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Determinants of Acceptance and Hesitancy on Measles-rubella Vaccination Uptake: A Household Survey in Bayelsa State, Niger-Delta Region

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Abstract

Background: Measles and rubella were significant public health challenges globally, particularly in Nigeria, where vaccination uptake faced numerous barriers due to prevailing myths, misinformation, and socio-cultural beliefs. These factors contributed to vaccine hesitancy, impacting the control of these diseases. The study aimed to identify and understand the determinants of acceptance and hesitancy toward measles-rubella vaccination uptake among households in Bayelsa State, Niger Delta Region, examining socio-demographic factors, beliefs, information sources, trust in health systems, and accessibility.

Methods: A cross-sectional design was employed, involving a household survey of 600 participants across eight Local Government Areas in Bayelsa State. Data were collected using structured questionnaires and analyzed for associations between caregiver characteristics, beliefs, and vaccination uptake.

Results: The findings revealed that 88% of children had received the measles-rubella vaccine, with 62% receiving one dose and 38% receiving two doses. High levels of skepticism were noted about beliefs linking the vaccine to infertility, autism, and immune system weakening. Health workers were identified as the primary source of information, and a majority of respondents expressed high trust in health authorities. Accessibility of vaccination services was generally perceived positively, although long waiting times and transportation costs were significant barriers.

Conclusion: The study highlighted a commendable level of vaccine acceptance in Bayelsa State but also identified critical barriers to vaccination uptake. Addressing misinformation and improving accessibility through targeted public health strategies could enhance vaccination rates and ultimately contribute to the control of measles and rubella in the region.

Keywords: Measles-Rubella; Acceptance; Hesitancy; Misinformation; Vaccination

Introduction

Measles and rubella were once pervasive diseases that shaped the health landscapes of many communities around the world [1]. In the years before widespread vaccination, measles travelled through populations with striking efficiency, leaving a trail of fever, cough, runny nose, and red, blotchy rashes [2]. Rubella, though often milder, carried its own burdens, particularly for pregnant women and their unborn children, where infection could result in serious congenital defects [3-5]. Measles began as a highly contagious viral illness that spread through respiratory droplets and direct contact. It began with high

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fever, cough, and conjunctivitis, followed by the appearance of the characteristic Koplik spots inside the mouth and, eventually, the telltale blotchy rash that spread from the head downward. Complications were common, especially among young children, and could include pneumonia, ear infections, encephalitis, brain damage, blindness, deafness, a hole on the hearth, and even death [6]. The disease did not respect borders, and outbreaks could sweep through communities with remarkable speed, disrupting schools, workplaces, and social life. Public health systems often faced the daunting task of containing transmission through isolation measures, contact tracing, and supportive care for those affected. Rubella presented a different but equally consequential public health challenge. In many cases, the illness manifested as a mild fever and a rash, and adults and children alike could recover without lasting harm. Yet rubella carried a hidden menace: if a pregnant woman contracted the infection during the first trimester, the virus could cross the placental barrier and cause *Congenital Rubella Syndrome* (CRS) in the developing foetus [7,8]. Infants afflicted with this condition might be born with cataracts, deafness, heart defects, and developmental delays. The realization of these risks underscored the imperative to protect populations through vaccination, even when the disease appeared deceptively benign in the general population [9]. Across communities, the social and economic costs of these diseases accumulated. Families faced medical expenses, caregivers spent long hours at the bedsides of their loved ones, and missed days at work or school translated into broader disruptions. In some regions, healthcare workers grappled with resource constraints as outbreaks stretched clinics and hospitals thin. The shared understanding that vaccines offered a powerful line of defence grew slowly but steadily, as researchers, clinicians, and public health officials collaborated to develop and refine immunization strategies. The advent of vaccination programs marked a turning point in the histories of measles and rubella [9,10]. Vaccines were developed, tested, and gradually integrated into routine childhood immunization schedules. Widespread immunization led to dramatic declines in the incidence of both diseases, transforming what had once seemed intractable into something controllable. Communities that achieved high vaccination coverage witnessed fewer outbreaks, better protection for vulnerable populations, and a renewed sense of optimism about the future of public health [11,12]. Yet challenges persisted. Misinformation, gaps in access to healthcare, and logistical hurdles sometimes limited the reach of vaccination campaigns [13,14]. In some places, disparities in coverage remained pronounced, and the diseases did not vanish entirely. Public health authorities continued to monitor surveillance data, respond to outbreaks, and advocate for sustained vaccination efforts to prevent resurgence. In a nutshell, measles and rubella were once formidable threats that caused substantial illness, disability, and societal disruption. Through the development and adoption of vaccines, many of the worst outcomes associated with these diseases were mitigated, saving countless lives and sparing future generations from the burdens of preventable infection. The historical arc of these illnesses thus underscored a fundamental tenet of public health: prevention through vaccination could transform destinies, turning feared pathogens into manageable concerns and enabling communities to thrive with greater resilience.

Statement of the problem

The statement of the problem centred on a constellation of myths, beliefs, and misconceptions surrounding the measles-rubella (MR) vaccine, which had shaped public perceptions, vaccination behaviours, and health outcomes in diverse communities. These narratives asserted that MR vaccination caused infertility, autism, and weakened immunity; they claimed that the vaccine was inefficacious and produced numerous adverse effects; and they posited that measles-related illness could be addressed effectively through traditional remedies and faith-based interventions. Such beliefs emerged from historical gaps in health literacy, mistrust in biomedical institutions, cultural worldviews, and prior experiences with health systems, all of which contributed to hesitancy and variable vaccine uptake. The problem was compounded by misinformation disseminated through informal networks, local media, social networks, and, in some contexts, organized religious or community groups that framed immunization within moral and spiritual contestations, thereby reinforcing resistance to vaccination campaigns. These myths undermined viral control efforts and impeded the attainment of high coverage necessary to achieve herd protection, potentially sustaining transmission chains and elevating the risk of vaccine-preventable disease outbreaks, particularly in settings with fragile health infrastructures, uneven access to services, and disparities in socioeconomic status [15]. Data gaps—such as inconsistent vaccination records, underreporting of adverse events, and limited longitudinal surveillance—further constrained the ability to quantify the burden of vaccine-preventable diseases and to attribute observed outcomes to specific beliefs or demographic determinants. The persistence of these beliefs threatened equity in health by disproportionately affecting marginalized populations who faced barriers to information, access, and trusted sources of guidance. In summary, the problem described a dynamic interplay between sociocultural beliefs, informational ecosystems, health system factors, and epidemiological consequences, highlighting the need for culturally attuned, evidence-based interventions that could address misinformation while preserving respect for community values and ensuring safe, equitable vaccine delivery.

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Justification of the problem

The justification for the study was anchored in a set of interconnected concerns about measles-rubella (MR) vaccination that had persisted across diverse communities. Foremost, myths, beliefs, and misconceptions—such as claims that MR vaccines caused infertility, autism, weakened immunity, or a spectrum of side effects—had steered parental choices and shaped community attitudes, contributing to suboptimal vaccination uptake and ongoing susceptibility to preventable diseases. In addition, assertions that measles-related illness could be easily treated with traditional remedies or faith-based practices had reinforced skepticism toward biomedical prevention and diminished perceived benefits of immunization, complicating public health efforts to attain high coverage. The study also identified gaps in knowledge and there was no documented empirical evidence about how these beliefs translated into vaccination behaviours within Bayelsa State and similar contexts, limiting policymakers' and health workers' ability to design culturally responsive interventions. Methodological and theoretical limitations in prior work—such as non-representative samples, reliance on self-reported data, and insufficient consideration of sociocultural determinants—had restricted the applicability and generalizability of findings for program planning. Health system implications were substantial: without robust, context-specific evidence on beliefs and their drivers, risk communication, community engagement, and service delivery strategies remained anchored to generic approaches that might fail to resonate with local values or address information gaps. Addressing these knowledge gaps promised to illuminate pathways for improving vaccine confidence, tailoring messages to local languages and norms, and strengthening trust in health authorities while upholding informed consent and respecting cultural worldviews. Ultimately, the study's justification rested on its potential to contribute to equitable health outcomes by identifying determinants of hesitancy and acceptance, informing targeted interventions, and supporting Nigeria's broader objectives of measles-rubella control and elimination through increased uptake. In synthesis, the justification stated that addressing misinformation with rigorous, culturally attuned research would yield actionable insights to reduce disparities, optimize immunization programs, and bolster population health resilience in Bayelsa State and comparable settings.

General objective

The study aimed to identify and understand the determinants of acceptance and hesitancy toward measles-rubella vaccination uptake among households in Bayelsa State, Niger Delta Region, by examining how socio-demographic factors, beliefs and misconceptions, information sources, trust in health systems, and accessibility influenced vaccination decisions.

Specific objectives

a. To describe the vaccination uptake for measles-rubella within the target population and to determine the overall level of acceptance and hesitancy among caregivers in Bayelsa State.

b. To assess the association between caregiver characteristics (age, education, income, urban/rural residence) and the acceptance or hesitancy toward MR vaccination.

c. To identify prevalent beliefs, myths, and misconceptions related to MR vaccines and to evaluate their relationship with uptake decisions.

d. To examine the influence of information sources (health workers, media, social networks, religious and community leaders) on caregivers' vaccination attitudes and behaviours.

e. To evaluate the role of trust in health systems, vaccine safety perceptions, and perceived disease risk in shaping MR vaccination uptake.

f. To assess logistical and health system factors (access to services, cold chain reliability, wait times, availability of vaccines) associated with acceptance or hesitancy.

g. To explore potential moderating or mediating factors (e.g., perceived social norms, cultural beliefs, prior vaccination experiences) in the relationship between beliefs and vaccination uptake.

h. To provide evidence-based recommendations for interventions aimed at improving MR vaccination acceptance and reducing hesitancy in Bayelsa State.

Research questions

a. What factors influenced acceptance and hesitancy toward measles-rubella vaccination uptake among households in Bayelsa State, Niger Delta Region?

b. How were socio-demographic characteristics, beliefs and misconceptions, information sources, and trust in health systems associated with caregivers' decisions to vaccinate their children against measles and rubella?

c. What were the prevalent myths and misconceptions about the MR vaccine, and how did these beliefs relate to vaccination uptake patterns across different communities?

d. How did logistical and health-system factors—such as access to services, cold chain reliability, wait times, and vaccine availability—mediate or moderated the relationship between beliefs and MR vaccination uptake?

Scopes and limitations

Scopes

a. The study encompassed households within Bayelsa

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State, located in the Niger Delta Region, and focused on measles-rubella vaccination uptake among children within the recommended age range during the specified campaign period.

b. It examined determinants of acceptance and hesitancy, including socio-demographic characteristics, beliefs and misconceptions, information sources, trust in health systems, and accessibility to vaccination services.

c. The analysis integrated multiple theoretical lenses—such as the Health Belief Model, Theory of Planned Behaviour, and 3C/5C vaccine hesitancy framework—to contextualize caregiver decisions.

d. Data collection combined quantitative household survey methods with qualitative elements (where applicable) to capture both prevalence and contextual nuance of beliefs and behaviours.

e. The study drew on existing health system records for triangulation, including vaccination registers and supply chain indicators, to complement self-reported information.

f. Ethical considerations were adhered to, with informed consent obtained from participants and confidentiality safeguarded; findings were interpreted within the local cultural and policy context of Bayelsa State.

Limitations

a. The cross-sectional design limited causal inferences and only allowed identification of associations between determinants and uptake at a single time point.

b. Potential recall bias affected self-reported vaccination status and beliefs, particularly for events occurring several months prior to data collection.

c. Social desirability bias might have led some respondents to overreport acceptance or desirable health behaviours.

d. Sampling constraints, including non-response or incomplete contact with households in hard-to-reach riverine areas, could have introduced selection bias and affected generalizability.

e. Measurement limitations existed for complex constructs such as beliefs, mistrust, and social norms, which might not have been fully captured by the survey instruments or scales used.

f. Variability in campaign timing, local events, or concurrent health interventions during the study period could have influenced uptake independently of the studied determinants, complicating attribution.

g. Data quality constraints, including incomplete vaccination records or inconsistencies between administrative data and caregiver reports, might have affected the accuracy of uptake estimates.

h. The study's findings were most directly applicable to Bayelsa State and similar contexts within the Niger Delta, limiting extrapolation to other regions with different cultural, infrastructural, or policy environments.

Literature Review

Epidemiology of measles and rubella in a global context and in Nigeria unfolded as a narrative of widespread transmission, persistent disparities, and gradual progress toward control through vaccination and public health infrastructure [8,16]. In the global arena, measles emerged as one of the most contagious human diseases, with the basic reproduction number (R0) estimated at 12 to 18. Its transmission occurred through respiratory droplets and extended through communities with relatively high efficiency, leading to periodic outbreaks that travelled across borders with ease. Before the widespread use of vaccines, measles caused millions of deaths annually, disproportionately affecting children in low- and middle-income countries. Rubella exhibited a different, often milder clinical profile but posed severe consequences when pregnant women were infected, giving rise to *congenital rubella syndrome* and lifelong disabilities in newborns. Globally, rubella circulated endemically in many regions, with periodic outbreaks that strained health systems and underscored the importance of vaccination to prevent congenital outcomes. The epidemiology of measles worldwide showed a pattern of rapid spread in populations lacking herd immunity [17,18]. Seasonal peaks, typically correlating with dry, crowded conditions and reduced ventilation in some settings, marked historical transmission cycles. Large metropolitan areas experienced rapid amplification of transmission, which complicated containment efforts. The introduction of measles-containing vaccines (MCV) in national immunization programs began to alter these patterns, gradually reducing incidence and mortality in many regions. Nevertheless, global progress varied by geography and era, with some countries achieving high coverage and sustained elimination targets, while others faced persistent gaps due to access barriers, conflict, and vaccine hesitancy. Rubella's global epidemiology highlighted the endemic circulation of the virus in numerous countries, often with underrecognized burden due to the perceived mildness of typical rubella infections. Congenital rubella syndrome (CRS) persisted in settings with gaps in vaccination coverage, leading to substantial long-term health and social costs [8]. The global introduction of rubella-containing vaccines, frequently administered as part of combined measles-mumps-rubella (MMR) or measles-rubella (MR) immunization schedules, gradually shifted the disease burden downward. Over time, several regions achieved substantial reductions in CRS and rubella incidence, though outbreaks continued to occur in areas with weak immunization systems or vaccine misinformation.

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In Nigeria, the epidemiology of measles and rubella reflected a mix of urban-rural disparities, variable routine immunization performance, and episodic outbreaks. Measles transmission persisted at detectable levels in many communities, particularly where vaccination coverage remained suboptimal or irregular [19,20]. Outbreaks often followed periods of extended transmission chains, with children under five years of age bearing a disproportionate share of cases [21]. Surveillance systems faced challenges such as incomplete case reporting, delayed laboratory confirmation, and limited laboratory capacity, which complicated timely assessment of disease burden and program impact. Measles mortality declined in areas where vaccination campaigns and routine immunization efforts reached higher coverage, yet pockets of susceptibility continued to fuel outbreaks in some states and regions. Rubella circulated in Nigeria as well, frequently going under the radar because many infections were mild or asymptomatic. However, the potential for CRS remained a critical concern when pregnant women contracted the virus. National immunization strategies gradually integrated rubella-containing vaccines into the child health schedule, aiming to reduce CRS incidence. The successful introduction of MR/MMR vaccines and the expansion of routine immunization services contributed to declines in rubella cases and CRS in parts of the country, although achievements varied by state and community. Public health authorities faced ongoing challenges, including vaccine supply logistics, rural access barriers, and the need for effective communication campaigns to counter misinformation. Across both diseases, global and national narratives demonstrated that high vaccination coverage, robust surveillance, and timely outbreak response were essential to altering epidemiologic trajectories. The reduction in measles incidence and CRS prevalence in many settings underscored vaccination's impact, while vigilance remained crucial to prevent resurgence. International collaboration, funding, and technical support facilitated vaccine introductions, cold chain strengthening, and data systems that improved monitoring of disease patterns and vaccination performance. In summary, the global context of measles and rubella epidemiology showed a trajectory from high, uncontained transmission toward progressively controlled disease with substantial, though variably distributed, gains. In Nigeria, epidemiologic patterns mirrored broader national efforts to strengthen immunization programs, address surveillance gaps, and close immunity gaps that fuelled outbreaks. The historical arc highlighted the central role of immunization, surveillance, and health system resilience in shaping the burden of these diseases and advancing public health outcomes for populations both within Nigeria and around the world.

Bayelsa State embarked on Measles Rubella Vaccination Campaigns with a clearly defined plan to achieve high coverage among the target population of 0–14 years, integrating MR vaccination into routine services while coordinating supplementary immunization activities to close immunity gaps; during the campaign, the state deployed multiple strategies, including community-based vaccination campaigns, school-based vaccination campaigns, faith-based vaccination initiatives, and other complementary approaches, thereby enhancing reach and engagement across diverse settings. The planned vaccination program was designed to align MR vaccination with national immunization policies and regional health priorities, coordinating inputs from state and local authorities, health workers, community leaders, religious organizations, and development partners to ensure coherent logistics, cold chain integrity, and efficient service delivery across fixed sites, outreach operations, schools, mosques, churches, and community venues. Pre-campaign assessments identified age-appropriate cohorts, with MR targeting typically encompassing children from ages 9 months to 14 years, and included catch-up activities where applicable, while logistics planning emphasized vaccine supply forecasting, cold chain capacity, syringe and safety stock, waste management, and transportation for outreach teams; risk communication strategies were developed to counter hesitancy and misinformation, utilizing culturally resonant messaging, local languages, and trusted messengers to sustain confidence and demand for MR and co-administered vaccines. The immunization schedule was crafted to harmonize with national guidelines and Bayelsa's epidemiological realities, featuring routine MR doses integrated within the measles-rubella schedule or measles-containing vaccine regimens, a second MR dose or MR-inclusive catch-up activities to ensure complete immunity, and synchronized administration of other vaccines such as malaria vaccines and HPV vaccines where feasible, alongside deworming and vitamin A supplementation during integrated campaigns; emphasis was placed on optimizing contact opportunities by coordinating with child health services, schools, community events, religious centres, and marketplace gatherings, while maintaining strict adherence to cold chain requirements, vaccine stock management, adverse event monitoring, and accurate data capture for monitoring and evaluation. Elimination goals and high-coverage targets were framed around interrupting transmission, reducing MR and CRS burden, and achieving sustained high coverage across local government areas; the campaigns sought to reach at least 90 percent coverage in defined strata, with particular focus on hard-to-reach communities, urban slums, riverine populations, and displaced persons, and to maintain or improve routine immunization performance to sustain herd protection [22,23]. Robust surveillance systems were maintained to detect outbreaks promptly, verify progress toward elimination, and guide timely corrective actions, including additional SIAs if necessary, while data systems, monitoring tools, and supervisory structures ensured accountability

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and quality control. Implementation plans featured phased rollouts, micro-planning at local government areas, and iterative monitoring cycles, with post-campaign evaluations, coverage surveys, and surveillance indicators employed to assess achievement against targets, and with adaptive strategies such as targeted outreach, extended campaign windows, or intensified health education campaigns applied where gaps emerged. Challenges encountered included logistical barriers in geographically dispersed and hard-to-reach communities, vaccine supply fluctuations, varying health-seeking behaviours, and sociocultural resistance in some locales; these challenges prompted adaptive measures such as mobile sessions, flexible scheduling, multilingual communications, and engagement with traditional and religious leaders to bolster uptake [24]. The overarching outcome indicated that the planned vaccination program, immunization scheduling, and elimination goals for high coverage contributed to incremental improvements in MR coverage, broader protection against vaccine-preventable diseases through co-delivered vaccines, and strengthened health system performance, while informing future iterations of Bayelsa State's immunization strategy within Nigeria's measles-rubella elimination efforts. The experience underscored the critical role of integrating routine immunization with supplemental campaigns, maintaining robust surveillance, sustaining reliable supply chains, and pursuing equity-centred implementation to advance toward higher coverage and reduced disease burden in Bayelsa State.

Theoretical Framework

Myths, beliefs, and misconceptions about vaccines and vaccination had worn many disguises, shifting with time, place, and circumstance. This synthesis organized them into a landscape that scholars could navigate to understand why people accepted or refused immunization [25-27]. Safety narratives dominated early discussions. Tales that vaccines caused infertility, autoimmune disorders, neurological harm, or chronic illness circulated in households and communities, often anchored by personal stories or whispered rumours. Fear of adverse outcomes and side effects was magnified by eye-catching headlines and, later, by unchecked online chatter, shaping risk perception and parental choices about vaccinating their children. Beliefs about efficacy and necessity formed another prominent strand. Some individuals doubted whether vaccines were truly effective or warranted, especially when disease threats seemed distant or when traditional health practices were valued. Arguments about natural immunity, doubts about schedule adequacy, and claims that vaccines offered limited protection contributed to hesitancy and delayed or skipped immunizations [25]. Issues of trust and credibility also loomed large. Skepticism toward pharmaceutical companies, government agencies, and international health organizations reflected historical grievances, governance concerns, and perceptions of inequity. Doubts about transparency, vaccine provenance, and how adverse events were reported undermined willingness to participate in vaccination programs [28,29]. Myths propagated by family, peers, leaders, or media personalities leveraged local norms and cultural narratives to shape collective attitudes toward vaccines. Rumours about origins, conspiracies, or misattributions of illness to vaccination persisted as powerful influencers [13,30,31]. Religious, cultural, and philosophical beliefs acted as formidable determinants. Worldviews that framed health as divine will, or that favoured traditional healing systems, could align with or oppose public health messages, directly affecting uptake patterns. These frames often interacted with the design and delivery of immunization campaigns. Logistical and access-related beliefs were structural yet pervasive. Perceptions of clinic inaccessibility, cost barriers, time constraints, or complex scheduling fostered a sense that vaccination was impractical, even when vaccines were available. Language barriers, confusing forms, and long waits time further solidified these impressions [32]. Knowledge gaps and cognitive simplifications also played a role. Limited scientific literacy, uncertainties about ingredients or mechanisms, and confusion about different vaccine types produced straightforward, sometimes erroneous conclusions. Educational disparities and cultural knowledge systems intersected with these gaps, shaping how communities interpreted immunization [33]. Past encounters with health interventions—whether positive, negative, or coercive—shaped current attitudes, sometimes producing intergenerational inertia. Visible benefits and personal trust in the health system, when present, tend to reinforce ongoing vaccination practices. People weighed disease risk against vaccine risk, a calculus coloured by personal experience, family history, and community narratives. When benefits appeared uncertain or risks seemed inflated, hesitancy intensified. Social and normative forces proved decisive in many contexts. The expectations of parents, elders, religious leaders, teachers, and neighbours created descriptive and injunctive norms that either supported or deterred vaccination. The degree of conformity to these social pressures often determined whether individuals pursued immunization for themselves or their children. From these observations, practical implications emerged. Public health communications needed to be culturally resonant, transparent, and evidence-based, acknowledging concerns while presenting clear information. Engagement with trusted community figures, use of local languages, and dialogue, non-punitive approaches tend to be more effective than mere instruction [34,35]. Strengthening health systems—ensuring steady vaccine supply, accessible services, and responsive adverse-event monitoring—helped align beliefs with opportunities to vaccinate. Ongoing monitoring of beliefs and attitudes, coupled with flexible, context-sensitive implementation strategies, was essential to

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address evolving myths and shifting social contexts [26,36]. In summary context, the categories of myths, beliefs, and misconceptions about vaccines and vaccination had proven to be diverse and context-dependent, reflecting the intricate weave of cognition, culture, institutions, and social networks. Viewing these categories through multidisciplinary lenses provided a nuanced map for designing more equitable and effective vaccination strategies across varied settings.

From a theoretical perspective, scholars examined these phenomena through lenses such as the *Health Belief Model, the Theory of Planned Behaviour*, and the *3C/5C Frameworks* of vaccine hesitancy, which helped elucidate how perceived susceptibility, perceived severity, perceived benefits and barriers, social norms, trust, and confidence interacted to influence vaccination behaviour. In many settings, misinformation propagated via word of mouth, community leaders, religious authorities, and evolving information ecosystems, including newspapers and early broadcast media, before digital platforms amplified rapid dissemination of unfounded claims. Myths commonly addressed feared adverse outcomes, such as rumours links between vaccines and chronic diseases, questions about the safety of biological products, and suspicions about pharmaceutical industry motives, all of which undermined confidence in immunization programs. In Bayelsa State, common beliefs and misconceptions about vaccination included fears that vaccines caused infertility, autism, and disruption of the immune system in children; perceptions that vaccines were not safe or efficacious, accompanied by concerns about numerous side effects; and the view that vaccine-preventable diseases could be cured through traditional or herbal medicines [3,13,24]. A scholarly analysis using the *Health Belief Model (HBM), the Theory of Planned Behaviour* (*TPB*), and the *3C/5C Model of Vaccine Hesitancy* contextualized these beliefs within households, communities, and health systems. From an HBM perspective, individuals perceived vaccines as potentially harming fertility and immune disruption, while perceiving the diseases targeted by vaccines as less threatening or less immediate than other health concerns; perceived susceptibility and severity varied across communities, with some caregivers underestimating their child's risk of vaccine-preventable diseases and overestimating the risks of vaccination. Perceived benefits were contested; some believed vaccines offered limited protection or were unnecessary due to reliance on traditional remedies, whereas perceived barriers—logistical challenges, distrust in health authorities, fear of adverse events, and cultural misgivings—reduced the likelihood of initiating or completing immunization schedules [37-39]. Cues to action, such as health worker recommendations or community campaigns, sometimes failed to overcome entrenched beliefs when they conflicted with local worldviews. Self-efficacy fluctuated with caregivers' confidence in navigating health facilities, managing potential side effects, and communicating with providers, influencing whether they proceeded with vaccination [40]. Within the TPB framework, attitudes toward vaccination in Bayelsa State reflected ambivalence and occasional negativity, shaped by concerns about safety, efficacy, and potential interference with natural or traditional healing practices. Subjective norms carried substantial influence; endorsements or discouragement from family members, religious leaders, and respected elders affected decisions, with some networks reinforcing acceptance while others reinforced hesitancy. Perceived behavioural control captured practical constraints—distance to clinics, transportation costs, clinic hours, and the perceived complexity of vaccination schedules—leading to lower perceived control and reduced vaccination intentions. Behavioural intentions thus translated into varied uptake behaviours, particularly in hard-to-reach communities where access barriers were salient [41-43]. The 3C/5C model illuminated three core components: confidence, complacency, and convenience; confidence encompassed trust in vaccine safety, efficacy, and the reliability of health systems, which was undermined by rumours and experiences of side effects; complacency reflected underestimation of disease risk and differing beliefs about the necessity of vaccination given alternative health practices; convenience captured the ease of accessing vaccination services, appointment systems, and the quality of service delivery; in extended 5C formulations, calculation and collective responsibility were added, highlighting how individuals weighed individual risks and benefits and considered community protection as a shared obligation. In Bayelsa, misinformation linking infertility, autism, and immune disruption acted as powerful drivers of diminished confidence, while claims of cures through traditional medicine reinforced complacency and reduced perceived behavioural control by implying that vaccination was optional or unnecessary [27,44,45]. From a policy perspective, these models suggested that interventions should be multifaceted and culturally resonant. Enhancing perceived threat and severity required culturally tailored risk communication that connected disease burden to local experiences; amplifying perceived benefits demanded transparent demonstrations of vaccine impact within communities; reducing perceived barriers involved improving service accessibility, ensuring reliable cold chains, providing respectful and effective provider communication, and offering clear information about adverse events. Strengthening self-efficacy could be achieved by guiding caregivers through vaccination processes, appointments, and post-vaccination care; leveraging positive subjective norms involved engaging trusted community figures, including religious and traditional leaders, to shift norms toward vaccination acceptance; increasing perceived behavioural control required flexible service delivery, outreach programs, and user-friendly vaccination channels; building

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confidence necessitated transparent information about vaccine development, regulatory oversight, monitoring of adverse events, and consistent messaging; addressing calculation and responsibility involved providing balanced, evidence-based risk–benefit analyses and reinforcing the social value of herd protection. Implications for health systems indicated a need for culturally appropriate communication strategies that respected local beliefs while delivering scientifically accurate information; they also underscored the importance of strengthening health system factors—consistent vaccine supply, adequately trained personnel, accessible clinics, and comprehensible documentation—to convert favourable beliefs and attitudes into sustained vaccination behaviour [34]. In context, the integration of HBM, TPB, and 3C/5C perspectives offered a comprehensive lens to understand how infertility fears, autism myths, concerns about immune disruption, safety and efficacy apprehensions, and beliefs in traditional cures interacted with individual perceptions, social influences, and structural barriers in Bayelsa State. These insights informed contextualized interventions aimed at enhancing confidence, modifying social norms, and removing practical barriers, thereby contributing to improved immunization coverage and protection against vaccine-preventable diseases.

Conceptual framework

Bayelsa State undertook an enlightenment campaign designed to dispel and debunk rumours and beliefs about vaccines by leveraging a comprehensive, multi-channel communication strategy that included radio, television, social media, Facebook, community stakeholders' engagement, marketplace announcements, town criers, community radio, and engagement with the National Orientation Agency (NOA), with the overarching aim of strengthening vaccine acceptance and uptake. Recognizing that information access varied across populations, campaign planners sought to tailor messages to diverse audiences, incorporating cultural contexts, linguistic diversity, and local realities across urban centres, riverine communities, and hard-to-reach areas. Radio broadcasts served as a foundational component of the outreach, featuring health professionals, traditional and religious leaders, and parents sharing clear, evidence-based information about vaccine safety, efficacy, and immunization benefits; dramatic sketches, call-in formats, and catchy audio cues were employed to stimulate dialogue, address common concerns, and provide practical guidance on vaccination schedules and service points. Television programming supplemented radio efforts by presenting visually engaging demonstrations of immunization processes, testimonials from families, and concise infographics that debunked prevailing myths in accessible formats; broadcasts were scheduled to maximize audience reach during peak viewing periods across local and national channels. Social media platforms, including Facebook and other digital channels, were used to counter misinformation and provide real-time updates on MR campaigns, vaccine availability, and outreach activities; content encompassed short videos, infographics, FAQs, myth-busting threads, and moderated discussions to minimize the spread of false claims; digital ambassadors—health workers, community influencers, parent advocates—facilitated conversations, answered questions, and directed users to reliable sources and service points; targeted promotions extended reach to younger caregivers who frequently used mobile devices and messaging apps. Community stakeholders' engagement formed a cornerstone of the approach, bringing together traditional leaders, religious authorities, teachers' associations, women's groups, youth organizations, marketplace associations, and student bodies to endorse vaccination, host interactive forums, and model supportive behaviours; mobilization activities included town hall meetings, door-to-door campaigns, school-based outreach, and marketplace announcements to align community norms with public health recommendations. Marketplace announcements, town criers, and community radio extended the campaign's reach into informal daily encounters, delivering succinct messages, reminders, and calls to action in local languages; the National Orientation Agency contributed through coordinated national messaging, aligning Bayelsa's efforts with broader public health campaigns and ensuring consistency in tone and content across regions. Content was crafted to address specific myths identified in prior assessments, including infertility, autism, immune disruption, safety and efficacy concerns, and perceived disease severity; messages emphasized vaccine safety monitoring systems, regulatory oversight, and transparent reporting procedures, while inviting questions and encouraging informed decision-making. The campaign integrated linkage to service delivery by promoting vaccination sites, outreach schedules, and reminder systems, thereby reducing missed opportunities for immunization. The campaign was evaluated through monitoring and evaluation activities that tracked reach, engagement, knowledge changes, attitudinal shifts, and reported intended behaviours; feedback mechanisms informed iterative refinements of content and delivery formats, with adaptations to improve accessibility for non-literate audiences through vernacular languages and audiovisual formats. Cross-channel consistency was maintained to prevent contradictions; spokespersons were trained to deliver harmonized messages, to minimize technical jargon, and to respond with empathy to caregiver concerns; collaborations with local media houses, NOA affiliates, and NOA bureaus ensured contextual relevance and sustainability, while data-sharing agreements with partners enabled rapid dissemination of accurate information. Challenges persisted, including deeply entrenched beliefs, variable access in remote areas, and occasional resource constraints; however,

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the multi-pronged approach demonstrated potentials for enhancing awareness of vaccine benefits, fostering trust in health authorities, and shifting norms toward greater vaccine acceptance and uptake in multiple communities. In a nutshell, Bayelsa State's enlightenment initiatives—across radio, television, social media, Facebook, community stakeholders' engagement, marketplace announcements, town criers, community radio, and the National Orientation Agency—represented a comprehensive, multi-modal effort to dispel myths about vaccines. The campaigns highlighted the capacity of coordinated, culturally attuned communication strategies to align public understanding with scientific evidence, support higher vaccination coverage, and bolster population health resilience, while underscoring the need for ongoing adaptation to evolving misinformation landscapes and diverse communication environments.

Methods

Study design

The study was conducted using a cross-sectional design in communities and settlements where measles-rubella vaccination took place, while also sampling stakeholders in the cold chain system to provide context and insights into the logistical challenges encountered during the campaign. Data were collected at a single point in time across multiple sites, employing quantitative survey instruments for residents and vaccination teams, as well as targeted assessments for cold chain personnel. The design enabled simultaneous examination of household-level uptake determinants and supply-chain factors, allowing for triangulation between immunization outcomes and logistical constraints. Analyses focused on associations between demographic, behavioural, and system-level variables and vaccination uptake, while acknowledging the limitations of cross-sectional data for establishing causality.

Study area

Bayelsa State is located in the southern part of Nigeria, in the Niger-Delta region. It is bordered by Rivers State to the West and Delta State to the East with a long span of Atlantic Ocean at the south. The capital city is Yenagoa. Bayelsa has a population of about 2,537,400 with a landscape area of 9,391 km^2 [46]. Demographic data for Bayelsa State indicates that most of the population belongs to the Ijaw ethnic group, which is the dominant ethnic group in the state. Other minority ethnic groups include the Ogbia, Nembe, and Epie-Atissa. The main languages spoken in Bayelsa State are Ijaw, Epie-Attisa, Isoko, Urhobo and English. Bayelsa State has a predominantly Christian population, with Christianity being the major religion practiced in the state. However, there are also adherents of other religions, including traditional Africans religions and Islam. The economy of Bayelsa State is predominantly petroleum resources, as the state is in the oil-rich Niger Delta region. Bayelsa has one of the largest crude oil and natural gas deposits in Nigeria, with the Oloibiri Oilfield being the site of the country's first oil discovery. Other mineral raw materials found in the state include salt, agro raw materials include cassava, plantain, rice, and fish.

Study population

The study population comprised individuals and units drawn from Bayelsa State, located in the Niger Delta Region, who participated in the Measles Rubella vaccination campaigns and related immunization activities during the campaign period. The population included households with children in the target age range for MR vaccination, caregivers responsible for immunization decisions, and community members residing across all eight Local Government Areas (LGAs) of Bayelsa State, including urban centres, riverine communities, and hard-to-reach settlements where vaccination services were delivered. The MR vaccination target encompassed children aged 0 to 14 years, with particular emphasis on those within the 9-month to 14-year bracket, aligning with policy guidelines and local epidemiological considerations. The sampling frame captured both accessible households and those in hard-to-reach areas across all LGAs to ensure representation of geographic, socioeconomic, and cultural diversity; inclusion criteria for the household component required residence in Bayelsa State during the campaign, at least one child within the MR target age range, and informed consent from caregivers, while the facility and stakeholder components included personnel involved in vaccination campaigns, cold chain management, and vaccine distribution who consented to participate. Exclusion criteria eliminated households without eligible children and individuals or facilities not engaged in MR vaccination activities. The study population reflected a cross-section of urban, peri-urban, riverine, and rural communities, enabling exploration of variations in access, uptake, and acceptance across different contexts within the Niger Delta region. Ethical considerations guided participant recruitment and engagement, ensuring confidentiality, minimizing risks, and respecting cultural norms and community governance structures. The population served as the empirical basis for analyzing determinants of uptake, acceptance, and hesitancy, as well as the interaction between household decisions and health system performance across the eight LGAs, contributing to a nuanced understanding of MR vaccination dynamics in Bayelsa State.

Sample size determination

To calculate the sample size for the study on vaccine acceptance and hesitancy in Bayelsa State, Nigeria, we used a formula suitable for unknown population sizes. Given that the population size was unknown, we applied Cochran's formula for sample size estimation. The formula is as follows:

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$$n_o = \frac{Z^2 \times p(1-p)}{E^2}$$

Where:

n_o = required sample size

Z = Z-value (the number of standard deviations from the mean for a given confidence level)

p = estimated proportion

E = margin of error

Given:

p = 0.5 (5%)

Z = 1.96 (confidence interval of 95%)

E = 0.04 (margin of error of 4%)

Calculation:

Using the assumed margin of error of 0.04, we could calculate the sample size:

Substitute the values into the formula:

$$n_o = \frac{(1.96)^2 \times 0.5 \times (1-0.5)}{(0.04)^2}$$

Calculate:

$Z^2 = (1.96)^2 \approx 3.8416$

$(1-p) = 1-0.5 \approx 0.5$

$p(1-p) = 0.5 \times 0.5 \approx 0.25$

$E^2 = (0.04)^2 = 0.0016$

$$n_o = \frac{3.8416 \times 0.25}{0.0016} = \frac{0.9604}{0.0016} = 600.25 \approx 600$$

Thus, the final sample size calculated for the study was 600 participants.

Sampling technique

The sampling technique deployed for this study combined multi-stage, stratified, and random sampling elements to achieve representativeness across Bayelsa State's eight Local Government Areas (LGAs) while capturing both household-level and stakeholder perspectives. First, all eight LGAs were selected to ensure comprehensive geographic coverage and to reflect the diverse urban, riverine, and rural contexts within the Niger Delta region. Within each selected LGA, a mapping exercise identified communities and settlements eligible for inclusion; a random number system was applied to allocate sampling units, thereby mitigating selection bias in site choice. At the community level, households with children aged 9 months to 14 years were eligible for sampling; a random approach (as appropriate to local listing availability) was used to select households within each community, ensuring that the MR target population was adequately represented. The cross-sectional design employed a single-point assessment across the sampled communities, capturing contemporaneous data on uptake determinants, beliefs, and logistical factors. Concurrently, critical stakeholders possessing knowledge of cold chain logistics and immunization operations were sampled to provide context and triangulate household-level findings. This stakeholder sampling leveraged purposive selection guided by predefined criteria—namely, involvement in vaccine storage, distribution, and inventory management—while also incorporating elements of randomization where feasible to reduce selection bias among eligible stakeholders. In terms of size and allocation, the study used a predetermined sampling frame that balanced logistical feasibility with the need for sufficient statistical power; sample sizes for households and for stakeholders were calculated to detect anticipated effect sizes with acceptable precision, and allocation across LGAs reflected population distribution and program reach. The technique integrated quantitative survey administration with potential qualitative components to enrich interpretation, while maintaining methodological rigour through standardized questionnaires, training of field teams, and consistent data collection protocols. Data quality checks, pilot testing, and supervision were embedded throughout the process to ensure reliability and validity. Overall, the sampling design combined randomization at site selection with systematic household and stakeholder sampling to enable robust analysis of MR vaccination uptake determinants across Bayelsa State's eight LGAs in a cross-sectional framework.

Selection criteria

The study employed clearly defined inclusion and exclusion criteria to ensure the reliability and relevance of findings across households and key stakeholders involved in the Measles-Rubella vaccination campaigns in Bayelsa State. The criteria were articulated prior to fieldwork and implemented consistently throughout the data collection process.

Inclusion Criteria

a. Households within Bayelsa State that resided in the eight Local Government Areas (LGAs) and contained at least one child aged 9 months to 14 years, thereby representing the Measles-Rubella target population.

b. Caregivers or guardians who provided informed consent and demonstrated willingness to participate in the survey, yield accurate information about vaccination uptake, and allow access to vaccination records where available.

c. Communities and settlements that were mapped and selected for inclusion using a random-number system, ensuring geographic representation across urban centres, riverine communities, and hard-to-reach areas within each LGA.

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d. Respondents who possessed adequate knowledge, or could reliably report, on MR vaccination status, exposure to vaccination campaigns, and related health-seeking behaviours, enabling assessment of determinants of acceptance and hesitancy.

e. Critical stakeholders with expertise in cold chain logistics and immunization operations who consented to participate, including vaccine logisticians, storekeepers, nurses, and supervisors directly involved in vaccine storage, distribution, and inventory management.

f. Data collection units across sites that permitted adherence to standardized survey instruments, ensuring uniformity in data capture and facilitating comparability across communities and stakeholder groups.

g. Participants who completed the survey instruments and any required qualitative components (where applicable) within the specified data collection window, without compromising respondent confidentiality.

Exclusion Criteria

a. Households lacking any child within the MR target age range (9 months to 14 years) or households in which no eligible child resided during the campaign period were excluded from the household sampling frame.

b. Individuals who declined informed consent or withdrew participation at any stage, thereby removing their data from analyses.

c. Communities or settlements that could not be randomly selected or that were inaccessible due to security, safety, or logistical constraints, leading to their exclusion from the randomization process.

d. Households where respondents were unable to provide reliable information about vaccination status due to recall limitations beyond the study's defined recall window or where records were unavailable and unverifiable.

e. Stakeholders who did not meet the predefined eligibility criteria for cold-chain and logistics expertise, or who declined to participate, were excluded from the stakeholder sampling frame.

f. Facilities or sites that were not actively involved in MR vaccination activities, vaccine storage, distribution, or supply management, and therefore could not contribute relevant system-level data.

g. Data entries that failed quality assurance checks or could not be linked to the corresponding household or stakeholder respondent, ensuring integrity in analytic datasets.

Methods of data collection

The study employed a structured questionnaire as the primary data collection instrument, designed to capture a standardized set of information on MR vaccination uptake, caregiver beliefs, and contextual factors across households and stakeholders. The questionnaires were configured within the Kobo Toolbox (Kobo Collect) framework to facilitate streamlined data collection, real-time reporting, and centralized data management, enabling field teams to upload responses from tablets or mobile devices to a secure server. Data collection proceeded with trained data enumerators who conducted face-to-face interviews with caregivers and household heads, as well as administered surveys to eligible stakeholders involved in the cold chain and immunization operations. The training encompassed study protocols, ethical considerations, informed consent procedures, interview techniques, privacy protections, and the appropriate handling of sensitive health information. Enumerators practiced using the digital tools, navigated skip patterns, and implemented quality assurance steps to ensure data completeness and accuracy. During fieldwork, data collection leveraged in-person interviews at households, vaccination sites, and outreach venues across the eight LGAs of Bayelsa State, with supplementary observational components where applicable. Real-time reporting features within Kobo Collect enabled supervisors to monitor progress, flag inconsistencies, and request follow-up for ambiguous responses. Data were synchronized daily to a central repository, where preliminary cleaning and consistency checks were performed before formal analysis. To safeguard ethical standards, informed consent was obtained from all participants prior to participation, with assurances of confidentiality, voluntary participation, and the right to withdraw at any time without penalty. Anonymity was preserved by assigning unique identifiers to respondents and by securing personal information in password-protected files with access restricted to authorized study personnel. The combination of a structured questionnaire and a digital data collection platform, supported by well-trained enumerators and robust ethical safeguards, yielded a high-quality dataset suitable for analyzing determinants of MR vaccination uptake, acceptance, and hesitancy within Bayelsa State.

Validity and reliability test

Validity test

The study's validity had been established through a layered, theory-informed process that began with content validation, where experts across immunization, survey methodology, and regional sociocultural contexts weighed each item for relevance and clarity; revisions were iterated until the instrument reflected local realities in Bayelsa State. Construct validity was pursued by anchoring measurement to the Health Belief Model, Theory of Planned Behaviour, and the 3C/5C framework, followed by exploratory factor analyses to ensure that items loaded on the intended latent constructs; confirmatory analyses then tested the predicted interrelations

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among beliefs, attitudes, norms, and intended behaviours. Criterion-related validity was considered by juxtaposing survey outputs with external indicators such as vaccination registers and program performance metrics where feasible, while known-groups validity was explored by examining differential responses across urban versus rural settings, caregiver education levels, and prior vaccination experiences. Content coverage received further scrutiny via pilot testing and cognitive interviewing to confirm interpretability and exhaustiveness, and measurement invariance checks were performed to ascertain that the instruments functioned equivalently across language and demographic subgroups.

Reliability Test

Reliability focused on internal consistency and temporal stability. For multi-item scales measuring constructs such as perceived threat, perceived benefits, perceived barriers, self-efficacy, perceived behavioural control, and social norms, Cronbach's alpha coefficients were calculated with a priori benchmarks of at least 0.70 to indicate acceptable reliability; when subdimensions existed, item-total correlations and alpha-if-item-deleted analyses guided item retention or removal to maintain coherence. Test-retest reliability was assessed by re-administering the instrument to a subsample after a defined interval, with intraclass correlation coefficients or Pearson correlations evaluated to determine stability over time. Composite reliability and convergent/discriminant validity checks complemented these efforts, ensuring that inter-item associations reflected distinct constructs rather than measurement artefacts. Quality-control practices—such as double data entry, thorough interviewer training, and ongoing field supervision—supported data integrity and contributed to the dependability of findings. Taken together, the validity and reliability evidence drawn from theory-driven validation, empirical testing, pilot work, and rigorous data quality protocols underpinned credible inferences about determinants of MR vaccination uptake, acceptance, and hesitancy in Bayelsa State.

Data management and analysis

The study's data management and analysis processes were conducted with a multi-software workflow designed to ensure data integrity, analytical rigour, and transparent reporting. Data were initially collected and stored within the Kobo Collect toolkit, where responses were organized in a structured digital database. Upon completion of fieldwork, the data were extracted and downloaded into Microsoft Excel worksheets for cleaning and preliminary descriptive analysis; data cleaning steps included checking for missing values, outliers, inconsistencies in coding, and verification against source documents where possible. To enrich the descriptive statistics and provide a clear overview of uptake patterns, the cleaned dataset was employed to generate frequency distributions, cross-tabulations, measures of central tendency, and graphical representations. For inferential statistics, SPSS version 23 was utilized to conduct hypothesis testing and to explore associations between key variables such as caregiver characteristics, knowledge, attitudes, and vaccination uptake; analyses included chi-square tests for independence, t-tests or ANOVA for group comparisons where appropriate, and regression models to identify potential predictors of acceptance and hesitancy. In addition, multivariate analyses were performed using XLMiner, a data-mining-oriented toolkit, to examine complex relationships among multiple determinants of vaccination uptake; this step facilitated exploration of interaction effects, predictive modelling, and cluster patterns that might illuminate subgroups with distinct profiles of hesitancy or acceptance. Throughout these analyses, data integrity was maintained by adhering to standardized coding schemes, documenting variable definitions, and implementing version-controlled syntax where feasible to ensure reproducibility. For literature management and citation, Mendeley Reference Manager was employed to organize sources, generate in-text citations, and produce reference lists in accordance with the chosen citation style. The workflow emphasized meticulous documentation of data provenance, including data cleaning decisions, variable transformations, and analytic steps, to facilitate auditability and future replication. Quality assurance measures supported the data lifecycle: regular backups, access controls, and audit trails safeguarded confidentiality and data security; parallel runs and validation check across software tools helped detect discrepancies early; and a final analytic report summarized methods, results, limitations, and interpretations with attention to methodological transparency. In summary, the study's data management and analysis pipeline integrated Kobo Collect for data capture, Excel for cleaning and descriptives, SPSS 23 for inferential statistics, XLMiner toolkit for multivariate analyses, and Mendeley for reference management, collectively ensuring a credible, replicable, and ethically sound examination of determinants influencing MR vaccination uptake in Bayelsa State.

Timeline of the study

Research planning and proposal – July 2025: Planning commenced and the research proposal was developed, refined, and prepared for submission, detailing objectives, methodology, theoretical frameworks, and anticipated outputs.

Institutional consent– August 2025: Ethical approval and institutional consent were sought and received from the Ethics Committee of the Bayelsa State Primary Health Care Board, reference number PHCB/AD/172/Vol.1/p.27, enabling the study to proceed in accordance with governance and ethical requirements.

Data collection preparedness – September 2025: Data collection preparations were completed, including finalization of instruments, recruitment and training of data collectors,

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pilot testing, establishment of data management protocols, and verification of logistical arrangements for fieldwork.

Data collection – October to November 2025: Data collection occurred across selected communities and LGAs in Bayelsa State, encompassing household surveys and stakeholder interviews within the cold chain and immunization operations, with concurrent data quality checks and supervisory oversight.

Report writing and dissemination – December 2025 to January 2026: The study culminated in the drafting of the final report, manuscript preparation, and dissemination activities, including presentations to stakeholders and policy brief development to inform MR vaccination strategies in Bayelsa State.

Ethical consideration

Institutional consent: Ethical approval and institutional consent were obtained from the Ethics Committee of the Bayelsa Primary Health Care Board, documented under reference number PHCB/AD/172/Vol.1/p.27. The approval signified formal governance clearance, ensured alignment with national and state research ethics guidelines, and established the framework for safeguarding participant rights, confidentiality, and welfare throughout the study. Conditions attached to the approval were respected, including permission to access health records where applicable, adherence to data protection standards, and the obligation to report adverse events or unanticipated risks to the ethics committee promptly.

Community consent: Community-level consent was secured through engagement with community leaders, traditional authorities, and resident associations prior to data collection. Communities were informed about the study aims, procedures, potential risks and benefits, and the voluntary nature of participation; discussions emphasized collective considerations, cultural sensitivities, and local governance norms. Gatekeepers provided approval for fieldwork within their jurisdictions, and community assent was recorded through formal meetings, public notices, or culturally appropriate consent mechanisms were given approval. Researchers acknowledged community autonomy, respected local decision-making processes, and maintained transparent channels for addressing concerns or refusals without coercion.

Individual consent: Individual informed consent was sought from all participants or their legal guardians prior to data collection. Researchers presented clear information about study purposes, procedures, confidentiality safeguards, voluntary participation, and the right to withdraw at any time without penalty; comprehension was verified and written or appropriately documented consent was obtained according to participants' literacy and language needs. For minors, permission was obtained from caregivers or guardians, complemented by age-appropriate assent from older children when feasible. Confidentiality agreements were reinforced, identifying data were securely stored, and access to information was restricted to authorized study personnel. In cases of potential vulnerability, additional protections were implemented, including enhanced privacy measures and

Table 1: Demographic information.

Variable	Category	Frequency (n=600)	Percent (%)
Settlement	Urban	158	26%
	Rural	442	74%
Nature of settlement	Upland	437	73%
	Riverine	163	27%
Age	18-24 years	88	13%
	25-34 years	202	29%
	35-44 years	192	28%
	45-54 years	92	13%
	55 years and above	118	17%
Gender	Male	125	21%
	Female	475	79%
Educational level	No formal education	21	3%
	Primary education	100	17%
	Secondary education	325	54%
	Tertiary education	154	26%
Occupation	Self-employed	327	54%
	Unemployed	82	14%
	Civil servant	155	26%
	Private sector employee	36	6%
Income	Less than N30,000	114	19%
	N31,000 – N50,000	221	37%
	N51,000m – N100,000	133	22%
	N100,000 and above	132	22%

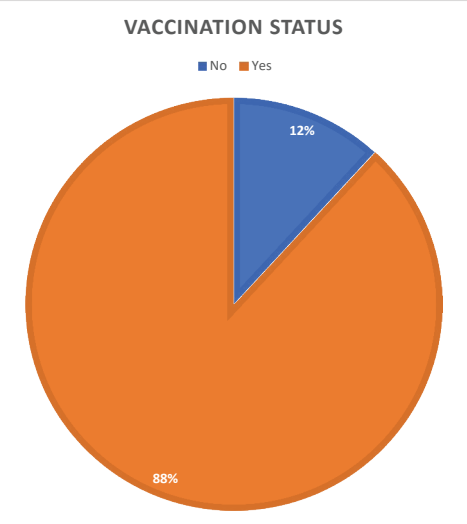

Figure 1: MR vaccination status.

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sensitivity to cultural or religious considerations. Overall, consent processes were designed to respect autonomy, minimize risk, and uphold ethical integrity across institutional, community, and individual levels.

Results

In a study examining vaccine acceptance and hesitancy among a sample of 600 participants (Table 1), demographic data revealed distinct patterns in settlement, age, gender, educational level, occupation, and income. The majority of participants, 442 individuals or 74%, resided in rural areas, while 158 participants, constituting 26%, lived in urban settings. Regarding the nature of their settlements, 437 participants, or 73%, were classified as living in upland areas, and 163 participants, representing 27%, lived in riverine regions. The age distribution indicated that the largest group of respondents fell within the 25-34 years category, comprising 202 individuals or 29%. This was followed closely by the 35-44 years age group, which included 192 participants or 28%. The younger demographic of 18-24 years accounted for 13% (88 individuals), while those aged 45-54 years represented another 13% (92 individuals), and participants aged 55 years and above made up 17% (118 individuals). In terms of gender, a significant majority of the participants were female, with 475 individuals or 79%, while males comprised only 125 participants or 21%. The educational level of respondents varied, with 325 individuals (54%) having completed secondary education, 154 (26%) possessing tertiary education, 100 (17%) having primary education, and a small fraction of 21 individuals (3%) with

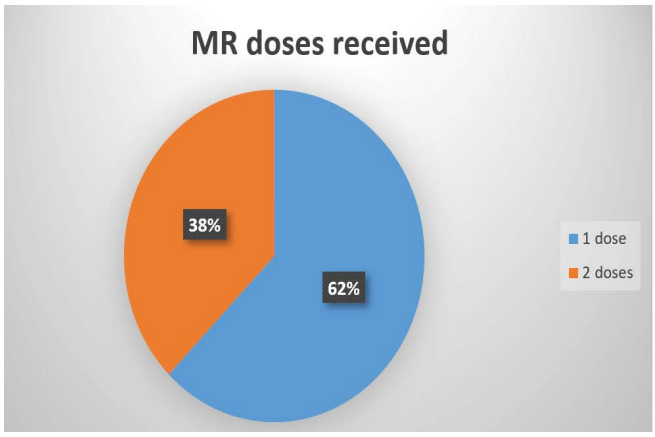

Figure 2: Number of MR doses received by children

no formal education. Occupationally, the largest group was self-employed, consisting of 327 participants or 54%. Civil servants accounted for 155 individuals (26%), while 82 participants (14%) were unemployed, and only 36 individuals (6%) were employed in the private sector. Income levels showed that most participants earned between N31,000 and N50,000, with 221 individuals (37%) in this category. Additionally, 114 participants (19%) earned less than N30,000, while 133 individuals (22%) and 132 individuals (22%) reported earning between N51,000 to N100,000 and N100,000 and above, respectively. These statistics provided a comprehensive overview of the demographic landscape of the participants, which is crucial for understanding the factors influencing vaccine acceptance and hesitancy within this population.

In the study examining the acceptance and hesitancy surrounding vaccination, the data revealed noteworthy insights regarding the vaccination of children against measles rubella. According to Figure 1, it was found that a significant majority of the children, 529 out of a total of 600, had received the measles rubella vaccine, indicating an acceptance rate of 88%. Conversely, only 71 children, or 12%, had not been vaccinated, reflecting a smaller proportion of vaccine hesitancy.

Table 2: Do vaccines cause infertility?

Variable	Frequency	Percent (%)
Agree	30	5%
Strongly agree	2	0%
Neutral	48	8%
Disagree	291	49%
Strongly disagree	229	38%

Figure 2 provided further details on the number of doses received by the vaccinated children. It showed that among the total population, 330 children, which accounted for 62%, had received one dose of the vaccine, while 199 children, or 38%, had received two doses. This distribution suggested that a substantial number of children were partially vaccinated, with a notable segment receiving the complete vaccination as recommended.

Figure 3 offered insights into the number of children vaccinated against measles rubella in relation to the number of children in each household. The data indicated that 58 households, making up 9%, had no children vaccinated. The

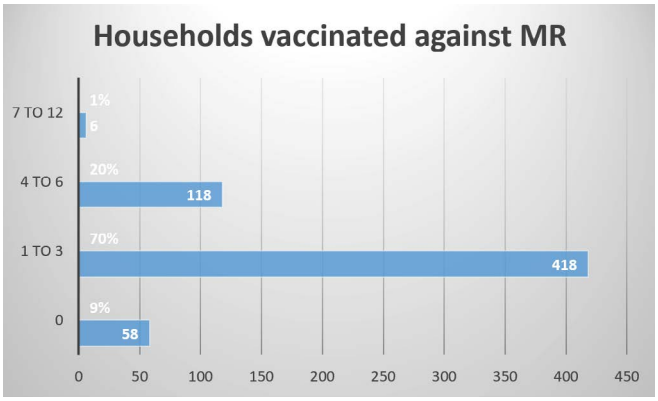

Figure 3: Number of households vaccinated against measle rubella.

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majority of households, totalling 418 or 70%, had between one to three children vaccinated, while 118 households, or 20%, reported four to six vaccinated children. Only 6 households, representing 1%, had seven to twelve children vaccinated.

Table 2 revealed that a significant majority of respondents did not believe that the measles rubella vaccine caused infertility. Specifically, 291 individuals (49%) disagreed with the statement, while 229 (38%) strongly disagreed. Only 30 respondents (5%) agreed, and 2 (0%) strongly agreed, indicating a general skepticism about the vaccine's link to infertility. Additionally, 48 respondents (8%) remained neutral on this issue.

Table 3: Do measles rubella vaccine has non-anticipated side-effects?

Variable	Frequency	Percent (%)
Agree	36	6%
Strongly agree	2	0%
Neutral	51	8%
Disagree	244	41%
Strongly disagree	267	45%

Table 3 focused on the perceived non-anticipated side effects of vaccines. Here, again, the majority of respondents expressed disbelief, with 244 (41%) disagreeing and 267 (45%) strongly disagreeing that vaccines had such side effects. Only 36 respondents (6%) agreed, and 2 (0%) strongly agreed, while 51 (8%) were neutral.

Table 4: Do measles rubella vaccine causes autism?

Variable	Frequency	Percent (%)
Agree	36	6%
Strongly agree	5	1%
Neutral	51	8%
Disagree	353	59%
Strongly disagree	155	26%

In Table 4, the respondents were asked whether they believed that the measles rubella vaccine caused autism. The data showed a high level of disagreement, with 353 respondents (59%) disagreeing and 155 (26%) strongly disagreeing. Only 36 individuals (6%) agreed, and 5 (1%) strongly agreed, while 51 respondents (8%) remained neutral, reinforcing the prevailing skepticism towards the vaccine's association with autism.

Table 5 addressed concerns about whether the measles rubella vaccine weakened the immune system. The results indicated that 288 respondents (48%) disagreed, and 221 (37%) strongly disagreed with this claim. A smaller segment, comprising 18 individuals (3%), agreed, while 3 (0%) strongly agreed. Additionally, 70 respondents (12%) were neutral, suggesting a strong inclination against the notion that the vaccine negatively affected immune strength.

Table 5: Do measles rubella vaccine weaken the immune system?

Variable	Frequency	Percent (%)
Agree	18	3%
Strongly agree	3	0%
Neutral	70	12%
Disagree	288	48%
Strongly disagree	221	37%

Table 6: Measles rubella was not serious disease?

Variable	Frequency	Percent (%)
Agree	29	5%
Strongly agree	5	1%
Neutral	56	9%
Disagree	326	54%
Strongly disagree	184	31%

Table 6 evaluated the perception of measles rubella as a serious disease. The findings indicated that a notable number of respondents, 326 (54%), disagreed with the assertion that it was serious, and 184 (31%) strongly disagreed. Only 29 (5%) agreed, while 5 (1%) strongly agreed, and 56 (9%) were neutral, reflecting a general perception that measles rubella was not viewed as a significant health threat.

Table 7: Use of traditional medicine for treatment of measles rubella was a better option.

Variable	Frequency	Percent (%)
Agree	42	7%
Strongly agree	4	1%
Neutral	58	9%
Disagree	335	56%
Strongly disagree	161	27%

In Table 7, respondents considered whether traditional medicine was a better option for treating measles rubella. The majority displayed skepticism, with 326 respondents (54%) disagreeing and 184 (31%) strongly disagreeing. Agreement was minimal, with only 42 (7%) agreeing, and 4 (1%) strongly agreeing, while 58 (9%) remained neutral.

Furthermore, Table 8 examined the belief in the capability of faith-based organizations to treat measles rubella associated diseases. The majority disagreed, with 343 respondents (57%) disagreeing and 189 (32%) strongly disagreeing. Agreement

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was again limited, with only 10 (2%) agreeing and 3 (0%) strongly agreeing, while 55 (9%) remained neutral.

Table 8: Faith-based organization could treat measles rubella disease.

Variable	Frequency	Percent (%)
Agree	10	2%
Strongly agree	3	0%
Neutral	55	9%
Disagree	343	57%
Strongly disagree	189	32%

Table 9 presented the statistics regarding the sources of information on the measles rubella vaccine. It was observed that health workers were the primary source of information, accounting for 23% of responses. Other notable sources included family members and friends, along with community leaders, each representing 15% of the information sources. Radio and banners/billboards/posters/pamphlets followed, with 11% each. Television provided information for 6% of the respondents, while social media contributed to 8%. Lastly, religious leaders accounted for 10%, and newspapers were the least consulted source, with only 1%.

Table 9: Source of information on vaccines.

Variable	Frequency	Percent (%)
Health workers	561	23%
Radio	269	11%
Television	136	6%
Social media	198	8%
Family members and friends	373	15%
Community leaders	373	15%
Religious leaders	250	10%
Banners/billboard/posters/pamphlets	279	11%
Newspaper	10	1%

Table 10 focused on the trust in information provided by the State Ministry of Health and the State Primary Health Care Board. A significant majority of respondents, 82%, expressed high trust in these sources, while 6% reported very high trust. Moderate trust was indicated by 7% of participants, while only 5% showed low trust and 0% reported no trust at all.

In Table 11, the trust in information from the Local Government Health Authority and Primary Health Centres was examined. Here again, a strong trust was noted, with 78% of respondents indicating high trust and 6% expressing very high trust. Moderate trust was reported by 12%, while 3% had low trust and 1% expressed no trust in these sources.

Table 10: How much do you trust the source of information on vaccine from State Ministry of Health and State Primary Health Care Board?

Variable	Frequency	Percent (%)
Low trust	27	5%
Moderate trust	43	7%
No trust	2	0%
High trust	492	82%
Very hight trust	36	6%

Furthermore, Table 12 presented the statistics on trust regarding information from partners such as WHO and UNICEF. The results were similar to the previous tables, with 77% of participants showing high trust and 7% indicating very high trust. Moderate trust was reported by 12%, while low trust was noted by 3%, and only 1% indicated no trust at all.

Table 11: How much do you trust the source of information on vaccine from Local Government Health Authority and Primary Health Centres?.

Variable	Frequency	Percent (%)
Low trust	21	3%
Moderate trust	71	12%
No trust	5	1%
High trust	467	78%
Very hight trust	36	6%

Table 12: How much do you trust the source of information on vaccine from partners such WHO, UNICEF?

Variable	Frequency	Percent (%)
Low trust	17	3%
Moderate trust	72	12%
No trust	10	1%
High trust	460	77%
Very hight trust	41	7%

In the study on vaccine acceptance and hesitancy, the accessibility of vaccination services was assessed, as shown in Table 13. The majority of respondents, 375 individuals, reported that vaccination services were easy to access, constituting 63% of the total responses. Additionally, 151 respondents (25%) indicated that the services were very easy to access. A smaller segment, 50 individuals (8%), expressed a neutral stance regarding accessibility, while only 17 respondents (3%) found the services difficult to access, and a mere 7 individuals (1%) reported that the services were very difficult to access. This data highlighted a generally positive perception of the accessibility of vaccination services in the area.

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Table 13: Accessibility of vaccination service in your area.

Variable	Frequency	Percent (%)
Easy	375	63%
Very easy	151	25%
Neutral	50	8%
Difficult	17	3%
Very difficult	7	1%

Table 14 examined the barriers to vaccination services, revealing several significant factors that impacted access. The most frequently cited barrier was long waiting times, reported by 343 respondents, which represented 31% of the total responses. Cost of transportation was also a notable concern, affecting 294 individuals (26%). Distance to the clinic was another barrier, mentioned by 244 respondents (22%). Furthermore, 208 individuals (19%) indicated a lack of information on MR vaccination as a barrier, while only 28 respondents (2%) noted the non-availability of MR vaccines as an issue. Overall, these findings illustrated the various challenges faced by individuals seeking vaccination services, with long wait times and transportation costs being the most prominent barriers.

Table 14: Barriers to vaccination services.

Variable	Frequency	Percent (%)
Distance to clinic	244	22%
Cost of transportation	294	26%
Long wait time	343	31%
Non availability of MR vaccines	28	2%
Lack of information on MR vaccination	208	19%

Table 15: Multiple regression model of households whom belief vaccine causes infertility.

ANOVA						
	Df	*SS*	*MS*	*F*	*Significance F*	
Regression	5	25.7814	5.15628	83.1908	3.55×10^{-66}	
Residual	594	36.81693	0.061981			
Total	599	62.59833				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.475898	0.064898	7.333011	7.41×10^{-13}	0.348441	0.603356
Disagree	0.463129	0.065741	7.044767	5.16×10^{-12}	0.334016	0.592242
Strongly disagree	0.496591	0.063431	7.828809	2.27×10^{-14}	0.372014	0.621167
Agree	0.061622	0.056875	1.083458	0.279045	-0.05008	0.173322
Neutral	-0.24645	0.069771	-3.53221	0.000444	-0.38348	-0.10942
Strongly agree	0.275806	0.179529	1.536274	0.125004	-0.07678	0.628396

Table 16: Multiple regression model of households whom belief vaccine causes autism.

ANOVA						
	Df	*SS*	*MS*	*F*	*Significance F*	
Regression	5	16.53324	3.306649	42.63856	1.48×10^{-37}	
Residual	594	46.06509	0.077551			
Total	599	62.59833				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.573506	0.043218	13.2702	2.2×10^{-35}	0.488628	0.658384
Disagree	0.351744	0.042694	8.238668	1.11×10^{-15}	0.267894	0.435594
Strongly disagree	0.38349	0.042119	9.104974	1.3×10^{-18}	0.30077	0.46621
Neutral	-0.04893	0.038539	-1.26972	0.204683	-0.12462	0.026756
Agree	0.024603	0.030294	0.812156	0.417027	-0.03489	0.0841
Strongly agree	-0.01713	0.031532	-0.54334	0.587103	-0.07906	0.044795

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Table 15 presented the results of the regression analysis concerning households that held the belief that vaccines could lead to infertility. The ANOVA section indicated a significant F-statistic of 83.1908 with a significance level of 3.55 x 10^{-66}, suggesting that the model was statistically significant. The regression coefficients highlighted that those who disagreed and strongly disagreed with the belief that vaccines cause infertility had positive coefficients of 0.463 and 0.497, respectively, both with p-values less than 0.001, indicating a strong association with vaccine acceptance. Conversely, those who felt neutral about the belief showed a negative coefficient of -0.246, with a p-value of 0.000444, suggesting that neutrality towards the belief was associated with lower acceptance of vaccination. Those who agreed with the belief had a minimal positive coefficient of 0.062, which was not statistically significant (p-value = 0.279), while those who strongly agreed had a positive coefficient of 0.276, but this was also not significant (p-value = 0.125).

Table 16 focused on households that believed vaccines could cause autism. Similar to the previous model, the ANOVA results indicated a significant F-statistic of 42.63856 with a significance level of 1.48 x 10^{-37}, confirming the model's statistical relevance. The coefficients revealed that participants who disagreed and strongly disagreed with the notion that vaccines cause autism had positive coefficients of 0.352 and 0.383, respectively, both with highly significant p-values (1.11 x 10^{-15} and 1.3 x 10^{-18}). In contrast, those who were neutral about the belief showed a negative coefficient of -0.049, which was not statistically significant (p-value = 0.205). The coefficients for those who agreed (0.025) and strongly agreed (-0.017) were also not statistically significant, indicating that these beliefs did not correlate positively with vaccine acceptance.

Discussion

In the study examining vaccine history, the results provided critical insights into vaccine acceptance and hesitancy, particularly concerning the measles rubella vaccine. The findings indicated a significant acceptance rate, with 88% of the children, or 529 out of 600, having received the vaccine. This high acceptance rate aligns with previous research that highlighted the importance of community trust in vaccines, suggesting that when parents perceive vaccines as beneficial, they were more likely to consent to vaccination for their children [47]. Conversely, the data revealed that 12% of the children, amounting to 71 individuals, had not been vaccinated. This reflected a noteworthy level of vaccine hesitancy, which has been documented in various studies as a growing concern in public health [48]. The hesitancy observed in this cohort could be attributed to several factors, including misinformation, fear of side effects, and a general distrust in healthcare systems. Further exploration of the vaccination status among the vaccinated children revealed that 62% had received only one dose of the vaccine, while 38% had completed the recommended two doses. This distribution indicated a substantial number of children were partially vaccinated, which has implications for herd immunity and the potential resurgence of vaccine-preventable diseases [49]. The phenomenon of partial vaccination has been previously noted, where families might intend to vaccinate but face barriers that prevent them from completing the full vaccination schedule. Additionally, the analysis of vaccination rates in relation to household size provided further context to vaccine acceptance. The data showed that 9% of households had no vaccinated children, while a majority, 70%, had between one to three vaccinated children. This distribution suggested that smaller households were more likely to have vaccinated children, which is consistent with literature indicating that larger families sometimes experience challenges such as competing priorities and limited access to healthcare resources [50]. In summary, the results from the study highlighted both a commendable level of vaccine acceptance and areas of hesitancy that warrant further investigation. Addressing these hesitancies through targeted public health messaging and community engagement could enhance vaccination rates and protect public health, echoing the recommendations from existing scholarly research.

The results of the survey on vaccine acceptance and hesitancy revealed significant insights into the beliefs and misconceptions surrounding the measles rubella vaccine. A substantial majority of respondents expressed skepticism regarding the vaccine's alleged links to infertility, autism, and immune system weakening, as indicated by their responses to the respective statements. Specifically, 49% disagreed and 38% strongly disagreed that the vaccine caused infertility, aligning with previous studies that highlighted the pervasive misinformation regarding vaccine side effects [13,51]. This skepticism likely stemmed from widespread rumours and unfounded claims circulating in various media outlets and social networks, which had been shown to significantly influence public perception and vaccine uptake. When considering the belief that vaccines could have non-anticipated side effects, the results showed a similar trend. The majority of respondents, 41% and 45% respectively, expressed disbelief in the existence of such side effects, indicating a rejection of misinformation often propagated by anti-vaccine movements. This reflects a broader societal trend where misinformation about vaccines often leads to hesitancy, as individuals struggle to reconcile scientific evidence with prevailing misconceptions. Further reinforcing these trends, the survey results indicated a high level of disagreement with the notion that the measles rubella vaccine caused autism, with 59% disagreeing and 26% strongly disagreeing. This aligns with the scientific consensus that had repeatedly debunked

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any causal relationship between vaccines and autism [52]. The persistence of this misconception could be traced back to a now-discredited study, which ignited widespread fear and skepticism [53]. Despite the abundance of evidence refuting this claim, the enduring impact of the initial misinformation continues to shape public attitudes toward vaccination. Respondents also largely perceived measles rubella as a non-serious disease, with 54% disagreeing with the assertion that it was serious. This perception might be influenced by a lack of awareness regarding the potential complications of measles, which could include severe health issues such as pneumonia and encephalitis [54]. The misconception that measles was not a significant health threat could diminish motivation to vaccinate, as individuals might underestimate the benefits of immunization. Additionally, skepticism towards traditional medicine as a viable treatment for measles rubella was evident, with 54% disagreeing with the notion of its superiority over vaccination. This skepticism was crucial, as it reflects a broader trend of relying on scientifically-backed interventions rather than anecdotal or traditional remedies, which could sometimes be rooted in cultural beliefs. However, the belief in faith-based organizations as effective treatment options was notably low, suggesting a recognition of the need for evidence-based medical practices in addressing health issues.

The results of the study on vaccine acceptance and hesitancy revealed critical insights into the sources of information that influenced respondents' perceptions of the measles rubella vaccine. Health workers emerged as the primary source of information, accounting for 23% of responses. This finding aligns with existing literature that emphasizes the role of healthcare professionals in shaping public health attitudes and behaviours. According to studies, healthcare providers were often viewed as trusted sources of information, and their recommendations could significantly impact vaccine uptake. Family members and friends, as well as community leaders, each represented 15% of the information sources. This observation supports the notion of social networks as vital conduits for information dissemination [55,56]. Their research highlighted the influence of interpersonal relationships on health-related decision-making, suggesting that individuals were more likely to accept vaccines when they receive endorsements from trusted personal connections. Radio and banners/billboards/posters/pamphlets followed, each contributing 11% to the information sources. This underscores the importance of traditional media in reaching broader audiences, particularly in regions where access to digital platforms was limited. A study indicated that mass media campaigns could effectively enhance public awareness and address vaccine hesitancy by providing accurate information [57,58]. The role of television as a source of information at 6% and social media at 8% reflects the evolving landscape of information consumption. While traditional media still holds significance, the increasing influence of digital platforms could not. Studies had shown that social media could both positively and negatively affect vaccine perceptions, depending on the nature of the content shared and the credibility of the sources [59]. Interestingly, the data indicated that religious leaders accounted for 10% of information sources, highlighting their potential influence in communities where faith plays a critical role in health decisions. This finding resonates with research which suggested that religious leaders could serve as effective advocates for vaccinations when they were adequately informed about the benefits of immunization. Trust in the information provided by various health authorities was also a significant factor in vaccine acceptance. A substantial majority, 82%, expressed high trust in the State Ministry of Health and the State Primary Health Care Board, while 78% indicated high trust in the Local Government Health Authority and Primary Health Centres. This trust was crucial, as it correlates with higher vaccine acceptance rates [56]. According to a systematic review, trust in healthcare institutions was a key determinant of vaccination behaviour, emphasizing that public confidence in health authorities could mitigate hesitancy. Furthermore, trust in information from partners like WHO and UNICEF was similarly high, with 77% of respondents expressing trust in these organizations. This finding supports the literature on the importance of international health organizations in fostering confidence in vaccination programs. Research had shown that endorsements from reputable global health entities could significantly enhance public trust and acceptance of vaccines [60].

The study on vaccine acceptance and hesitancy revealed significant insights regarding the accessibility of vaccination services and the barriers faced by individuals seeking these services. A substantial majority of respondents, amounting to 375 individuals, reported that vaccination services were easy to access, which constituted 63% of the total responses. This finding aligns with previous research that emphasizes the importance of accessibility in increasing vaccination rates, as accessible services were often linked to higher acceptance and lower hesitancy [61]. Moreover, 151 respondents (25%) indicated that the services were very easy to access, further underscoring a generally favourable perception of vaccination accessibility in the area. However, the study also identified notable barriers that affected this accessibility. Long waiting times emerged as the most significant barrier, reported by 343 respondents (31% of total responses). This concern was consistent with existing literature that highlighted waiting times as a critical factor influencing patients' decisions to seek vaccination [62]. Additionally, transportation costs were identified as a concern by 294 individuals (26%), reinforcing findings from studies that had shown how financial barriers could deter individuals from accessing healthcare services, including vaccinations [63]. Distance to the clinic was

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another barrier, mentioned by 244 respondents (22%), which supports the notion that geographical factors significantly impact healthcare access, particularly in rural or underserved areas. Furthermore, 208 individuals (19%) reported a lack of information regarding measles-rubella (MR) vaccination as a barrier, echoing research that emphasizes the role of health literacy and information dissemination in vaccine acceptance [64]. In contrast, only 28 respondents (2%) noted the non-availability of MR vaccines as an issue, suggesting that supply-side constraints were less of a concern in this context. Overall, while the accessibility of vaccination services was perceived positively by a majority, the study highlighted critical barriers that could hinder vaccine uptake. Addressing these barriers, particularly long waiting times and transportation costs, as well as improving the dissemination of information regarding vaccination, could enhance accessibility and foster greater vaccine acceptance in the community.

The results of the regression analysis on vaccine acceptance and hesitancy provided compelling insights into the beliefs surrounding vaccines and their purported associations with infertility and autism. In the first analysis concerning the belief that vaccines could lead to infertility, the ANOVA results revealed a significant F-statistic of 83.1908, with a significance level of 3.55×10^{-66}, indicating that the model was statistically significant and that the predictors had a meaningful relationship with vaccine acceptance. Regression coefficients demonstrated that participants who disagreed and strongly disagreed with the assertion that vaccines cause infertility exhibited positive coefficients of 0.463 and 0.497, respectively, both with p-values less than 0.001. This suggested a strong association with vaccine acceptance, aligning with previous research that emphasized the importance of addressing misconceptions in vaccine discourse. In contrast, those who expressed neutrality towards the belief showed a negative coefficient of -0.246, with a p-value of 0.000444, indicating that neutrality was linked to lower vaccine acceptance, which echoed findings that ambivalence could undermine public health initiatives. Interestingly, individuals who agreed with the belief exhibited a minimal positive coefficient of 0.062, which was not statistically significant (p-value = 0.279), while those who strongly agreed had a positive coefficient of 0.276, but this was also not significant (p-value = 0.125). This lack of significance suggested that those who held strong negative beliefs about infertility and vaccines were less likely to accept vaccinations, consistent with the literature on vaccine hesitancy [25,26]. The second analysis focused on the belief that vaccines could cause autism. Similar to the previous model, the ANOVA results indicated a significant F-statistic of 42.63856, with a significance level of 1.48×10^{-37}, confirming the model's statistical relevance. The coefficients revealed that participants who disagreed and strongly disagreed with the notion that vaccines cause autism had positive coefficients of 0.352 and 0.383, respectively, with highly significant p-values of 1.11×10^{-15} and 1.3×10^{-18}. These findings underscored the strong correlation between rejection of the autism-vaccine myth and increased vaccine acceptance, reinforcing the importance of scientific communication in combating misinformation. Conversely, those who were neutral about the belief showed a negative coefficient of -0.049, which was not statistically significant (p-value = 0.205). Additionally, the coefficients for those who agreed (0.025) and strongly agreed (-0.017) with the belief held no statistical significance, indicating that such beliefs did not correlate positively with vaccine acceptance. This further highlighted the critical need for effective public health messaging to address and dispel myths related to vaccine safety, particularly surrounding autism, as these misconceptions could significantly hinder vaccination efforts. Overall, the analyses underscored the crucial role of addressing vaccine-related misconceptions to enhance public health outcomes and foster greater vaccine acceptance in the community.

Conclusion

In conclusion, the study on vaccine acceptance and hesitancy regarding measles-rubella vaccination in Bayelsa State revealed a substantial level of acceptance, with 88% of children having received the vaccine. Despite this positive outcome, a notable segment of the population, amounting to 12%, remained unvaccinated, highlighting the persistence of hesitancy driven by various factors, including misinformation and cultural beliefs. The analysis identified key misconceptions surrounding the vaccine, such as unfounded links to infertility and autism, which influenced caregiver decisions. The findings underscored the critical role of trusted information sources, with health workers being the primary providers of vaccine-related information, while community leaders and family members also played significant roles in shaping perceptions. Trust in health authorities, including the State Ministry of Health and international organizations like WHO and UNICEF, was high among the respondents, suggesting a foundation upon which public health initiatives could build to enhance vaccine uptake. Accessibility to vaccination services was perceived positively, yet barriers such as long waiting times and transportation costs were prominent concerns that required attention. The regression analyses highlighted those rejecting misconceptions about vaccines was strongly associated with acceptance, reinforcing the need for effective communication strategies to counter misinformation. Overall, the study provided valuable insights that could inform targeted interventions aimed at improving vaccine confidence and addressing hesitancy, thereby contributing to the broader goals of public health in the region. The research findings emphasized the necessity of culturally sensitive approaches and community engagement to foster a supportive environment for vaccination, ultimately

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aiming to enhance immunization coverage and protect public health in Bayelsa State and similar contexts.

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No Conflict of Interest

The authors declare that the research work was conducted without the intention to undo or undermine any individual, agency, or partner. The funding for this study was conducted with personal savings, and no external financial support or sponsorship influenced the study design, data collection, analysis, or interpretation of the results. There were no financial or non-financial interests that could be perceived as potential conflicts of interest related to this work.

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