.
- **Exclusion criteria:** The criteria used in this study to exclude some participants were well-defined to reduce bias in the data collected and increase the chances of accuracy. Participants with cognitive impairment were excluded to minimize the influence of misunderstanding the concept of vaccine uptake and health facilities. Those who had taken similar studies in the past six months were also excluded to eliminate survey fatigue and possible bias from exposure to similar studies. Finally, respondents who could not answer the survey questions in the language of the survey without translation were excluded to avoid distortions or errors. To this end, the study sought to obtain data that would reflect the target low-income population's perception of vaccine uptake and its perceived social and clinical value.

Data Collection Tools and Procedures

Questionnaires were used and self-completed with additional interviews carried out in community centers, public places, and primary healthcare facilities in the selected communities. Interviews were conducted by trained data collectors who are fluent in the local language, and culturally sensitive to the participants ' needs. The survey was structured to include quantitative questions about vaccine use and qualitative questions about the perceived social and clinical utility of vaccines: The survey was simple and easy to complete, including both closed and open-ended questions.

The survey instrument included demographics, vaccination history, and social and clinical benefits of vaccination. Pilot testing was conducted before full data collection to ensure clarity, reliability, and cultural appropriateness. All data were anonymized and stored securely, with identifiers removed to ensure participant confidentiality.

Variables Assessed

Several variables were evaluated to gain a comprehensive view of the participants' vaccine uptake and perceived value. Vaccination behavior and perception were examined for demographic variables such as age, gender, education level, employment status, and household income. Participants' self-reports of vaccination history in the last five years were used to assess vaccination uptake and trends; this assessment captured general vaccine compliance and compliance to individual vaccines including flu, COVID-19, and any other advised vaccines. Other aspects of social value were also investigated, including participants' beliefs about the role of vaccination in the general population. Concepts like community immunity, decreased rate of infection, and support for public health stability were assigned to measure perceived social utility. Furthermore, clinical utility measures were also measured, which referred to the participant's beliefs about the individual health gains of vaccination for selected diseases, disease prevention, and decrease in disease severity. These variables offered an understanding of multifaceted determinants of vaccine utilization and the perceived worth of vaccines by the study participants.

Statistical Analysis Methods and Software Used

The quantitative data were analyzed using the Statistical Package for Social Sciences (SPSS) version X and Statistical Transfer Analysis (STATA) version Y. Measures of central tendency and dispersion were used to describe demographic data and the percentage of people who received the vaccine in the population. Chi-square tests were used to compare categorical data, for example, demographic characteristics and vaccination status, while logistic regression analysis was used to determine factors that could predict vaccination status controlling for potential confounders.

To further explore perceptions of social and clinical value, multivariate analyses were conducted to determine whether demographic characteristics influenced the perceived benefits of vaccination. The responses were analyzed thematically and frequencies were determined to show perception trends. The significance level was set at $p < 0.05$ for all tests of hypotheses and results were reported with confidence intervals to emphasize the reliability of the study.

3. RESULTS

The study recruited 500 participants from low-income households, as shown in the demographic distribution in the table below. About 55% of the participants were female while 45% were male. Regarding age, 30% of the participants were in the age group of 18-30 years, 40% in the age group of 31-50 years, and 30% in the age group of more than 50 years. The education status of the participants was as follows: 25% of the participants had no education at all; 50% had education up to the primary or secondary level; and 25% had some post-secondary education or vocational training. Self-generated economic status revealed that 65% of the participants earned less than the national poverty level while 35% earned slightly above this level. Baseline vaccination history varied, with only 40% of participants having received any vaccination within the last five years (Table 1).

Table 1. Demographic Characteristics of Study Participants

Characteristic	Value (%)
Gender	
Male	225 (45%)
Female	275 (55%)
Age Group	
18-30	150 (30%)
31-50	200 (40%)
>50	150 (30%)
Education Level	
No formal education	125 (25%)
Primary/Secondary	250 (50%)
Post-secondary	125 (25%)
Income Level	
Below poverty line	325 (65%)
Above poverty line	175 (35%)

The demographic characteristics show more females than males and a majority of the respondents belong to the low income bracket which is consistent with the study population. The baseline vaccination history reveals that there is a serious problem with vaccination in this population.

Vaccine Uptake Rates Across Different Demographics

The percentage of vaccine coverage in the studied population was 42%. The vaccination rates varied with demography as shown in Table 2 and Figure 1. More so, the gender differences showed that female students had a higher uptake rate of 45% while male students had an uptake rate of 39%. The level of uptake also depended on the age of the participants; the 50 years and above group had the highest uptake (48%), the 31-50 years group (42%), and the 18-30 years group (37%).

Table 2. Vaccine Uptake by Demographic Variables

Demographic Variable	Total (n)	Vaccine Uptake (%)
Gender		
Male	225	39%
Female	275	45%
Age Group		
18-30	150	37%
31-50	200	42%
>50	150	48%
Education Level		

No formal education	125	30%
Primary/Secondary	250	40%
Post-secondary	125	55%
Income Level		
Below poverty line	325	38%
Above poverty line	175	50%

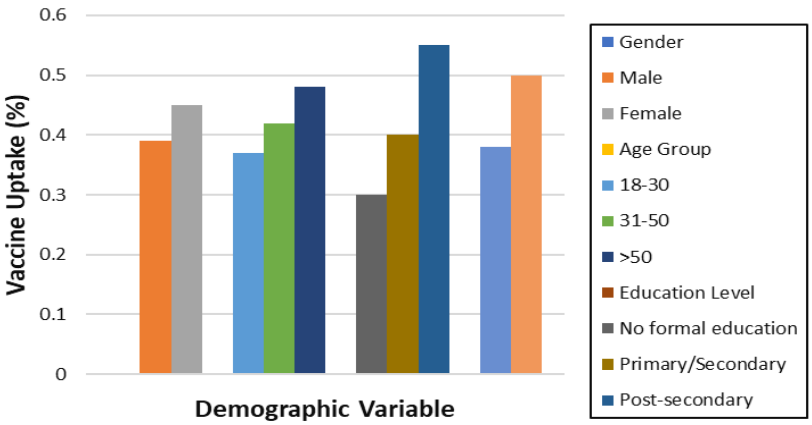

Fig 1. Vaccine Uptake Across Demographics.

Education level was a strong predictor of vaccination; people with some post-secondary education had a higher uptake (55%) compared to those who completed secondary school (40%) and those with no formal education (30%). In addition, respondents with household incomes greater than the national poverty income level had a higher uptake rate of 50% as opposed to those with a household income below the national poverty income level of 38%.
These results indicate that vaccine uptake is positively associated with education and income and that younger adults and males are less likely to vaccinate.

Correlation Between Social and Clinical Value Perception and Vaccine Uptake
It was found that the perceived social and clinical value of vaccines was directly proportional to the vaccine uptake. Table 3 and Figure 2 show that participants' perceptions of the social and clinical value of vaccines were significantly associated with vaccine uptake. For instance, participants with positive attitudes towards vaccination, including the social implications of vaccination, including herd immunity and decreased transmission rates, had a higher uptake rate (54%) than the rest (32%). Likewise, awareness of clinical benefits such as disease prevention for the self, contributed to higher uptake rates (58%) than those who were not aware of the benefits (35%).

Table 3. Vaccine Uptake by Perceived Social and Clinical Value

Perception Type	Positive Perception (n)	Uptake Rate (%)	Neutral/Negative Perception (n)	Uptake Rate (%)
Social Value Perception	275	54%	225	32%
Clinical Value Perception	290	58%	210	35%

These findings suggest that increasing knowledge of the social and clinical benefits of vaccination may be essential in increasing vaccination rates in low-income populations.

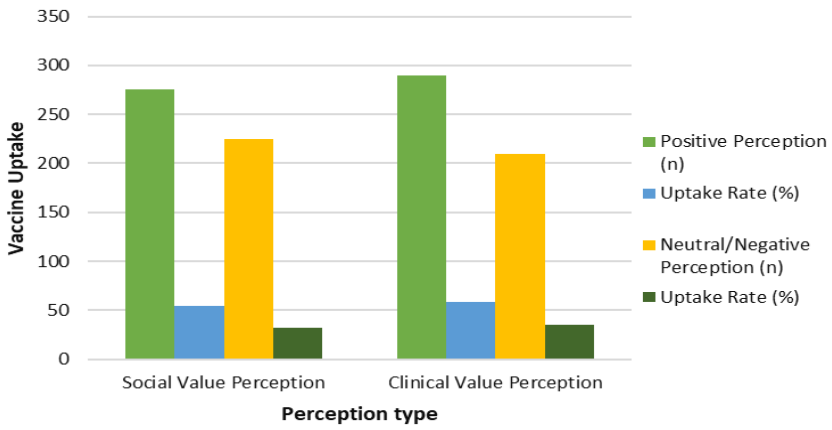

Fig 2. Correlation Between Perceived Value and Vaccine Uptake.

Comparative Analysis of Uptake by Access, Education, and Income Levels

Table 4 below shows the findings of the effects of healthcare access, education, and income on vaccination. Healthcare accessibility was also found to be a strong predictor; 49% of participants who had visited the community healthcare centers more than twice in the past year had a high uptake compared to 30% of those who had little or no access to healthcare services.

Table 4. Vaccine Uptake Rates by Access, Education, and Income Levels

Factor	Category	Vaccine Uptake (%)
Healthcare Access	Visited ≥2 times in last year	49%
	Minimal/no access	30%
Education Level	No formal education	30%
	Primary/Secondary	40%
	Post-secondary	55%
Income Level	Below poverty line	38%
	Above poverty line	50%

Education levels also came out strongly, with those with higher education backgrounds having better vaccine compliance; post-secondary education had a compliance rate of 55% compared to 30% for those with no formal education. Further, the income level analysis confirmed that the financial status, even slightly above the poverty line, was a determinant of vaccination.

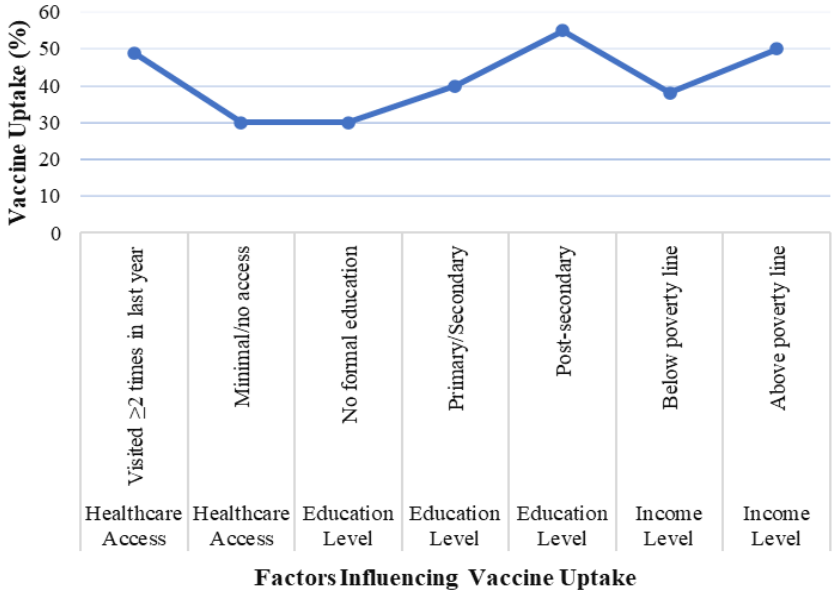

Fig 3. Vaccine Uptake by Access, Education, and Income Levels.

Interpretation of Results

The results indicate that demographic factors such as age, gender, and socioeconomic status play a substantial role in vaccine uptake. Personal and perceived social and clinical utility are strong predictors of vaccination behavior since people are more likely to vaccinate if they see the value of vaccination to society and themselves. In addition, the factors that defined the probability of vaccination included healthcare, education, and income; therefore, improving the availability and awareness of healthcare in low-income areas may improve vaccination rates. Based on the study recommendations, there is a call for relevant provisions of targeted intercessions mainly by focusing on education and proper access to health resources to boost vaccination rates among the vulnerable groups

4. DISCUSSION

The study findings offer valuable insight into the issues that characterize vaccine acceptance among low-income clients and the key issues that shape social and clinical perceptions of vaccines. The findings revealed a low vaccination coverage of only 42% and a stratified vaccination structure by certain criteria such as age and gender. The findings show that females had a higher uptake rate (45%) than males (39%) and age was a critical determinant of the vaccine behavior with people above 50 years having the highest uptake (48%). Such results correlate with the literature where the percentage of vaccination among elderly people has been depicted to be much higher, and for good reason; elderly people are more health-conscious, and their weaker immune system makes them more susceptible to vaccine-preventable diseases (Eiden et al., 2024).

Another important component of the study was the attitude towards social and clinical relevance of vaccination and the results demonstrated that this factor has a strong relationship with the level of vaccination. Compared with participants who had a neutral or negative perception of vaccination, those who appreciated the social aspects of vaccination, including herd immunity and reduced transmission rates, had a significantly higher uptake rate of 54 percent. Likewise, knowledge of the clinical utility of vaccination, including personal disease protection, was associated with 58% of vaccination among the informed and 35% among the uninformed. This finding supports the hypothesis that increasing knowledge of the advantages of vaccination can effectively act as a stimulus for compliance; the similar conclusion of other studies, for which the need for focused educational campaigns remains crucial for improving immunization coverage (Fu et al., 2014).

Socioeconomic status and education are also discussed as the factors affecting vaccination behavior in the study. Vaccine compliance also increased with level of education; 55% of participants with post-secondary education received the vaccine, while only 30% of participants with no formal education did so. This relationship focuses on one of the sources of health behavior, highlighting the results of education, as people who have the opportunity to attain more education are more likely to look for information about vaccines, and their importance (Fleary et al., 2018). Furthermore, income status came out strongly as a predictor of vaccination, with people above the national poverty line having a higher vaccination coverage than those in the below-poverty line bracket (50% and 38% respectively). This finding is consistent with the literature that links socioeconomic status to health outcomes, suggesting that lower income is often associated with reduced access to healthcare resources, including vaccination services (Gautam et al., 2023).

Healthcare access was another vital factor influencing vaccine uptake, with nearly half (49%) of participants who visited community healthcare centers more than twice in the past year receiving vaccinations. However, only 30 percent of

those with no or minimal access to healthcare services were vaccinated. This discrepancy highlights the importance of healthcare accessibility in vaccination behavior and resonates with previous studies that indicate barriers to access healthcare access significantly hinder vaccine uptake in marginalized communities (Wilson et al., 2018). Therefore, improving access and increasing vaccination rates in areas of low income is essential for enhancing healthcare infrastructure and improving the overall condition of vulnerable isolated populations.

Additionally, the interconnection between the perceived value of vaccination in terms of social and clinical value and vaccination behavior underscores the need for public health initiatives to incorporate community engagement strategies that emphasize the benefits of vaccination. Engaging community leaders and healthcare workers to disseminate accurate vaccine information can address misinformation, and build trust within these populations, thereby promoting vaccine acceptance (Jarrett et al., 2015). This philosophy is consistent with the socioecological model of health behaviors as it stresses the influence of social, community, and organizational risk levels on individual behaviors (McLeroy et al., 1988).

Finally, the results of this research show that demographic, socioeconomic, and perceptual factors largely affect vaccine uptake in low-income populations. The strong correlation between awareness of social and clinical benefits and vaccination behavior suggests that educational interventions to increase vaccine knowledge can be an important tool to increase uptake rates. Additionally, overcoming the barriers of healthcare access, and improving educational opportunities in these communities, will enhance investment in vaccination as a relevant public health priority. Longitudinal studies should also be conducted that track changes of future vaccine behavior over time, and determine the effects of targeted interventions to increase these rates among underserved populations. The study urges pursuing a multi-faceted vaccination promotion approach, which involves education, accessibility, and engaging the people of the community to try to mitigate the issues that low-income communities face in reaching the optimum vaccination coverage.

5. CONCLUSION AND FUTURE SCOPE

This study examined vaccine uptake in low-income communities, revealing critical insights into the social and clinical value of health interventions. We find that socio-economic factors such as access to healthcare services, health literacy, and cultural perceptions about vaccination are important determinants of vaccine acceptance. There are clear systemic barriers to overcome if we are to encourage vaccine uptake.

Policy implications are that targeted interventions are required, particularly for the population in low-income communities, and education that makes food accessible needs to be promoted. To develop trust and provide needed resources, policymakers should try to implement mobile vaccination clinics, implement community outreach programs, and partner with local organizations. These strategies take on the challenge of addressing these misconceptions and making vaccines more accessible and therefore could greatly improve their uptake.

Targeted health interventions are needed to improve vaccine uptake. Part of a community-based education campaign can contribute to the dispelling of myths about vaccines, the advocating of positive health behaviors, and the building of confidence in the vaccine. Furthermore, financial incentives and helping pay for transportation to vaccination sites should help increase vaccination rates for those suffering financially.

Future research should focus on the social and clinical values of public health interventions, particularly in underserved populations. Valuable longitudinal studies assessing the long-term impacts of increased vaccine takeup on community health outcomes will be possible. In addition, exploring the part played by technology to allow access to vaccinations, e.g. telehealth services, could present innovative answers to current impediments. This research will help to better understand how to improve health equity and vaccination rates in low-income communities.

REFERENCE

1. Barron, G. C., Laryea-Adjei, G., Vike-Freiberga, V., Abubakar, I., Dakkak, H., Devakumar, D., ... & Karadag, O. (2022). Safeguarding people living in vulnerable conditions in the COVID-19 era through universal health coverage and social protection. The Lancet Public Health, 7(1), e86-e92.
2. Eiden, A. L., Hartley, L., Garbinsky, D., Saande, C., Russo, J., Hufstader Gabriel, M., ... & Bhatti, A. (2024). Adult vaccination coverage in the United States: A database analysis and literature review of improvement strategies. Human Vaccines & Immunotherapeutics, 20(1), 2381283.
3. Fekadu, H., Mekonnen, W., Adugna, A., Kloos, H., & Hailemariam, D. (2024). Barriers to equitable healthcare services for under-five children in Ethiopia: a qualitative exploratory study. BMC Health Services Research, 24(1), 613.
4. Fleary, S. A., Joseph, P., & Pappagianopoulos, J. E. (2018). Adolescent health literacy and health behaviors: A systematic review. Journal of Adolescence, 62, 116-127.
5. Fu, L. Y., Bonhomme, L. A., Cooper, S. C., Joseph, J. G., & Zimet, G. D. (2014). Educational interventions to increase HPV vaccination acceptance: a systematic review. Vaccine, 32(17), 1901-1920.
6. Gautam, N., Dessie, G., Rahman, M. M., & Khanam, R. (2023). Socioeconomic status and health behavior in children and adolescents: a systematic literature review. Frontiers in Public Health, 11, 1228632.
7. Jarrett, C., Wilson, R., O'Leary, M., Eckersberger, E., & Larson, H. J. (2015). Strategies for addressing vaccine hesitancy–A systematic review. Vaccine, 33(34), 4180-4190.
8. KB, M., Nayar, S. A., & PV, M. (2022). Vaccine and vaccination as a part of human life: given Covid-19.

Biotechnology Journal, 17(1), 2100188.
9. Larson, H. J., De Figueiredo, A., Xiahong, Z., Schulz, W. S., Verger, P., Johnston, I. G., ... & Jones, N. S. (2016). The state of vaccine confidence 2016: global insights through a 67-country survey. EBioMedicine, 12, 295-301.
10. MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. Vaccine, 33(34), 4161-4164.
11. McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. Health Education Quarterly, 15(4), 351-377.
12. Nandi, A., & Shet, A. (2020). Why vaccines matter: understanding the broader health, economic, and child development benefits of routine vaccination. Human vaccines & immunotherapeutics, 16(8), 1900-1904.
13. Poland, C. M., & Ratishvili, T. (2022). Vaccine hesitancy and health care providers: using the preferred cognitive styles and decision-making model and empathy tool to make progress. Vaccine: X, 11, 100174.
14. Rader, B., Astley, C. M., Sewalk, K., Delamater, P. L., Cordiano, K., Wronski, L., ... & Brownstein, J. S. (2022). Spatial modeling of vaccine deserts as barriers to controlling SARS-CoV-2. Communications Medicine, 2(1), 141.
15. Rodrigues, C. M., & Plotkin, S. A. (2020). Impact of vaccines; health, economic and social perspectives. Frontiers in microbiology, 11, 1526.
16. Sahu, G., Kumari, P., & Goyal, A. K. (2024). Vaccines and sera. In Molecular Pharmaceutics and Nano Drug Delivery (pp. 15-62). Academic Press.
17. Schoch-Spana, M., Brunson, E., Long, R., Ravi, S., Ruth, A., & Trotochaud, M. (2020). The public's role in COVID-19 vaccination: planning recommendations informed by design thinking and the social, behavioral, and communication sciences. Johns Hopkins Center for Health Security.
18. Suneja, N., & Bose, K. (2022). Communicating COVID: Learnings and Way Forward. In Health Dimensions of COVID-19 in India and Beyond (pp. 289-308). Singapore: Springer Nature Singapore.
19. Taha, M. K., Martinon-Torres, F., Köllges, R., Bonanni, P., Safadi, M. A. P., Booy, R., ... & Abitbol, V. (2022). Equity in vaccination policies to overcome social deprivation as a risk factor for invasive meningococcal disease. Expert review of vaccines, 21(5), 659-674.
20. Valentine, N. B., & Bonsel, G. J. (2016). Exploring models for the roles of health systems' responsiveness and social determinants in explaining universal health coverage and health outcomes. Global Health Action, 9(1), 29329.
21. Wilson, L., Rubens-Augustson, T., Murphy, M., Jardine, C., Crowcroft, N., Hui, C., & Wilson, K. (2018). Barriers to immunization among newcomers: a systematic review. Vaccine, 36(8), 1055-1062.