the conclusions made by Lynskey and colleagues that these lineages have different evolutionary histories (appendix). None of the scarlet fever genomes from east Asia carry the $M1_{UK}$ defining polymorphisms, including *rofA* mutations. Variable carriage of scarlet fever associated virulence genes (*ssa*, *speA*, and *speC*) and the DNase *spd1* is also evident within the global scarlet fever *emm1* population, providing further support that scarlet fever *emm1* lineages from different geographical regions are evolving independently and are associated with different virulence characteristics. These data show that multiple mechanisms related to toxin carriage and expression characteristics probably play a key role in global disease outcomes.

The continuing increase in scarlet fever and invasive disease notifications in the UK exemplifies the essential need to install global surveillance systems and address the increased group A streptococcus disease activity as a public health priority. The report by Lynskey and colleagues sends out an important warning for the global public health community: recently emerging scarlet fever group A streptococcus strains have enhanced invasive potential, which might have profound implications for the future global health burden.

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We declare no competing interests.

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See **Online** for appendix

Essential metrics for high-quality reporting of neonatal sepsis research in low-resource settings

Published **Online** September 12, 2019 http://dx.doi.org/10.1016/S1473-3099(19)30495-5

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Although mortality in children younger than 5 years in sub-Saharan Africa has declined by 58% since 1990, neonatal deaths (in infants younger than 28 days) represent an increasing proportion, currently at 37%.[1–3] Infection remains the third most important cause overall, and the leading cause of late neonatal deaths is hospital-acquired sepsis.[1,4] It is within this context that, in *The Lancet Infectious Diseases*, Uduak Okomo and colleagues reviewed the causes of severe bacterial infections (bloodstream infection and meningitis) and the antimicrobial resistance profile of the causative pathogens among neonates in sub-Saharan Africa.[5] The authors also assessed the quality of neonatal infection reporting by use of the Strengthening the Reporting of Observational Studies in Epidemiology for Newborn Infection (STROBE-NI) checklist.[6] This review is timely, in the leadup to the Sustainable Development Goal of ending preventable neonatal deaths by 2030. Annual cost estimates for neonatal sepsis in sub-Saharan Africa range from US$10 billion to 469 billion, with an associated loss of 5·3–8·7 million disability-adjusted life years.[7,8] Current and regionally-representative data on neonatal pathogens and their antibiotic susceptibility patterns in sub-Saharan Africa are essential to guide


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therapy and ensure antibiotic availability to manage neonatal infections.

The authors confirm the predominance of Gram-negative bacilli and *Staphylococcus aureus* among bacteraemic neonates, with group B streptococcus and *Streptococcus pneumoniae* as additional important pathogens in neonatal meningitis. They highlight the threat posed by antimicrobial resistance to the recent advances made in reducing under-5 mortality.[9,10] Although it is clear that WHO recommendations for empiric therapy of neonatal sepsis are no longer effective in many situations, the answer might not be as simple as it might appear. Despite casting a wide net, the available data do not adequately represent the entire sub-Saharan Africa region, with over-representation of tertiary neonatal units and particular countries—eg, Nigeria, South Africa, and Kenya. It is concerning that the source studies do not report the differentiation between maternally-derived, community-acquired infections and hospital-acquired infections or detailed contextual information both for the clinical and laboratory settings from which these neonatal infection data are reported.

Neonatal units in sub-Saharan Africa that do not have the resources to conduct prospective studies, high-quality microbiological surveillance, and linkage of clinical and laboratory data, might find it difficult, if not impossible, to satisfy the minimum criteria of the STROBE-NI checklist. If African researchers cannot meet the demands of the STROBE-NI checklist, does it diminish the importance of the acquired data or indeed the utility of the checklist? The inability to publish information that meets every element of the STROBE-NI checklist should not prevent researchers in sub-Saharan Africa from collecting and disseminating data on neonatal sepsis. We think that identifying a limited set of key parameters, with provision of specific guidance to researchers, could improve the quality of reporting and in turn, our understanding of the current situation.

For instance, a minimum set of key parameters could be age at culture (to determine maternally-derived infection), birthweight (for risk stratification), previous antibiotic use (for selection of pathogens with antimicrobial resistance), the duration of hospital admission at the time of culture, and the interval from sepsis diagnosis or culture sampling to death (for estimation of sepsis-attributable mortality). Additional guidance should recommend which bacterial isolates are probable culture contaminants and which specific but limited clinical and health systems information must be reported. Recommendations could be developed on how best to collect local data to satisfy the checklist requirements and consider which STROBE-NI elements could be modified, omitted, or substituted, depending on available data or resources. Also, wider dissemination of the STROBE-NI checklist to all stakeholders and data generators (not only researchers) is needed, for example, for routine laboratories, clinicians, professional societies, national health ministries, and WHO.

Facility-level and regional-level harmonisation of routine clinical, laboratory, and pharmacy data is crucial to develop effective empirical and targeted antimicrobial therapies for neonatal sepsis in sub-Saharan Africa. For this goal, we need health-care information from maternal, neonatal, environmental, and health-care systems to meaningfully interpret the multifactorial determinants of neonatal sepsis and sepsis-associated deaths and to plan surveillance, infection diagnosis, treatment regimens, antimicrobial stewardship, and infection prevention programmes. To achieve this objective, health information systems must be strengthened with a focus on integration across platforms. This will need strong advocacy and funding from all stakeholders.

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HR, MC, and AD report grant support for research outside the submitted work.

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Early vaccination: a provisional measure to prevent measles in infants

The optimal age for measles-containing vaccine (MCV) administration depends on various factors, mainly the duration of the protection induced by transplacentally acquired maternal immunity, the maturity of the infant's immune system, and the average age of measles infection in different geographical areas.[1] Demographics and vaccine coverage also contribute.[2]

Initially, experts thought that if an area had a high risk of measles outbreaks, a first dose of MCV at 9 months of age could be enough to protect most infants, as those younger than 9 months could avoid infection through transplacentally acquired immunity. Subsequently, it was shown that this supposition was partly wrong, as many measles cases, sometimes very severe, were diagnosed in infants younger than 6 months.[3] This finding was attributed to a shorter-than-expected duration (9–12 months) of passive maternal immunity, evidenced in both infants born from immunised mothers and those born from mothers with naturally acquired immunity. It was shown that vaccination stimulated the immune system less than natural infection, and infants born from vaccinated mothers had lower specific antibody titres with more rapidly waning protection than infants born from naturally infected mothers.[4] Nevertheless, with the introduction of MCV administration, the circulation of measles virus progressively declined and, without this natural booster, even previously naturally infected mothers transferred reduced antibody concentrations to their fetuses.[5]

To address the problem of measles infection in young infants, an early MCV dose before 9 months of age was suggested. Infants living in or travelling to countries with frequent measles outbreaks, or considered at risk because of HIV exposure or infection, and refugees or people living in conflict zones were the target populations. However, because of the risk that an early MCV dose could lead to poor short-term and long-term protection, this dose was considered only supplemental. Infants vaccinated before 9 months of age had to receive the usual two doses at scheduled times to achieve long-term protection.[1]

Unfortunately, the real effect of an early MCV dose has not been definitively established. Attempts to fill this gap have been made by Laura Nic Lochlainn and colleagues with two systematic reviews and meta-analyses published in *The Lancet Infectious Diseases*.[6,7] The results indicate that MCV administration before 9 months of age is safe and immunogenic.[6] Moreover, early immunisation did not blunt the immune response to subsequent MCV doses.[7] Consequently, the authors concluded that administration of MCV to infants younger than 9 months can be an effective solution to reduce measles-related morbidity and mortality in a substantial proportion of infants at risk.

However, the results of Nic Lochlainn and colleagues strongly suggest that MCV administration before 9 months of age must only be considered as an emergency solution to contain or prevent outbreaks and cannot replace either scheduled dose. Compared with infants administered MCV at 9 months of age or later, seroconversion and antibody concentrations in those vaccinated before 9 months of age were significantly reduced. Vaccine efficacy was 51% versus 83%, highlighting that a substantial proportion of infants younger than 9 months remained susceptible to measles, and that only further doses could ensure that all infants were protected. Moreover, analysis of the immunogenicity and efficacy of further doses, despite showing that MCV efficacy and cell-mediated responses to a second and a third dose were independent of the age of the first dose, suggests that an early dose might decrease long-term protection because further doses were associated with reduced antibody titres and avidity. Further studies are needed to solve the problem of reduced long-term immunity after early MCV administration. In the meantime,


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Published **Online** September 20, 2019 https://doi.org/10.1016/S1473-3099(19)30520-1

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