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New Global Study Pinpoints Main Causes of Childhood Diarrheal Diseases, Suggests Effective Solutions

Findings published in The Lancet can guide prevention, treatment and research on diarrheal diseases, which claim the lives of 800,000 children annually

A new international study published today in The Lancet provides the clearest picture yet of the impact and most common causes of diarrheal diseases, the second leading killer of young children globally, after pneumonia. The Global Enteric Multicenter Study (GEMS) is the largest study ever conducted on diarrheal diseases in developing countries, enrolling more than 20,000 children from seven sites across Asia and Africa.

GEMS, coordinated by the University of Maryland School of Medicine’s Center for Vaccine Development, confirmed rotavirus – for which a vaccine already exists – as the leading cause of diarrheal diseases among infants and identified other top causes for which additional research is urgently needed. GEMS found that approximately one in five children under the age of two suffer from moderate-to-severe diarrhea (MSD) each year, which increased children's risk of death 8.5-fold and lead to stunted growth over a two-month follow-up period.

"Better information is critical to changing the way we fight diarrheal diseases," said Dr. Abu Faruque, Principal Investigator at the Bangladesh trial site. "GEMS shows us clearly how we can target our approach and where we need to invest our resources to make a difference."

Despite many causes, GEMS found that targeting just four pathogens could prevent the majority of MSD cases. Expanding access to vaccines for rotavirus, the leading cause of MSD among infants at every site, could save hundreds of thousands of lives. Likewise, GEMS data suggests that accelerating research on vaccines, treatments and diagnostics for the three other leading pathogens – Shigella, Cryptosporidium and ST-ETEC, a type of E. coli – could have a similar impact. Prior to GEMS, Cryptosporidium was not considered a major cause of diarrheal disease and as a result there is currently little research on this pathogen underway.

"The GEMS findings help set priorities for investments that could greatly reduce the burden of childhood diarrheal diseases," said Dr. Thomas Brewer, Deputy Director of the Enteric & Diarrheal Diseases team at the Bill & Melinda Gates Foundation, which funded the study. "Vaccines and treatments available today can save thousands of children right now but targeted research to develop new tools to combat severe diarrhea could save many more lives in the future."

The GEMS findings also suggest that longer-term monitoring and care of children with diarrheal diseases could reduce mortality and developmental delays. Children with MSD grew significantly less in height in the two months following the diarrheal episode when compared with control children without diarrhea, and were 8.5 times more likely to die over the course of the two-month follow-up period.
Notably, 61 percent of deaths occurred more than a week after the initial diarrheal episode, with 56 percent of deaths happening after families had returned home from a healthcare facility.

The GEMS study in Bangladesh was conducted in Mirzapur through the International Centre for Diarrhoeal Disease Research. Locally, rotavirus was the leading cause of MSD in infants – reinforcing the importance of rotavirus vaccines – while Shigella, a type of bacteria, caused the largest number of infections in toddlers and older children. Unlike at sites in Africa, Aeromonas, another type of bacteria, was the third leading cause of MSD, confirming its regional importance as a pathogen. Linear growth delays were significant among children in all age groups in the two months following their MSD episode, and a single episode of MSD increased children’s risk of death more than twelvefold over the same period.

“GEMS strongly indicates that follow-up care after the initial diarrheal episode is critical to protect the health and wellbeing of children,” said Professor George Griffin, Senior Co-Chair of the GEMS International Strategic Advisory Committee and Professor at St. George’s, University of London. “By focusing only on the acute diarrhea that brings children to hospitals, we overlook a significant portion of diarrheal diseases’ burden.”

Expanding access to existing interventions that protect against or treat all diarrheal diseases, including oral rehydration solutions, zinc supplements, clean water and sanitation, can save lives and improve the health of children immediately.

“GEMS is a landmark study for the child health community,” said Professor Fred Binka, Co-Chair of the GEMS International Strategic Advisory Committee and Vice-Chancellor at the University of Health and Allied Sciences, Ghana. “By using consistent methods across countries, GEMS sites generated data that can guide evidence-based decision making at both the local and global levels.”

Release of the GEMS findings follows last month’s announcement by the World Health Organization and UNICEF of the first-ever Integrated Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD). The GEMS findings add to the scientific evidence cited in the GAPPD strategy for effectively controlling pneumonia and diarrhea, which together are the two leading causes of death among young children globally.

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About GEMS

GEMS, coordinated by the University of Maryland School of Medicine’s Center for Vaccine Development, was a case control study conducted at seven diverse, high-burden sites in Asia and Africa: the Gambia, Kenya, Mali, Mozambique, Bangladesh, India and Pakistan. The study enrolled 22,569 children under five years of age, a sample size that is large enough to provide comprehensive data on the causes, incidence and impact of the range of diarrheal diseases affecting children around the world.
GEMS established a network of well-equipped laboratories in the study countries that can be used to accelerate future research on diarrhea and other child health priorities. Investigators have provided open access to their data, which can provide baselines for further studies. Supplemental materials on GEMS methods and sub-studies can be found in *Clinical Infectious Diseases* (volume 55, supplement 4, and December 2012) and *The American Journal of Tropical Medicine and Hygiene*. Additional analyses of GEMS data are ongoing.

For further information, please visit [http://medschool.umaryland.edu/GEMS/](http://medschool.umaryland.edu/GEMS/).

*About icddr,b*

*icddr,b* is an international public health research institution based in Bangladesh. For more than fifty years, the institution has provided practical, low-cost solutions to health problems that affect billions of people living in poverty in South Asia and across the globe. *icddr,b*’s unique proximity to the health challenges of the developing world, both urban and rural, allows for cutting-edge research that is relevant, rigorously tested, scalable in resource-poor settings, and, most importantly, improves health outcomes and well-being of individuals in low-income countries around the world. *icddr,b*’s hospital treats over 160,000 diarrheal patients annually and has a zero percent case fatality rate. It is regularly called upon by the World Health Organization and local Ministries of Health to share their expertise worldwide.

*About the Center for Vaccine Development*

The Center for Vaccine Development (CVD) at the University of Maryland School of Medicine in Baltimore has earned an international reputation as an academic vaccine development enterprise. Since its inception in 1974, the Center is known for creating and testing vaccines against cholera, typhoid fever, paratyphoid fever, non-typhoidal Salmonella disease, shigellosis (bacillary dysentery), Escherichia coli diarrhea, malaria, and other infectious diseases, including influenza. Its global staff includes molecular biologists, microbiologists, immunologists, internists, pediatricians, epidemiologists, malarialogists, biostatisticians and informaticians. The CVD is engaged in the full range of vaccinology, from basic laboratory science research through vaccine development, early clinical evaluation, large-scale pre-licensure field studies and post-licensure assessments. In addition to its research and outpatient facilities in Baltimore, Maryland, the CVD has facilities to conduct clinical studies in Mali, West Africa, Malawi, Southern Africa and Santiago, Chile and undertakes time-limited field studies in many other countries in Africa, Asia and Latin America.

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