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Letters to the Editor

A call for improved occupational surveillance for measles in the United States

To the Editor:

Measles in the United States has reached a 27-year high. Since January 1, 2019, the Centers for Disease Control and Prevention has logged at least 1,109 cases affecting more than half of United States—a 300% increase over 2018.[1] Many of these cases are among returning travelers who were infected abroad, but who have not spread the virus further. However, some imported cases have led to outbreaks with ≥3 infections in New York, California, Pennsylvania, and Washington. With 620 confirmed cases as of July 8, 2019, New York City is currently experiencing the largest of these ongoing outbreaks.[2]

Data from past measles outbreaks identify occupationally acquired infections, particularly among health care workers (HCWs). In the United States, just over 2% of 1,318 nonimported cases recorded between January 1, 2001, and December 31, 2014, were linked to occupational exposures among HCWs.[3] Between 1998 and 2010, HCWs made up as much as 23% of cases associated with 31 different outbreaks worldwide.[4,5] These data include 3 US outbreaks in which HCWs accounted for 0-22% of cases.[6-8] In 2014, all 4 secondary cases, and likely the index patient, associated with an outbreak in New York City were occupationally acquired: 3 among HCWs who cared for the index patient (who was a theater worker who had frequent exposure to tourists) and a fourth in a coworker of the index patient.[9] Notably, the index patient and all secondary patients were either vaccinated or had measles previously.

Despite clear occupational exposure risks, especially during outbreaks, there are few if any sources of surveillance data available to inform and support national-level efforts to prevent workplace-linked measles cases or control further disease spread from infected employees. The Centers for Disease Control and Prevention's National Notifiable Diseases Surveillance System does not include occupational exposure data for measles cases submitted by the 57 reporting jurisdictions (ie, at the local, state, and territorial levels) in its network.[10] Although health care providers, hospitals, and laboratories must inform their state or territorial health departments about reportable diseases, submitting information to the National Notifiable Diseases Surveillance System is voluntary. Whether or not state and territorial health departments aim to ascertain occupational exposure information for cases of reportable diseases, which typically include measles, in their jurisdictions likely varies significantly by state.

It is also sometimes difficult to attribute measles cases to occupational exposures, especially when infected individuals have many potential sources of or opportunities for exposure in communities with ongoing transmission. Although the Occupational Safety and Health Administration (OSHA) requires US employers to maintain records of illnesses when employees are infected at work, such challenges in determining work-relatedness of measles cases mean that OSHA logs (ie, OSHA forms 300, 300A, or 301) are also poor sources of data, even if such data could be collected and aggregated from many employers whose workers are at risk of exposure on the job. Similar pitfalls limit the use of data from OSHA-required employer reports of work-related hospitalizations, which would include inpatient stays resulting from measles infection: in addition to the potentially unclear etiologic link with workplace exposures, only about 25% of US measles cases require inpatient hospitalization,[11] which is a trigger for employer reporting requirements under OSHA's recordkeeping rules at 29 CFR part 1904.

Although measles cases ultimately may present at physician offices, clinics, or hospitals (especially when patients have classical symptoms, including the characteristic rash or Koplik spots) or be identified through public health departments' outbreak investigations, improving occupational surveillance efforts at the state/territorial and federal levels could significantly benefit US workers. Specifically, occupational surveillance efforts can help identify uncontrolled exposures in workplaces, including instances in which engineering and administrative controls, safe work practices, and use of personal protective equipment fail to prevent worker exposures to sick patients, contaminated environments, or other sources of the virus.

This type of information is important not only because of the employer duty under the Occupational Safety and Health Act to protect workers from such exposures, but also because it informs recommendations for improving worker infection prevention measures, such as changing the recommended controls or improving worker training on how to implement them. Research that guides those recommendations depends on having adequate, available data to characterize exposure and infection risks, including describing when and where workers are typically exposed and whether certain job tasks or other considerations increase their exposure and infection risks. Occupational surveillance may also improve understanding of factors that influence vaccine failure, incomplete immunity, or particular exposures that lead to infection despite previous history of immunologic experience with measles. It should go without saying that, to the extent worker infections can be prevented, identified, and controlled through improved occupational surveillance, such efforts also protect public health by preventing workers from further spreading measles to others.

References

1. Centers for Disease Control and Prevention. Measles: cases and outbreaks. 2019. Available from: https://www.cdc.gov/measles/cases-outbreaks.html. Accessed June 12, 2019.
2. New York City Department of Health and Mental Hygiene. Measles. 2019. Available from: https://www1.nyc.gov/site/doh/health/health-topics/measles.page. Accessed June 12, 2019.

3. Fiebelkorn AP, Redd SB, Kuhar DT. Measles in healthcare facilities in the United States during the postelimination era, 2001–2014. Clin Infect Dis 2015;61:615-8.
4. Botelho-Nevers E, Gautret P, Biellik R, Brouqui P. Nosocomial transmission of measles: an updated review. Vaccine 2012;30:3996-4001.
5. Thierry S, Alsibai S, Parent du Chatelet I, Investigation team. An outbreak of measles in Reims, eastern France, January-March 2008—a preliminary report. Euro Surveill 2008:13.
6. Chen SY, Anderson S, Kutty PK, Lugo F, McDonald M, Rota PA, et al. Health care–associated measles outbreak in the United States after an importation: challenges and economic impact. J Infect Dis 2011;203:1517-25.
7. Hinman AR, Rooney JA, Milton JD, Hackler RL, Harris JH, Reynolds D, et al. The largest outbreak of measles in the United States during 1999: imported measles and pockets of susceptibility. J Infect Dis 2004;189:78-80.
8. Centers for Disease Control and Prevention. Hospital-associated measles outbreak–Pennsylvania, March-April 2009. MMWR Morb Mortal Wkly Rep 2012;61:30-2.
9. Rosen JB, Rota JS, Hickman CJ, Sowers SB, Mercader S, Rota PA, et al. Outbreak of measles among persons with prior evidence of immunity, New York City, 2011. Clin Infect Dis 2014;58:1205-10.
10. Centers for Disease Control and Prevention. National Notifiable Diseases Surveillance System (NNDSS)–data collection and reporting. 2018. Available from: https://wwwn.cdc.gov/nndss/data-collection.html. Accessed June 12, 2019.
11. Centers for Disease Control and Prevention. Measles data and statistics. 2018. Available from: https://www.cdc.gov/measles/downloads/MeaslesDataAndStatsSlideSet.pdf. Accessed June 12, 2019.

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"Methods for microbial needleless connector decontamination: A systematic review and meta-analysis" – Interpret results with caution

To the Editor:

We recently read with interest the systematic review and meta-analysis by Flynn et al,[1] which aimed to "compare the effectiveness of connector decontamination with 70% alcohol wipes, alcoholic chlorhexidine gluconate wipes, or alcohol impregnated caps to prevent catheter-associated bloodstream infection (CABSI)." The article concludes that "alcohol impregnated caps and alcoholic chlorhexidine gluconate wipes were associated with significantly less CABSI than 70% alcohol wipes," and that these results require confirmation in randomly assigned controlled trials.

Among the 5 studies included in this meta-analysis, 2 compared chlorhexidine gluconate in isopropyl alcohol (IPA) wipes with IPA wipes for catheter-associated bloodstream infection (CABSI) (Fig 2), and 3 compared IPA caps versus IPA wipes for CABSI (Fig 3). We commend the authors for performing this interesting study. However, we have several statistical suggestions and queries that we would like to share with them.

The authors state that they used a random effect model, but present the results of a fixed effect model, which can be used if there is no heterogeneity. Higgin's I^2 was used to assess heterogeneity. Although this approach is widely mentioned, the point estimate I^2 should be interpreted cautiously when a meta-analysis has few studies,[2] and the confidence interval should be provided.

Conventional meta-analysis relies on several within- and between-study distributional assumptions that are sometimes hidden.[3]

Performing meta-analysis with low event rates or with few studies is challenging, as some of the standard methods are not well suited. For example, estimating between-study heterogeneity is difficult in this situation, and inaccurate estimation of heterogeneity may lead to too narrow confidence intervals.

Different methods may give different results, and using a suboptimal approach may lead to erroneous conclusions.[4]

To avoid selective reporting and to assess the robustness of the results, we performed a sensitivity analysis using a range of statistical methods by using the data provided by Flynn et al.[1]

Frequentist and Bayesian meta-analysis were performed. For frequentist meta-analysis, several methods are available for the random effect model (eg, the Hartung-Knapp-Sidik-Jonkman approach), instead of the classical DerSimonian and the Laird's approach.[5,6] We also used the Mandel-Paule method[7] and Profile Likelihood,[8] with Bartlett's correction.

For Bayesian meta-analysis, we used a binomial-normal model (ie, modeling probabilities of success in each group), instead of modeling estimates of log odds-ratios directly (normal-normal model),[9] with weakly informative priors for the between–trial heterogeneity. We also used a beta-binomial model, which has shown good statistical properties for meta-analysis of sparse data.[7]

Statistical analyses were performed with Stata software (Version 15; StataCorp, LLC, College Station, TX) for the frequentist meta-analysis and R software (R Foundation for Statistical Computing, Vienna, Austria) for Bayesian meta-analysis.

All estimates are shown in Table 1. All confidence intervals (credible interval) contain 1 (except with the DerSimonian-Laird method, which should not be used in the case of meta-analysis with a few studies). That means that alcohol impregnated caps were not associated with significantly less CABSI than 70% alcohol wipes.

In conclusion, the results of this study are interesting. However, readers should interpret them with caution according to the statistical methods used for meta-analysis.

References

1. Flynn JM, Larsen EN, Keogh S, Ullman AJ, Rickard CM. Methods for microbial needleless connector decontamination: A systematic review and meta-analysis. Am J Infect Control 2019;.
2. von Hippel PT. The heterogeneity statistic I2 can be biased in small meta-analyses. BMC Med Res Methodol 2015;15:35.
3. Jackson D, White IR. When should meta–analysis avoid making hidden normality assumptions? Biom J 2018;60:1040.
4. Efthimiou O. Practical guide to the meta-analysis of rare events. Evid Based Ment Health 2018;21:72-6.
5. IntHout J, Ioannidis JPA, Borm GF. The Hartung-Knapp-Sidik-Jonkman method for random effects meta-analysis is straightforward and considerably outperforms the standard DerSimonian-Laird method. BMC Med Res Methodol 2014;14:25.
6. Röver C, Knapp G, Friede T. Hartung-Knapp-Sidik-Jonkman approach and its modification for random-effects meta-analysis with few studies. BMC Med Res Methodol 2015;15:99.
7. Mathes T, Kuss O. A comparison of methods for meta-analysis of a small number of studies with binary outcomes. Res Synth Methods 2018;9:366-81.
8. Bohning D, Rattanasiri S, Kuhnert R, Rattanasiri S, Kuhnert R. Meta-analysis of binary data using profile likelihood. Chapman and Hall/CRC; 2008..
9. Hamza TH, van Houwelingen HC, Stijnen T. The binomial distribution of meta-analysis was preferred to model within-study variability. J Clin Epidemiol 2008;61:41-51.

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