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Original Research Article

Compliance and Determinants of Incomplete Anti-Rabies Vaccine Schedule Among Animal Bite Patients Attending the Rabies Clinic of a Tertiary Care Hospital in Eastern India: A Prospective Cohort Study

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Abstract:

Background: Rabies is still a zoonotic disease that is always fatal but preventable, and post-exposure prophylaxis (PEP) is the cornerstone of prevention following animal bites. Inadequate immunization is still a significant issue, particularly in places with limited resources, even though anti-rabies vaccines are freely available in public health institutions. Failure to adhere to the prescribed immunization schedule increases the risk of rabies-related death and compromises protection.

Objectives: To assess the level of adherence to the anti-rabies vaccination schedule and identify the sociodemographic, clinical, and health system-related factors associated with inadequate vaccination among animal bite victims.

Methods: From April to June 2025, a prospective cohort study was carried out at the Rabies Clinic, Department of Community Medicine, Nalanda Medical College and Hospital (NMCH), Patna. 150 patients who had been bitten by an animal were enrolled in the anti-rabies vaccination program, and they were monitored until the recommended schedule was either fulfilled or not. A pretested structured questionnaire was used to gather information on sociodemographic traits, animal bite specifics, wound category, rabies awareness, and reasons for non-compliance. Completing all required dosages within the suggested timeframe was the definition of compliance. To determine the variables linked to partial vaccination, statistical analysis was done.

Results: A significant percentage of the 150 patients that were enrolled did not receive all of the recommended anti-rabies vaccinations. A number of variables, including lower educational attainment, living in a remote area, indirect travel expenses, lack of follow-up reminders, perceived symptom improvement, and ignorance about rabies' mortality, were substantially linked to incomplete vaccination. Although they did not always result in complete schedule completion, Category III bites and bites from stray animals shown improved initial uptake.

Conclusion: Anti-rabies vaccination noncompliance is still a serious public health issue. Reducing avoidable rabies-related deaths and increasing vaccination completion rates may be achieved by addressing modifiable factors such patient education, reminder systems, and better counseling at initial contact.

Keywords: Rabies; Anti-rabies vaccine; Compliance; Animal bite; post-exposure prophylaxis; Vaccine default

Introduction

The rabies virus, a member of the Lyssavirus genus, causes rabies, an acute, progressive viral encephalitis that is nearly always fatal once clinical symptoms manifest. Rabies is a major public health concern, especially in low- and middle-income nations, even though it is completely avoidable with prompt and proper post-exposure prophylaxis (PEP). An estimated 59,000 people die from rabies each year worldwide, with Asia and Africa accounting for a sizable share of these deaths. India is a crucial priority location for rabies preventive and control measures since it bears roughly one-third of the world's rabies burden [1,2].

The main way that rabies is spread to people is through animal bites, particularly from dogs. Most rabies cases in India are caused by bites from stray or unvaccinated dogs. Prompt wound washing, anti-rabies vaccination (ARV), and rabies immunoglobulin (RIG) for category III exposures are highlighted by the National Rabies Control Programme as crucial elements of PEP [3]. When given in accordance with the suggested schedule, contemporary cell culture vaccines are very

immunogenic and efficacious. However, following the entire dosage schedule within the allotted time window is crucial to the protective benefit of vaccination [4].

The effectiveness of PEP is severely compromised by non-compliance or inadequate immunization, which continues to be a substantial barrier to rabies prevention. Even though anti-rabies vaccines are provided at no cost in government health institutions, several studies from various parts of India have found unsatisfactory completion rates, ranging from 40% to 70% [5–7]. Due to a lack of knowledge about the deadly nature of the disease, patients frequently stop receiving vaccinations once local wound symptoms go away or when the perceived danger of rabies decreases [8].

A complex interaction of sociodemographic, behavioral, clinical, and health system-related factors affects adherence to the anti-rabies immunization schedule. Important factors that have been found to contribute to vaccine default include low educational status, living in a rural area, being far from medical facilities, indirect costs like travel and lost wages, and inadequate counseling at the point of service [9–11]. Incomplete adherence is also exacerbated by myths and misconceptions about the safety of vaccines and the spread of rabies [12]. Health system issues like vaccine shortages, lengthy wait times, and a lack of follow-up procedures can potentially be a factor in some situations [13].

Since many patients from a variety of socioeconomic situations seek care in tertiary care hospitals and referral centers, the problem of inadequate vaccination is especially pertinent there. Although PEP initiation rates are typically high in these situations, it is nevertheless challenging to maintain follow-up over several visits. Compared to retrospective or cross-sectional designs, prospective cohort studies are particularly useful in this context because they enable systematic patient follow-up from vaccination initiation to completion or default, resulting in more accurate estimates of compliance and related determinants [14].

Rabies is still a serious but little-known public health issue in Bihar. Animal bite cases from both urban and rural parts of the region are referred to Nalanda Medical College and Hospital (NMCH), Patna. Designing focused interventions in this context requires an understanding of the anti-rabies vaccine compliance patterns and the variables causing incomplete schedules. Context-specific tactics including improved counseling, reminder-based follow-up systems, decentralized vaccination delivery, and community awareness campaigns can be informed by evidence gathered from local settings.

There is still a dearth of prospective data from eastern India analyzing adherence to anti-rabies immunization schedules and the causes of default, despite the availability of national guidelines and efficacious vaccinations. Most of the current research is cross-sectional or record-based, which limits their capacity to identify temporal correlations and record patient-reported non-compliance causes in real time [15]. To close this gap, the current prospective cohort study was conducted to evaluate adherence to the anti-rabies vaccination schedule and investigate the sociodemographic, clinical, and health system-related factors that contribute to incomplete vaccination among patients who have been bitten by animals and visit the Rabies Clinic at NMCH, Patna.

Aim and Objectives

Aim: To evaluate adherence to the anti-rabies vaccination schedule and determine the factors that contribute to partial immunization among patients who have been bitten by animals and visit the Rabies Clinic at Nalanda Medical College and Hospital in Patna.

Objectives

1. To determine the proportion of animal bite patients who complete the recommended anti-rabies vaccine schedule.
2. To assess the proportion of patients with incomplete or defaulted anti-rabies vaccination.
3. To study the socio-demographic factors associated with incomplete compliance to the anti-rabies vaccine schedule.
4. To evaluate clinical and exposure-related factors (type of animal, category of bite, site of bite) influencing vaccine compliance.
5. To identify patient-reported and health system-related reasons for non-completion of the anti-rabies vaccine schedule.

Materials and Methods

Study Design: In order to track animal bite victims from the start of post-exposure prophylaxis to the completion or noncompliance of the anti-rabies vaccination regimen, this study was carried out as a prospective cohort study.

Study Setting: The study was conducted at the Rabies Clinic, Department of Community Medicine, Nalanda Medical College and Hospital (NMCH), Patna. NMCH is a government tertiary care facility that serves both rural and urban residents of Bihar and its surrounding areas.

Study Duration: The investigation was carried out between April and June of 2025, a span of three months. Participants were enrolled during this time, and each was monitored prospectively until the recommended vaccination schedule was completed or discontinued.

Study Population: Patients who had been bitten by an animal and went to the rabies clinic to start their anti-rabies vaccine during the study period made up the study population.

Sample Size: The study comprised 150 patients who had been bitten by animals. Until the required sample size was reached, all eligible patients who presented throughout the trial period and gave their agreement to participate were enrolled.

Inclusion Criteria

- Patients of all age groups and both sexes presenting with a history of animal bite.
- Patients initiating anti-rabies vaccination at the rabies clinic during the study period.
- Patients willing to provide informed consent (or assent with consent from guardians in case of minors).

Exclusion Criteria

- Patients who had already received anti-rabies vaccination for the same exposure from another health facility.
- Patients with incomplete baseline information.
- Patients who were critically ill or unable to participate in follow-up.

Data Collection Tool and Technique: A pre-made, pre-tested, structured questionnaire was used to gather data during in-person interviews on the initial visit. After a review of pertinent research, the questionnaire was created and then modified through pilot testing to guarantee its relevance and intelligibility.

The questionnaire captured information on:

- Socio-demographic variables (age, sex, residence, education, occupation, socioeconomic status)
- Details of animal exposure (type of animal, ownership status, provoked/unprovoked bite)
- Clinical characteristics (category of bite, site and number of wounds, time interval between bite and reporting)
- Awareness regarding rabies and its fatal nature
- Follow-up visits and vaccination status
- Reasons for missed or incomplete doses, if applicable

Vaccination Schedule and Follow-up: In accordance with national norms, intramuscular cell culture vaccinations were administered to all patients to prevent rabies. At the time of enrollment, patients received advice about the significance of finishing the entire vaccine schedule.

Participants were prospectively followed for subsequent scheduled doses through:

- Review of clinic vaccination records
- Telephonic follow-up in case of missed appointments

Operational Definitions

- **Complete compliance:** Receipt of all prescribed doses of anti-rabies vaccine within the recommended schedule.
- **Incomplete compliance (default):** Missing one or more scheduled doses or failure to complete the vaccination schedule within the stipulated time.
- **Animal bite categories:** Classified as Category II or Category III as per standard guidelines.

Data Management and Statistical Analysis: Microsoft Excel was used to enter the collected data, and the relevant statistical software was used for analysis. Clinical and sociodemographic features were gathered using descriptive statistics. Frequencies and percentages were used to represent categorical variables and mean and standard deviation were used to summarize continuous variables.

Appropriate statistical tests were used to evaluate associations between possible factors and inadequate vaccination. Statistical significance was defined as a p-value of less than 0.05.

Ethical Considerations: After receiving approval from the NMCH, Patna Institutional Ethics Committee, the study was carried out. Prior to enrollment, each subject provided written informed permission. Participants' information was kept completely private, and data was only utilized for study. Patients were allowed to leave the study at any time without having their medical care impacted, and participation was completely voluntary.

Results

During the study period, 150 animal bite patients who received anti-rabies vaccinations at the Rabies Clinic, NMCH, Patna, were enrolled and prospectively monitored.

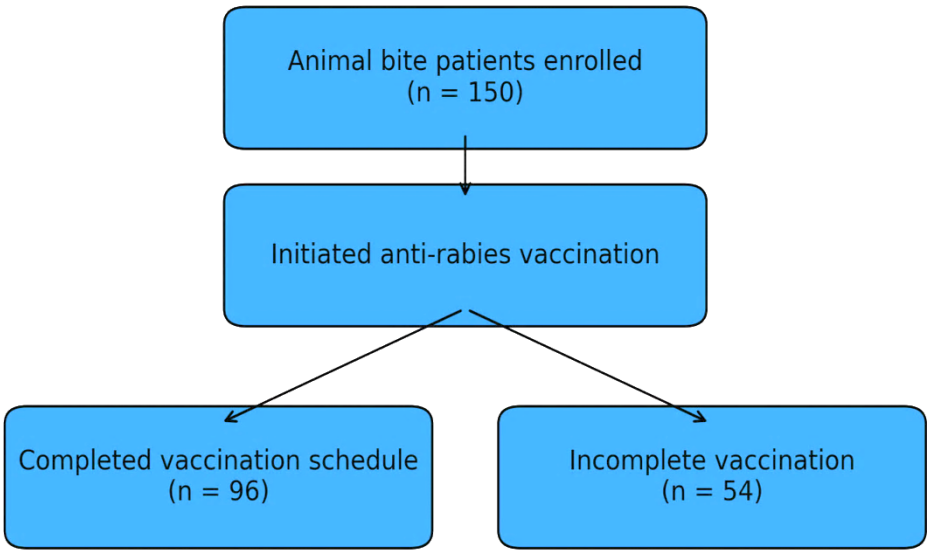

Figure 1: Flow diagram showing enrolment of animal bite patients and compliance with the anti-rabies vaccination schedule.

Socio-demographic Profile of Study Participants: Table 1 provides a summary of the study participants' sociodemographic traits. Most patients were in the 15–45 age range, which is economically productive. Compared to females, males made up a larger percentage of victims of animal bites. Rural residents made up more than half of the participants. A sizable percentage worked in menial or semi-skilled jobs, and a sizable share had only completed elementary or middle school.

Patients who did not finish the vaccine schedule were more likely to have lower educational status and live in a remote area, which may have an impact on compliance due to accessibility concerns and awareness levels.

Table 1: Socio-demographic characteristics of animal bite patients (n = 150)

Variable	Frequency	Percentage (%)
Age group (years)		
<15	22	14.7
15–45	88	58.6
>45	40	26.7
Sex		
Male	102	68.0
Female	48	32.0
Residence		
Urban	64	42.7
Rural	86	57.3
Education level		
Illiterate	28	18.7
Primary/Middle	54	36.0
Secondary & above	68	45.3

Characteristics of Animal Exposure: Table 2 provides information about animal exposure. Most cases were caused by dog bites, with stray dogs being the most frequent source. Lower limbs were the most bitten area, and most bites were unprovoked. A significant percentage of individuals had Category III exposure, which indicates serious exposure necessitating immediate and thorough post-exposure treatment.

Even though category III bites were thought to be more severe, partial immunization was nevertheless seen in a significant percentage of these individuals, suggesting that severity by itself did not guarantee adherence to the entire vaccination regimen.

Table 2: Distribution of animal bite characteristics among participants

Variable	Frequency	Percentage (%)
Type of animal		
Dog	132	88.0
Cat	12	8.0
Others	6	4.0
Ownership status		
Stray	108	72.0
Pet	42	28.0
Type of bite		
Provoked	44	29.3
Unprovoked	106	70.7
Category of bite		
Category II	58	38.7
Category III	92	61.3

Compliance with Anti-Rabies Vaccine Schedule: Of the 150 patients that were enrolled, 96 (64.0%) received all recommended doses of the anti-rabies vaccine, whereas 54 (36.0%) did not. Table 3 displays the vaccination completion and default patterns. With each dose, there was a noticeable decrease in attendance. The highest dropout rate was observed following the second dose, suggesting that a major obstacle to guaranteeing full compliance is early loss to follow-up.

Table 3: Compliance status of anti-rabies vaccination among study participants

Vaccination status	Frequency	Percentage (%)
Complete schedule	96	64.0
Incomplete schedule	54	36.0

Association Between Socio-demographic Factors and Incomplete Vaccination: Table 4 displays the association between certain sociodemographic factors and vaccine compliance. Patients from remote areas, those with less education, and those working in menial jobs were more likely to have incomplete vaccinations. These results suggest that health-seeking behavior and continuity of care are significantly influenced by social variables.

Table 4: Association of socio-demographic factors with vaccination compliance

Variable	Complete n (%)	Incomplete n (%)
Urban residence	48 (75.0)	16 (25.0)
Rural residence	48 (55.8)	38 (44.2)
Education ≤ Primary	28 (41.8)	39 (58.2)
Education ≥ Secondary	68 (77.3)	20 (22.7)

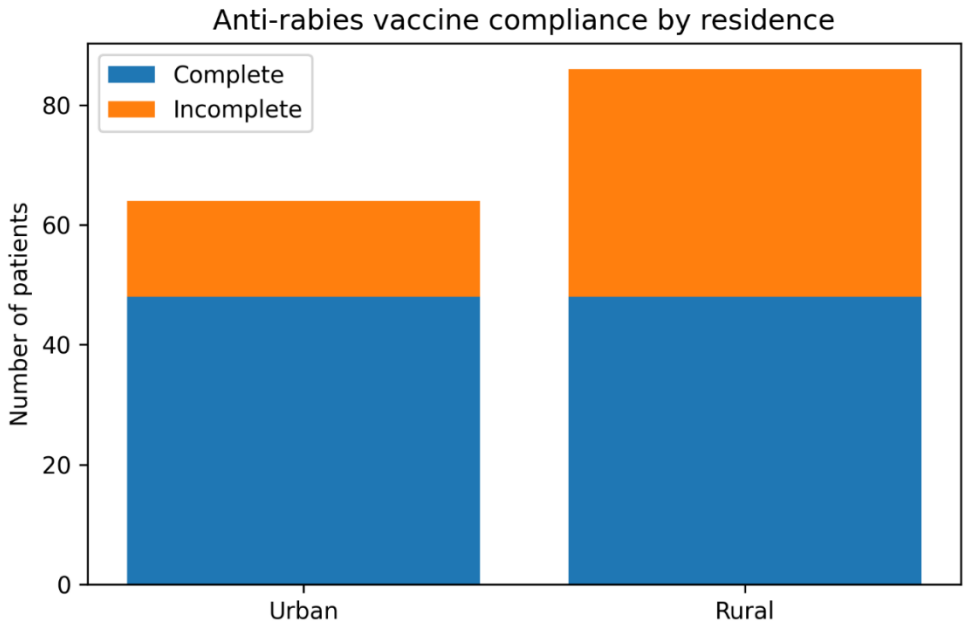

Figure 2: Distribution of anti-rabies vaccine compliance according to place of residence.

Clinical Factors Associated with Incomplete Vaccination: Table 5 shows clinical and exposure-related parameters linked to vaccination status. Patients with category II bites and those who arrived late to the clinic after exposure had higher default rates than other patients. This implies that delayed health-seeking behavior and perceived decreased risk may be factors in vaccine non-completion.

Table 5: Clinical determinants of incomplete anti-rabies vaccination

Factor	Complete n (%)	Incomplete n (%)
Category II bite	30 (51.7)	28 (48.3)
Category III bite	66 (71.7)	26 (28.3)
Reporting within 24 hours	62 (73.8)	22 (26.2)
Reporting after 24 hours	34 (54.8)	28 (45.2)

Reasons for Incomplete Vaccination: Table 6 shows the reasons given by patients for not getting vaccinated. Perceived wound healing, ignorance of the deadly nature of rabies, daily wage loss, considerable trip distance, and forgetting follow-up dates were the most often mentioned causes. These explanations emphasize how practical obstacles and information gaps interact to affect vaccination compliance.

Table 6: Reasons for incomplete anti-rabies vaccination (n = 54)

Reason	Frequency	Percentage (%)
Felt vaccination unnecessary after wound healed	18	33.3
Loss of wages / work constraints	14	25.9
Distance / travel difficulty	10	18.5
Forgot follow-up date	8	14.8
Fear of side effects	4	7.4

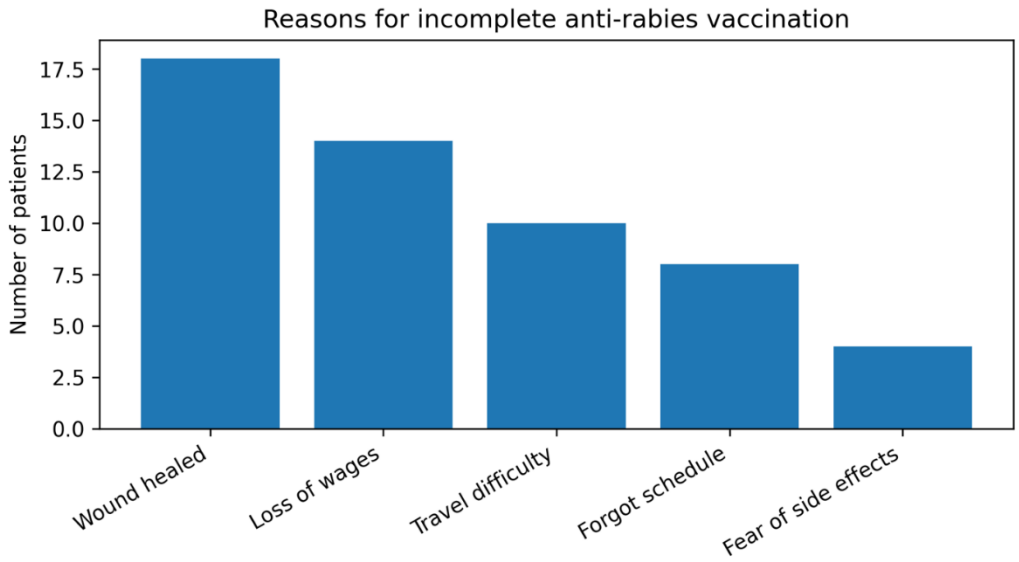

Figure 3: Patient-reported reasons for incomplete anti-rabies vaccination among defaulters.

Discussion

The current prospective cohort study examined factors contributing to partial immunization among animal bite patients visiting a tertiary care rabies center in eastern India and evaluated adherence to the anti-rabies vaccine (ARV) schedule. The results show that even after starting post-exposure prophylaxis, over one-third of patients did not finish the recommended vaccination schedule. Given that rabies is always lethal once clinical signs manifest, this degree of non-compliance is alarming and highlights ongoing deficiencies in rabies prevention initiatives, particularly in tertiary healthcare settings.

This study's total vaccination completion percentage is similar to those from other regions of India, where compliance rates have been reported to range from 50% to 70% [5–7]. As in previous research, a progressive drop in attendance was observed with subsequent vaccination doses, suggesting early loss to follow-up as a significant obstacle. The asymptomatic phase that follows animal bites and the false sense of security that patients feel after the wound heals have been linked to this pattern [8,9].

Vaccination compliance was significantly influenced by sociodemographic variables. Patients from remote areas and those with less education were more likely to miss vaccinations in the current study. These results are in line with data from other Indian contexts where adherence to ARV schedules has been found to be adversely affected by low awareness, limited access to healthcare facilities, and indirect costs such travel fees and wage loss [9–11]. Higher levels of education seem to be a crucial enabling element since they are more likely to comprehend that rabies is lethal and that vaccination is required regardless of the resolution of symptoms.

Compliance was also impacted by the clinical aspects of exposure. Even while category III bites accounted for most occurrences and were linked to comparatively higher completion rates, a sizable percentage of these individuals did not finish the immunization. This result is consistent with earlier research showing that even severe exposures may not ensure complete adherence, especially when patients have early wound healing or do not receive regular follow-up counseling [6,12]. Higher default rates were seen in patients with category II bites and those who arrived late to the clinic, indicating that vaccination motivation may be diminished by perceived lesser severity.

This study's findings about the prevalence of dog bites, particularly from stray animals, are consistent with national and international epidemiological trends [1,2]. Although vaccination is frequently started almost away after being bitten by a stray dog out of fear of rabies, long-term compliance is still not ideal. This demonstrates a lost chance to emphasize important points during first contacts, especially the fact that incomplete immunization provides no rabies protection [3,4].

In the current study, patient-reported causes for inadequate immunization offer important insights into modifiable barriers. The notion that vaccination was no longer required once the lesion healed was the most frequent cause of default, indicating a lack of knowledge about the pathophysiology and incubation period of rabies. Previous research has extensively documented similar misunderstandings [8,12]. Financial limitations, such as daily salary loss and travel-related challenges, were also major causes of non-compliance, particularly among rural and economically disadvantaged groups. These results are in line with earlier studies that found

indirect costs to be a significant barrier to finishing multi-dose vaccination schedules [10,11].

Even though they weren't measured separately, health system-related issues like inadequate counseling and a lack of reminder systems were indirectly represented by things like forgetfulness and missed appointments. Other research indicates that basic interventions like follow-up messages, reminder calls, and more intensive counseling at the initial point of contact can greatly increase completion rates [13,14]. Incorporating such low-cost strategies into regular rabies clinic procedures could result in significant public health benefits in high-burden environments like India.

Unlike retrospective or cross-sectional research, this study's prospective approach eliminated recall bias and permitted real-time follow-up [14]. But there are also certain restrictions on the study. The results may not be entirely transferable to other contexts due to the study's single-center design and brief length. Furthermore, certain factors, such delays in the health system or shortages of vaccines, could not be thoroughly evaluated.

Notwithstanding these drawbacks, the study offers significant local data from eastern India, an area with little published information on rabies vaccination compliance. The results confirm that incomplete anti-rabies vaccination is a multifaceted problem impacted by socioeconomic, behavioral, and systemic factors rather than just a patient-level issue. Strengthening rabies prevention programs and advancing the objective of rabies elimination need addressing these variables through focused health education, better counseling, reminder-based follow-up mechanisms, and decentralization of vaccination services [15].

Conclusion

The present prospective cohort study highlights that incomplete compliance with the anti-rabies vaccine schedule remains a significant public health concern, even in a tertiary care setting where vaccines are readily available. More than one-third of animal bite patients failed to complete the recommended vaccination regimen, thereby remaining at risk of developing a uniformly fatal yet preventable disease. The findings underscore that initiation of post-exposure prophylaxis alone is insufficient unless accompanied by sustained adherence to the complete schedule.

It was discovered that a mix of clinical, behavioral, and sociodemographic factors affected incomplete vaccination. Key factors that contributed to non-compliance included living in a rural area, having less education, believing that wounds would heal, indirect financial expenses, and not being aware of how deadly rabies is. Even while patients with severe exposures were more likely to start vaccinations, a significant percentage nevertheless stopped taking them before finishing the entire course, highlighting the fact that adherence is not always guaranteed by exposure intensity.

These findings suggest that patient counseling should be strengthened at the initial point of contact, emphasizing the urgency of finishing the vaccination schedule and the certainty of death once rabies develops. Compliance rates may be significantly increased by implementing reminder-based follow-up systems, decentralizing immunization services to reduce indirect costs, and implementing focused community awareness initiatives. Reducing avoidable rabies-related death and achieving national and international rabies elimination goals depend on addressing these controllable factors.

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