Changing epidemiology and antimicrobial resistance in *Vibrio cholerae*: findings of a decade from national AMR surveillance

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Objectives

• To monitor the changing serotype of *V. cholerae* prevalent in Nepal

• To assess the change in antimicrobial susceptibility trend of *V. cholerae* over a period of 11 years (2006-2016)
Epidemiology of Cholera in Nepal

- Cholera is endemic in Nepal.
- Nearly 20% of the population at risk.
- Every year, there are reports of cholera outbreaks from rural and urban areas, including areas that are remote and difficult to access.
- The hill districts are particularly at high risk due to poor sanitation and hygiene.

http://www.gettyimages.com
Status of cholera in Nepal

• The first recorded cholera epidemic took place in 1823, followed by a series of epidemics occurring in the Kathmandu Valley in 1831, 1843, 1856, 1862, and 1887.

Status contd..

• Nepal has a weekly reporting of six priority diseases including Acute Gastroenteritis (AGE) through a network of Early Warning and Reporting System (EWARS) in 63 hospitals.

• It focuses on immediate reporting (to be reported within 24 hours of diagnosis) of one confirmed case of Cholera.
AGE cases suspected to be cholerae claim the lives of many, before being laboratory confirmed and treated.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total suspected AGE cases</th>
<th>Districts affected</th>
<th>Deaths reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>71341</td>
<td>27</td>
<td>378</td>
</tr>
<tr>
<td>2010</td>
<td>101</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>2011</td>
<td>10</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>2678</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>2014</td>
<td>600</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: Epidemiology and Disease control division, annual reports (www.edcd.gov.np)
Phenotypic and genetic characterization of *Vibrio cholerae* O1 clinical isolates collected through national antimicrobial resistance surveillance network in Nepal
An Outbreak of Vibrio cholerae in 2012, Kathmandu, Nepal

Sher Bahadur Pun1, Rosina Maharjan2, Dina Shrestha3, Deepak Pokhare4, Yogesh Shah5, Anup Bassole1 and Rajesh Shah1

1Sukraraj Tropical and Infectious Disease Hospital, Kathmandu, Nepal
2Kantipur College of Medical Sciences, Tribhuvan University, Kathmandu, Nepal
3Kathmandu College of Science and Technology, Kathmandu, Nepal
4National Zoosporas and Food Hygiene Research Center, Kathmandu, Nepal

Multiple drug resistant Vibrio cholerae, Salmonella and Shigella from Nepalgunj Cholera outbreak and different hospitals of Nepal

Binod Kumar Shah1, Sapana Sharma1, Gita Shakyra1 and Bishnu Prasad Upadhyay2

Cholera outbreak caused by drug resistant Vibrio cholerae serogroup O1 biotype ElTor serotype Ogawa in Nepal; a cross-sectional study

Pappu Kumar Gupta1, Narayan Dutt Pani2, Ramkrishna Bhandari3 and Padma Shrestha1
Hendriksen, R.S

Objective: evaluate the suggested epidemiological link with the Haitian outbreak

Result: The Nepalese isolates were divided into four closely related clusters. One cluster contained three Nepalese isolates and three Haitian isolates that were almost identical, with only 1- or 2-bp differences.
Methodology for sample collection/transport and isolation of Vibrio at Laboratory
National AMR surveillance Network

Send feedback to lab

Send feedback to NRL for confirmation

Collect Samples from outbreak areas

Epidemiology and disease Control Division

21 sentinel Lab

Culture and identification
Laboratory diagnosis

Stool is collected from Outbreak sites (fresh or in transport media)

Transported maintaining a cold chain to the laboratory

Enriched in APW and incubated for 6 hrs

Biochemical Testing

Plated on MA and TCBS

Confirmed by serotyping
FINDINGS (2006-2016)
Total number of *V. cholerae* isolates reported (2006-2016)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>32</td>
</tr>
<tr>
<td>2007</td>
<td>204</td>
</tr>
<tr>
<td>2008</td>
<td>148</td>
</tr>
<tr>
<td>2009</td>
<td>109</td>
</tr>
<tr>
<td>2010</td>
<td>45</td>
</tr>
<tr>
<td>2011</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>34</td>
</tr>
<tr>
<td>2013</td>
<td>2</td>
</tr>
<tr>
<td>2014</td>
<td>14</td>
</tr>
<tr>
<td>2015</td>
<td>82</td>
</tr>
<tr>
<td>2016</td>
<td>165</td>
</tr>
</tbody>
</table>
Distribution of Vibrio from various sentinel sites

Laboratories/Sites

B.P. Koirala Institute of Health... 4
Dhulikhel Hospital 10
Kanti Children Hospital 37
Kathmandu Medical College 1
KIST Medical College 9
Lumbini Zonal Hospital 23
National Public Health Laboratory 249
Tribhuvan University teaching... 351
Patan Hospital 1
Shree Birendra Hospital 8
Sukraraj Tropical and Infectious... 143
Distribution of various serotypes

[Graph showing the distribution of various serotypes (Ogawa, Inaba, Hikojima) from 2006 to 2016.]

- Ogawa serotype: 147, 164
- Inaba serotype: 2, 1
- Hikojima serotype: 71, 10
Age and Gender wise distribution of cases
Antimicrobial susceptibility results

% Resistance

Antibiotics

Ampicillin  Ciprofloxacin  Cotrimoxazole


9%
Antimicrobial susceptibility results

- Nalidixic acid
- Furazolidone
- Tetracycline

40%
Multidrug resistance
<table>
<thead>
<tr>
<th>Antibiogram typing</th>
<th>Total number of isolates exhibiting resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amp/Cip/Cot/NA/FR</td>
<td>1</td>
</tr>
<tr>
<td>Amp/Cot/NA/Tet/FR</td>
<td>21</td>
</tr>
<tr>
<td>Amp/Cip/Cot/NA/Tet</td>
<td>1</td>
</tr>
<tr>
<td>Amp/Cot/NA/FR</td>
<td>140</td>
</tr>
<tr>
<td>Cot/NA/Tet/FR</td>
<td>11</td>
</tr>
<tr>
<td>Cip/Cot/NA/Tet</td>
<td>2</td>
</tr>
<tr>
<td>Amp/Cip/NA/FR</td>
<td>1</td>
</tr>
<tr>
<td>Amp/Cot/Tet/FR</td>
<td>1</td>
</tr>
<tr>
<td>Amp/Cip/Cot/Tet</td>
<td>1</td>
</tr>
<tr>
<td>Cot/NA/FR</td>
<td>136</td>
</tr>
<tr>
<td>Amp/Cip/Cot</td>
<td>6</td>
</tr>
<tr>
<td>Amp/Cot/NA</td>
<td>188</td>
</tr>
<tr>
<td>Amp/NA/FR</td>
<td>16</td>
</tr>
<tr>
<td>NA/Tet/FR</td>
<td>3</td>
</tr>
<tr>
<td>Amp/Cot/Tet</td>
<td>2</td>
</tr>
<tr>
<td>Amp/Cot/FR</td>
<td>1</td>
</tr>
<tr>
<td>Cot/Tet/FR</td>
<td>1</td>
</tr>
</tbody>
</table>

Of the total Vibrio isolates 532 (63.6%) were MDR.

Amp - Ampicillin  
Cip – Ciprofloxacin  
Cot – Cotrimoxazole  
NA – Nalidixic Acid  
FR – Furazolidone  
Tet - Tetracycline
Summary

• Shift in prevalent serotype is noted.
• Resistance to ampicillin decreased from 93% in 2006 to 18% by 2010 and again raised to 100% by 2016.
• Cotrimoxazole resistance remained at constant range (77-100%).
• Ciprofloxacin and tetracycline resistance emerged in 2007, reached a peak during 2010-2012 and declined to 0 by 2016.
• Susceptibility to Furazolidone has re-emerged.
• 63.6% of the isolates were Multi drug resistant.
Acknowledgements

• All sentinel sites participating in AMR surveillance
• Technical experts involved in AMR surveillance
• Patients
• National Public Health Laboratory
• WHO
• Shift in prevalent serotype noted, with Ogawa being the prevalent serotype.

• Males are predominantly infected. Infection is prevalent in 15-29 years age group.

• Resistance to ampicillin decreased from 93% in 2006 to 18% by 2010 and again raised to 100%.

• Ciprofloxacin and tetracycline resistance emerged in 2007, reached a peak during 2010-2012 and declined to 0 by 2016.

• Susceptibility to Furazolidone has re-emerged.

• 63% of the isolates were Multi drug resistant.

THANK YOU FOR YOUR ATTENTION