American Journal of Case Reports

e-ISSN 1941-5923
© Am J Case Rep, 2026; 27: e954333
DOI: 10.12659/AJCR.954333

Received: 2026.06.03
Accepted: 2026.09.21
Available online: 2026.11.04
Published: 2026.XX.XX

A 30-Year-Old Male Pediatrician With Documented Complete Vaccination History and Laboratory-Confirmed Breakthrough Measles With Respiratory Involvement During a Measles Outbreak in Mexico

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEF 1 María Julieta Cárdenas de Luna
BCF 1 María Fernanda Hernández Vásquez
CDEF 2 Nidia Leon Sicairos
ADE 3 Adrian Canizalez Roman
CDE 2 Uriel A. Angulo-Zamudio
CDE 2 Jorge Velazquez-Roman
and collaborators*

* A full list of authors is available on the website

1 Epidemiology Service, Instituto Mexicano del Seguro Social, Hospital General de Zona #1 "Emilio Varela Luján", Zacatecas, México
2 Faculty of Medicine Research Unit, Universidad Autónoma de Sinaloa, Culiacán, México
3 Health Services, Hospital de la Mujer, Culiacán, México

Corresponding Author: Juan Carlos Borrego Moreno, Avenida Torreón # 233. Colonia Centro, Zacatecas México CP. 98000
Phone: +524931103251, e-mail: bogue6@hotmail.com

Financial support: None declared
Conflict of interest: None declared

Patient: Male, 30-year-old
Final Diagnosis: Measles
Symptoms: Fever and a cephalocaudal maculopapular rash, followed by progressive systemic and respiratory symptoms, including cough, pharyngitis, and mild pain on breathing
Clinical Procedure: —
Specialty: Public Health
Objective: Unusual clinical course

Background: The global resurgence of measles has been accompanied by reports of breakthrough infection in previously immunized individuals, including healthcare personnel. Breakthrough measles can present with attenuated or atypical findings, but the clinical spectrum in fully vaccinated adults remains incompletely characterized. During outbreaks, documenting laboratory-confirmed cases in vaccinated healthcare workers is clinically relevant.

Case Report: We describe a 30-year-old male pediatrician with a fully vaccinated history for measles, including 2 childhood doses and a measles-rubella booster in 2017, who developed measles after occupational exposure to an unvaccinated 6-year-old patient. Six days after exposure, he developed fever and a cephalocaudal maculopapular rash, followed by progressive systemic and respiratory symptoms, including cough, pharyngitis, and mild pain on breathing. On day 9, a room-air oxygen saturation of 92% prompted brief supplemental oxygen and short inpatient observation. Chest auscultation was normal, and thus chest radiography was not performed. Oxygenation improved rapidly with supportive care. Measles virus RNA was detected by real-time reverse-transcription polymerase chain reaction in a pharyngeal swab. He received supportive care, was hospitalized for 2 days, and recovered fully after 2 weeks of follow-up, with no documented complications or secondary cases among monitored contacts.

Conclusions: This case provides a descriptive, laboratory-confirmed example of breakthrough measles in a fully vaccinated healthcare worker during an active outbreak. Although these observations are consistent with partial or waning immunity, the exact mechanism of vaccine failure could not be established because pre-exposure measles serology and viral genotyping were not performed. Serological surveillance or targeted booster strategies for healthcare personnel should be regarded as context-dependent considerations requiring support from broader epidemiologic and serologic evidence.

Keywords: Disease • Disease Outbreaks • Measles • Measles Vaccine
Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/954333

2461 2 1 11

Publisher's note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher

APPROVED GALLEY PROOF

This work is licensed under Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0)

Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

APPROVED GALLEY PROOF

Introduction

During 2025, a substantial measles outbreak affected the Region of the Americas, representing a significant public health concern. Between epidemiological weeks 1 and 24, a total of 7132 confirmed cases, including 13 deaths, were reported across Argentina, Belize, Bolivia, Brazil, Canada, Mexico, and the United States [1].

The resurgence has been linked to declining vaccination coverage and the influence of vaccine-hesitant movements [2]. In the United States, the Centers for Disease Control and Prevention reported 800 confirmed cases between January 1 and April 17, 2025, the second-highest count in 25 years; 82% of cases were associated with low vaccination coverage, 11% required hospitalization, and 3 deaths occurred in individuals without documented vaccination, primarily in Texas, New Mexico, and Oklahoma [3].

In Mexico, the General Directorate of Epidemiology notified the first confirmed case in epidemiological week 5, in the state of Chihuahua. By epidemiological week 28, a total of 3361 confirmed cases and 11 deaths had been registered, mostly in individuals with uncertain prior vaccination status. Females were more frequently affected (52%); the most affected age group was 0-4 years (838 cases; incidence rate [IR] 8.05 per 100 000 children under 4 years of age), followed by the age group 25-29 years (512 cases; IR 4.83 per 100 000) [4]. In the state of Zacatecas, 21 confirmed cases had been reported as of July 25, 2025 (IR: 1.22 per 100 000) [4]. In response, on July 16, 2025, the Pan American Health Organization supported the launch of a National Rapid Response Plan focused on Chihuahua and Sonora, reinforcing response teams, strengthening epidemiological surveillance, and recommending at least 95% coverage of 2-dose measles-mumps-rubella vaccination, particularly in active-outbreak areas [5].

Despite the high efficacy of the measles vaccine, breakthrough infection in previously immunized individuals is increasingly recognized [6]. In persons with partial immunity, breakthrough disease may present as modified measles, often described as an attenuated or atypical illness with low-grade fever, maculopapular rash, and less prominent respiratory symptoms [7]. However, clinical expression can vary, and vaccinated healthcare personnel remain relevant in outbreak control because exposure can occur in clinical settings before measles is suspected. Reports from well-vaccinated settings, including outbreaks involving healthcare personnel in the Republic of Korea after imported cases, illustrate the diagnostic and infection-control challenges posed by measles in previously vaccinated adults [2].

The contribution of this case report is deliberately bounded and descriptive. It documents laboratory-confirmed breakthrough measles in a fully vaccinated healthcare worker with a compatible occupational exposure, real-time reverse-transcription polymerase chain reaction (RT-PCR) confirmation, respiratory manifestations accompanied by borderline oxygen desaturation, brief supplemental oxygen use, short hospital observation, and subsequent infection-control follow-up without documented secondary cases. Although these observations are consistent with possible partial or waning immunity, the exact mechanism of vaccine failure could not be established because pre-exposure measles serology, acute serologic characterization, IgG-avidity testing, and viral genotyping were not performed. Broader implications regarding serological surveillance or booster strategies could represent cautious practice considerations.

Case Report

A 30-year-old male pediatrician was evaluated after occupational exposure to measles. The patient's medical history included endemic diffuse goiter, secondary to iodine deficiency, and gynecomastia treated with raloxifene 7 years earlier. Thyroid function was normal at the time of exposure, and he had no other known comorbidities. He denied tobacco and illicit drug use and reported occasional social alcohol consumption once per month.

He had documented evidence of a complete measles-containing vaccination schedule, consisting of 2 childhood doses and 1 measles-rubella booster dose administered in 2017. The directly documented patient-level evidence included vaccination records, the compatible clinical course, and RT-PCR confirmation. Baseline measles IgG status before exposure, acute measles-specific IgM/IgG characterization, IgG-avidity testing, cellular immune assessment, and viral genotyping were not obtained; therefore, the mechanism of vaccine failure could not be determined at the individual level.

On May 5, 2025 (day 0), the physician provided medical care to an unvaccinated 6-year-old patient from a Mennonite community in northern Zacatecas, Mexico; the source patient was subsequently confirmed to have measles. On day 6 after the reported exposure, the physician developed fever and a cephalocaudal maculopapular rash (**Figure 1**). Cough, rhinitis, conjunctivitis, and Koplik spots were not present at rash onset. Because the 6-day interval was shorter than the usual incubation period for measles, the temporal association was interpreted cautiously; an unrecognized earlier exposure or imprecision in identifying the relevant exposure date could not be excluded. Nevertheless, in the setting of an active outbreak and confirmed occupational contact, measles remained a leading diagnosis despite the incomplete classic prodrome. Rubella and other acute viral exanthems were included in the differential

This work is licensed under Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0)

Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]



APPROVED GALLEY PROOF

Figure 1. Cephalocaudal maculopapular rash observed on day 6 after occupational measles exposure. Written informed consent was obtained for publication of the clinical image.

diagnosis. From day 7 through day 9, the patient developed progressive asthenia, malaise, marked fatigue, cough, pharyngitis, and mild pain on breathing.

On day 9 after the reported exposure, persistent symptoms, tachypnea, and a borderline room-air oxygen saturation of 92% prompted hospital admission for observation and respiratory monitoring. On admission, the patient's temperature was 38.5 °C, with a peak of 39 °C; respiratory rate reached 26 breaths per minute; and blood pressure was 100/60 mm Hg. His heart rate was reported as normal, although he described brief episodes of mild tachycardia during febrile peaks. Chest

This work is licensed under Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0)

Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

APPROVED GALLEY PROOF

Table 1. Clinical timeline.

Time point	Clinical event
Day 0, May 5, 2025	Occupational exposure while attending an unvaccinated patient from the Mennonite community in northern Zacatecas, Mexico, later confirmed with measles
Day 6 after exposure	Onset of fever and cephalocaudal maculopapular rash with clinical characteristics compatible with measles. No occurrence of cough, rhinitis (runny nose), and conjunctivitis (watery eyes), collectively known as coryza. No Koplik spots
Days 7-9 after exposure	Progressive increase in clinical symptoms, including systemic deterioration with asthenia, adynamia, and marked fatigue, along with respiratory symptoms such as cough, pharyngitis, and mild pain during breathing
Day 9 after exposure	Hospital admission due to worsening symptoms, tachypnea (26 breaths per minute), and borderline room-air oxygen saturation of 92%. These findings prompted observation and respiratory monitoring but did not establish a radiographically confirmed lower respiratory complication
Hospitalization period	Two days of inpatient observation, fever control, symptomatic management, and respiratory monitoring
Acute diagnostic phase	Pharyngeal swab positive for measles virus RNA by real-time RT-PCR using the AgPath-ID One-Step RT-PCR assay
Follow-up laboratory testing	Glucose 106 mg/dL (prediabetes)
After clinical suspicion and laboratory confirmation	The rapid implementation of institutional infection-control measures, active monitoring of close contacts, and temporary preventive isolation were associated with the absence of documented secondary cases

Table 2. Laboratory test result tracking.

Value	Units	Ref. range	April 3, 2024	May 18, 2025	July 28, 2025	Comment on variation
MCHC	g/dL	32-35	32.7	N/A	35.5 ↑	Elevated in Jul-2025 (↑)
Leukocytes	K/uL	4.3-10.3	6.5	N/A	7.3	Normal
Lymphocytes%	%	10-50	37.3	N/A	31.6	Normal
Glucose	mg/dL	70-105	103	N/A	106 ↑	Elevated in Jul-2025 (↑)
Urea	mg/dL	13-43	27.82	N/A	47.08 ↑	Elevated in Jul-2025 (↑)
Total cholesterol	mg/dL	140-220	N/A	N/A	197.0	Borderline high normal
LDL cholesterol	mg/dL	100-190	N/A	N/A	154 ↑	Elevated in Jul-2025 (↑)
Measles IgM (ELISA)	-	Negative (< 0.8)	N/A	Negative	N/A	No recent infection by IgM (antibodies)
Measles PCR (RT-PCR)	-	Negative	N/A	Positive	N/A	Active infection confirmed – viral RNA detected in pharyngeal swab
Rubella IgM (ELISA)	-	Negative (< 0.8)	N/A	Negative (0.091)	N/A	Normal – no recent infection
Rubella PCR (RT-PCR)	-	Negative	N/A	Negative	N/A	Normal

Abbreviations: MCHC, mean corpuscular hemoglobin concentration; LDL, low-density lipoprotein; N/A, not applicable; PCR, polymerase chain reaction.

This work is licensed under Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0)

Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

auscultation was normal, chest radiography was not performed, and oxygenation improved rapidly with supportive care. The respiratory course was therefore assigned as temporary and of low severity. Routine clinical laboratory values were within normal parameters. A pharyngeal swab obtained during the acute phase was positive for measles virus RNA by RT-PCR using the AgPath-ID One-Step RT-PCR assay (**Table 1**).

The patient remained hospitalized for 2 days and received supportive care, including antipyretic therapy, antihistamine treatment, respiratory monitoring, and supplemental oxygen for approximately 12 hours. Paracetamol 500 mg 3 times daily and loratadine 10 mg once daily were administered. Vitamin A was not administered. No additional complications were documented during hospitalization. He was discharged with instructions for home isolation and close clinical monitoring and achieved complete clinical recovery after 2 weeks of follow-up, including laboratory tests. During follow-up in July 2025, annual laboratory test results showed mild abnormalities, including glucose level of 106 mg/dL, urea level of 47.08 mg/dL with normal creatinine level, and low-density lipoprotein cholesterol level of 154 mg/dL. A slight increase in mean corpuscular hemoglobin concentration level to 35.5 g/dL was noted; however, the increase was not considered clinically relevant (**Table 2**).

Infection-control measures were implemented immediately after measles was clinically suspected and were reinforced after laboratory confirmation. The case was reported to the hospital epidemiology and infection-prevention team and to public health authorities, according to institutional outbreak-response procedures. The patient was placed under airborne isolation precautions, healthcare personnel used appropriate respiratory protection, and work exclusion was maintained throughout the infectious period, with return to clinical duties only after clinical recovery and completion of the recommended isolation period.

Follow-up and measles IgM and IgG testing were requested for the patient's 7 direct contacts: his intimate partner, 2 family members, and 4 coworkers. None developed clinical symptoms or had laboratory test results confirming measles. Preventive isolation was recommended during the initial evaluation period until measles infection was ruled out through clinical follow-up and laboratory testing. None of the monitored contacts developed fever, rash, respiratory symptoms, or laboratory evidence compatible with secondary measles infection, and no additional epidemiologically linked cases were documented.

Discussion

This report documents laboratory-confirmed breakthrough measles in a young adult pediatrician with a complete measles-containing vaccination history, including a measles-rubella booster dose administered 8 years before exposure. The central inference is intentionally limited: during an active outbreak, a fully vaccinated healthcare worker can still develop clinically meaningful measles after occupational exposure, and the clinical course may be moderate enough to require hospital observation and supportive respiratory monitoring.

Breakthrough measles in previously immunized persons is often discussed under the concept of modified measles, which has classically been described as an attenuated illness with low-grade fever, maculopapular rash, and minimal respiratory symptoms. The present case is compatible with breakthrough measles in a previously vaccinated individual, but its course was not temporary. The patient developed progressive systemic and minimal but important respiratory symptoms, as borderline hypoxemia, which required inpatient care. Thus, this case should not be interpreted as proving a new phenotype or as establishing a specific immune mechanism; rather, it illustrates the variable clinical occurrence, even in minimal severity, that can appear when measles develops in vaccinated adults during outbreaks. In this case, fever and rash began 6 days after the reported occupational exposure, earlier than the usual measles incubation interval, and cough, rhinitis, and conjunctivitis were absent at rash onset. These features required diagnostic caution, broadened the differential diagnosis to include rubella and other acute viral exanthems, and prevented definitive attribution of the illness to that single exposure on temporal grounds alone. Nevertheless, the active outbreak setting, confirmed occupational contact, compatible febrile exanthem, subsequent cough and pharyngitis, negative rubella testing, and detection of measles virus RNA in a pharyngeal swab provided strong support for acute measles. RT-PCR confirmed the diagnosis despite the incomplete classic presentation, but it could not determine whether vaccination altered the incubation period or clinical phenotype. In addition, the absence of viral genotyping precluded virologic confirmation of linkage to the presumed source case. The presentation is therefore best interpreted as atypical breakthrough or modified measles without asserting a distinct phenotype, altered incubation, or specific immune mechanism.

Published reports have already documented measles among vaccinated healthcare personnel, so the novelty of this manuscript is incremental rather than unprecedented. Choi et al emphasized the infection-control relevance of identifying susceptibility among healthcare workers in highly vaccinated settings [6]. In a nosocomial outbreak in the Republic of Korea reported by Song et al, 26 cases were identified; most infected workers had serological evidence of vaccination, several had received a 2-dose measles-mumps-rubella schedule, and 4 patients required hospitalization for infection-related complications [7]. A challenging outbreak among vaccinated healthcare providers was also reported in Lebanon [8]. Breakthrough measles has

APPROVED GALLEY PROOF

This work is licensed under Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0)

Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

APPROVED GALLEY PROOF

additionally been described among vaccinated adults in other outbreak contexts [9,10]. Together, these reports support the clinical plausibility of breakthrough infection among vaccinated adults while underscoring that single cases should be interpreted within the broader outbreak and serologic context.

The contextual value of the present report lies in its documentation of an outbreak-era Mexican case in a fully vaccinated pediatrician with RT-PCR confirmation, a clear occupational exposure to an unvaccinated child from an underimmunized community, a moderate disease course requiring hospitalization, and infection-control actions without documented secondary transmission. This value is confirmatory and contextual. It adds a real-world clinical correlate to population-level concerns regarding susceptibility among adults, including the recent national serosurvey in Mexico, in which low measles IgG seroprotection was observed among young adults aged 20 to 49 years, with 63.6% positivity in the group aged 20 to 29 years [9]. However, those population data provide epidemiologic context and do not establish the immunologic mechanism in this individual patient, define a new clinical phenotype, or justify broader policy conclusions from this case alone.

Waning immunity is one plausible explanation because the most recent measles-containing dose was administered in 2017 and disease occurred in 2025, but the elapsed interval alone is not evidence of secondary vaccine failure. Measles vaccination may be followed by primary failure, in which a protective immune response is not achieved, or secondary failure, in which protection declines over time [11]. Other possibilities include incomplete cellular protection despite humoral memory and host-related or exposure-related factors. Without pre-exposure serology, acute IgM and IgG characterization, IgG-avidity testing, cellular immune assessment, or viral genotyping, this case cannot distinguish among these mechanisms. It therefore supports no causal attribution to waning immunity.

This report has important limitations that constrain causal inference. Pre-exposure measles IgG status was unknown because routine serological screening of healthcare personnel was not performed in this setting. Acute measles-specific IgM and IgG serology and IgG-avidity testing were not available, which prevents differentiation between primary and secondary vaccine failure. Chest radiography was not performed; therefore, pneumonia or another lower respiratory complication could not be assessed radiographically, and respiratory severity could not be formally graded. Viral genotyping was also not performed; therefore, the epidemiological link to the source case remains clinically and temporally plausible rather than virologically confirmed. These limitations do not weaken the diagnosis, which was supported by RT-PCR detection of measles virus RNA, but they require restraint in interpreting the mechanism and in deriving policy recommendations from this single case.

From a practical standpoint, the case primarily supports infection-control preparedness rather than direct policy conclusions about booster programs. In outbreak settings, compatible symptoms after exposure should prompt clinical suspicion for measles even in vaccinated healthcare personnel, followed by rapid laboratory confirmation, airborne isolation, work exclusion, reporting to infection-prevention teams and public health authorities, and systematic contact tracing. In the present case, rapid institutional response, active monitoring of close contacts, and temporary preventive isolation were followed by the absence of documented secondary cases. Serological verification of immunity or targeted booster strategies may be reasonable context-dependent considerations for high-risk personnel in areas with active transmission, but such strategies should be guided by institutional risk assessment and broader epidemiologic, serologic, and effectiveness data rather than by this case alone.

Conclusions

This case documents laboratory-confirmed breakthrough measles in a fully vaccinated healthcare worker during an active outbreak in Mexico and shows that disease in this setting can be clinically meaningful, with respiratory involvement and hospitalization. The most directly supported lesson is the need to recognize and manage possible breakthrough measles in vaccinated healthcare personnel with compatible exposure and symptoms. Timely reporting, RT-PCR confirmation, airborne isolation, work exclusion, and contact tracing remain the immediate practical actions supported by this case. Waning immunity is a plausible but unproven explanation because pre-exposure serology, IgG-avidity testing, and viral genotyping were not available. Therefore, serological surveillance and targeted booster strategies should remain context-dependent considerations requiring broader epidemiologic and serologic evidence.

Acknowledgements

The authors thank Eduardo Vazquez Badillo for the timely reporting of the case and for facilitating access to the clinical information that made this report possible.

Institution Where Work Was Done

General Hospital No. 1, Mexican Institute of Social Security (IMSS), Zacatecas, México.

Informed Consent

Written informed consent was obtained from the patient for the collection and publication of clinical data and clinical photographs for academic and scientific purposes.

This work is licensed under Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0)

Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

Artificial Intelligence Disclosure

ChatGPT (OpenAI) was used solely as a language-assistance tool to translate the original manuscript prepared by the authors in Spanish into English and to improve grammar and linguistic readability. The tool was not used to generate clinical data, scientific interpretations, conclusions, or references. All scientific content was developed, reviewed, and verified by the authors, who take full responsibility for the final manuscript.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

References:

1. Pan American Health Organization. Epidemiological update: Measles in the Region of the Americas, 1 July 2025 [Internet]. Washington (DC): Pan American Health Organization; 2025 [cited 2025 Jul 21]. Available from: https://www.paho.org/es/documentos/actualizacion-epidemiologica-sarampion-region-americas-1-julio-2025
2. Han SB, Park SH, Yi Y, et al. Measles seroprevalence among healthcare workers in South Korea during the post-elimination period. Hum Vaccin Immunother. 2021;17(8):2517-21
3. Centers for Disease Control and Prevention. Measles: Data and research [Internet]. Atlanta (GA): Centers for Disease Control and Prevention; 2025 [cited 2025 Jul 25]. Available from: https://www.cdc.gov/measles/data-research/index.html
4. General Directorate of Epidemiology. Daily report on the measles outbreak in Mexico, 2025 [Internet]. Mexico City: Ministry of Health; 2025 [cited 2025 Jul 28]. Available from: https://www.gob.mx/salud/documentos/informe-diario-del-brote-de-sarampion-en-mexico-2025
5. Pan American Health Organization. Mexico launches a national rapid response plan to interrupt the measles outbreak [Internet]. Washington (DC): Pan American Health Organization; 2025 Jul 16 [cited 2025 Jul 28]. Available from: https://www.paho.org/es/noticias/16-7-2025-mexico-lanza-plan-nacional-respuesta-rapida-para-interrupcion-brote-sarampion
6. Choi S, Chung JW, Chang YJ, et al. A lesson from a measles outbreak among healthcare workers in a single hospital in South Korea: The importance of knowing the prevalence of susceptibility. Vaccines (Basel). 2023;11(9):1505
7. Song K, Lee JM, Lee EJ, et al. Control of a nosocomial measles outbreak among previously vaccinated adults in a population with high vaccine coverage: Korea, 2019. Eur J Clin Microbiol Infect Dis. 2022;41(3):455-66
8. Zmerli O, Chamieh A, Maasri E, et al. A challenging modified measles outbreak in vaccinated healthcare providers. Infect Prev Pract. 2021;3(1):100105
9. Carnalla M, Gaspar-Castillo C, Dimas-González J, et al. A population-based measles serosurvey in Mexico: Implications for re-emergence. Vaccine. 2025;51:126886
10. Hagan JE, Crooke SN, Gunregjav N, et al. Breakthrough measles among vaccinated adults born during the post-Soviet transition period in Mongolia. Vaccines (Basel). 2024;12(6):695
11. Fappani C, Gori M, Canuti M, et al. Breakthrough infections: A challenge towards measles elimination? Microorganisms. 2022;10(8):1567

APPROVED GALLEY PROOF

This work is licensed under Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0)

Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]