



Combating Measles Transmission in the General Pediatrics Ward

Genel Pediatri Servisinde Kızamık Bulaşı ile Mücadele

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Abstract

Objective: Measles is an acute viral disease transmitted via the respiratory route and characterized by fever, cough, conjunctivitis, and rash. The attack rate among susceptible individuals is 90%, and infectivity occurs from 4 days before to 4 days after the onset of rash. High-cost measles outbreaks have been reported in hospitals. This study aimed to evaluate the control measures taken and their costs in individuals exposed to an index measles case who was hospitalized before the onset of rash.

Material and Methods: Measles serology was sent for a 17-month-old patient who was hospitalized in the general pediatrics ward with a diagnosis of bronchiolitis after the onset of rash one day following admission. As there was no negative-pressure room in our hospital, the patient was isolated in a standard room. Two days later, measles IgM tested positive. A list was prepared of patients, caregivers, and healthcare workers who had contact with the patient during his stay in the pediatric emergency department and the general pediatrics ward. The contacts were reported to the hospital Infection Control Committee and the İzmir Provincial Health Directorate. Post-exposure prophylaxis (PEP) was implemented based on the recommendations of the Ministry of Health Measles Elimination Program and the American Academy of Pediatrics. In this retrospectively planned study, the number of individuals exposed to the index case, the type of PEP applied, vaccination or immunoglobulin doses, and their costs were evaluated.

Results: A total of 125 patient contacts and 58 healthcare workers were identified. Seventeen of the exposed patients were still hospitalized.

Öz

Giriş: Kızamık, solunum yoluyla bulaşan, ateş, öksürük, konjonktivit ve döküntüyle seyreden akut viral bir hastalıktır. Duyarlı bireylerde atak hızı %90 olup bulaştırıcılık, döküntü başlangıcından dört gün öncesi ile sonrası arasında gerçekleşir. Hastanelerde yüksek maliyetli kızamık salgınları bildirilmiştir. Bu çalışmada, döküntü başlamadan önce hastaneye yatırılan bir indeks kızamık olgusuyla temas eden kişilerde alınan kontrol önlemleri ve bunların maliyetlerinin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntemler: Genel pediatri servisine bronşiolit nedeniyle yatırılan 17 aylık hastanın yatışından bir gün sonra, döküntülerin başlaması üzerine kızamık serolojisi gönderilmiştir. Hastanemizde negatif basınçlı oda bulunmadığı için hasta normal bir odada izole edilmiştir. İki gün sonra kızamık IgM pozitif olarak sonuçlanmıştır. Hastanın çocuk acil servise ve genel pediatri servisinde yatışı süresince temas ettiği hastalar, refakatçiler ve sağlık çalışanlarının listesi hazırlanmıştır. Temaslılar, hastane Enfeksiyon Kontrol Komitesine ve İzmir İl Halk Sağlığı Hizmetleri Başkanlığına bildirilmiştir. Temas sonrası profilaksi (TSP) için Sağlık Bakanlığı Kızamık Eliminasyon Programı ve Amerikan Pediatri Akademisinin önerileri temel alınmıştır. Retrospektif olarak planlanan bu çalışmada indeks kızamık vakasıyla temas eden kişilerin sayısı, uygulanan TSP yöntemi, aşılama veya immünoglobulin dozları ve maliyetleri değerlendirilmiştir.

Bulgular: Toplam 125 temaslı hasta ve 58 sağlık çalışanı tespit edilmiştir. Temaslı hastalardan 17'sinin hastanede yatışı devam etmekteydi. İntravenöz immünoglobulin (IVIG) üç temaslı hastaya uygulanmıştır. Temaslı

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Intravenous immunoglobulin (IVIG) was administered to 3 exposed patients. The total cost of IVIG administered to exposed patients was calculated as 94.494 TL (2.999\$). Two caregiver mothers received IVIG due to pregnancy. The total cost of hospitalization and IVIG for caregivers was calculated as 225.321 TL (7.153\$). Three patients and 9 caregivers were vaccinated. Measles serology was requested from 47 exposed healthcare workers, and 37 of them were vaccinated before results were available. The total cost of serological tests was 1.932 TL (61\$).

Conclusion: Preventing measles transmission in healthcare facilities can lead to substantial costs. Patients with suspected measles should be monitored in negative-pressure isolation rooms. All healthcare workers, especially those in pediatrics, infectious diseases, and emergency departments, should be fully immunized against measles and other childhood infectious diseases.

Keywords: Measles, respiratory isolation, post-exposure prophylaxis, vaccination, intravenous immunoglobulin

Introduction

Measles is an acute viral disease transmitted via the respiratory route and characterised by fever, cough, conjunctivitis, and rash. The attack rate among exposed susceptible individuals is 90% (1). Infectiousness begins 4 days before the onset of the rash and continues until 4 days after rash onset (2). In young children and immunocompromised patients, it may cause complications such as otitis media, bronchopneumonia, laryngotracheobronchitis (croup), and diarrhoea, as well as mortality (1). Severe complications of measles include pneumonia and encephalitis. Subacute sclerosing panencephalitis is a rare, incurable, and fatal neurological complication of measles (3).

There is no specific antiviral treatment for measles. In resource-limited countries, the administration of vitamin A to children with active measles reduces morbidity and mortality (4). The World Health Organization (WHO) recommends administering vitamin A to children with measles (1). The best way to prevent measles is active immunisation with the measles vaccine. The measles vaccine may provide protection against measles if administered within 72 hours of exposure. Human immunoglobulin administered intramuscularly or intravenously within 6 days of exposure may be used to prevent or attenuate measles in individuals without evidence of immunity (5).

In our country, the Measles Elimination Programme, which aims to eliminate measles and rubella in accordance with the measles elimination targets established by the WHO European Region, has been implemented since 2002. Measles is classified as a notifiable communicable disease. Within the scope of the Measles Elimination Programme, routine childhood vaccination, catch-up vaccination, vaccination of healthcare workers, the management and isolation of suspected measles cases in healthcare institutions, and prophylaxis and isolation measures for persons who have been in contact with measles are systematically implemented and monitored (6).

hastalara uygulanan IVIG'in toplam maliyeti 94.494 TL (2.999 \$) olarak hesaplanmıştır. Refakatçilerden iki anneye gebelikleri nedeniyle IVIG tedavisi verilmiştir. Refakatçilere yönelik yatış ve IVIG tedavilerinin toplam maliyeti 225.321 TL (7.153 \$) olarak hesaplanmıştır. Üç hastaya, dokuz refakatçiye aşı uygulanmıştır. Temaslı sağlık çalışanlarından 47'sinden kızamık serolojisi istenmiş, sonuçlar beklenmeden 37 kişiye kızamık aşısı uygulanmıştır. Serolojik tetkiklerin toplam maliyeti 1.932 TL (61 \$) olarak belirlenmiştir.

Sonuç: Sağlık kuruluşlarında kızamık bulaşının önlenmesi yüksek maliyetlere yol açabilmektedir. Kızamık şüphesi bulunan hastalar, negatif basınçlı izolasyon odalarında izlenmelidir. Başta çocuk sağlığı ve hastalıkları, enfeksiyon hastalıkları ve acil servis çalışanları olmak üzere tüm sağlık çalışanlarının, kızamık gibi çocukluk çağıının bulaşıcı hastalıklarına karşı aşılama tam olmalıdır.

Anahtar Kelimeler: Kızamık, solunum izolasyonu, temas sonrası profilaksi, aşı, intravenöz immünoglobülin

In recent years, a marked increase in measles cases has been reported worldwide, particularly in the European Region. The WHO has stated that more than half of the world's countries are at risk of measles outbreaks (7). A study examining the economic burden of measles outbreaks in the United States reported that the mean total cost per outbreak was USD 152,308. The mean cost per measles case was estimated at USD 32,805, while the mean cost per contact was reported to be USD 223 (8).

This study aimed to retrospectively evaluate the control measures implemented through a multidisciplinary approach by the Paediatric Infectious Diseases Clinic, the Infection Control Committee (ICC), the occupational physician, and the İzmir Provincial Directorate of Public Health Services following exposure to a measles case in the general pediatric ward, as well as the costs of these measures.

Materials and Methods

Ethical approval for this study was obtained from the Non-Interventional Clinical Research Ethics Committee of İzmir Bakırçay University (Decision No: 2059, Date: 19.02.2025). İzmir Bakırçay University Çiğli Training and Research Hospital is a tertiary healthcare institution with a 24-bed paediatric ward. The pediatric ward has two isolation rooms; however, these rooms are not equipped with negative-pressure systems. All paediatric cases requiring hospitalisation are admitted to rooms in the paediatric ward and cohorted according to their clinical diagnoses. Patient rooms other than the isolation rooms have a capacity of two beds.

A 17-month-old male patient who presented to the paediatric emergency department with fever and cough and was admitted to the general paediatrics ward with a diagnosis of bronchiolitis underwent measles serological testing after maculopapular rashes beginning on his face were observed one day after admission. It was learned that the patient was a migrant and had not received childhood vaccinations. Since our hospital does not have a negative-pressure isolation room, the

patient was isolated in a standard room. Serological testing performed two days later revealed positive measles IgM. During the three-day period between admission and confirmation of the diagnosis, patients, caregivers, and healthcare workers came into contact with this index measles case in the paediatric emergency department and paediatric ward.

A list was prepared of the patients, caregivers, and healthcare workers who had been in contact with the patient in the paediatric emergency department and general paediatrics ward before he was diagnosed with measles three days after presenting to the hospital. Healthcare workers among the contacts were reported to the hospital Infection Control Committee (ICC), while patients and caregivers were reported to the Communicable Diseases Unit of the İzmir Provincial Directorate of Public Health Services. The screening and follow-up of patients discharged from the hospital and their caregivers were planned by the İzmir Provincial Directorate of Public Health Services. PEP was arranged on the basis of the recommendations of the Ministry of Health Measles Elimination Programme and the American Academy of Pediatrics (1,6). The ages, underlying chronic conditions, and vaccination status of contact patients hospitalised in the ward were evaluated. The patients were divided into three groups: those aged <6 months, those aged 6–11 months, and those aged ≥12 months, and PEP was administered accordingly. Intravenous immunoglobulin (IVIG) was planned for infants aged <6 months within the first 6 days; vaccination within the first 72 hours was planned for unvaccinated infants aged 6–11 months, while IVIG (GenIVIG®, *Gen İlaç ve Sağlık Ürünleri A.Ş., Türkiye*) was planned up to day 6 for those identified after 72 hours; and vaccination within the first 72 hours was planned for those aged >12 months in the absence of contraindications.

The ages, pregnancy status, underlying chronic conditions, and vaccination status of the caregivers of patients who remained hospitalised in the ward were evaluated. The measles vaccination status of all contacts was checked through the e-Nabız and Vaccine Tracking Systems by a physician employed by the İzmir Provincial Directorate of Public Health Services. Caregivers who could not provide documentation of having received two doses of the measles vaccine and who had no contraindications to vaccination were vaccinated within the first 72 hours following exposure.

The ages, pregnancy status, underlying chronic conditions, and vaccination status of contact healthcare workers were evaluated by the ICC and the occupational physician. Healthcare workers who could not provide documentation of having received two doses of the measles vaccine and who had no contraindications to vaccination were vaccinated within the first 72 hours following exposure.

In this study, contacts were considered immune to measles if they had documentation of having received two doses

of the measles vaccine or laboratory evidence of immunity to measles [positive anti-measles immunoglobulin G (IgG)]. All vaccines administered to healthcare workers, patients, and patients' relatives were combined measles-mumps-rubella (MMR) vaccines (*Serum Institute of India*) supplied by the İzmir Provincial Directorate of Public Health Services. Since measles IgG testing cannot be performed at our hospital, samples are sent to an external centre when testing is required. At this external centre, measles IgG antibodies are measured using an ELISA-based test. Since obtaining the results may take longer than 72 hours, PEP was planned and administered without awaiting the measles IgG results. Under the coordination of the İzmir Provincial Directorate of Public Health Services, contacts continued to be monitored for fever and rash for 21 days (28 days for those who received IVIG).

Ethics approval for this study was obtained from the İzmir Bakırçay University Non-Interventional Clinical Research Ethics Committee (Approval number: 2059; Decision date: 19 February 2025).

Results

The index measles case was found to have been in contact with a total of 125 patients and 58 healthcare workers during his stay in the paediatric emergency department and general paediatrics ward. Seventeen of the contact patients were still hospitalised. Of the contact patients who remained hospitalised, 10 were male and 7 were female, and the median age was 72 months (2 months–17 years). One patient was aged <6 months, 5 were aged 6–11 months, and 11 were aged ≥12 months. One 2-month-old patient was found to have stayed in the same room as the index measles case. This patient received IVIG as PEP. When the measles vaccination status of the 5 patients aged 6–11 months was evaluated, no additional prophylaxis was administered to one 10-month-old patient because 28 days had not yet elapsed since the most recent measles vaccination. Measles-mumps-rubella (MMR) vaccine was administered to the 6-month-old and 11-month-old contacts. Nine-month-old twin patients who had stayed in another room in the same corridor as the index measles case and had not previously received the measles vaccine were found to have received IVIG because more than 72 hours had elapsed since their exposure. Of the 11 contacts aged >1 year, 10 were documented as having previously received two doses of the measles vaccine through examination of their vaccination cards. A 17-year-old patient was found to have previously received a single dose of the vaccine and was therefore administered the MMR vaccine as PEP. The cost of IVIG treatment administered to the contact patients was calculated as TRY 94.494 (USD 2.999). Nine patient caregivers who could not provide documentation of having received two doses of the measles vaccine were found to have received the measles vaccine. Two caregivers who were found to be pregnant and whose

immunity to measles could not be documented received IVIG. The total cost of hospital accommodation and IVIG treatment for the caregivers was calculated as TRY 225.321 (USD 7.153). The total cost of IVIG treatment administered to contact patients and caregivers for PEP was calculated as TRY 319.815 (USD 10.153).

Of the 58 contact healthcare workers, 18 were paediatric residents, 16 were specialists, 13 were nurses, 6 were support staff, 1 was a medical secretary, and 4 were students. No additional intervention was performed for 11 (18.9%) healthcare workers who had documented immunity to measles through vaccination or positive measles IgG. Measles IgG and IgM tests were requested for 47 healthcare workers who were unaware of their serological status; 37 received the MMR vaccine without awaiting the results. Vaccination was initially postponed for the other 10 contact healthcare workers. These workers' previous immunity status was subsequently documented. The total cost of the serological tests was calculated as TRY 1.932 (USD 61). A second dose of the MMR vaccine was planned one month later for 16 (27.5%) individuals whose measles IgG results were negative.

No adverse events were observed following the administration of the MMR vaccine or IVIG as PEP. No measles infection developed by the end of the 21-day follow-up period for the contacts or the 28-day follow-up period for those who received IVIG.

Discussion

In this study, PEP was effectively implemented for 125 patients, 58 healthcare workers, and caregivers who had been exposed to an index case diagnosed with measles. These measures were carried out through a multidisciplinary approach by a team comprising a paediatric infectious diseases specialist, the hospital infection control committee, the occupational physician, and the İzmir Provincial Directorate of Public Health Services, thereby preventing the occurrence of any secondary measles cases. However, the IVIG treatments and serological tests used during this process were found to have resulted in a total direct cost of TRY 321.747 (USD 10.214), as well as a substantial additional workforce burden.

Measles is a vaccine-preventable disease. The immune response is approximately 95% after a single dose of the vaccine and increases to as high as 99% after two doses. Two doses administered at least 28 days apart are required for measles control and elimination (1). According to the vaccination schedule in our country, two doses of the MMR vaccine are administered at 12 and 48 months of age. Owing to the increase in measles cases in recent years, an additional dose of the MMR vaccine at 9 months of age has been introduced (9).

The successful implementation of the measles elimination programme in our country resulted in a dramatic decline in measles cases after 2002. However, a major measles outbreak

occurred in 2013 because of international migration and inadequate vaccination rates in neighbouring European countries (10).

In 2013, when an increase in the number of cases was observed throughout Türkiye, 44 measles cases were followed at a tertiary children's hospital in Ankara. During this period, hospital-acquired measles infection was reported in two paediatric residents who had received only a single dose of the measles vaccine and in three children who had presented for medical examination (11). The study did not indicate whether any PEP had been administered to the patients or healthcare workers identified as having been exposed to measles. Nevertheless, these findings support the view that a single dose of the measles vaccine may not provide sufficient protection for healthcare workers and that two-dose vaccination is required to achieve complete immunity. In our study, all healthcare workers without evidence of immunity to measles received the measles vaccine within the first 72 hours following exposure, and none developed measles infection.

Even in countries where vaccination programmes are effectively implemented and measles cases are extremely rare, hospital-acquired outbreaks involving measles transmission among both hospitalised patients and healthcare workers have been reported, particularly following cases imported from abroad, resulting in substantial costs (12-14). Our index case was also an unvaccinated migrant child. In a hospital-acquired outbreak reported in the United States, a total of five secondary measles cases, including one physician, were identified among individuals who had been present in the same emergency department as an index case originating from India (14). In our study, individuals identified as contacts in the emergency department were contacted by telephone and monitored for fever and rash under the coordination of the İzmir Provincial Directorate of Public Health Services; however, no cases of measles infection were identified.

Because measles is transmitted via the respiratory route and has an attack rate of 90%, airborne isolation must be initiated whenever a case of measles is suspected in a healthcare institution, and the patient with suspected measles must be monitored in a dedicated room with negative-pressure ventilation. However, such specialised rooms are not always available in many hospitals. According to a study conducted by Tapisız et al. at Gazi University in 2014, a mother accompanying her hospitalised child in a general paediatrics ward without a negative-pressure isolation room was diagnosed with measles on the third day of her stay (15). A total of 44 children and 101 adults were identified as having been exposed to the index case. As part of PEP, 32 individuals, comprising 19 children and 13 adults, required vaccination or IVIG administration, and 9 of these individuals received IVIG at a dose of 400 mg/kg/dose. No new measles cases

were detected following appropriate PEP interventions (15). In our study, the number of contacts was similarly high because our hospital did not have a negative-pressure room; nevertheless, no new cases developed following appropriate PEP interventions.

Nosocomial measles transmission through an unvaccinated healthcare worker has been reported in the literature (16). In this case reported from England, an unvaccinated healthcare worker was infected with measles and was found to have had a total of 110 contacts. Despite the administration of IVIG to 5 contacts and the measles vaccine to 61 contacts following contact tracing, measles infection developed in a 10-month-old patient (16). Although 18.9% of the healthcare workers employed at our hospital were known to have positive measles serology, the immunity status of the remaining workers was initially unknown. Serological investigations revealed negative measles IgG in 27.5% of the healthcare workers. In a cross-sectional study investigating measles seroprevalence among healthcare workers employed in departments with a high risk of measles exposure at a university hospital in İzmir, 79 participants (24.2%) were found to be seronegative. Although all participants aged >50 years were seropositive, those aged 20–29 years had the highest seronegativity rate, at 29.4% (17). The seronegativity rates reported in the literature are similar to those identified at our hospital. Under the Measles Elimination Programme published on 5 February 2015 by the Department of Vaccine-Preventable Diseases of the Public Health Institution of Türkiye, Ministry of Health of the Republic of Türkiye, it is recommended that MMR vaccination be completed for all healthcare workers, particularly those employed in paediatrics, infectious diseases, 112 Emergency Medical Services, and emergency departments (6). This case enabled deficiencies in the vaccination status of healthcare workers at our institution to be identified and addressed.

The single-centre and retrospective design of this study is an important limitation. Only the direct costs of IVIG and serological tests could be calculated in the cost analysis. The inability to calculate workforce losses and logistical costs constitutes another important limitation. Nevertheless, by systematically describing measles contact management and PEP practices under real-world conditions using a multidisciplinary approach, this study provides a valuable example for institutions that may encounter similar situations.

Conclusion

Preventing measles transmission in healthcare institutions entails substantial costs. Patients with suspected measles should be monitored in negative-pressure isolation rooms. MMR vaccination should be completed for all healthcare workers, particularly those working in paediatrics, infectious diseases, and emergency departments.

Ethics Committee Approval: Ethics approval for this study was obtained from the İzmir Bakırçay University Non-Interventional Clinical Research Ethics Committee (Approval number: 2059; Decision date: 19 February 2025).

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References

1. American Academy of Pediatrics. Measles. In: Kimberlin DW, Banerjee R, Barnett ED, Lynfield R, Sawyer MH. Red Book: Report of the Committee on Infectious Diseases. American Academy of Pediatrics 2024;570-85.
2. Guidelines for measles and rubella outbreak investigation and response in the WHO European Region [Internet]. Copenhagen: World Health Organization Regional Office for Europe. Erişim adresi: https://cdn.who.int/media/docs/librariesprovider2/euro-health-topics/vaccines-and-immunization/outbreakguidelines-updated.pdf?sfvrsn=6f-0c7b0d_1&download=true (Erişim tarihi: 16.10.2025)
3. Lebon P, Gelot A, Zhang SY, Casanova JL, Hauw JJ. Measles Sclerosing Subacute PanEncephalitis (SSPE), an intriguing and ever-present disease: Data, assumptions and new perspectives. Rev Neurol (Paris) 2021;177(9):1059-68. <https://doi.org/10.1016/j.neurol.2021.02.387>
4. Sudfeld CR, Navar AM, Halsey NA. Effectiveness of measles vaccination and vitamin A treatment. Int J Epidemiol 2010;39:48-55. <https://doi.org/10.1093/ije/dyq021>
5. McLean HQ, Fiebelkorn AP, Temte JL, Wallace GS; Centers for Disease Control and Prevention. Prevention of measles, mumps, rubella, congenital rubella syndrome and mumps, 2013: Summary recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep (Morb Morb Wkly Rep) 2013;62:1-34.
6. T.C. Sağlık Bakanlığı, Türkiye Halk Sağlığı Kurumu. Kızamık Eliminasyon Programı, 05.02.2015. Erişim adresi: https://hsgm.saglik.gov.tr/depo/Mevzuat/Genel_Nitelikli_Yazi_ve_Gorusler/Kizamik_Eliminasyon_Programi.pdf (Erişim tarihi: 16.10.2025)
7. Parums DV. A Review of the Resurgence of Measles, a Vaccine-Preventable Disease, as Current Concerns Contrast with Past Hopes for Measles Elimination. Med Sci Monit 2024;30:e944436. <https://doi.org/10.12659/MSM.944436>
8. Pike J, Leidner AJ, Gastañaduy PA. A Review of Measles Outbreak Cost Estimates From the United States in the Postelimination Era (2004-2017): Estimates by Perspective and Cost Type. Clin Infect Dis 2020;71(6):1568-76. <https://doi.org/10.1093/cid/ciaa070>
9. T.C. Sağlık Bakanlığı. Aşı Portalı. Erişim adresi: <https://asi.saglik.gov.tr/bagisiklama-programi-ve-asi-takvimi/asi-takvimi.html>. (Erişim tarihi: 16.10.2025)
10. Tanır G, Yalçınkaya R. Dünyada ve Ülkemizde Kızamığın Yeniden Ortaya Çıkışı: Nedenler ve Sonuçlar. Klimik Derg 2022;35(3):120-5. <https://doi.org/10.36519/kd.2022.3742>

11. Metin O, Tanir G, Oz FN, Kalaycioglu AT, Yolbakan S, Tuygun N ve ark. 2012-2013 kızamık salgını sürecinde Ankara'da saptanan 44 çocuk olgunun değerlendirilmesi ve iki olgudan elde edilen virusların moleküler analizi. *Mikrobiyol Bul* 2014;48(2):259-70. <https://doi.org/10.5578/mb.7024>
12. Lee SSJ, Ke CM, Cheng MF, Chen JH, Lin LJ, Hung MN, et al. Nosocomial transmission of undetected, imported measles in Taiwan, 2008. *Infection Control and Hospital Epidemiology* 2009;30:1026-8. <https://doi.org/10.1086/606044>
13. Chen SY, Anderson S, Kutty PK, Lugo F, McDonald M, Rota PA, et al. Healthcare-associated measles outbreak in the United States after an importation: Challenges and economic impact. *Journal of Infectious Diseases* 2011;203:1517-25. <https://doi.org/10.1093/infdis/jir115>
14. Centers for Disease Control and Prevention (CDC). Hospital-associated measles outbreak - Pennsylvania, March-April 2009. *MMWR Morb Mortal Wkly Rep* 2012;61(2):30-2.
15. Tapısız A, Polat M, Kara SS, Tezer H, Simsek H, Aktas F. Prevention of measles spread on a paediatric ward. *Epidemiol Infect* 2015;143(4):720-4. <https://doi.org/10.1017/S0950268814001344>
16. Baxi R, Mytton OT, Abid M, Maduma-Butshe A, Iyer S, Ephraim A, et al. Outbreak report: Nosocomial transmission of measles through an unvaccinated healthcare worker-implications for public health. *J Public Health* 2014;36(3):375-81. <https://doi.org/10.1093/pubmed/fdt096>
17. Emre BA, Alp Çavuş S. Kızamık Eliminasyon Programı Sürecinde Sağlık Çalışanlarının Kızamık Seroprevalansı: Kesitsel Bir Çalışma. *Klimik Derg* 2023;36(4):234-8. <https://doi.org/10.36519/kd.2023.4717>