produces. These include enterotoxins and colonization fac-
tors apart from other antigens like the lipopolysaccharide
(LPS), which are part of the 'O' antigen. Over 100 types
of 'O' groups have been detected in ETEC strains in com-
bination with different flagellar (H) antigens, that together
make the serotype (O:H) of the bacteria. Although exten-
sive efforts have been made to determine the prevalence of
the toxins and colonization factors in ETEC strains isolated
in different regions of the world, relatively little is known
about the serotype of the bacteria circulating in different
countries, especially those that are prevalent at this time.

Recent epidemiological studies have shown that ETEC
strains from different regions differ in their phenotypic char-
acteristics. These findings are important to determine which
vaccines would be suitable for use in one region but not in
another as a measure of protection against ETEC infections.

ETEC isolated from two geographically different locations,
Mexico and Bangladesh, have been characterized for their
'O' and 'H' antigens as well as for their enterotoxin types
and colonization factor production. Overall a variety of
ETEC phenotypes were found to be present in both set-
tings. Twelve serotypes were common in both settings. A few
serogroups were only present in isolates from Bangladesh
(O20, O115, O126, O128, O114), while others were present
only in strains isolated in Mexico (O103, O170, O22). The pre-
dominant colonization factors in both settings were CFA/I,
CS5+CS6, CS6 as well as CS1+CS2/CS3. Colonization factors
were produced by strains belonging to 'O' serogroups,
CFA/I (O126 and O128), CS5+CS6 (O115 and O167), CS6
(O169), CS1+CS2/CS3 (O6). Based on these results, formu-
lation of an effective multivalent ETEC vaccine will have to
include not only the major colonization factors and LT tox-
obid but also the LPS of important serogroups. An inactivated
killed ETEC vaccine that has undergone extensive testing
includes strains of serogroups O6, O25, O78 and O167. Based
on the present data this vaccine would in addition need the
incorporation of strains belonging to serogroups O115 and
O126 to be more effective in the protection against the most
common cause of bacterial diarrhea in early childhood and
the second most predominant cause of diarrhea in adults
in endemic countries, including tourists travelling to these
areas.

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5.002

Typhoid Vaccines as Routine Public Health Tools for
Developing Countries: An Idea Whose Time Has Come
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Despite the availability of two internationally licensed,
newer generation typhoid vaccines that are safe and effec-
tive and despite an annual global typhoid mortality burden
estimated at over 200,000 deaths, typhoid vaccines are not
routinely used as public health interventions in develop-
ing countries with high typhoid burdens. Although there are
multiple reasons for the failure to introduce these vaccines
into public health programs for the poor, a gap in evi-
dence to inform vaccine policy is a major factor. To address
this gap in evidence, the International Vaccine Institute,
with the support of the Bill and Melinda Gates Foundation,
has coordinated a multi-country, multidisciplinary program
of research, called the Diseases of the Most Impoverished
(DOMI) Program, to inform policy about typhoid vaccine
introduction in Asia. This research program, which has been
undertaken in Bangladesh, China, India, Indonesia, Pakistan,
and Vietnam, has demonstrated the burden of typhoid fever
to be high, but geographically heterogeneous. The research
has also demonstrated a high financial cost associated with
typhoid fever, and a modest cost of purchasing and deliv-
ering one of the two currently available, internationally
licensed typhoid vaccines (Vi polysaccharide). Demonstra-
tion projects with Vi vaccine have shown that the vaccine is
feasibly delivered in mass immunization campaigns in both
school and community settings, and when delivered in these
campaigns the vaccine confers both direct and herd protec-
tion. As well, there is a high population demand for a vaccine
with the cost and characteristics of Vi polysaccharide, and
even a willingness on the part of developing country popu-
lations to pay for this vaccine, particularly for vaccination
of children. In aggregate, these findings have helped to
motivate a recently published, strengthened WHO recom-
endation for routine typhoid vaccination in settings with
high typhoid disease burdens.

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5.003

The New Emerging Strain of Cholera: One Step Ahead of
Genomics
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A remarkable event in recent years has been the emergence
of strains of Vibrio cholerae O1 that possess traits of both
the classical and El Tor biotypes. These strains were first
encountered from sporadic cases of cholera isolated from
1992 onwards in Matlab, Bangladesh. Phenotypic and geno-
typic traits failed to categorize these strains into classical
or El Tor biotype and were designated as the Matlab vari-
ants. The Matlab variants assumed greater significance when
strains of V. cholerae O1 isolated from Beira, Mozambique
in 2005 displayed typical traits of the El Tor biotype but car-
ried the classical CTX prophage. A more recent analysis of
V. cholerae O1 strains isolated in Bangladesh during the past
four and a half decades revealed that from 2001 onwards
all strains associated with cholera belonged to the El Tor
biotype but produced classical cholera toxin (CT) which was
different from the prototype El Tor biotype that produced
El Tor CT. This new variant of the El Tor biotype is now
dominant in several other countries. At this time, it is not
certain whether the change in CT subtype in the El Tor strains
will enhance their epidemic potential. Given that there are
differences between the classical and El Tor biotypes, the
selection of the El Tor biotype which produces classical CT
would seem to indicate an evolutionary optimization of the
El Tor biotype and represents a new more efficient emerging
form of the El Tor biotype. Under the cholera surveillance
program of the International Centre for Diarrheal Disease
Research in Bangladesh, an increasing trend in the number