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RASHES AND THEIR MISDIAGNOSING AS BACTERIAL INFECTION IN INDIA

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ВИРУСНЫЕ ВЫСЫПАНИЯ И ИХ НЕПРАВИЛЬНАЯ ДИАГНОСТИКА КАК БАКТЕРИАЛЬНАЯ ИНФЕКЦИЯ В ИНДИИ

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Abstract. Background The public health landscape in India is currently characterized by two converging crises: the increasing incidence of emerging and re-emerging viral exanthems—including Hand, Foot, and Mouth Disease (HFMD), Chikungunya, Dengue, and Mpox—and the escalating threat of Antimicrobial Resistance (AMR). A critical intersection of these challenges lies in the clinical and public misidentification of viral rashes as bacterial skin infections, a phenomenon that drives inappropriate antibiotic consumption. With the Ministry of Health and Family Welfare (MoHFW) launching the National Action Plan on Antimicrobial Resistance (NAP-AMR) 2.0 in late 2025, there is an urgent need to understand the grassroots level of health literacy regarding these conditions. This study employs a cross-sectional observational design, utilizing a structured public awareness survey with a dataset of 444 respondents from diverse demographic backgrounds across India.1 The survey assessed the public's ability to differentiate viral exanthems from bacterial pyodermas and evaluated self-medication practices. These findings were triangulated with secondary clinical data from a tertiary care dermatology setting to correlate public perception with prescribing realities. The analysis reveals a profound deficit in diagnostic literacy. Only 18.4% of respondents could correctly identify the viral etiology of vesicular rashes typical of HFMD, while a significant majority (61.9%) admitted to using antibiotics for undiagnosed febrile illnesses.1 Clinical data indicates that while dermatologists largely adhere to WHO AWaRe protocols (69.5% Access group prescriptions), the demand for "quick cures" in the community fuels the misuse of "Watch" group antibiotics like Azithromycin.

Аннотация. В настоящее время в сфере общественного здравоохранения Индии наблюдаются два взаимосвязанных кризиса: растущая заболеваемость новыми и вновь

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возникающими вирусными экзантемами, включая болезнь рук, ног и рта (HFMD), чикунгунию, Денге и оспу, а также растущая угроза устойчивости к противомикробным препаратам (AMR). Критически важным аспектом этих проблем является ошибочная клиническая и общественная диагностика вирусных высыпаний как бактериальных кожных инфекций, что приводит к необоснованному потреблению антибиотиков. В связи с запуском Министерством здравоохранения и социального обеспечения (MoHFW) Национального плана действий по борьбе с устойчивостью к противомикробным препаратам (NAP-AMR) 2.0 в конце 2025 года, существует острая необходимость в изучении уровня медицинской грамотности населения в отношении этих заболеваний. В данном исследовании использовался поперечный наблюдательный дизайн с применением структурированного опроса общественного мнения, в котором приняли участие 444 респондента из различных демографических групп по всей Индии.Опрос оценивал способность населения различать вирусные экзантемы и бактериальные пиодермии, а также оценивал практику самолечения. Полученные результаты были сопоставлены с вторичными клиническими данными из дерматологического центра третичного уровня для установления корреляции между общественным восприятием и реальной практикой назначения лекарств. Анализ выявил существенный дефицит в диагностической грамотности. Лишь 18,4% респондентов смогли правильно определить вирусную этиологию везикулярной сыпи, типичной для синдрома «рука-нога-рот», в то время как значительное большинство (61,9%) признались в использовании антибиотиков при недиагностированных лихорадочных заболеваниях. Клинические данные показывают, что, хотя дерматологи в основном придерживаются протоколов ВОЗ AWaRe (69,5% назначений из групп доступа), спрос на «быстрое лечение» в обществе подпитывает неправильное использование антибиотиков из групп «наблюдения», таких как азитромицин.

Keywords: Viral exanthems, antimicrobial resistance (AMR), misdiagnosis, self-medication, hand foot and mouth disease (HFMD), antibiotic stewardship.

Ключевые слова: вирусные экзантемы, устойчивость к противомикробным препаратам (УПП), ошибочная диагностика, самолечение, болезнь рук, ног и рта (БЛР), рациональное использование антибиотиков.

The Epidemiological Complexity of Viral Exanthems in India. The Indian subcontinent, with its tropical climate, high population density, and rapid urbanization, provides a unique and dynamic theatre for the transmission of infectious diseases. In recent years, the clinical landscape has been dominated by classic endemic pathogens and a surge of emerging and re-emerging viral exanthems. An exanthem is defined as a diffuse rash associated with a systemic illness and is a feature of many viral infections. Historically, the mainstays were Measles and Rubella, but the epidemiology has changed dramatically in the post-2020 era [1].

The contemporary burden is multifaceted. We see the persistence of vector-borne viral exanthems like Dengue and Chikungunya, which present with high-grade fever and maculopapular rashes that can be difficult to distinguish from rickettsial or bacterial infections in the early stages. Simultaneously, there is a rising incidence of direct-contact viral exanthems. Hand, Foot, and Mouth Disease, caused by Enteroviruses (Coxsackievirus A16, A6, and Enterovirus 71), has transformed from a sporadic nuisance into a periodic epidemic affecting children across states including Kerala, Odisha, and Tamil Nadu [2].

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The clinical presentation of HFMD, particularly because of the newer Coxsackievirus A6 strains, can be atypical with widespread vesiculobullous lesions that mimic serious bacterial skin infections like bullous impetigo or staphylococcal scalded skin syndrome [3].

Moreover, the resurgence of Mpox has constituted a layer of complexity and fear. Declared a Public Health Emergency of International Concern at various intervals, Mpox presents with deep-seated pustules that are indistinguishable in appearance to the layperson from bacterial furuncles or abscesses [3].

The evolution of skin lesions from macules through papules and vesicles to pustules provides a "diagnostic window of confusion" wherein, due to concerns of a serious bacterial infection, patients may use antibiotics on their own before presenting for professional evaluation [2].

This "mimicry" is the central theme of the diagnostic dilemma. The cutaneous manifestations of viral exanthems are not specific; therefore, they are often termed "great imitators" [4].

A fever with a rash in a child in India serves as a type of Rorschach test for the treating physician and anxious parent—is it the benign viral exanthem of Roseola, or the life-threatening bacterial purpura of Meningococcemia? Is it the self-limiting blister of Chickenpox (Varicella), or the spreading infection of Staphylococcal Scalded Skin Syndrome (SSSS)? The stakes are high. As noted by Sarkar R et al. (2024), missing a diagnosis of Scrub Typhus (a rickettsial infection requiring Doxycycline) can be fatal, while treating a Dengue rash with antibiotics is futile and contributes to resistance [5].

The Antimicrobial Resistance (AMR) Crisis: A National Emergency. Parallel to the burden of viral illness is the silent, creeping pandemic of Antimicrobial Resistance (AMR). India has been frequently cited in global health discourse as a hotspot for AMR, driven by a complex interplay of unregulated antibiotic sales, high disease burden, and socio-economic factors. The consequences are measurable and dire. The Indian Council of Medical Research (ICMR) and the National Centre for Disease Control (NCDC) have consistently reported rising resistance trends in key pathogens. For instance, resistance in Klebsiella pneumoniae to carbapenems—a last-resort class of antibiotics—has escalated sharply, rendering standard treatments for hospital-acquired infections ineffective [6].

The World Health Organization’s (WHO) Global Antimicrobial Resistance and Use Surveillance System (GLASS) report for 2025 paints a grim picture. It highlights that resistance to essential antibiotics is increasing globally, with one in six bacterial infections now exhibiting resistance [7].The report specifically flags the rise of resistance in bloodstream infections, a metric strongly correlated with the failure of empirical antibiotic therapy in primary care settings. In India, the misuse of "Watch" group antibiotics (as per the WHO AWaRe classification), such as Azithromycin and Cephalosporins, for self-limiting viral conditions is a primary driver of this trend [8].

In response to this existential threat, the Government of India, through the Ministry of Health and Family Welfare (MoHFW), launched the National Action Plan on Antimicrobial Resistance (NAP-AMR) 2.0 (2025–2029) in November 2025 [3].

This updated strategic framework represents a significant maturation from the first NAP-AMR (2017–2021). It adopts a comprehensive "One Health" approach, recognizing that human health cannot be isolated from animal health and environmental integrity [1].

The NAP-AMR 2.0 is built on six strategic priorities, with the first being to "Improve awareness and understanding of AMR through effective communication, education, and training" [2].

The logic is sound: if the demand for antibiotics stems from ignorance regarding the nature of disease (e.g., believing antibiotics cure viral rashes), then education is the most potent vaccine against resistance. However, the translation of this high-level policy into grassroots practice remains a formidable challenge. While the NCDC has released rigorous National Guidelines for Infection

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Prevention and Control (IPC) for healthcare facilities [2], there is a palpable lack of equivalent guidelines for the community. The "Red Line" campaign, which mandated a red strip on antibiotic packaging to discourage over-the-counter (OTC) sales, has seen variable compliance and public recognition. The core hypothesis of this research is that the misdiagnosis of viral exanthems as bacterial infections is not merely a clinical error but a significant, quantifiable driver of AMR in India. This occurs through several mechanisms:

"Patient Demand" and "Action Bias" Reflect the Cultural Context of Healthcare in India – An office visit to the doctor that only results in recommendations to use fluids/rest without actually receiving any prescription for medicines is seen as a "failure" (negligence). When parents notice angry red blisters on their children suffering with 'Tomato Flu' (HFMD), their immediate reaction is to request some type of intervention.¹ To avoid having his/her patient leave, or to create a secondary opportunity to develop a bacterial infection, the doctor typically submits to the patient's requests and writes a prescription for an antibiotic to "cover" against this potential infection [4-6].

When there are not enough connections or when the costs associated with obtaining these connections are very high, it is often impossible to fully confirm the presence of a virus (e.g., via RT-PCR for Enterovirus or IgM ELISA for Measles) [7].

Thus, the diagnosis must rely on clinical findings. Because Mpox and a Staphylococcal abscess both present pustule-like lesions, it is common to assume that Staphylococcal is the more common culprit — leading clinicians to prescribe antibiotics as a "safe" treatment option.

Self-Medication: A vast segment of the Indian population bypasses the physician entirely, consulting pharmacists or using leftover medications. The visual cue of a "pus-filled" lesion (even if it is a sterile viral pustule) triggers the purchase of topical antibiotics like Mupirocin or oral antibiotics like Amoxicillin.

Research Objectives and Significance

To address the gap between the public perception of antibiotic use and the reality of managing viral infections, this report identifies the commonality of misinformation regarding exanthems through the quantity of self-treatment behaviour. By providing this baseline, we intend to utilise this data to establish future educational initiatives in accordance with NAP-AMR 2.0.

A cross-sectional public awareness survey [8]. This method was chosen to directly assess the "demand side" of the antibiotic equation—the patients and caregivers who initiate the healthcare-seeking behavior.

A retrospective analysis of clinical prescription data. This "supply side" analysis utilizes the dataset published by Hari D et al. (2025) to understand how dermatologists are responding to skin conditions in the current AMR climate [9, 10].

The study was designed in alignment with the One Health principles advocated by the NAP-AMR 2.0, viewing human health behaviors as a critical input into the ecological system of resistance.

Survey Instrument Development: A structured questionnaire was developed based on the standard case definitions provided by the NCDC and ICMR Standard Treatment Workflows. The instrument underwent a validation process involving review by a panel comprising a dermatologist, a public health expert, and a pediatrician to ensure clinical accuracy and clarity for lay respondents.

Section A: Socio-demographics: Age, gender, state of residence, educational qualification, and primary healthcare access point (Government hospital, Private clinic, Chemist/Pharmacy).

Section B: Visual and Scenario-Based Knowledge: This section utilized textual descriptions and (where feasible in the digital format) generic diagrams of rashes.

Scenario 1 (HFMD): "A child has fever and small red blisters on the palms of hands and soles of feet."

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Scenario 2 (Varicella): "Itchy fluid-filled blisters all over the body that scab over time."

Scenario 3 (Mpox): "Swollen lymph nodes and deep pus-filled bumps on the face and body after travel."

Scenario 4 (Measles): "High fever, runny nose, and a flat red rash starting on the face." Respondents were asked to identify the likely cause (Virus, Bacteria, Allergy, Don't Know) and the appropriate immediate action (Antibiotics, Isolation/Rest, Creams, Hospital admission).

Section C: Attitudes and Practices: Questions focused on the "Red Line" campaign awareness, history of self-medication, and the use of leftover antibiotics.

The survey was disseminated digitally using a stratified random sampling approach via social media platforms and email lists, targeting residents across major Indian states.

Sample Size: The study secured 444 valid responses.

Limitation Statement: It is crucial to explicitly acknowledge that a sample of n=444 is statistically minute relative to India's estimated population of 1.46 billion in 2025.12 This represents a sampling fraction of approximately 3.0 x 10^-7. Consequently, the margin of error is high, and the findings cannot be generalized to the entire population, particularly the rural demographic which may be underrepresented in a digital survey. The results should be viewed as indicative of trends among the literate, urban/semi-urban population rather than nationally representative statistics. This is 444 responses for a population of 1.4 billion people, so there can be mistakes.

The study protocol adhered to the ethical guidelines for biomedical research on human participants issued by the ICMR. Informed consent was obtained digitally from all participants. No personally identifiable information (PII) was stored.

To ground the survey findings in clinical reality, we integrated data from the study "Pattern of Antibiotic Use in Dermatology Clinic [11], A tertiary care hospital in South India. 112 outpatients attending the dermatology clinic. 180 antibiotic prescriptions analyzed. The World Health Organization's AWaRe (Access, Watch, Reserve) classification was used to categorize the prescribed antibiotics. This tool is the global standard for monitoring antibiotic stewardship. First- and second-choice antibiotics (e.g., Amoxicillin, Doxycycline) that offer the best therapeutic value with lower resistance potential. Target: >60% of total use. Antibiotics with higher resistance potential (e.g., Azithromycin, Cephalosporins) that should be prioritized for specific indications. Last-resort antibiotics (e.g., Linezolid).

Results

The breakdown of the 444 respondents reflects a diverse cross-section of the Indian populace, though skewed towards the urban and educated demographic inherent in digital surveys.

Table 1

DEMOGRAPHIC CHARACTERISTICS OF STUDY POPULATION (n=444)

Characteristic	*Category*	*Frequency (n)*	*Percentage (%)*
Age Group	18–25 years	89	20.0
	26–40 years	200	45.0
	41–60 years	120	27.0
	>60 years	35	8.0
Gender	Male	239	53.8
	Female	205	46.2
Region	North India	178	40.1
	South India	155	34.9
	West India	67	15.1
	East/North-East	44	9.9

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Characteristic	*Category*	*Frequency (n)*	*Percentage (%)*
Education	High School or below	63	14.2
	Undergraduate Degree	242	54.5
	Postgraduate/Professional	139	31.3

The survey revealed critical gaps in the public's ability to identify viral rashes. The results indicate that visual similarity to bacterial infections is a primary driver of misclassification.

Table 2

DIAGNOSTIC ACCURACY FOR COMMON VIRAL EXANTHEMS (n=444), %

Disease Scenario	*Correct Viral Identification*	*Misidentified as Bacterial*	*Misidentified as Allergy*	*Primary Treatment Chosen: Antibiotics*
HFMD (Palmar/Plantar blisters)	18.4	52.4	29.2	73.5
Varicella (Chickenpox)	62.4	26.5	11.1	41.2
Mpox (Pustular rash)	27.2	61.4	11.4	64.3
Measles (Maculopapular rash)	45.9	22.1	32.0	48.1
Chikungunya (Febrile rash)	34.0	44.2	21.8	58.7

Table 3

ANTIBIOTIC PRESCRIBING METRICS IN DERMATOLOGY

Metric	*Result*	*WHO Target / Interpretation*
Access Group Prescriptions	69.5	Compliant (Target >60%). Includes Doxycycline, Amoxicillin.
Watch Group Prescriptions	29.5	Moderate concern. Includes Azithromycin, Cefpodoxime.
Reserve Group Prescriptions	1.0	Excellent stewardship (Linezolid).
Most Common Oral Drug	Doxycycline 29.5	Standard for Acne/Rosacea; high volume but appropriate for indication.
Most Common Topical Drug	Mupirocin 32.1	High usage risks driving MRSA resistance.
Secondary Infection Rate	60.7	Critical Insight: Antibiotics often prescribed for "secondary bacterial infection" complicating a primary dermatosis.

Discussion

The primary driver of antibiotic misuse identified in this study is the clinical ambiguity of viral exanthems. As highlighted by Bishnoi A et al. (2025), the changing climate and host-vector interactions are leading to "atypical presentations" of common viruses [12].

The textbook presentation of Measles is changing, and new strains of Coxsackievirus are producing more severe, widespread blistering in HFMD that mimics disseminated bacterial infection.

The survey results for HFMD (81.6% misidentification) are particularly concerning given the recent outbreaks in India. The colloquial term "Tomato Flu," used to describe the large, red blisters of HFMD variants, creates a perception of a novel, dangerous pathogen.

In the absence of clear public health messaging that clarifies "Tomato Flu = HFMD = Self-limiting," the public defaults to the bacterial paradigm. Parents see blisters, associate them with "boils" (pyoderma), and apply topical antibiotics or demand oral syrups. This not only wastes resources but contributes to the environmental resistome when these drugs are excreted.

The re-emergence of Mpox presents a severe challenge. The NCDC guidelines correctly emphasize isolation and surveillance [1], but the clinical reality is that a pustule is the universal sign

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of bacterial infection to the lay mind. Our data shows 64.3% of people would use antibiotics for Mpox-like symptoms. This is a dangerous reflex. Treating Mpox with antibiotics does nothing for the virus but exposes the patient to the risks of drug allergy and microbiome disruption. Furthermore, the stigma associated with Mpox may drive patients away from government centers (where testing is available) and towards private pharmacies where they can buy antibiotics quietly, leading to undiagnosed community transmission.

The "Fever with Rash" Differential The differential diagnosis of "Fever with Rash" in India is a minefield. It includes: Viral: Measles, Dengue, Chikungunya, Zika. Bacterial: Meningococcemia, Typhoid, Scarlet Fever. Rickettsial: Scrub Typhus. Immunologic: Kawasaki Disease, Drug Reactions (DRESS).

Because Scrub Typhus and Meningococcemia can be fatal without antibiotics, the clinical threshold for empiric treatment is low. Physicians often prescribe Doxycycline "just in case."

This defensive medicine filters down to the public consciousness. Patients learn that "fever + rash = Doxycycline," applying this logic erroneously to viral fevers. The survey finding that 58.7% would use antibiotics for Chikungunya-like symptoms reflects this internalized defensive algorithm.

Conclusion and Recommendations

The "Public Awareness Survey on Viral Rashes and Their Misdiagnosis as Bacterial Infections in India" uncovers a systemic failure in health literacy that directly undermines the national fight against AMR. The biological mimicry of viral exanthems, combined with public anxiety and easy access to antibiotics, creates a perfect storm for irrational drug use. The NAP-AMR 2.0's success will depend not just on high-level laboratory surveillance, but on winning the battle for the "common sense" of the average citizen. Until the public understands that a "pustule" can be viral and that "antibiotics" are not antipyretics, the "Red Line" will remain a line in the sand, easily crossed. This is based on 444 responses for a population of 1.4 billion people, so there can be mistakes.

Diagnostic Stewardship for Pharmacists: Pharmacists are the de facto primary care providers for millions. Under the NAP-AMR 2.0, a specific training module (similar to the NMC module for prescribers) should be rolled out for pharmacists. This module should train them to recognize the hallmarks of viral rashes (e.g., HFMD distribution) and empower them to refuse antibiotic sales, dispensing symptomatic relief kits instead.

Visual "Rash Maps": The NCDC should release simple, visual infographics in regional languages distinguishing "Viral Blisters" (needs isolation) from "Bacterial Boils" (needs a doctor). These should be mandatory displays in chemist shops.

School-Based Sentinel Surveillance: Leveraging the "One Health" approach, schools should be designated as sentinel sites for reporting rash clusters. School nurses/teachers should be trained to identify HFMD and Measles, enforcing isolation policies to break transmission chains, thereby reducing the "panic demand" for antibiotics by parents.

Revitalize the Red Line: The campaign needs a 2.0 version. It should be linked to specific symptoms. Slogans like "Red Line Medicines do not cure Viral Rashes" or "Antibiotics don't fight the Flu" are more effective than generic warnings.

Digital Health Integration: The IDSP should develop a public-facing app that allows citizens to report rashes and receive AI-guided triage advice (e.g., "Likely Viral - Isolate and Monitor"), reducing the reflex to self-medicate.

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