vaccination, or no vaccination, on a recurrent episode of infection.

Despite the contributions of this Article, many questions remain unanswered. Is immunity more robust for those who had a longer (eg, 3 month) gap between vaccinations? What about the need for a third vaccination among those who received the mRNA-1273 (Moderna) vaccine series or a second vaccination for those who received the Ad26.COV2.S (Janssen) vaccine? Is mixing and matching vaccine products (eg, BNT162b2 followed by mRNA-1273) beneficial and safe? Does this immunity wane in a similar manner as the vaccine for those who have had COVID-19 previously? Does vaccination after SARS-CoV-2 infection generate broader and more durable immunity? Or do these individuals, too, need a booster? With preservation of protection against severe disease and hospital admissions, should vaccine distribution be prioritised to resource-constrained regions before commitment to a third vaccination for people who are immunocompetent?

The reason so many questions exist is simple: the rapid release of the vaccines, which is estimated to have saved more than 100 000 lives in the USA during the first 5 months,[5] did not allow collection of durability data. We are learning as we go. Studies like Tartof and colleagues' study provide essential insights into the nature of immune protection induced by COVID-19 vaccines that can inform public policy. Yet, data from one study are not sufficient to answer the remaining questions.

I declare no competing interests.

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Childhood lower respiratory tract infections: more evidence to do less

Paediatric overtesting and overtreatment are well known issues in the field of quality of care. Children are vulnerable, with a potentially fast-changing clinical course, meaning they might have more investigations than an adult, and inappropriate prescription of medications is more common.[1] Overtesting and over-treatment of children are especially prominent in infectious diseases, when fever or other symptoms such as cough can be unspecific and can be of viral or bacterial origin. Through the implementation of public health measures, such as vaccination, the spectrum of infectious pathogens has changed. Most common infections, including lower respiratory tract infections (LRTIs), are viral induced, and have a high prevalence of misuse of some medications, such as antibiotics. Different methods and clinical prediction models have been proposed to simplify stratification of children at high risk for bacterial disease[2] and support reduction of unnecessary diagnostics and treatment.[3-5] However, most prediction models do not provide accurate diagnostics to all subgroups of patients. Furthermore, biomarkers (eg, procalcitonin) to discriminate bacterial versus viral infection have been suggested[6] but are rarely used in primary care. Moreover, other factors, such as cognitive biases or fears of medical error can result in overtreatment.[7,8] The proportion of paediatric recommendations that are evidence based is increasing. Organisations, such as the American Academy of Pediatrics or the Choosing Wisely initiative assess the quality of different scientific studies, summarise them, and provide evidence-based recommendations for clinicians. These guidelines are regularly updated with new evidence, which can help guide the process of reducing inappropriate prescriptions of medications and overtesting.

A clinical trial by Paul Little and colleagues[9] published in *The Lancet* compared antibiotic treatment with


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Published **Online** September 22, 2021 https://doi.org/10.1016/S0140-6736(21)01955-3

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amoxicillin versus placebo in 432 children aged 6 months to 12 years with uncomplicated acute LRTI in primary care. 233 (54%) participants were male and 199 (46%) were female; most (371 [86%]) were British, Irish, or other White ethnicity. The results showed that antibiotics did not affect the primary outcome—the median duration of symptoms rated moderately bad or worse (5 days [IQR 4–11] for the antibiotic group *vs* 6 days [4–15] for the placebo group; hazard ratio 1·13 [95% CI 0·90–1·42]). Thus, despite antibiotics, most children did have moderately bad or worse symptoms on day 3. Symptoms had improved in about 75% of children in both groups at day 14. There was neither a reduction in duration of symptoms in the whole cohort nor in subgroups, including patients with respiratory signs or fever. The rates of hospital admission and complications were equally low in both groups. Notably, no difference was observed in the number of antibiotic-related side-effects. However, one limitation of the study is that it was underpowered to measure the real occurrence of antibiotic side-effects. Another limitation is the small sample size compared with the number of general practices through which recruitment was conducted (n=56), with a risk of different clinical practices between the centres and physicians. To prevent bias on conceptual differences between the physicians from different sites in defining, for example, an LRTI or ill appearance requires a complex process of providing study instructions (eg, criteria of LRTI and clear definition of ill appearance) with no guarantee of uniform inclusion. Nevertheless, this study is a multicentre trial that reflects common practices and interindividual interpretation. A significant strength of this study is the follow-up approach—ie, monitoring of symptoms through a diary, and its assessment for up to 28 days.

This clinical trial provides more evidence that children with an uncomplicated LRTI do not benefit from treatment with antibiotics. Symptoms such as fever, cough, or dyspnoea are not specific enough to identify the cause of an LRTI. Furthermore, prolonged acute cough or unspecific respiratory symptoms are not useful in predicting disease outcome or severity, but they do lead to increased concern of parents and general practitioners.[10,11] A notable finding of this study is that only a few children had moderately bad or worse symptoms by day 14, and antibiotics did not alleviate the symptoms compared with placebo. Additionally, this trial aligns with other studies that have shown that reducing antibiotic treatment for LRTI is not associated with prolonged morbidity or higher incidence of complications.[12] Children could also benefit from a reduction in antibiotic prescriptions because it would result in fewer side-effects and lower costs, especially in low-risk patients. Precautions should be taken when considering reducing antibiotic prescriptions for LRTIs, particularly focusing on children at high risk of worse outcomes (eg, those with concomitant diseases such as respiratory disease, heart disease, or immunodeficiency; or low birthweight). Thus, closer monitoring is needed, with accessibility to health care and parent cooperation important considerations when choosing treatment for uncomplicated LRTI in children.

We declare no competing interests.

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