

ABSTRACT

Rubella was first described in the 1750s but took until 1941 when Congenital Rubella Syndrome was characterized to become medically significant. Similarly, zika virus was discovered in 1947 but only made headlines in 2016 when its infection during pregnancy was associated with fetal microcephaly. Interestingly, despite zika being primarily a disease of the developing world and rubella historically being a worldwide disease, zika was found to have been studied and controlled at a much faster rate than rubella – particularly in the United States (U.S.). This correlation is further highlighted by the fact that there are currently no therapies or vaccines available for zika. A review of Thomas McKeown's work, the McKeown Thesis, provides insight into the U.S.'s successful zika control. The Thesis posits that broad-based social efforts at the population level are more significant at affecting public health than narrow-based medical interventions at the individual level. The swift control of zika despite the lack of specific therapeutics suggests the McKeown Thesis's applications. This presentation will reflect on the progress and history of medicine within the past century and demonstrate the need for continued vigilance within the medical community.

Passing of the TORCH: A Medical, Historical, and Social Comparison between Rubella and Zika

Nhat M. Pham, M.S.
Peter S. Marcus, M.D.

Division of Biomedical Sciences
Marian University College of Osteopathic Medicine
Indianapolis, Indiana

Zika

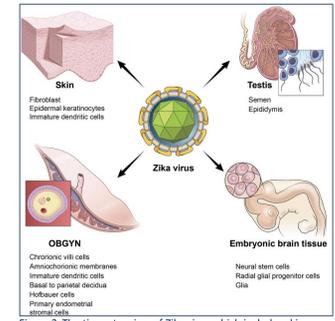


Figure 3. The tissue tropism of Zika virus which includes skin, male and female reproductive systems, and fetal tissue. Gorshkov et al., 2019⁴

- Flavivirus: spherical, enveloped, (+) ssRNA
- Arbovirus with many potential reservoirs, hosts, and vectors – notably the *Aedes* mosquitoes
- Transmission most commonly via mosquitoes but also as an STD and through blood products
- Generally a mild, non-specific disease in children and adults; infections tend to be about 80% asymptomatic
- Potential complications include Guillain-Barré syndrome (GBS) and Congenital Zika Syndrome (CZS) in fetuses
- CZS can result in congenital defects such as ocular abnormalities, sensorineural deafness, craniofacial disproportion, and microcephaly
- Risk of fetal malformations, especially microcephaly, are dependent on trimester of infection
- Risk of Zika-associated birth defects are 8-15% in the first trimester, 5% in the second, and 4% in the third⁵

Rubella



Figure 1. An infant with microcephaly. Jennifer Ryals Photography¹

- Togavirus: spherical, enveloped, (+) ssRNA
- Strictly human disease with no known animal reservoir
- Transmission via contact with contagious droplets or transplacental from mother to fetus
- Mild, generally harmless disease in children and adults, but potential for Congenital Rubella Syndrome (CRS) in fetuses resulting in congenital defects
- Congenital defects commonly include cataracts, sensorineural deafness, cardiac abnormalities, and microcephaly
- Risk of maternal-fetal transmission and risk of fetal malformations dependent on week of gestation and gestational age
- Risk of fetal infection is 80-90% in the first 12 weeks, 54% at 13-14 weeks, and 25% by the end of the second trimester; risk increases again toward the end of pregnancy²
- Risk of fetal malformations is 85-100% in the first 8-12 weeks, 50% from 13-16 weeks, 25% during late second trimester, and rare after 20 weeks of gestation³

Rubella & Zika

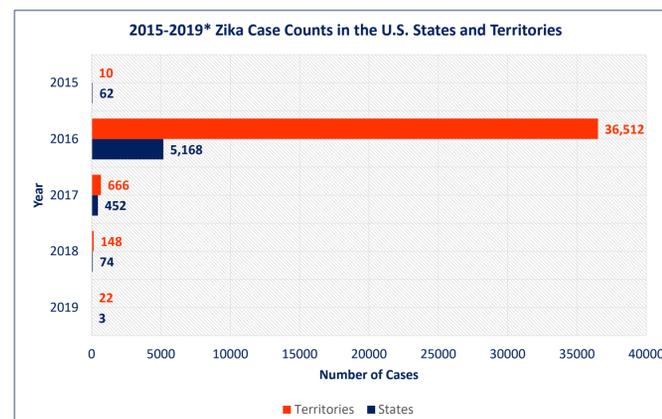


Figure 2. Number of symptomatic ZIKV cases in the U.S. States and Territories from 2015 to 2019* (*2019 case counts are currently still ongoing and a complete total is not yet available).

Table 1. Significant dates between Rubella virus and Zika virus from the 20th to 21st century^{7,8}.

Date	Event
1941	Norman McAlister Gregg classified CRS – Rubella became the first identified viral teratogen
1947	Zika virus (ZIKV) was first isolated from a rhesus macaque monkey in Uganda
1964-1965	Major U.S. and European rubella epidemic – affected 12.5 million people and ~20,000 babies were born with CRS
1969-1972	Four live-attenuated rubella vaccines were licensed in the U.S. and Europe: HPV-77, HPV-77/DEV, Cendehill, RA 27/3
2004	U.S. was declared rubella free
2007	First major ZIKV outbreak on Yap Island – 73% of the population was infected ZIKV arrived in the Western Hemisphere
2014-2015	Major outbreaks in Brazil affected up to 1.3 million people with 5,280 reported cases of microcephaly WHO declared Zika a "Public Health Emergency of International Concern"
2016	Zika arrived in the U.S. states and territories

- The West African Ebola epidemic was still an active threat at the time of Zika outbreaks – the public had a hyperawareness of global public health
- Social network platforms were used by the CDC and WHO along with collaborations from global news networks to disseminate preventative information to the public
- It took more than 30 years to eradicate Rubella in the U.S. while it took only 2 years to reduce Zika cases in the U.S. by >99%
- Zika had major outbreaks for almost 10 years before the world took notice – potentially due to sociopolitical reasons

CONCLUSIONS

- McKeown Thesis: Are public health goals better achieved by narrow interventions at the individual level, or by broad measures to redistribute social, political, and economic resources that can then influence health at the population level?
- While vaccines and medications are vital in the management of disease, larger, overarching public health initiatives that effect an entire population should not be overlooked
- Further emphasis needs to be placed on public health initiatives in the future to prevent a situation like Zika – outreach, screening, and social marketing

Key References

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