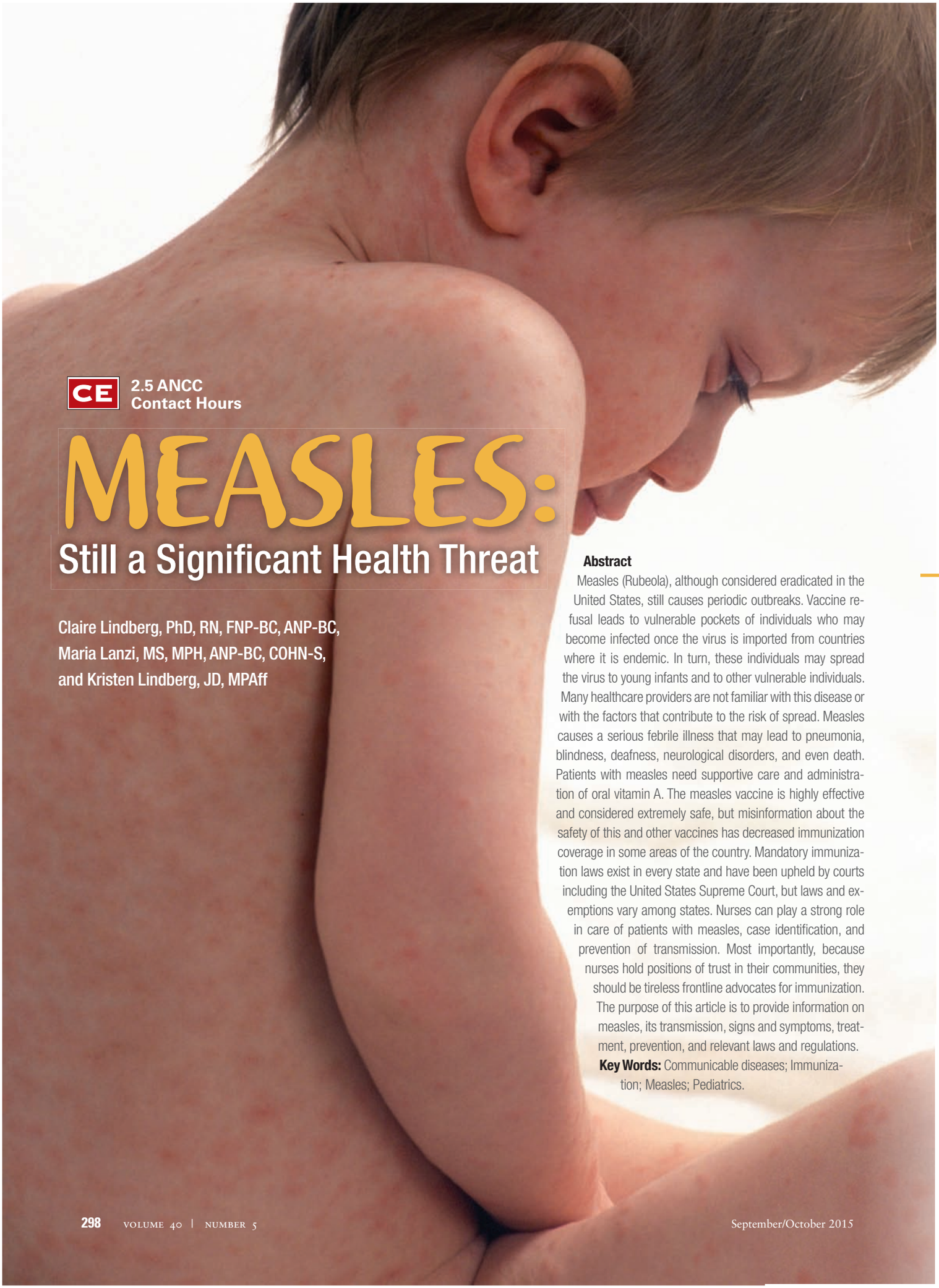

CE 2.5 ANCC Contact Hours

MEASLES: Still a Significant Health Threat

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Abstract

Measles (Rubeola), although considered eradicated in the United States, still causes periodic outbreaks. Vaccine refusal leads to vulnerable pockets of individuals who may become infected once the virus is imported from countries where it is endemic. In turn, these individuals may spread the virus to young infants and to other vulnerable individuals. Many healthcare providers are not familiar with this disease or with the factors that contribute to the risk of spread. Measles causes a serious febrile illness that may lead to pneumonia, blindness, deafness, neurological disorders, and even death. Patients with measles need supportive care and administration of oral vitamin A. The measles vaccine is highly effective and considered extremely safe, but misinformation about the safety of this and other vaccines has decreased immunization coverage in some areas of the country. Mandatory immunization laws exist in every state and have been upheld by courts including the United States Supreme Court, but laws and exemptions vary among states. Nurses can play a strong role in care of patients with measles, case identification, and prevention of transmission. Most importantly, because nurses hold positions of trust in their communities, they should be tireless frontline advocates for immunization. The purpose of this article is to provide information on measles, its transmission, signs and symptoms, treatment, prevention, and relevant laws and regulations.

Key Words: Communicable diseases; Immunization; Measles; Pediatrics.

From January 1 to June 26, 2015, 178 measles (Rubeola) cases were reported across 24 states and Washington, DC (Centers for Disease Control and Prevention [CDC], 2015a). Most of these cases (66%; *n* = 117) are linked to a single outbreak originating at an amusement park in California. This recent outbreak of measles has healthcare professionals and public health officials concerned, the media buzzing, and celebrities and politicians offering opinions that are often not based on scientific evidence. Although alarming, this current outbreak is not an isolated incident. Historically, measles was a widespread childhood disease. Prior to the introduction of the first measles vaccine in 1963, the average number of cases in the United States was 549,000 /year, resulting in nearly 500 deaths annually (The College of Physicians of Philadelphia, 2015). In 1978, a measles eradication campaign led by the CDC resulted in increased immunization rates and an 80% decrease in the number of cases. However, pockets of unvaccinated persons left the country vulnerable and a 1989–1991 outbreak resulted in 55,622 cases and 123 deaths (The College of Physicians of Philadelphia). Thereafter, implementation of new recommendations for a two-shot vaccination series led to significant decreases in measles cases in the United States (The College of Physicians of Philadelphia). By 2000, the CDC considered measles to be eliminated in the United States, defined as the absence of continuous transmission of cases in a geographic area for ≥12 months (CDC, 2013). Since that time there have been sporadic outbreaks, primarily in unvaccinated individuals (Kutty et al., 2013). Between 2001 and 2011, 911 cases of measles were reported in the United States. In 2013, there were 187 cases. Incidence surged to 644 cases in 2014 (CDC, 2015b).

Although **measles was eradicated in the United States** in 2000, increases in **immigration from and travel** to countries where measles is endemic have **contributed to recent outbreaks.**

Low vaccination rates in certain areas of the country, primarily related to vaccine refusal, play a primary role in recent measles outbreaks. Outbreaks in countries with lower vaccination rates and the ability of infected people to spread the virus prior to being symptomatic are also factors. Currently, measles cases in the United States are considered "imported," meaning that the virus is either brought to the United States by persons who contracted it in their native country, or by unvaccinated Americans who contracted the virus outside of the United States and carried it home. In this way, increases in immigration from countries where measles is endemic and international travel to and from those countries have contributed to the recent rise in measles in the United States.

Since the introduction of the measles vaccine, the disease has become increasingly rare in the United States and many U.S. healthcare providers have never seen a case of clinical measles (Brawley, 2015; Harpaz, 2004). Lack of awareness of measles signs and symptoms can lead to diagnostic errors and failure to isolate suspected measles cases from waiting rooms, enabling spread to vulnerable patients. This article aims to provide information to nurses and other healthcare providers on measles, its transmission, signs and symptoms, treatment, and prevention. Relevant laws and regulations regarding immunization will also be reviewed. In this article, the term measles is used to indicate Rubeola. Rubella (German measles) is not discussed.

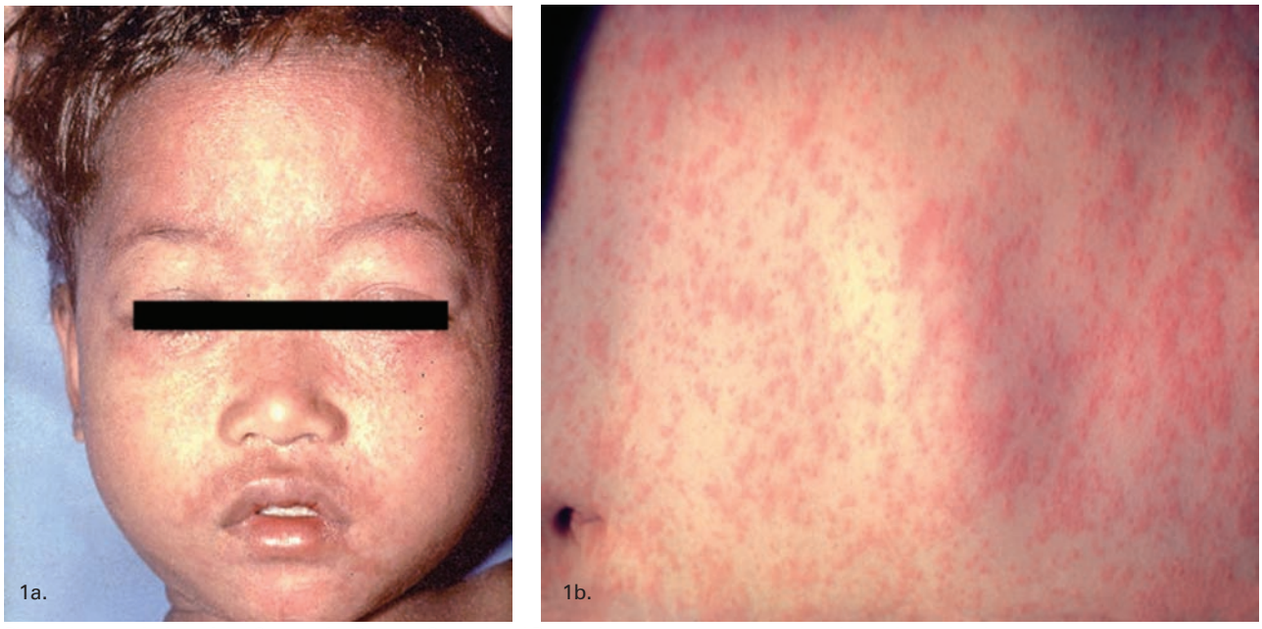
Measles

Measles is a febrile illness with serious and potentially fatal consequences. The mortality rate is about 5% in many areas of the world. The Paramyxoviridae virus (genus Morbillivirus) that causes measles is one of the most contagious known to man. Multiple methods of viral spread include direct contact with infected secretions, contact with contaminated fomites, and inhalation of virus-laden airborne droplets. Aerosolized viral particles remain suspended for prolonged periods and a nonimmune person can become infected by just walking into a room where a person with measles has recently been. The measles virus can survive up to 2 hours on fomites such as handles, tabletops, and linen soiled with infected secretions. An infected individual produces infectious particles before clinical symptoms appear and is contagious from 4 days before to 4 days after the rash appears (CDC, 2013; Gould, 2015; Parker Fiebelkorn & Goodson, 2014). The measles virus is so contagious that an estimated 90% of nonimmune persons who are exposed to it will develop the disease (CDC, 2013). This high infectivity rate and ease of viral spread have concerning implications throughout the community and particularly for primary care offices and emergency rooms as well as for schools and day care centers where children congregate.

Signs and Symptoms

Prodromal symptoms of cough, runny nose, conjunctivitis, and increasing fever appear after an incubation period of 10 to 12 days. Fever is typically high by the 4th day (39–40.5 °C) and diarrhea and vomiting may also occur. The characteristic morbilliform rash associated with measles appears about 14 days (range 7–21 days) from initial exposure (CDC, 2013; Iannone, 2009). The rash begins on the face and spreads downward to the trunk and extremities. It lasts for 3 to 7 days and fades in the same directional pattern as it appears. The rash appears first as discrete red macules that become confluent. A fine desquamation sometimes occurs as the rash fades (Perry & Halsey, 2004). Figures 1a and 1b illustrate the typical measles rash. Koplik spots that are 2 to 3 mm bluish-white raised lesions on a red base are unique to measles. These lesions typically occur on the posterior buccal mucosa but may also be present on the conjunctiva and, less commonly, on the vaginal mucosa. Koplik spots, which typically appear about 2 days prior to the

Figure 1: a. Child With Typical Morbilliform Rash Associated With Measles. **b.** Closeup View of Morbilliform Rash on Child's Abdomen



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onset of rash and increase in number for about 4 days (Iannone, 2009), have been reported in 60% to 70% of patients with measles (Perry & Halsey). The presence of Koplik spots differentiates measles from similar exanthems such as roseola and rubella. Figure 2 shows Koplik spots in the mouth of a patient with measles.

Although Koplik spots and the typical rash are pathognomonic of measles, cough is also consistently present throughout the course of the disease. Other symptoms may include abdominal pain, sore throat, mild lymphadenopathy, headache, and iridocyclitis (inflammation of the iris and ciliary bodies) leading to photophobia.

Figure 2: Koplik's Spots

Photo by permission of Centers for Disease Control and Prevention www.cdc.gov/measles/about/photos.html

Complications and Sequelae

Complications are more common in young children, in adults >20 years old, and in persons with immunocompromising conditions. About 30% of cases will result ≥1 complication including pneumonia (1/20), otitis media (1/10), and diarrhea (<1/10). Permanent hearing loss may develop in children who develop otitis as a result of measles. Laryngotracheobronchitis ("measles croup") occurs in 9% to 32% of hospitalized measles cases. Ocular complications include keratitis (corneal inflammation) that may lead to corneal ulcers, perforations, scarring, and blindness. One of 1,000 patients with measles will develop seizures and encephalitis. The most common cause of death among children with measles is pneumonia (CDC, 2014; Perry & Halsey, 2004).

A rare, delayed complication of measles is subacute sclerosing panencephalitis (SSPE), which is a fatal neurological disease that develops 7 to 10 years after recovery from clinical measles. Caused by persistence of the virus in the central nervous system, SSPE causes a slow, progressive, demyelination of areas in the brain. The initial signs of SSPE include decreased school performance and behavioral changes. The patient with SSPE later progresses to myoclonic seizures and eventually to a vegetative state (Perry & Halsey, 2004). Between 1989 and 1991, 4–11/100,000 persons with measles developed SSPE. The risk of developing SSPE may be higher for a child who gets measles before age 2 (CDC, 2014).

Measles and Pregnancy: Studies of measles in pregnancy are rare and come from countries where measles is still endemic. In a study from Saudi Arabia, 49 women with measles during pregnancy were compared with a control group of 120 pregnant women without measles and to a group of 37 nonpregnant women with measles (Ali & Albar, 1997). They found that pregnant women with measles suffered significantly higher rates of intrauterine fetal death (p = 0.5),

premature birth (p = 0.003), and NICU admissions (p = 0.0005) than pregnant women without measles. Compared with nonpregnant women with measles, pregnant women had higher rates of hospital admission ($p \leq 0.001$) and longer hospital stays (p = 0.0001), and were more likely to have fever (p = 0.04) and elevated liver enzymes (p = 0.008) (Ali & Albar). Considering immune system changes during pregnancy, it is not unexpected that pregnant women with measles would suffer a more serious course of the disease. Available evidence shows that, unlike Rubella, measles during pregnancy is not associated with congenital defects.

Diagnosis

Diagnosis of measles may be made by clinical signs or laboratory criteria. Clinical measles is determined by the presence of all of the following: (1) generalized maculopapular rash for ≥3 days, (2) fever of ≥101 °F (38.3 °C), plus (3) cough, coryza, or conjunctivitis. A case identified by clinical symptoms requires evidence that the case is epidemiologically linked to another confirmed case. Laboratory criteria for diagnosis do not require epidemiologic confirmation and include any one of the following: a positive serologic test for measles IgM, documentation of seroconversion by a significant rise in measles IgG level, or identification of measles virus RNA by PCR (Parker Fiebelkorn & Goodson, 2014).

Treatment

Treatment is supportive and includes monitoring for and management of fever, dehydration, and other discomforts and complications (Parker Fiebelkorn & Goodson, 2014). Keeping the patient away from bright lights may ease discomfort related to photophobia. Co-infections, such as otitis media and pneumonia should be treated per current guidelines.

Low vitamin A levels are associated with higher rates of complications and increased mortality from measles. Based on World Health Organization recommendations, the CDC recommends treatment with vitamin A for all children with acute measles regardless of where they live. The recommendation is for vitamin A to be administered once daily parenterally or for 2 days orally at age-specific doses (50,000 IU for infants <6 months old; 100,000 IU for infants 6 to 12 months old; 200,000 IU for children ≥12 months old). A third age-specific dose is recommended 2 to 4 weeks later for children who have clinical signs and symptoms of vitamin A deficiency (Parker Fiebelkorn & Goodson, 2014).

Preventing Measles Through Immunization

Immunization is successful in controlling the spread of measles; however, vaccination compliance has been difficult to maintain in the 21st century. In 2013, national measles immunization rates exceeded the Healthy People 2020 target rate of 90%; however, 17 states did not meet the criteria of >90% of children receiving ≥1 dose of Measles Mumps and Rubella (MMR) vaccine by age 35 months (Elam-Evans, Yankey, Singleton, & Kolasa, 2014). Decreasing vaccination rates in the United States reflect increasing rates of vaccine refusal. Although only 1% to 2% of U.S. parents absolutely refuse all vaccines, 11% to 17% refuse certain vaccines or choose not to follow the recommended vaccine schedule (Gowda & Dempsey, 2013). There are many reasons given by parents for not vaccinating, however refusal is often based on false assumptions about dangers associated with the measles vaccine. A major contributor to misconceptions about vaccine safety was a fraudulent research paper that proposed a correlation between the MMR vaccine and childhood autism. This "study," published in Lancet in 2008, led to a flood of publicity about the "dangers" of the measles vaccine and immunizations in general. Although the article was eventually retracted by the journal, its message was advocated by influential celebrities and their antivaccine campaign continues to contribute to skepticism about vaccination (The College of Physicians of Philadelphia, 2015). The truth is that there is no scientific evidence that MMR causes autism or autism spectrum disorders (Atkinson, Wolfe, & Hamborsky, 2012; Jain et al., 2015).

The most recent supportive evidence demonstrating no link between MMR vaccination and autism included 95,727 children continuously enrolled in a commercial health plan from birth to at least 5 years of age during 2001 to 2012 who also had an older sibling continuously enrolled for at least 6 months between 1997 and 2012 (Jain et al., 2015). In this sample, 994 (1.04%) children were diagnosed with autism spectrum disorders (ASD), and 1,929 (2.01%) had an older sibling

Measles is a serious febrile illness with **complications that may include** pneumonia, permanent hearing loss, corneal damage leading to blindness, **seizures and encephalitis.**

with ASD (Jain et al.). Receiving the MMR vaccine was not associated with increased risk of ASD, regardless of whether older siblings had ASD. No harmful association was found between getting the MMR vaccine and developing ASD, even among children already at higher risk for ASD (Jain et al.).

Measles Vaccine

The measles vaccine now in use in the United States is the live, attenuated Edmonston-Enders vaccine that was introduced in 1968 and combined in 1971 with mumps and rubella vaccines to form the trivalent MMR vaccine (Plotkin, Orenstein, & Offit, 2013). In 2005, a combined measles, mumps, rubella, and varicella vaccine was licensed as the quadrivalent MMRV. Both contain the same Edmonston-Enders measles vaccine and convey equal immunity against measles. Vaccination with either MMR or MMRV causes a mild, noncommunicable infection. Resulting efficacy is 93% to 95% after 1 immunization and 98% to 99% after two doses. Secondary vaccine failure/waning immunity is rare (Atkinson et al., 2012).

MMR and MMRV are each licensed for use in infants older than 12 months. MMR may be administered to older adolescents and adults; however, MMRV is only approved up through age 12 years. The CDC (2015c) recommends MMR be administered as the 1st dose when given between 12 and 47 months due to evidence that MMRV carries a slightly higher risk of febrile seizures at those ages. MMRV is recommended for all doses in children 48 months to 12 years. Both MMR and MMRV require a 0.5 cc dose administered subQ (Atkinson et al., 2012). MMR vaccine can be stored in either the refrigerator or freezer. It must be protected from light and used within 8 hours of reconstitution. MMRV vaccine must be stored in the freezer and used within 30 minutes of reconstitution (Atkinson et al.). In the United States, initial measles vaccination is recommended at 12 to 15 months, with a booster at 4 to 6 years of age. Vaccination is also recommended for all adults born in 1957 or later who have not been vaccinated or have no evidence of immunity. Adults born prior to 1957 are assumed to be immune. Childhood, adult, and catch-up schedules are available at www.cdc.gov/vaccines/schedules/. A minimum of 28 days is required between dose 1 and dose 2 (CDC, 2015c).

Vaccination against measles is not recommended prior to 12 months of age due to poor immune response to the vaccine that may be at least partly due to interference from circulating maternal antibodies (Premenko-Lanier et al., 2006). In outbreak conditions or before international travel, one dose of MMR vaccine may be given to infants prior to travel or within 72 hours of exposure or potential exposure. Any dose of the measles vaccine given before 12 months of age does not count as part of the two-dose series (CDC, 2013).

Vaccine Contraindications, Precautions, and Adverse Reactions

Contraindications include severe allergic reaction (anaphylaxis) to any vaccine component or to a prior vaccine dose. Medical contraindications include blood dyscrasias, leukemia, lymphomas, or other malignant bone marrow or lymphatic neoplasms, and immunodeficiency states including chemotherapy within the past 3 months, recent large doses of steroids for ≥14 days, and moderate or severe illness. Persons with HIV are at risk for severe measles disease and should be vaccinated according to routine vaccination schedules if asymptomatic and not severely immunocompromised. Symptomatic individuals can be considered for vaccination based on their level of immune compromise as measured by the level of CD4 and T-lymphocyte counts or

percentage of total lymphocytes. Readers are referred to the CDC Pink Book (Atkinson et al., 2012) for more information on determination of immunosuppression status relative to vaccination decisions. Immunization should be delayed for those who have recently received a blood transfusion or other blood products. Seizure history in the patient or a close family member is a precaution for MMRV due to the higher risk for febrile seizures. MMR plus the varicella vaccine should be used in these cases. Pregnancy is a contraindication to measles vaccines. Females receiving MMR should avoid pregnancy for 4 weeks after vaccination. Breastfeeding women may receive MMR (Atkinson et al.).

Adverse Reactions: Adverse reactions usually occur within 5 to 12 days post vaccination and may include fever (temp ≥ 103 in 5–15%), rash (5%), and arthralgia (25%). Rare adverse reactions include transient thrombocytopenia (0.03%), parotitis (rare), lymphadenopathy (<0.2%), deafness (rare), and encephalopathy (0.0001%) (Atkinson et al., 2012).

Evidence of Immunity: Documentation of two doses of measles vaccine ≥28 days apart, with the first dose on or after the first birthday or laboratory confirmation by serologic testing (positive measles titer), indicates immunity. Routine

serologic testing is not recommended prior to immunization due to issues of cost effectiveness (Atkinson et al., 2012).

Legal Considerations Related to Immunization

Mandatory immunization laws have existed for more than a century and have been upheld in modern courts, including the United States Supreme Court. Federal vaccination laws generally address persons immigrating to the United States. Laws affecting children attending school are normally within the purview of state and local governments, which are authorized to protect public health as part of their "police powers" (Cole & Swendiman, 2014). Each state and the District of Columbia (DC) have laws requiring schoolchildren to meet immunization requirements, which are generally based on the CDC's recommendations and schedules. Every state, along with DC, also allows medical exemptions for children who cannot safely receive vaccines, usually requiring documentation from a medical professional. Forty-eight states plus DC allow immunization exemptions based on religious reasons and 20 allow exemptions based on philosophical or personal opposition to vaccination (Cole & Swendiman). There is great variation among states with religious and/or philosophical exemptions regarding how these provisions are administered and enforced (Salmon, 2003). For a map showing vaccination laws and exemptions by state, see www.ncsl.org/research/health/school-immunization-exemption-state-laws.aspx

Two important legal questions regarding mandatory vaccination have been examined by the U.S. courts. The first is whether compulsory vaccination laws are permissible uses of the states' powers to regulate conduct in the interest of public health. The second question is whether states are required to include exemptions for those who claim religious objections to vaccination.

Mandatory immunization laws have existed for more than a century and have been **upheld by modern courts** including the United States Supreme Court.

Compulsory vaccination laws have been strongly supported in the U.S. courts. As far back as 1905, the United States Supreme Court addressed mandatory vaccination. Plaintiff Jacobson, an adult living in Cambridge MA, refused vaccination against smallpox on the grounds that he believed it could harm his health and argued that the township's mandatory vaccination program violated his constitutional rights. The Court disagreed, noting that mandatory vaccination was appropriate given the state's duty to protect public health and safety and that an individual's right to liberty can be limited when reasonably necessary to ensure the safety of the general public (*Jacobson v. Commonwealth of Massachusetts*, 1905). The United States Supreme Court later upheld the power of states to deny schoolchildren admission to school if they refused required vaccinations (*Zucht v. King*, 1922).

Multiple courts have examined and upheld school-based mandatory vaccination laws that did not contain religious or personal belief exemptions. One example is Workman v. Mingo County Board of Education (2011), a case brought by the mother of an unvaccinated child against officials in West Virginia, a state with no religious exemption. The plaintiff claimed that the officials violated her First Amendment right to free exercise of religion by excluding her unvaccinated daughter from school. The Court concluded that the law did not violate Workman's First Amendment rights (*Workman v. Mingo County Board of Education*). Thus, it is considered settled law that states may compel vaccination of school-age children and that states are not required to offer religious exemptions. Where compulsory vaccination laws do contain religious exemptions, the courts have stated that the exemptions may not be offered only to members of certain religious sects (Cole & Swendiman, 2014). States have been permitted, however, to deny religious exemptions for children's vaccinations when state or local officials have determined that their parents' objections to immunization were based on personal, rather than religious, beliefs (*Phillips v. City of New York*, 2015).

Knowing the federal and state laws and regulations regarding immunization will assist nurses and other healthcare professionals in developing accurate immunization plans and educating patients and parents on vaccination requirements.

Clinical Implications

Measles is a reportable disease in all states, but compliance with reporting regulations has been shown to be low. Harpaz (2004) studied literature on measles reporting and determined that completeness of reporting varied from 3% to 58% across studies done in the 1980s and 1990s, before measles was considered eliminated in the United States. Reasons for low reporting levels in their study included failure of parents to seek care for symptomatic children as well as failure of healthcare personnel to recognize clinical measles.

State laws vary by criteria for reporting, for example, suspected or probable cases, cases confirmed by clinical signs versus laboratory confirmed cases. Laws also vary concerning who is responsible for reporting cases or suspected cases. In all states physicians are required to report measles and in some states nurses, laboratories, day care workers, and even the general public are required to report measles or suspected measles. Nurses and nurse practitioners need to know the clinical signs of measles so they may participate in case finding. Nurses should also ensure that procedures to report measles are in place in their practice sites. In order to comply with reporting requirements, nurses must understand the reporting requirements in their state of practice and know procedures for reporting cases. These can be found on the respective state department Web sites.

The CDC (2012) states that nurses are essential in helping parents overcome fears regarding vaccination primarily

Clinical Implications

- Measles is a reportable disease. Nurses should be sure that cases are reported as per state law.
- Provaccine messages and stories may assist in overcoming parental vaccine hesitancy.
- Vaccine refusal should be documented in the patient's medical record and addressed with educational messages at each visit.
- Nurses should be able to recognize the signs and clinical symptoms of measles.
- Knowing the safety profiles of MMR and MMRV vaccines allows nurses to better counsel patients and parents about these vaccines.
- Nurses should be aware of the mandatory immunization laws that affect children in their practice and should promote complete immunization of all children.

due to nurses' role in patient education but also because they are trusted healthcare providers. However, there is little research on effective ways to overcome vaccine refusal or hesitancy. Some evidence-based interventions for overcoming vaccine hesitancy include tailoring educational interventions to each parent's individual concerns, enlisting vaccine champions (either staff members or proimmunization parents) in provaccine campaigns, and using health IT for vaccine-positive messages and reminders (Gowda & Dempsey, 2013; Stockwell & Fiks, 2013). Stories told by providers, even personal ones, about positive decisions regarding vaccination are also suggested (Shelby & Ernst, 2013). Knowing the safety profiles of MMR and MMRV allows nurses to clarify parental misconceptions about the vaccines.

Despite good educational and other effective interventions, some parents will refuse vaccination for their children. When this happens, the American Academy of Pediatrics (AAP, 2013) recommends documentation of the discussion about immunization held with the parents including what was conveyed regarding the serious risks that could be faced by an unvaccinated child. They recommend providing parents with the relevant vaccine information statements and documenting that they have received it. In addition, AAP recommends having parents sign a "refusal to vaccinate" form to be kept in the child's medical record. Flagging the records of unvaccinated or undervaccinated children will alert nurses to revisit the topic with parents at subsequent visits. This form can be found at www2.aap.org/immunization/pediatricians/pdf/refusaltovaccinate.pdf.

There is little evidence to guide nurses in developing programs and interventions to overcome vaccine hesitancy and refusal. Qualitative nursing research may provide further insight into these topics. Nurses can develop research projects that test methods for improving immunization rates among at-risk groups and groups where refusal levels are high.

All nurses should champion complete and on-time immunizations. Mandatory vaccination laws are clear and don't violate individuals' rights as we have discussed above. Nurses should be able to clearly explain these laws to parents. Further nursing interventions are aimed at ensuring compliance with state-mandatory vaccine requirements. There are important roles for school, college health, and public health nurses in monitoring and reporting compliance. ✣

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References

Ali, M. E., & Albar, H. M. (1997). Measles in pregnancy: Maternal morbidity and perinatal outcome. *International Journal of Gynaecology & Obstetrics, 59*(2), 109-113. http://dx.doi.org/10.1016/S0020-7292(97)00196-3

American Academy of Pediatrics. (2013). *Documenting parental refusal to have their children vaccinated*. Retrieved from www2.aap.org/immunization/pediatricians/pdf/refusaltovaccinate.pdf

Atkinson, W., Wolfe, S., & Hamborsky, J. (Eds.). (2012). *Epidemiology and prevention of vaccine-preventable diseases* (12th ed). Washington, DC: Public Health Foundation.

Brawley, R. (2015). *Public Health Alert: Kentucky hospitals, healthcare facilities, and healthcare providers should prepare now for possible measles cases to present to medical care in Kentucky*. Retrieved from http://pharmacy.ky.gov/Documents/Public%20Health%20Alert%20Regarding%20Possible%20Measles%20Outbreak%20-%20January%202015.pdf

Centers for Disease Control and Prevention. (2012). *Nurses essential in easing parental concerns about vaccination*. Retrieved from www.cdc.gov/vaccines/events/niiw/

Centers for Disease Control and Prevention. (2013). Prevention of measles, rubella, congenital rubella syndrome, and mumps, 2013: Summary recommendations of the Advisory Committee on Immunization Practices (ACIP). *Morbidity and Mortality Weekly Report, 62*(RR-04), 1-34.

Centers for Disease Control and Prevention. (2014). *Measles*. Retrieved from www.cdc.gov/measles/about/

Centers for Disease Control and Prevention. (2015a). *Measles cases and outbreaks*. Retrieved from www.cdc.gov/measles/cases-outbreaks.html

Centers for Disease Control and Prevention. (2015b). Notifiable diseases and mortality tables. *Morbidity and MortalityWeekly Report, 64*(3), 45-80.

Centers for Disease Control and Prevention. (2015c). *Recommended childhood immunization schedule*. Retrieved from www.cdc.gov/vaccines/schedules/

Cole, J., & Swendiman, K. (2014). *Mandatory vaccinations: Precedent and current laws. Congressional Research Service*. Retrieved from www.fas.org/sgp/crs/misc/RS21414.pdf

Elam-Evans, L. D., Yankey, D., Singleton, J. A., & Kolasa, M. (2014). National, state, and selected local area vaccination coverage among children aged 19-35 months—United States, 2013. *Morbidity and Mortality Weekly Report, 63*(34), 741-748.

Gould, D. (2015). Measles: Symptoms, diagnosis, management and prevention. *Primary Health Care, 25*(1), 34-40. doi:10.7748/phc.25.1.34.e908

Gowda, C., & Dempsey, A. F. (2013). The rise (and fall?) of parental vaccine hesitancy. *Human Vaccines and Immunotherapeutics, 9*(8), 1755-1762. doi:10.4161/hv.25085

Harpaz, R. (2004). Completeness of measles case reporting: Review of estimates for the United States. *Journal of Infectious Diseases, 189*(Suppl. 1), S185-S190.

Iannone, R. (2009). Contagious exanthamatous diseases. In T. McInerny, H. Adam, D. Campbell, D. Kamat, & K. Kelleher (Eds.), *Textbook of pediatric care* (pp. 1976-1981). Elk Grove, IL: American Academy of Pediatrics.

Jacobson v. Commonwealth of Massachusetts, 197 U.S. 11, 27-36 (1905).

Jain, A., Marshall, J., Buikema, A., Bancroft, T., Kelly, J. P., & Newschaffer, C. J., (2015). Autism occurrence by MMR vaccine status among US children with older siblings with and without autism. *Journal of the American Medical Association, 313*(15), 1534-1540. doi:10.1001/jama.2015.3077

Kutty, R., Rota, J., Bellini, W., Redd, S., Barskey, A., & Wallace, G. (2013). Measles. In *Centers for Disease Control and Prevention. Manual for the surveillance of vaccine-preventable diseases* (pp. 7-1-7-21). Retrieved from www.cdc.gov/vaccines/pubs/surv-manual/chpt07-measles.html

Parker Fiebelkorn, A., & Goodson, J. (2014). Measles (Rubeola). In *CDC. CDC health information for international travel: The yellow book, 2014*. New York, NY: Oxford University Press. Retrieved from wwwnc.cdc.gov/travel/page/yellowbook-home-2014

Perry, R.T., & Halsey, N. A. (2004). The clinical significance of measles: A review. *Journal of Infectious Diseases, 189*(Suppl. 1), S4-S16.

Phillips v. City of New York, 775F.3d538 (2nd Cir. 2015).

Plotkin, S., Orenstein, W., & Offit, P. (2013). *Vaccines* (6th ed.). Philadelphia, PA: Elsevier/Saunders.

Premenko-Lanier, M., Hodge, G., Rota, P., Tamin, A., Bellini, W., & McChesney, M. (2006). Maternal antibody inhibits both cellular and humoral immunity in response to measles vaccination at birth. *Virology, 350*(2), 429-432. doi:10.1016/j.virol.2006.02.029

Salmon, D. (2003). *Mandatory immunization laws and the role of medical, religious and philosophical exemptions*. Retrieved from www.vaccinesafety.edu/exemptreview101503.pdf

Shelby, A., & Ernst, K. (2013). Story and science. *Human Vaccines & Immunotherapeutics, 9*(8), 1795-1801. doi:10.4161/hv.24828

Stockwell, M. S., & Fiks, A. G. (2013). Utilizing health information technology to improve vaccine communication and coverage. *Human Vaccines & Immunotherapeutics, 9*(8), 1802-1811. doi:10.4161/hv.25031

The College of Physicians of Philadelphia. (2015). *Vaccines—A project of the College of Physicians of Philadelphia*. Retrieved from www.historyofvaccines.org/

Workman v. Mingo County Board of Education, 419 Fed. Appx. 348, 354 (14th Cir. 2011).

Zucht v. King, 260 U.S. 174, 176-177 (1922).

ONLINE

Centers for Disease Control and Prevention (CDC): Measles Cases and Outbreaks
www.cdc.gov/measles/cases-outbreaks.html

CDC: Immunization Home Page
www.cdc.gov/vaccines/schedules/index.html

CDC: Advisory Committee on Immunization Practices Recommendations
www.cdc.gov/vaccines/hcp/acip-recs/index.html

CDC: Epidemiology and Prevention of Vaccine-Preventable Diseases: The Pink Book
www.cdc.gov/vaccines/pubs/pinkbook/index.html

CDC: Health Information for International Travel: The Yellow Book
wwwnc.cdc.gov/travel/page/yellowbook-home-2014

Directory of Immunization Coalitions
www.izcoalitions.org/

Immunization Action Coalition
www.immunize.org/

National Library of Medicine, National Institutes of Health, Medline Plus Immunization Page
www.nlm.nih.gov/medlineplus/immunization.html

American Academy of Pediatrics Immunization Page
www2.aap.org/immunization/

World Health Organization Immunization Page
www.who.int/topics/immunization/en/

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