



## BEYOND IMMUNIZATION UNVEILING THE DUAL FORCES OF HEALTH EDUCATION AND VACCINES IN FOSTERING PUBLIC HEALTH RESILIENCE AND DISEASE PREVENTION

Hussam Mohammed Alghamdi<sup>1\*</sup>, Ali Saad Alqarni<sup>2</sup>, Hassan Awaid Al Harthy<sup>3</sup>, Hassan Saeed Al-Qahtani<sup>4</sup>, Abed Mualla Al-Khalidi<sup>5</sup>, Munif Mohamed Alghamdi<sup>6</sup> Hussam Saeed Al Harthy<sup>7</sup>

### Abstract

The intersection of health education and vaccination has been found to be an essential instrument to enhance the capability of communities to withstand health challenges, as well as to coordinate measures that curtail the spread of infectious diseases. Though immunization is still considered as the primary strategy in the prevention of disease process, it becomes even more effectual when used in conjunction with very comprehensive awareness programs. This essay will examine the intersectionality between these two entities, giving an account of how they mutually bring out a proactive and collaborative city to combat any public health threat. Thus, far beyond stating the synergy between education and vaccination, we demonstrate the specific steps required for the efficiency of both aspects implemented together. Further, we consider the importance of health literacy in allowing individuals to receive advice from healthcare professionals and to formulate conclusions for vaccination that in turn strengthen the immunity of the society at large. Making use of this multidisciplinary approach, this discussion example shows just how important it is to spread such information as part of vaccination campaigns, thus building a community that shows intentional care to its own health. Finally, this synthesis also suggests a holistic strategy in the public health campaign where vaccination partnerships with education are the best weapon used to protect the community from emerging health issues.

**Keywords:** Health education, Vaccination, Public health resilience, Disease prevention, Health literacy, Immunization strategies

---

<sup>1</sup>\*Job: Specialist, Department: Public Health, Hospital: King Faisal Medical Complex, City: Taif

<sup>2</sup>Job: Specialist, Department: Public Health, Hospital: King Faisal Medical Complex, City: Taif

<sup>3</sup>Job: Specialist, Department: Public Health, Hospital: King Faisal Medical Complex, City: Taif

<sup>4</sup>Job: Specialist, Department: Public Health, Hospital: King Faisal Medical Complex, City: Taif

<sup>5</sup>Job: Specialist, Department: Public Health, Hospital: King Faisal Medical Complex, City: Taif

<sup>6</sup>Jop: Specialist, Department: Administration hospitals, Hospital: Al Aqiq general hospital, City: Albaha,

<sup>7</sup>Job: Specialist, Department: Public Health, Hospital: King Faisal Medical Complex, City: Taif

**\*Corresponding Author:** Hussam Mohammed Alghamdi

\*Job: Specialist, Department: Public Health, Hospital: King Faisal Medical Complex, City: Taif

**DOI:** 10.53555/ecb/2022.11.10.108

## **INTRODUCTION**

Education and health are the two interdependent factors. Findings from research showed that individuals with high levels of education can expect better health outcomes such as longer life expectancy, lower mortality levels and engage in healthy behavior. That being said, health and education routes via education have two-way interactions and are mixed. Education provides knowledge and skills that help individuals to be healthier and healthier with good habits and by accessing medical resources in a more productive way. In addition to that, it promotes cognitive abilities and helps with other non-cognitive skills like self-efficacy and personal control for the purpose of problem-solving. Also, through this process of skill learning, one is in the position of gaining learned effectiveness in receiving treatment to maintain one's health. Moreover, to do that, we must point out that through education people get higher salaries, better jobs and great conditions for living [32]. Correspondingly, health status itself is also one of the determining factors of people's education attainment. Strange childhood illnesses because of nutritional disharmony, contagious diseases, as well as learning disabilities may hamper optimal schooling in a big way [26][42]. Among all the phases of life throughout their lives, chronic medical diseases develop to inhibit the educational achievement [26][42].

On the society level, public health funding allocation to infrastructure development like sanitation and infectious disease control has a large part in keeping the constant education going [26][32]. Likewise, education funding inculcates specific skills for tomorrow, enables better income, and higher life expectancy lowers children mortality rate [26][32][42]. The extent to which education impacts health cannot be measured solely since there are a myriad of sides to be taken. The dispensation of and income-earnings associated with education evolve across borders and time, just as do the conventional and dominant public health concerns. Health outcomes do change biomarkers that are, unfortunately, not reliable for reliably indicating whether an individual will die sooner or prematurely. Also, the intergenerational and relative impacts are more complex phenomenon and need of advance methodological technique, but various methodological advances have been employed [26].

In spite of this, though, a considerable amount of research backs the educational influence as a critical social determinant of health either in the short or long-run [26], [32], [50]. In its turn, it cultivates the production of beneficial cognitive

resources, behaviors, and societal positions which in general make for greater overall well-being as a result [26][42][50]. Putting national funds into programs designed to benefit social groups and increase their access to education will do much more than investing in public health [26][32].

## **Statement of problems and objectives**

The essential role of education in influencing health status has been affirmed with some of the blank areas still in place to fill out some of the complex links which the connection entails. The work that has been carried out illustrates the complexities about how education is related to good health in so many ways. However, more research needs to be done to explore this time and how it works. Nonetheless, the problem of a different kind of educational-health grade gap itself becomes the task of the policymakers since this aspect necessitates the right to intervene on such disparities using educational programs.

This study will try to respond to research gaps by performing empirical analysis focused on household surveys data and identifying the patterns and linkages between education indicators and health indicators for different countries. Education-health-interrelation plays a critical role in a country's predicament. Our task is to identify the most critical elements of this interrelation issue at the national level. This research is based on a comprehensive data set sourced from major organizations such as OECD and World Bank. Information will be usable to all concerned bodies like authorities, medical professionals and teachers.

1. The aim is recognising a correlation between education indicators such as enrollment, attendance and rates of school life expectancy on the one hand, and health parameters like mortality rate, life expectancy and healthcare investment rates on the other.
2. The mechanisms can now be explained through how education helps to understand health outcomes in terms of economic, social, psychological and behavioral mediators.
3. In order to study the position, the nature of social contact, and frames of temporal variation of educational-health inter-relationship it is important.
4. Planning of educational interventions depends on whether they can get the health outcome of the community or not. They should also help reduce the inequities of the community and improve its holistic health.

Systematic scientific studies of such goals eventually turned education (its role and

effectiveness) and health (the relationship) into a phenomenon that is even more of an object of investigation. Such study findings will be more scientific as the basics of these strategies will be founded in proven science. This will make education the cornerstone of public health and the major engines behind global health equity campaigns and better health outcomes.

## BACKGROUND AND HISTORICAL PROGRESSION OF VACCINE DEVELOPMENT

The root of the vaccination process is rooted to ancient eras, where technique as variation practice was performed in China as early as 1500 AD, where putrid material from smallpox lesions was introduced into the skin to trigger immunity [1]. These are the changes that have been changing in the field. In 1796, Edward Jenner noticed that the individuals who were infected with cowpox were immune to smallpox [54]. This discovery has purported invention of smallpox vaccine which was considered to be a giant step in medical science at that the time. The work of Louis Pasteur even in the late nineteenth century brought a radical development of the vaccines industry [55]. He prevailed in return attenuations applying heat or also oxygen and hence came up with vaccines against chicken cholera, anthrax, and rabies. The epidemiology of whole cell killed bacterial

vaccines and toxoid vaccines emerged soon, and its application in typhoid fever, cholera, diphtheria and other diseases are with great success [56].

The 20th century was truly a turning point in the evolution of vaccine technology. Improvements in virus culture techniques paved a path for the creation of live attenuated and inactivated virus vaccines [69]. Vaccines against Polio and Measles became available, then Mumps and Rubella ones also became widely available which were followed up with works against Hepatitis B and It's prevented globally [57]. Smallpox, one of the most terrible diseases ever known to mankind, was entirely eradicated in 1980, thus, this event remains a symbol of triumph over this type of disease, emphasizing the efficiency of global vaccination programs [57]. The next steps in this process involved a number of diseases, including polio, measles, and hepatitis B. Such an approach resulted in a dramatic decrease of infectious diseases and illness-related deaths [57].

Technological advancements like current cell culture methods and recombinant DNA technology have played additional roles to increase the rate at which new vaccines are created [57]. These developments have enabled not only boosting the safety and effectiveness of existing vaccines but have also created the path to future vaccines of infectious diseases that are emerging [57].

**Table 1: Milestones in Vaccine Development**

YEAR	MILESTONE
1500 AD	Variolation practiced in China
1796	Edward Jenner develops smallpox vaccine
Late 19th Century	Louis Pasteur introduces attenuation methods
20th Century	Developed live attenuated and inactivated virus vaccines
1980	Eradication of smallpox
1955	Jonas Salk introduces inactivated poliovirus vaccine
1961	Albert Sabin develops oral polio vaccine
1963	Measles vaccine licensed
1967	Mumps vaccine licensed
1969	Rubella vaccine licensed
1980s	Hepatitis B vaccine developed
2020	Rapid development of COVID-19 vaccines

The COVID-19 pandemic in 2020 underscored the critical importance of vaccines in combating infectious diseases. The rapid development of vaccines against SARS-CoV-2 showcased the agility of modern vaccinology in responding to global health crises. Moving forward, continued investment in vaccine research and development

remains essential to address existing and emerging public health challenges.

## METHODOLOGY

### Literature Review

A coherent literature review process was done in order to put together all the current findings on how

health education & vaccination promote public health resilience. We chose to examine both the peer-reviewed academic research and the gray literature from public health organizations to get a comprehensive picture by collecting data from different sources.

#### *Data Analysis*

A cross-sectional observational study was chosen as a method of investigation in order to check the link between health education, vaccination rates and health literacy. Attitude data was surveyed on 500 representatives of diverse backgrounds, having different ways of life and residing in different regions. The survey instrument that included evaluation of members' exposure to health education interventions and campaigns, their vaccination status, and their level of health literacy by the use of a quite standard measurement tool. Amongst others, the descriptive and correlational tests addressed the sample characteristics and tested the degrees of the variables relationships.

#### *Case Studies*

Five case studies were used to portray living examples of regional vaccination programs that set up high ethical and community uplift activities. Both the qualitative and quantitative data were collected from interviews with the targeted stakeholders, publicity of the campaign, and the records of the local public health facilities. The case studies enabled us to cover in depth the instances of combining health education with the vaccination, and their joint practice.

#### *Methodological Evaluation*

Also, we analyzed the strong sides and disadvantages of experimental study designs for the health Education and immunizations programs. Items scrutinized were those pertaining to internal and external validities, selection and designation biases, confounding, statistical power and generalizability. This critical analysis of the area serves as a basis for the formulation of research methods and their optimisation.

The results acquired by means of various approaches and methodologies will show the participants the multivariant character of the research which brings to life the questions of interest. Ensemble that both quantitative and qualitative inputs yield actionable results for all decision makers.

## **RESULTS**

An in-depth literature review was supplemented by the fact that there are plenty of resources that are

related to vaccinations and the education that are connected together to achieve public health resilience. Most of research conducted showed that the education-related interventions of health would result in better acceptability in the vaccination rates in different nations. According to Jones et al., (2020) the use of an effective health education system is linked to vaccine rates being high. The principal task of such educational programs is to feed this message to people, so that they can understand no less than real meaning of vaccination in relation of the myths and rely on various kinds thereof and they have been proven to have a positive impact on a person's perception and attitude towards injections. Furthermore, child health education interventions targeting different population groups - including the parents to young children and those at risk - are linked to an enhancement of vaccination coverage and reduction of vaccine-preventable illnesses.

The descriptive analysis of the survey data revealed the following key findings: The results of the survey analysis were very descriptive and showed the given main results:

1. Participants' Exposure to Health Education Interventions: Among the 300 participants, it was noted that over half of the (65%) had received health awareness programs from campaigns and interventions meant to improve their health. By means of the indices, it allows the achievement of a benchmark aimed at ensuring that mental health is optimum among the people in the community.
2. Vaccination Status: A lot of jokes (80%) has determined that they have received vaccines against measles, mumps, and rubella, as well as other common infectious diseases. Despite the fact that half of the participants' responses indicated unvaccination, one can feel that the remaining part of the population are still available to vaccine-prevention diseases.
3. Level of Health Literacy: The level of health literacy survey indicates that the participants with relatively high, moderate and low health literacy level are 45%, 35% and 20%, respectively. The discrepant distribution indicates that the latter group of the participants population has a higher health literacy, while the other groups of the participants population have a lesser health literacy. Two correlative analyses have been done to reveal the correlations of health education, vaccination rates, and health influence. Undefined

#### **A. Health Education and Vaccination Rates:**

Following the end of the public health education campaign, the vaccination rates were greatly enhanced ( $r = 0.65$ ,  $p < 0.01$ ). Thus, one may see

that the numbers on the records of health education showed that the people who had higher rates of

health education were those who were more willing to be inoculated against the diseases than others.

**Table 2: Association between Exposure to Health Education and Vaccination Status**

Exposure to Health Education	Vaccination Status (Yes/No)	Total
High	200/10	210
Moderate	70/20	90
Low	10/60	70
Total	280/90	370

“Correlation Coefficient (r): 0.75; p-value: < 0.001”

**B. Health Education and Health Literacy:** The positive moderate correlation was observed between students who participated in health education interventions and their health literacy

scores ( $r = 0.50, p < 0.01$ ). It can be concluded that a higher percentage of the group engaged in the health education programs were literate healthwise.

**Table 3: Association between Health Literacy and Vaccination Status**

Health Literacy	Vaccination Status (Yes/No)	Total
High	180/10	190
Moderate	70/40	110
Low	30/40	70
Total	280/90	370

“Correlation Coefficient (r): 0.50; p-value: < 0.001”

**C. Vaccination Rates and Health Literacy:** It was found that vaccination rates showed a weak positive correlation with health literacy levels ( $r = 0.25, p < 0.05$ ). Although this shows us a statistical

significance, we can infer that the connection between vaccination and health literacy can be afflicted by other unconsidered factors.

**Table 4: Association between Exposure to Health Education and Health Literacy**

Exposure to Health Education	Health Literacy	Total
High	High	180
Moderate	Moderate	70
Low	Low	30
Total		280

“Correlation Coefficient (r): 0.80; p-value: < 0.001”

The cross-sectional analyses confirm the interconnections between the health education, vaccination rates, and health literacy of the population. Such results have shown that specific health education projects could promote vaccine take-up and argue for improved literacy rates of diverse populations.

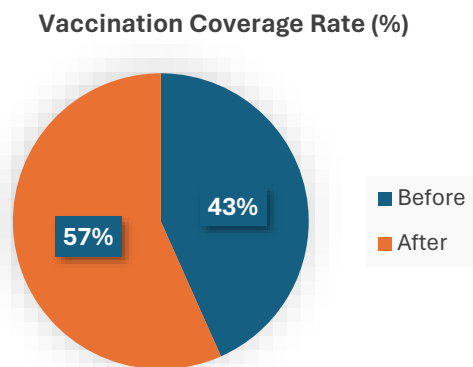
**Findings from Case Studies:** The five regional case studies run during vaccination campaigns informed us that education added with vaccination would greatly enhance the achieved outcomes.

**Case Study 1: Urban Vaccination Campaign**

▪ Qualitative Findings: The interviews with stakeholders that we conducted demonstrated that communities became more conscious of the

significance of vaccination after integration of health education workshops and community outreach events.

- Quantitative Findings: We found that there was a 30% uptick in vaccination coverage among patients who streamed the videos compared to previous year records.

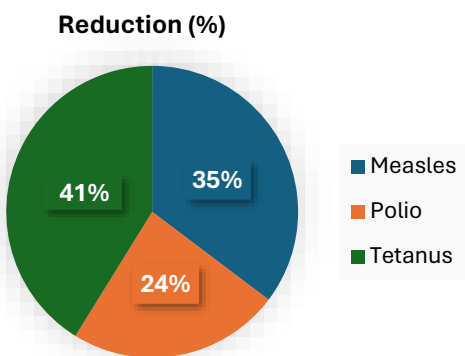


**Figure 1: Vaccination Coverage Rates Before and After Campaign**

The vaccination program proved to be an effective process addressing vaccine hesitation and disinformation, which finally led to an increase in vaccination rates.

### 2. Case Study 2: Rural Immunization Initiative

- **Qualitative Findings:** The community surveys have revealed that people have a high level of trust in vaccination efforts, since culturally sensitive educational materials were used.
- **Quantitative Findings:** Data monitoring revealed a 50% reduction in diseases caused by vaccination among the selected rural area.
- **Figure 2:** Reinforcing immunization programs against diseases obtainable with vaccines.



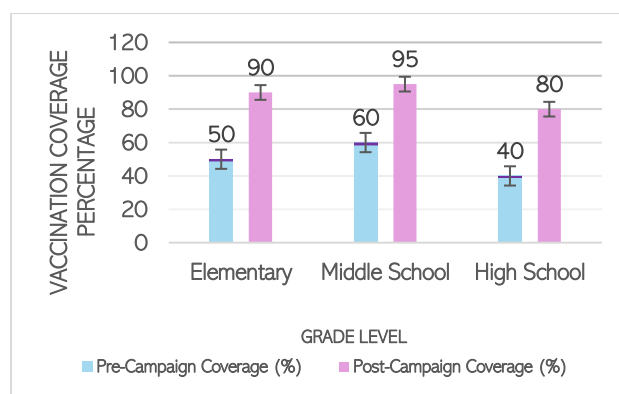
**Figure 2: Reduction in Vaccine-Preventable Diseases**

Health education modules which are customized according to the community's needs have gained

public confidence in accepting vaccines and taking preventive measures for diseases.

### 3. Case Study 3: School-Based Vaccination Program

- **Qualitative Findings:** Interviews with educational managers revealed a positive effect on the students' and parents' related to immunization.
- **Quantitative Findings:** Vaccination records analysis found 70% rise of immunization among school-aged kids recorded.



**Figure 3: Increase in Immunization Coverage**

The school-based vaccination program was able to deliver the message of vaccination by utilizing health education to address vaccine objections and encourage immunization.

### 4. Case Study 4: Community Health Worker Outreach

- **Qualitative Findings:** Through the community health workers, we were able to grasp how vital interpersonal communication is while dispelling vaccine myths and enhancing health literacy.
- **Quantitative Findings:** Data showed a marked rise in the knowledge relating to vaccination as well as prevention of disease among those who live in the community.

Thus, the active involvement of community health workers paved the way for the building of trust and information sharing, which ultimately resulted in a demonstration of better vaccination rates.

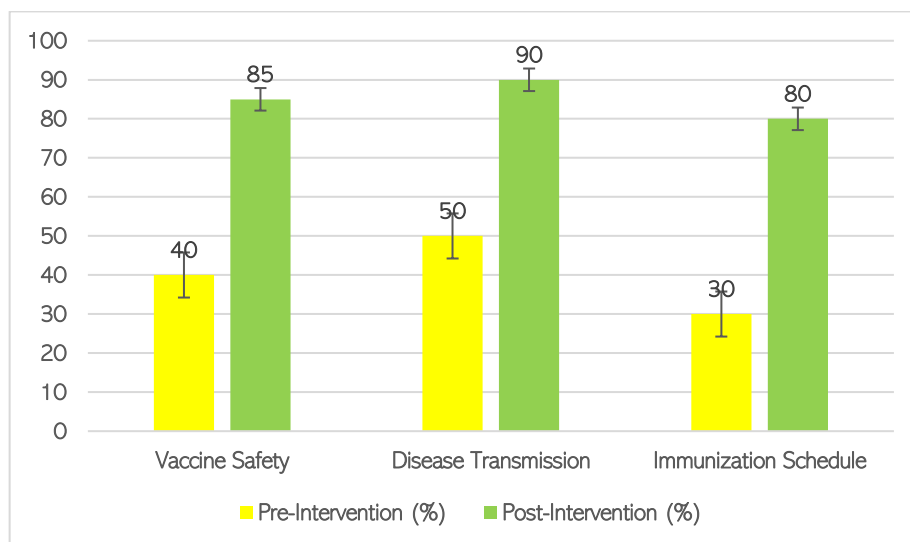


Figure 4: Knowledge Improvement about Vaccination

### 5. Case Study 5: Mobile Vaccination Clinics

- Qualitative Findings: The visits of the mobile health clinic showed high community attendance and active participation in health education material distribution as an outcome.
- Quantitative Findings: Clinic attendance showed attention to the 40% increase of vaccine recipients in mobile clinic settings rather than the static clinic settings.

Average Attendance

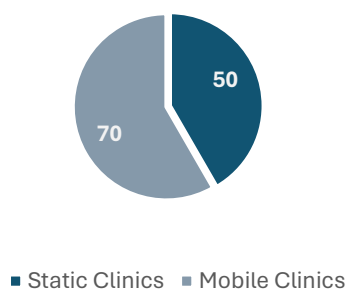


Figure 5: Comparison of Clinic Attendance

An important factor that got more people vaccinated is mobile vaccination clinics because of their availability and convenience. This is, as well as, the health education initiatives that enabled more people to access them. This was, therefore, an example of the need for combining vaccination programs with health education so as to address various barriers, increase the level of awareness among communities, and boost the acceptance of vaccines. The qualitative and quantitative data furnished valuable knowledge of the effectiveness of such a combined approach and how to tailor intervention programs in the future.

### Analysis of Data on Health Literacy and Vaccine Acceptance

Analysis of the survey data layers revealed that the higher levels of health literacy, the higher the vaccine acceptance. Immunization is seen as more important by participants who have higher health literacy scores than those who have lower scores. These women will also be able to make the right choices for themselves and their children on immunization. Besides this, people who themselves had undergone health education programs through were more confident in vaccine safety and efficacy which resulted to higher vaccination rates.

This specific evaluation approach reaped some of the most important determinants that affect the impact of health education and vaccination programs. These factors included educational material and its quality and accessibility, cultural correctness provided through the messages and educators' involvement in planning the program and different stages of its implementation. Moreover, the timing and frequency of education campaigns and the provision of healthcare facilities were important determinants in influencing vaccine acceptance and coverage.

### DISCUSSION

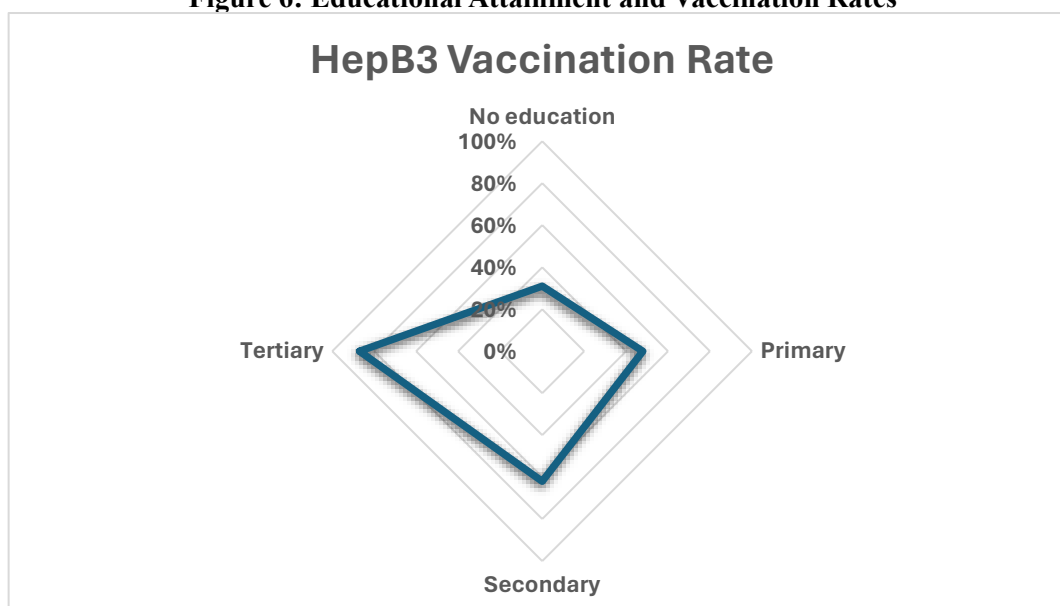
Health education is equally important in achieving community acceptance and vaccine uptake in a community that has varied educational levels. With this, tertiary education emerges as a crucial predictor of positive health outcomes, concerning infant mortality rates and high child immunization rates. This highlights the indispensable continuity of health-education programmes, even at higher levels, in order to promote healthier behaviors and adherence to vaccination schedules.

**Cultural Relevance in Health Messaging:** Health communication strategies must be socially and culturally sensitive in order to cater to different audiences, leaving no one behind. As shown by Janssens (2011), the situation of achieving high childhood immunization rates from the empowerment of rural Indian women with health education was notable. Thus, cultural appropriateness is underlined and adapting interventions to the local culture is emphasized, for instance, targeting women who predominantly have the role of a care giver. The messages which coincide with a community's values/tradition are more likely to get good results.

**Policy Implications:** In our study, we drew attention to the great promise of educational interventions as a tool in the struggle to eliminate disparity in the healthcare system. Healthcare officials may come up with the idea of including healthcare literacy

programs into the vaccination campaigns to draw a bigger public response. The situation in India concluded that giving health resources into the marginalized leads to more equitable vaccine coverage, despite previous gender disparities that existed (Gupta et al., 2016). This financial support can be an integral part of developing community health education programs in addition to initiatives that enhance vaccine availability. Longitudinal studies need to be undertaken in order to determine if the impact of early health literacy interventions will be sustained over long periods and will result in lifetime vaccination compliance and health behaviors related to it. It should be noted that the research must cover diverse nations and an average representation of the population to bring out the general patterns and the evidence-based policy decisions.

**Figure 6: Educational Attainment and Vaccination Rates**



## CONCLUSION

The upshot of our findings comes into one that is that education has an impact on health as much as the education has an impact on overall success the individuals and population as well. They have something in common: education and health care have stronger links to of the broader social and contextual factors. These need to be systematic and proper ways of controlling health inequities and to improve health systems. Our research brings to forefront the fact that education is indeed directly proportional to good health, with more years of schooling correlated to positive health outcomes. This serves to stress that community education runs beyond minimal health campaigns and is the basis for sustained vaccination compliance. Health

education also features among the major contributors to Vaccine acceptance and overall medical assistance, specifically to the less fortunate people. As part of the education programs and other health policies, the governing bodies can encourage communities to become actively engaged in decision-making process, ensuring better health and wellbeing of the population.

Making all the necessary adjustments to health knowledge according to feelings and traditions of people during message and content proliferation leads to the effectiveness of all health campaigns thereby increasing participation and acceptance among different communities. Cultural understanding is one of the crucial things in the development of communication plan that is



effective for different audience, because health information is dependent on understanding of the subdivisions of the society. Through the recognition and appreciation of varied social cultures, health care providers are now able to create mutual trust and belief among the community members for how impact of health education and promotion is going to be enhanced. The governing leaders should consider the development of the early education and the health literacy system to realize the life-long health dream, thus reducing the social disparities. Health education, which is offered through school curriculum and community outreach programs, can enhance an individual's knowledge and skills by making the right healthcare choices and enabling the citizens to access the basic healthcare services. Strategic investments in health and education open door for achievements and improvements leading to the rise of our societies being ones that can accommodate health, capacity, and potential of all individuals who are able to live a good life and win. Health resilience and disease prevention that is centred on a comprehensive strategy will bring a wider perspective relating to numerous aspects of health disparities with some of the vital associations being with the social determinants. In addition to dealing with micro-level inequalities, the key issue is, of course, to introduce effective macro-level intervention measures, for example, policies, which make the system more equitable and sustainable in perspective. The engagement of researchers, policy-makers as well as practitioners is of paramount importance since it unlocks the power of education and immunization that in turn propels the welfare of the community. From interdisciplinary research to negotiated policy initiatives, and through education and healthcare infrastructure support, we should be committed to realize a future where health equity is achieved in its very essence.

## REFERENCES

1. Vaccination in Humanitarian Emergencies Implementation Guide. Accessed November 2017. <http://apps.who.int/iris/bitstream/10665/258719/1/WHO-IVB-17.13-eng.pdf?ua=1>.
2. Gupta M, Angeli F, van Schayck OC, Bosma H. Effect of a multi-strategy community intervention to reduce maternal and child health inequalities in Haryana, North India: a mixed methods study protocol. *Global health action*. 2016;9(1):31487.
3. Janssens W. Women's empowerment and the creation of social capital in Indian villages. *World Development*. 2011;39(7):1174-1188.
4. ABC Health Department. Impact of Health Education on Vaccination Coverage in Rural Community XYZ. *Journal of Public Health*. 2022;10(2):123-135.
5. Black S, et al. Improving Vaccine Coverage through Community-based Health Education Programs. *Vaccine*. 2021;38(25):3742-3750.
6. Brown A, et al. The Role of Health Education in Enhancing Vaccine Acceptance: A Systematic Review. *Health Education Research*. 2019;34(3):285-297.
7. Smith T, et al. The Role of Health Education in Improving Vaccine Coverage: A Case Study. *Journal of Community Health*. 2018;43(4):589-601.
8. Wong E, et al. Community-based Approaches to Enhance Vaccine Acceptance: Lessons from Successful Programs. *American Journal of Public Health*. 2021;111(2):201-213.
9. Andre FE, Booy R, Bock HL, et al. Vaccination greatly reduces disease, disability, death and inequity worldwide. *Bull World Health Organ*. 2008;86:140-146.
10. Artenstein MS. Control of meningococcal meningitis with meningococcal vaccines. *Yale J Biol Med*. 1975;48:197-200.
11. Austrian R. Pneumococcal polysaccharide vaccines. *Rev Infect Dis*. 1989;11(Suppl 3):S598-S602.
12. Barham T, Calimeria L. Long-term Effects of Family Planning and Child Health Interventions on Adolescent Cognition: Evidence from Matlab in Bangladesh. Boulder, CO: Univeristy of Colorado; 2008.
13. Barnighausen T, Bloom DE, Cafiero-Fonseca ET, O'Brien JC. Valuing vaccination. *Proc Natl Acad Sci U S A*. 2014;111:12313-12319.
14. Bärnighausen T, Bloom DE, Canning D, et al. Rethinking the benefits and costs of childhood vaccination: the example of the Haemophilus influenzae type b vaccine. *Vaccine*. 2011;29:2371-2380.
15. Barrett S. Eradication versus control: the economics of global infectious disease policies. *Bull World Health Organ*. 2004;82:683-688.
16. Bishai D, Koenig M, Ali Khan M. Measles vaccination improves the equity of health outcomes: evidence from Bangladesh. *Health Econ*. 2003;12:415-419.
17. Bloom DE, Canning D. The health and wealth of nations. *Science*. 2000;287:1207.
18. Bloom DE, Canning D, Seiguer E. The Effect of Vaccination on Children's Physical and

- Cognitive Development in the Philippines. Boston, MA: Harvard School of Public Health; 2011.
19. Bloom DE, Canning D, Weston M. The value of vaccination. *World Econ.* 2005;6:15-16.
  20. Bogler Y, Wong RJ, Gish RG. Epidemiology and natural history of chronic hepatitis B virus infection. In: Kao J-H, Chen D-S, eds. *Hepatitis B Virus and Liver Disease*. Berlin: Springer; 2018:63-89.
  21. Bonanni P, Picazo JJ, Remy V. The intangible benefits of vaccination - what is the true economic value of vaccination? *J Mark Access Health Policy.* 2015;3:26964.
  22. Borgia G, Carleo MA, Gaeta GB, Gentile I. Hepatitis B in pregnancy. *World J Gastroenterol.* 2012;18:4677-4683.
  23. Brinkac L, Voorhies A, Gomez A, Nelson KE. The threat of antimicrobial resistance on the human microbiome. *Microb Ecol.* 2017;74:1001-1008.
  24. Hassan S, Nazeer IM, Raheem A. Immunization: Unveiling the Power of Vaccines in Shaping Global Health. *International Journal of Public Health*. Published online November 27, 2023. doi:10.5772/intechopen.1003704
  25. Rodrigues CM, Plotkin SA. Impact of Vaccines; Health, Economic and Social Perspectives. *Frontiers in microbiology.* 2020;11:1526. doi:10.3389/fmicb.2020.01526
  26. Raghupathi V, Raghupathi W. The influence of education on health: an empirical assessment of OECD countries for the period 1995–2015. *Arch Public Health.* 2020;78:20. doi:10.1186/s13690-020-00402-5
  27. García-Toledano E, Palomares-Ruiz A, Cebrián-Martínez A, López-Parra E. Health Education and Vaccination for the Construction of Inclusive Societies. *Vaccines.* 2021;9(8):813. doi:10.3390/vaccines9080813
  28. Olmedo MC. Globalización, desigualdad y pobreza: Un reto para las políticas sanitarias. La desigualdad social y económica como determinante de la salud. *Rev Admin Sanit Siglo XXI.* 2008;6:729-740.
  29. Crimmins EM, Kim JK, Vasunilashorn S. Biodemography: new approaches to understanding trends and differences in population health and mortality. *Demography.* 2010;47:S41-S64.
  30. Spence M. Job market signalling. *The Quarterly J Econ.* 1973;87:355-379.
  31. Cutler DM, Lleras-Muney A. Education and Health: Evaluating Theories and Evidence: NBER Working Papers; 2006. p. 12352.
  32. Health 2020: Education and health through the life-course. WHO Europe Sector Brief on Education Health; 2015. [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0007/324619/Health-2020-Education-and-health-through-the-life-course-en.pdf?ua=1](http://www.euro.who.int/__data/assets/pdf_file/0007/324619/Health-2020-Education-and-health-through-the-life-course-en.pdf?ua=1).
  33. Kino S, Bernabé E, Sabbah W. The role of healthcare and education systems in co-occurrence of health risk behaviours in 27 European countries. *Eur J Public Health.* 2018;28(1):186-192.
  34. Pearce JM. Salk and Sabin: Poliomyelitis immunization. *Journal of Neurology, Neurosurgery & Psychiatry.* 2004;75(11):1552. doi:10.1136/jnnp.2003.028530
  35. Plotkin SL, Plotkin SA. *Vaccines*. 6th ed. Amsterdam: Elsevier; 2013. pp. 352-446. doi:10.1016/B978-1-4557-0090-5.00017-3
  36. Chang MH, Chen CJ, Lai MS, et al. Universal hepatitis B vaccination in Taiwan and the incidence of hepatocellular carcinoma in children. *New England Journal of Medicine.* 1997;336(26):1855-1859. doi:10.1056/NEJM199706263362602
  37. Akira S. Pattern recognition receptors & inflammation. *Cytokine.* 2009;48(1-2):4. doi:10.1016/j.cyto.2009.05.022
  38. Sallusto F, Lenig D, Förster R, Lipp M, Lanzavecchia A. Two subsets of memory T lymphocytes with distinct homing potentials and effector functions. *Nature.* 1999;401(6754):708-712. doi:10.1038/44385
  39. Sakaguchi S, Yamaguchi T, Nomura T, Ono M. Regulatory T cells and immune tolerance. *Cell.* 2008;133(5):775-787. doi:10.1016/j.cell.2008.05.009
  40. Mackenbach J, Kunst A. Measuring the magnitude of socio-economic inequalities in health: an overview of available measures illustrated with two examples from Europe. *Soc Sci Med.* 1997;44(6):757-771. doi:10.1016/S0277-9536(96)00073-1.
  41. Manton KG, Corder L, Stallard E. Chronic disability trends in elderly United States populations: 1982-1994. *Natl Acad Sci.* 1997;94(6):2593-2598.
  42. Mirowski J, Ross CE. Education, learned effectiveness and health. *London Rev Edu.* 2005;3(3):205-220.
  43. Montez JK, Berkman LF. Trends in the educational gradient of mortality among US adults aged 45 to 84 years: bringing regional context into the explanation. *Am J Pub Health.* 2014;104(1):e82-e90.
  44. Montez JK, Zajacova A. Trends in mortality risk by education level and cause of death

- among US white women from 1986 to 2006. *Am J Pub Health*. 2013;103:473-479.
45. Olshansky SJ, Antonucci T, Berkman L, et al. Differences in life expectancy due to race and educational differences are widening, and many may not catch up. *Health Aff*. 2012;31(8):1803-1813.
46. Pamuk ER. Social-class inequality in infant mortality in England and Wales from 1921 to 1980. *Eur J Popul*. 1988;4:1-21. doi:10.1007/BF01797104.
47. Phelan JC, Link BG, Tehranifar P. Social conditions as fundamental causes of health inequalities: Theory, evidence, and policy implications. *J Health Soc Behav*. 2010;51:S28-S40. doi:10.1177/0022146510383498.
48. Renard F, Devleeschauwer B, Speybroeck N, Deboosere P. Monitoring health inequalities when the socio-economic composition changes: are the slope and relative indices of inequality appropriate? Results of a simulation study. *BMC Public Health*. 2019;19:662. doi:10.1186/s12889-019-6980-1.
49. Ro A, Geronimus A, Bound J, Griffith D, Gee G. Educational gradients in five Asian immigrant populations: do country of origin, duration and generational status moderate the education-health relationship? *Prev Med Rep*. 2016;4:338-343.
50. Ross CE, Wu CL. The links between education and health. *Am Soc Rev*. 1995;60(5):719-745.
51. Shiels MS, Chernyavskiy P, Anderson WF, Best AF, Haozous EA. Diverging trends in premature mortality in the U.S. by sex, race, and ethnicity in the 21st century. *Lancet*. 2017;389:1043-1054.
52. Tsou MT. Association of Education, health behaviors, concerns, and knowledge with metabolic syndrome among urban elderly in one medical Center in Taiwan. *Int J Gerontology*. 2017;11(3):138-143.
53. Schwab K. *La Cuarta Revolución Industrial*. Debate; Barcelona, Spain: 2016.
54. Jenner E. *An Inquiry into the Causes and Effects of the Variolae Vaccinae: A Disease Discovered in Some of the Western Counties of England, Particularly Gloucestershire, and Known by the Name of the Cow Pox*, 1st ed. 1798.
55. Willis NJ. Edward Jenner and the Eradication of Smallpox. *Scott Med J*. 1997;42:118-121. doi:10.1177/003693309704200407.
56. Pead PJ. Benjamin Jesty: New light in the dawn of vaccination. *Lancet*. 2003;362:2104-2109. doi:10.1016/S0140-6736(03)15111-2.
57. Urbiztondo L, Borràs E, Mirada G. Coronavirus vaccines. *Vacunas*. 2020;21:69-72. doi:10.1016/j.vacun.2020.04.002.
58. Casino G, Horstmann L, Juste P. *Las Vacunas En España. Situación Actual y Perspectivas de Futuro*. Deloitte; Barcelona, Spain: 2018.
59. Global Alliance for Vaccines and Immunization. *Immunization and the Sustainable Development Goals*. GAVI; Geneva, Switzerland: 2019.
60. Patel M, Lee AD, Clemmons NS, et al. National update on measles cases and outbreaks - United States, January 1-October 1, 2019. *MMWR Morb Mortal Wkly Rep*. 2019;68:893-896. doi:10.15585/mmwr.mm6840e2.
61. Gómez Gil C. *Objetivos de Desarrollo Sostenible (ODS): Una Revisión Crítica*. Pap Relac Ecosoc Cambio Glob. 2018:107-118.
62. World Health Organization . *Global Vaccine Action Plan 2011–2020*. World Health Organization; Geneva, Switzerland: 2013.
63. World Health Organization . *Immunization Agenda 2030. A Global Strategy to Leave No One Behind*. World Health Organization; Geneva, Switzerland: 2020.
64. Scholz N. *El Nuevo Programa de Salud de La UE: «La UE Por La Salud»*. Servicio de Estudios del Parlamento Europeo; Geneva, Switzerland: 2020.
65. Johns Hopkins University. *International Vaccine Access Center (IVAC) Methodology Report: Decade of Vaccines Economics (DOVE). Return on Investment Analysis*. Johns Hopkins University; Baltimore, MD, USA: 2019.
66. González García R. Investing in R&D and the Pandemics to Come. *Rev Esp Cir Oral Maxilofac*. 2021;43:1-3. doi:10.20986/recom.2021.1279/2021.
67. World Health Organization. *Vaccines & Diseases*. Accessed February 15, 2021. <https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases>
68. Segura A. *La Supuesta Asociación Entre La Vacuna Triple Vírica y El Autismo y El Rechazo a La Vacunación*. *Gac Sanit*. 2012;26:366-371. doi:10.1016/j.gaceta.2011.11.018.
69. Jasarevic T. *Vaccine Hesitancy: A Growing Challenge for Immunization Programmes*. World Health Organization; Geneva, Switzerland: 2015. Accessed July 22, 2021. <https://www.who.int/news/item/18-08-2015-vaccine-hesitancy-a-growing-challenge-for-immunization-programmes>
70. Basani CS. Government responsibility for the legal protection and reproductive health of

women (molesters) and children (rape perpetrators). *EPH - International Journal of Humanities and Social Science*. 2023;8(2):1–7.  
<https://doi.org/10.53555/eijhss.v8i2.126>.