

## Diarrhegenic *Escherichia coli* Replaces *Shigella* spp. as the Predominant Bacteria Causing Childhood Diarrhea in Andaman and Nicobar Islands, India

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The Andaman and Nicobar Islands is an archipelago of more than 500 islands situated in the Bay of Bengal, about 1,200 km away from peninsular India (92° to 94°E longitude; 6° to 14°N latitude). The archipelago, a Union Territory of India, is inhabited by more than 350,000 people, including six aboriginal tribes and settlers from mainland India. Acute diarrhea is common among the children of Andaman Islands.<sup>1,2</sup> Regional Medical Research Center has been monitoring its clinical, epidemiological, and microbiological aspects since 1994 through a hospital-based surveillance. Shigellosis, with an isolation rate of *Shigella* spp. varying from 10% to 30% had been the principal cause of bacterial diarrhea over the years.<sup>1,2</sup> Species and serotype composition of *Shigella* isolates varied considerably over the years. Endemic infections had been mainly due to *Shigella flexneri 2a* whereas *Shigella dysenteriae* Type 1 was responsible for occasional epidemics.<sup>3</sup> Among the four serogroups of *Shigella*, *S. flexneri 2a* was found to be predominant in the island since 1994, which was replaced by *Shigella sonnei* during 2002–2005.<sup>4</sup> During 2003–2009, multidrug-resistant strains started to emerge.<sup>3</sup> The Earthquake and Great Asian Tsunami in 2004 not only altered the topography of the islands, but also resulted in the massive rebuilding of infrastructure, changes in administration policies, social and demographic characteristics of the residents, and increase in the number of tourists. Revamped water supply and sanitation systems with changes in infrastructure were cited as reasons for substantial decrease in the number of diarrheal cases.<sup>5</sup> Although screening for diarrheogenic *Escherichia coli* (DEC) was included in the surveillance from

the year 2008, infection due to DEC remained significantly lower than that due to *Shigella* till 2011. During 2011–2013, the frequency of infections due to DEC became almost equal to that of *Shigella*, and in 2014, it emerged as the predominant bacterial cause of acute childhood diarrhea (Figure 1). The DNA templates from bacterial isolates were subjected to multiplex polymerase chain reaction (PCR) using specific primers described previously.<sup>6</sup> The cycling condition was 96°C for 4 minutes, 35 cycles of 95°C for 20 seconds, 57.5°C for 20 seconds, 72°C for 1 minute, with a final extension at 72°C for 7 minutes following Panchalingam et al.<sup>6</sup> with slight modifications. Positive and negative controls were used with each PCR set up. Strains known to possess the target genes were used as the positive control and sterile distilled water was used as the negative control. Control strains were kindly provided by National Institute of Cholera and Enteric diseases, Calcutta.

Enterotoxigenic *E. coli* (EAEC) was identified as the most common pathotype, followed by Enteropathogenic *E. coli* and Enterotoxigenic *E. coli* (ETEC). EAEC has been reported to cause persistent diarrhea in children where it is endemic, and it is the second most common causative agent of traveler's diarrhea next only to ETEC.<sup>7</sup> With a sudden change in the topography and ecology of the islands after the Earthquake and Great Asian Tsunami of 2004, and with significantly large number of tourists visiting Andaman Islands in recent years,<sup>8</sup> it is possible that there had been a change in the epidemiology of the diarrheal pathogens in the islands, after the post-tsunami lull. A 3-fold rise in the number of tourists has been

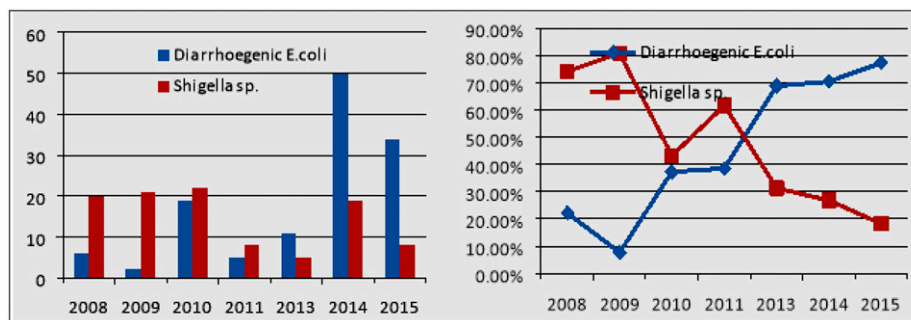


FIGURE 1. (A) Number of cases of childhood diarrhea caused by diarrheogenic *Escherichia coli* and *Shigella* spp. (B) The proportion of childhood diarrhea cases attributable to these by years in Andaman Island. This figure appears in color at [www.ajtmh.org](http://www.ajtmh.org).

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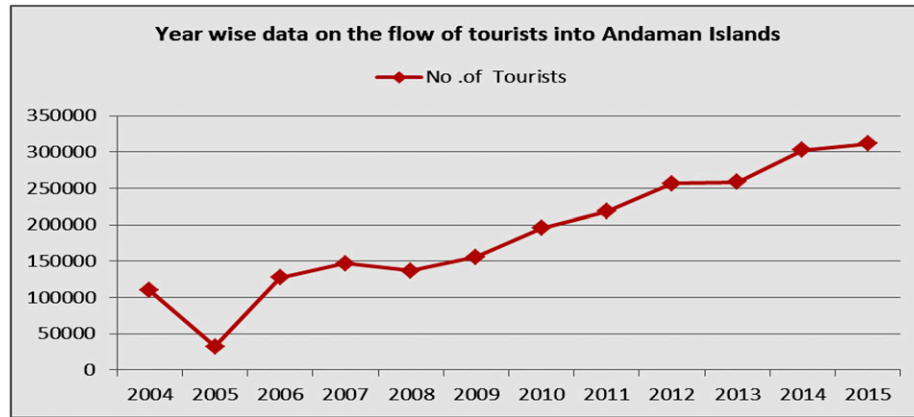


FIGURE 2. Year-wise number of tourists visiting Andaman and Nicobar Island. This figure appears in color at [www.ajtmh.org](http://www.ajtmh.org).

reported in the last 10-year period (Figure 2), and this rapid inflow of people from mainland India and abroad could be a possible reason for the introduction of new clones into the ecosystem. The environmental and ecological changes caused by the land subsidence and tsunami also might have played a role. With DEC emerging as the primary cause of childhood diarrhea and EAEC constituting the commonest pathotype, the Andaman Islands present a scenario not common elsewhere in India. The epidemiology of DEC in the Island ecosystem needs to be studied and its antimicrobial resistance patterns need to be monitored for devising public health strategies for prevention and control of diarrheal diseases in the Andaman Islands.

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