Spatial and Temporal Patterns of Typhoid and Paratyphoid Fever Outbreaks: A Worldwide Systematic Review, 1990-2016

Vittal Mogasale

11th International Conference on Typhoid
& other invasive salmonellosis

March 26, Hanoi, Vietnam

International Vaccine Institute

Contents

- Why typhoid outbreak review?
- Methodology
- Results
- Discussion
- Limitations
- Implications

Why Enteric Fever Outbreaks Review?

- Outbreaks are not often included in disease burden studies
- May not be captured in surveillance studies
- Enhances the comprehensiveness of disease burden
- Outbreak are not systematically collected and reported: under reported
- Helpful in geo-spatial risk-prediction models

Systematic Literature Review

- PRISMA guidelines
- Medical literature databases PUBMED and EMBASE
- Epidemiology-specific databases GIDEON and ProMEDmail (https://www.gideononline.com/ , http://www.promedmail.org/)
- From January 1st 1990 to December 31st 2016
- English language
- Outbreak definition: Author defined
- Diagnostic criteria (Any: culture, serology, clinical)

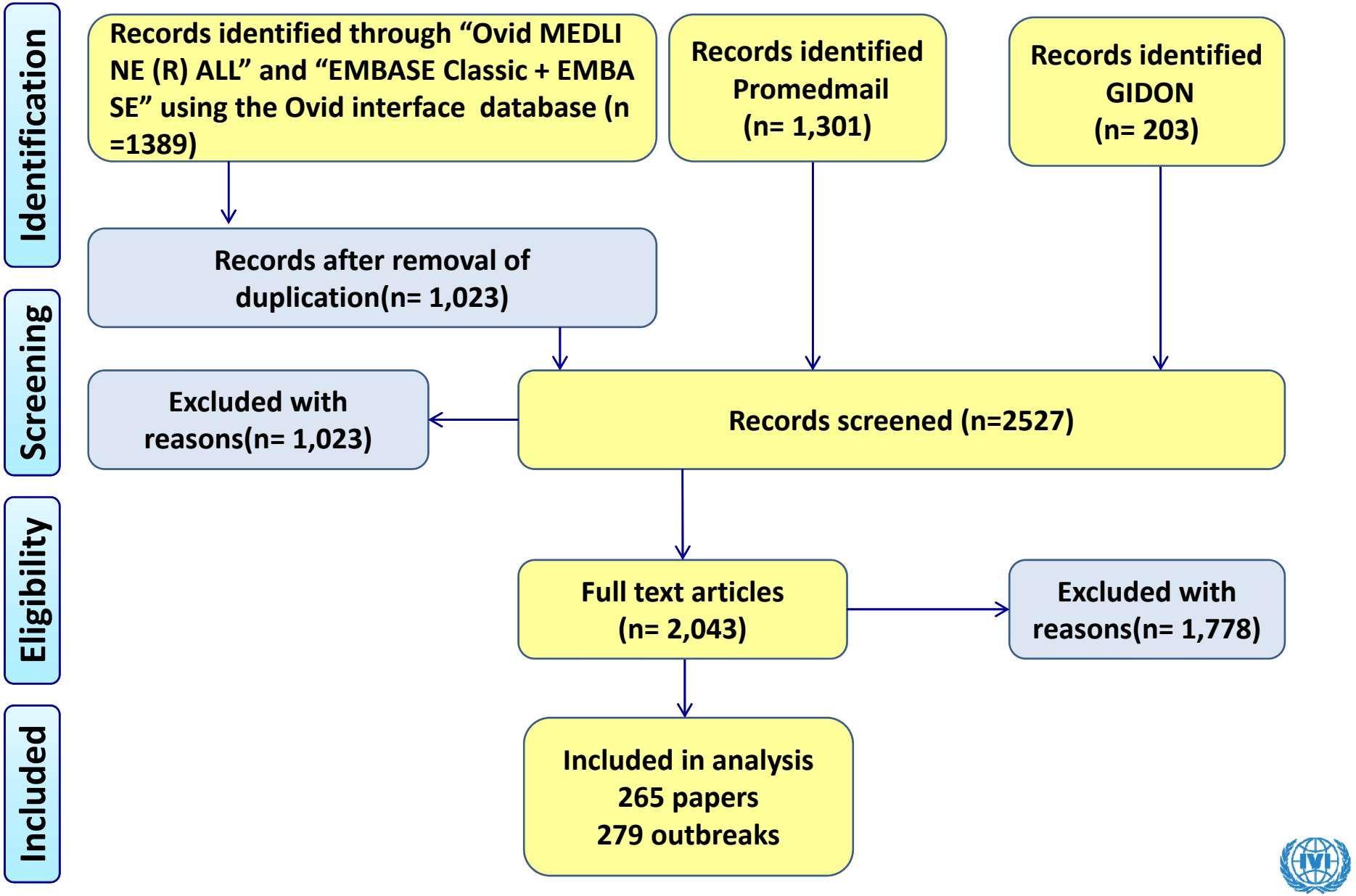
Search Methodology

- Search terms

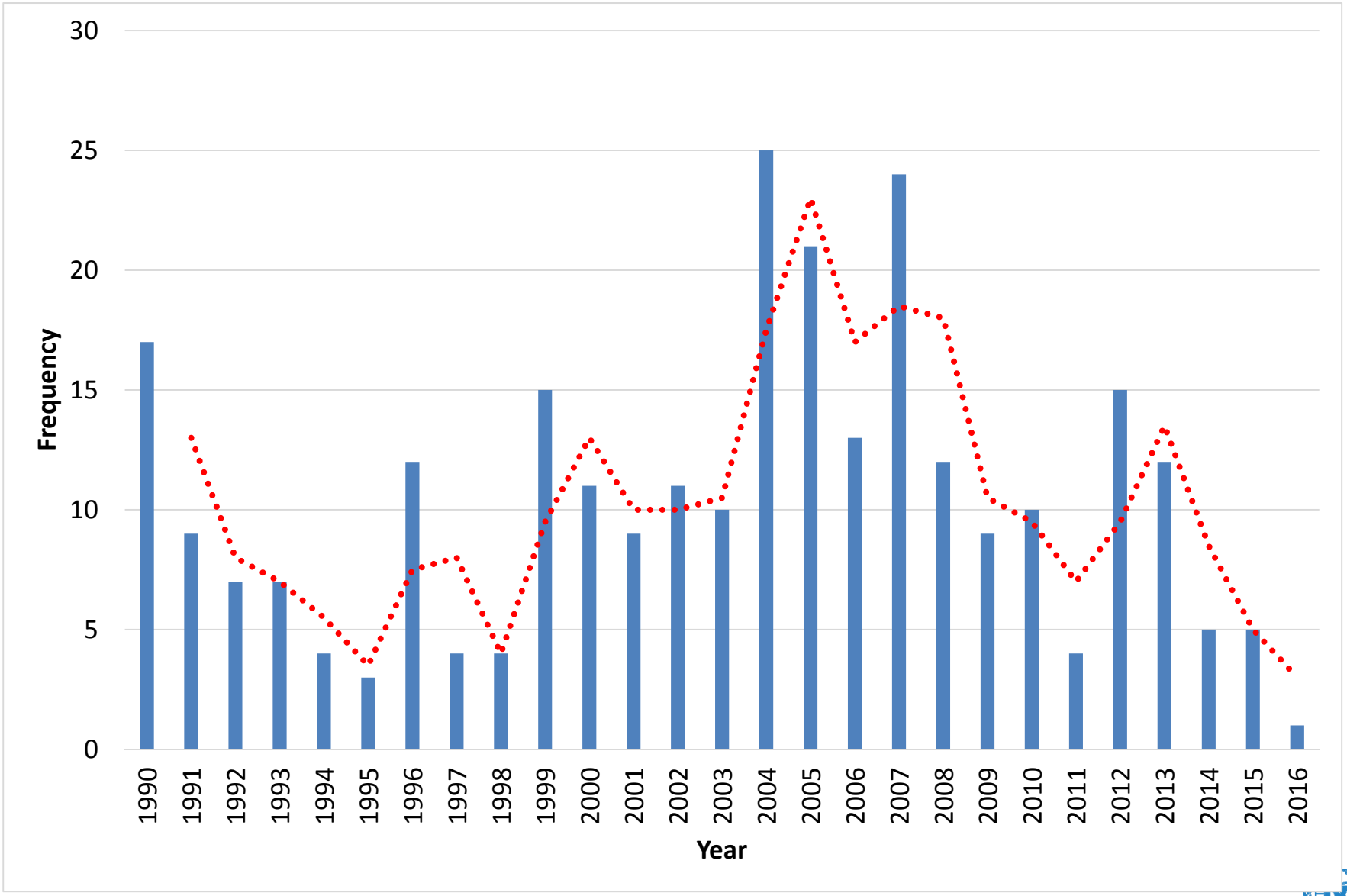
((“typhoid” OR “typhoid fever” OR “salmonella typhi” OR “s. typhi” OR “salmonella infection” OR “enteric fever” OR "paratyphi" OR "paratyphoid" OR "paratyphoid fever") AND (“outbreaks” OR “resurgence” OR “re-emergence” OR “relapse”))

- Duplicates removed
- Unique outbreaks identified
- Linked to GIS using google map
- Predefined data extraction
- Two researchers involved

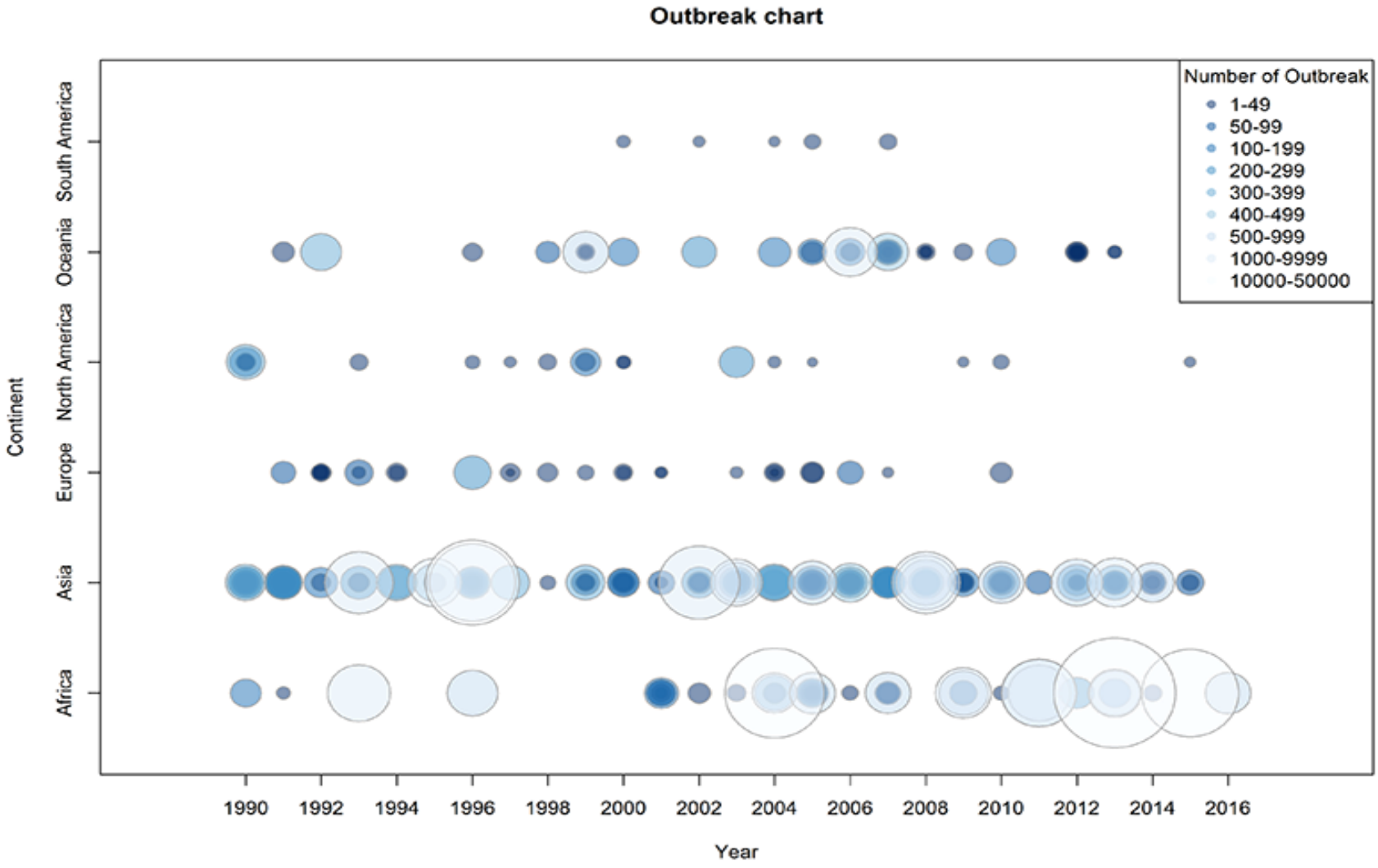
PRISMA Flow Chart of Literature Review



Number of Outbreaks per Year



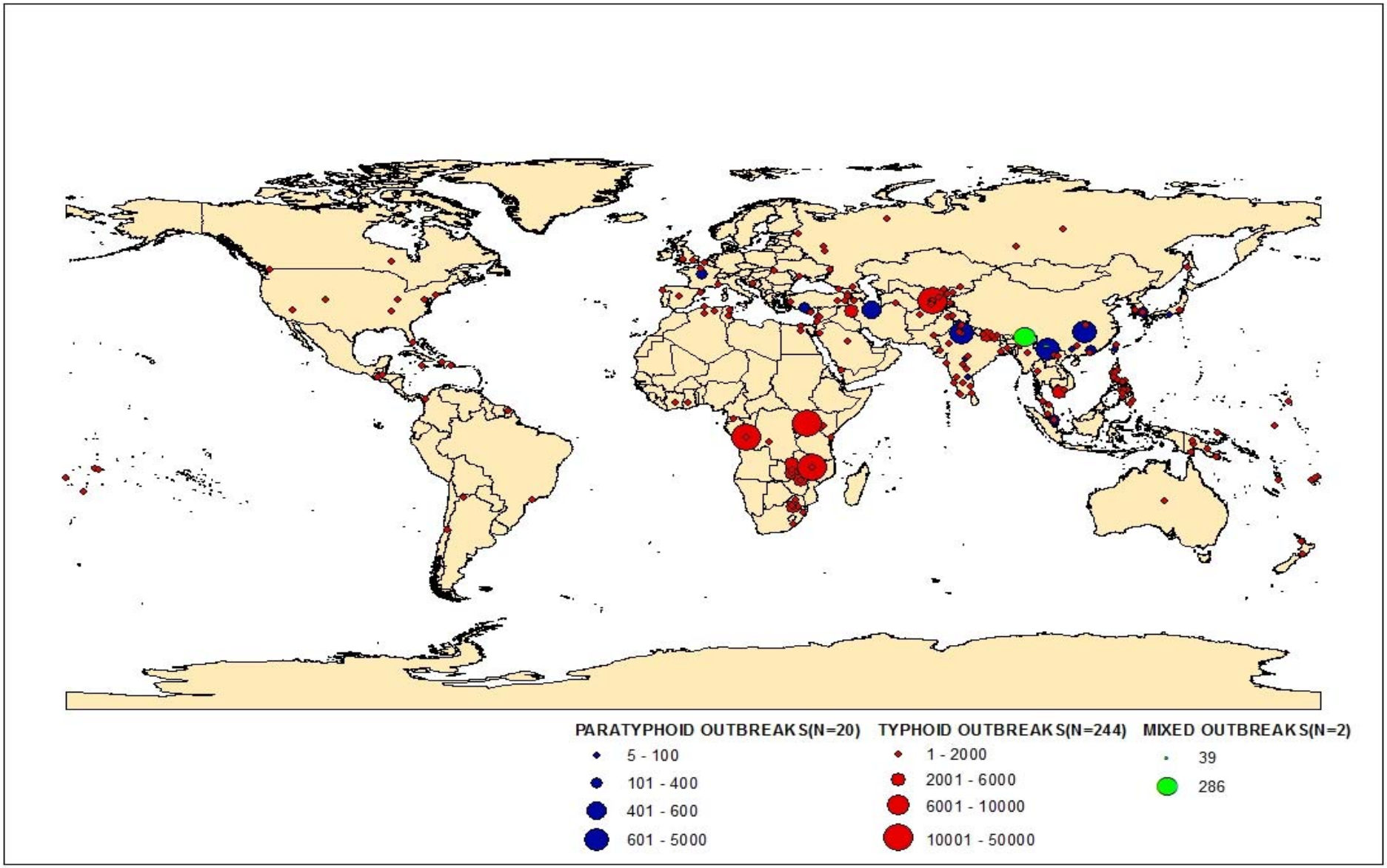
Distribution of Outbreaks 1990-2016



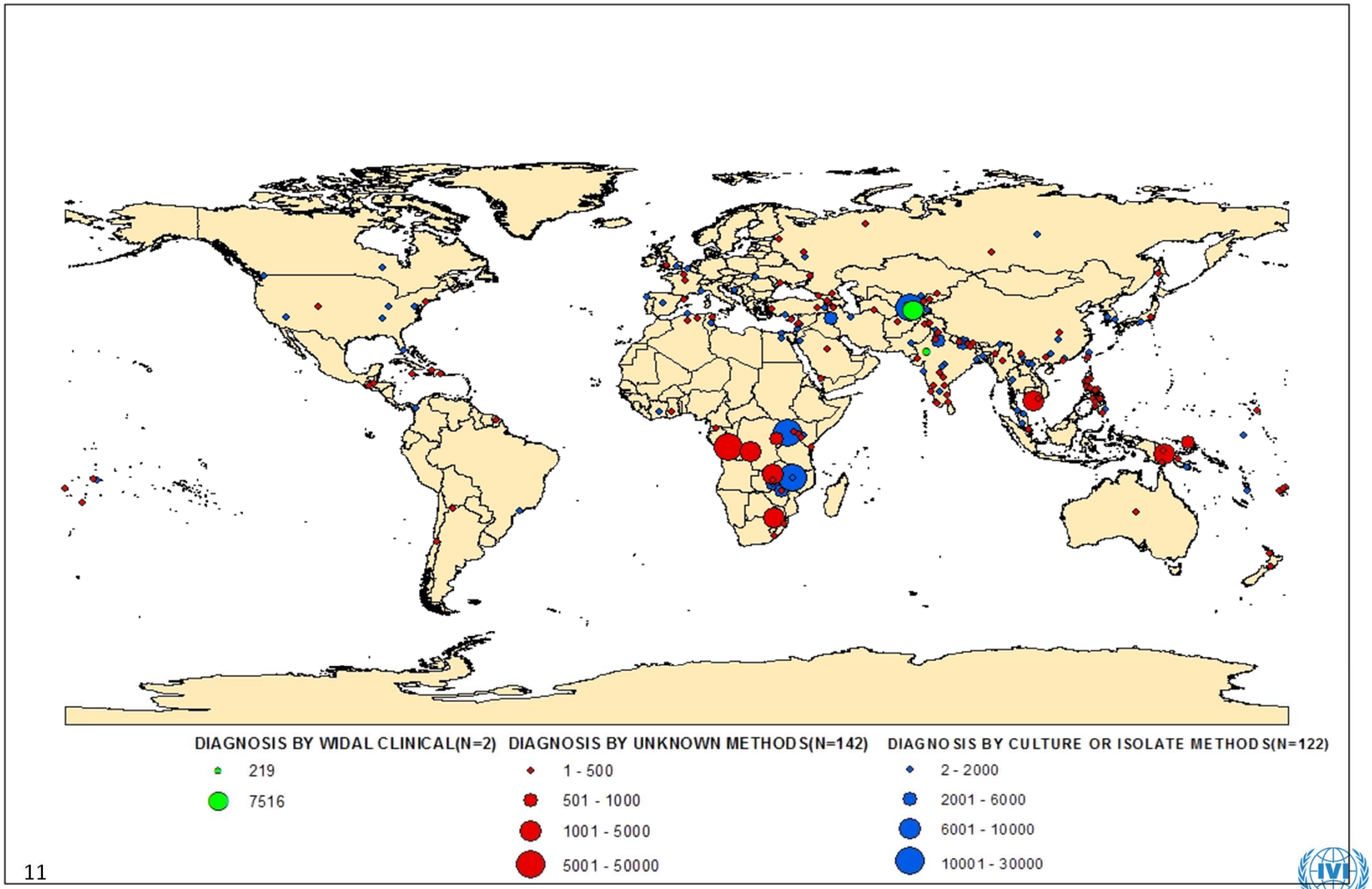
Number of Outbreaks and Cases

Region	No. outbreaks	Min. cases	Max. cases	Sum of cases	Mean	Median	Std. Dev
Africa	40	3	30,000	77,284	1,932	147	5,374
Asia	148	1	10,677	53,040	358	80	1,219
Europe	27	1	277	860	32	16	54
North America	22	2	321	992	45	12	82
South America	5	3	15	41	8	6	5
Oceania	37	2	1,200	4,021	109	25	225
Total/overall	279	1	30,000	136,238	488	49	2,283

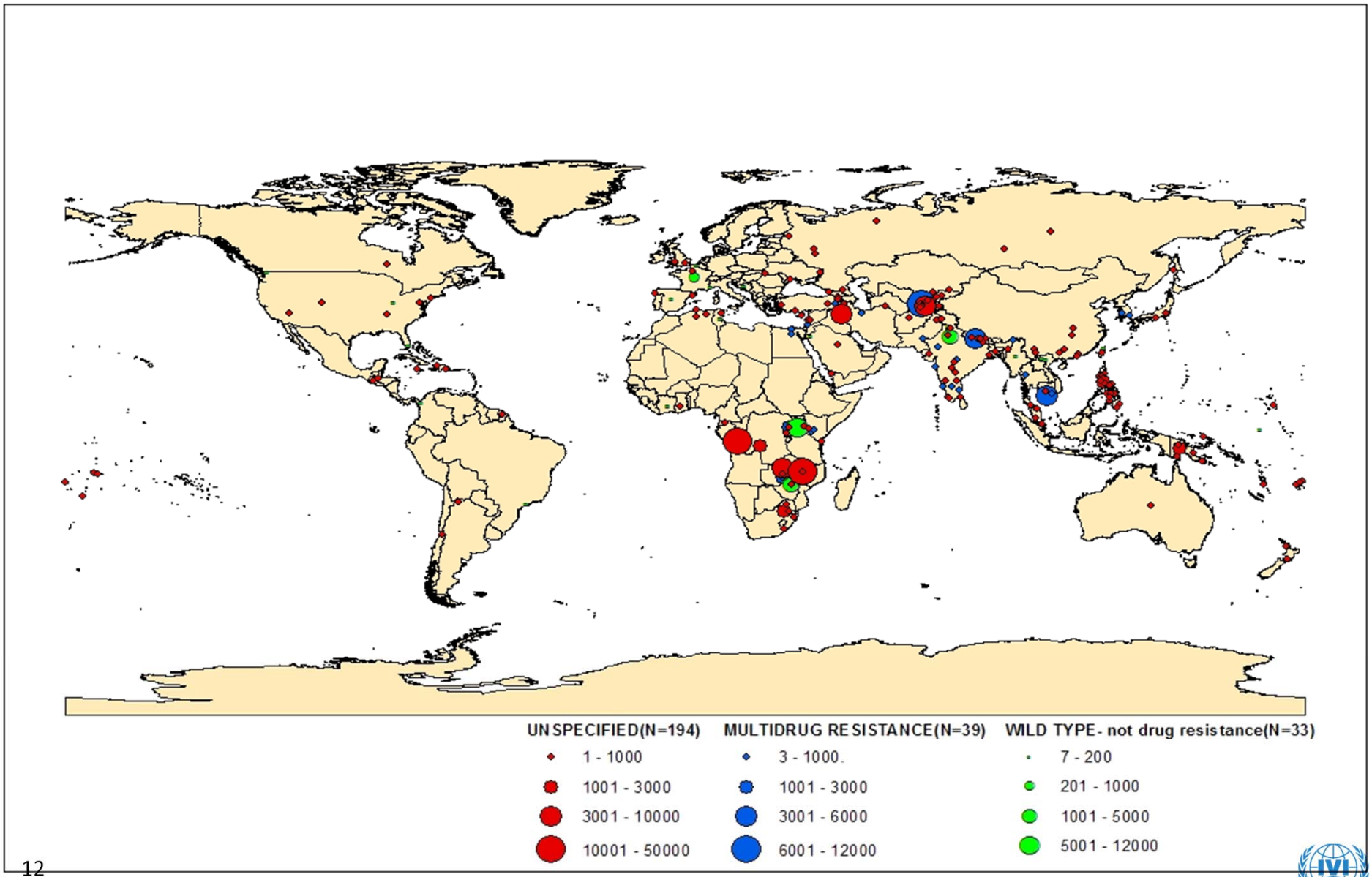
Typhoid and Paratyphoid Outbreaks



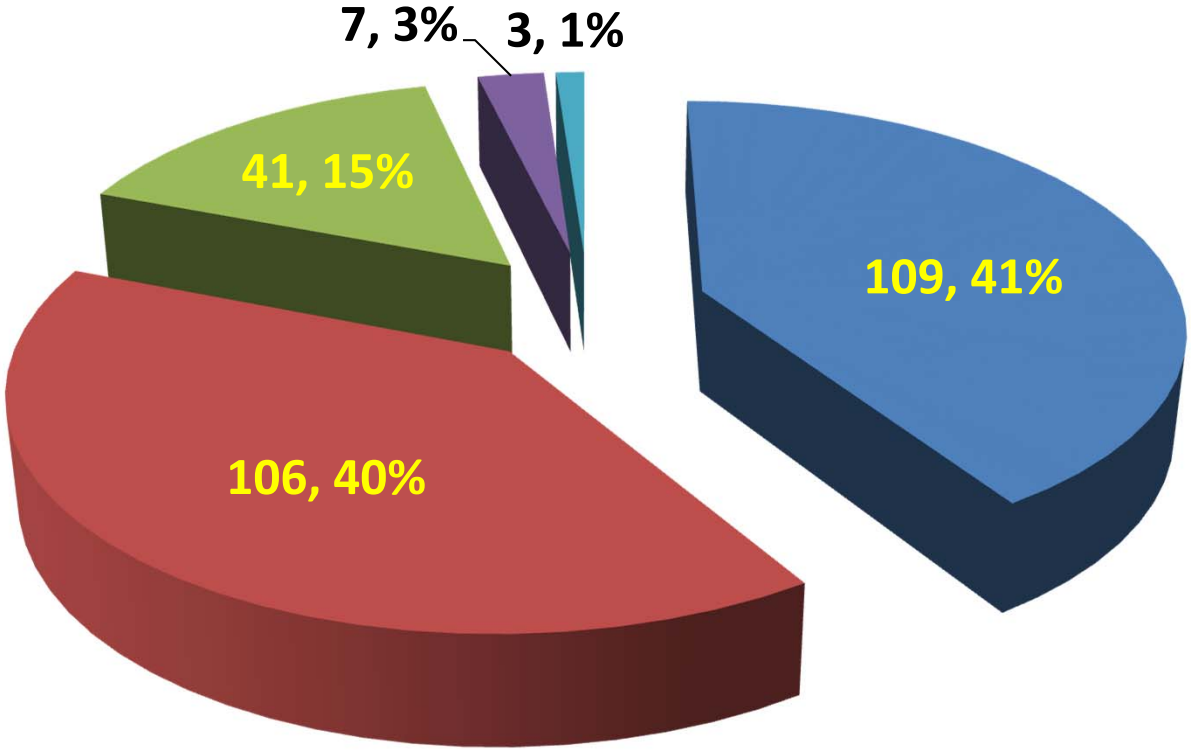
Diagnostic Method Used in Outbreaks



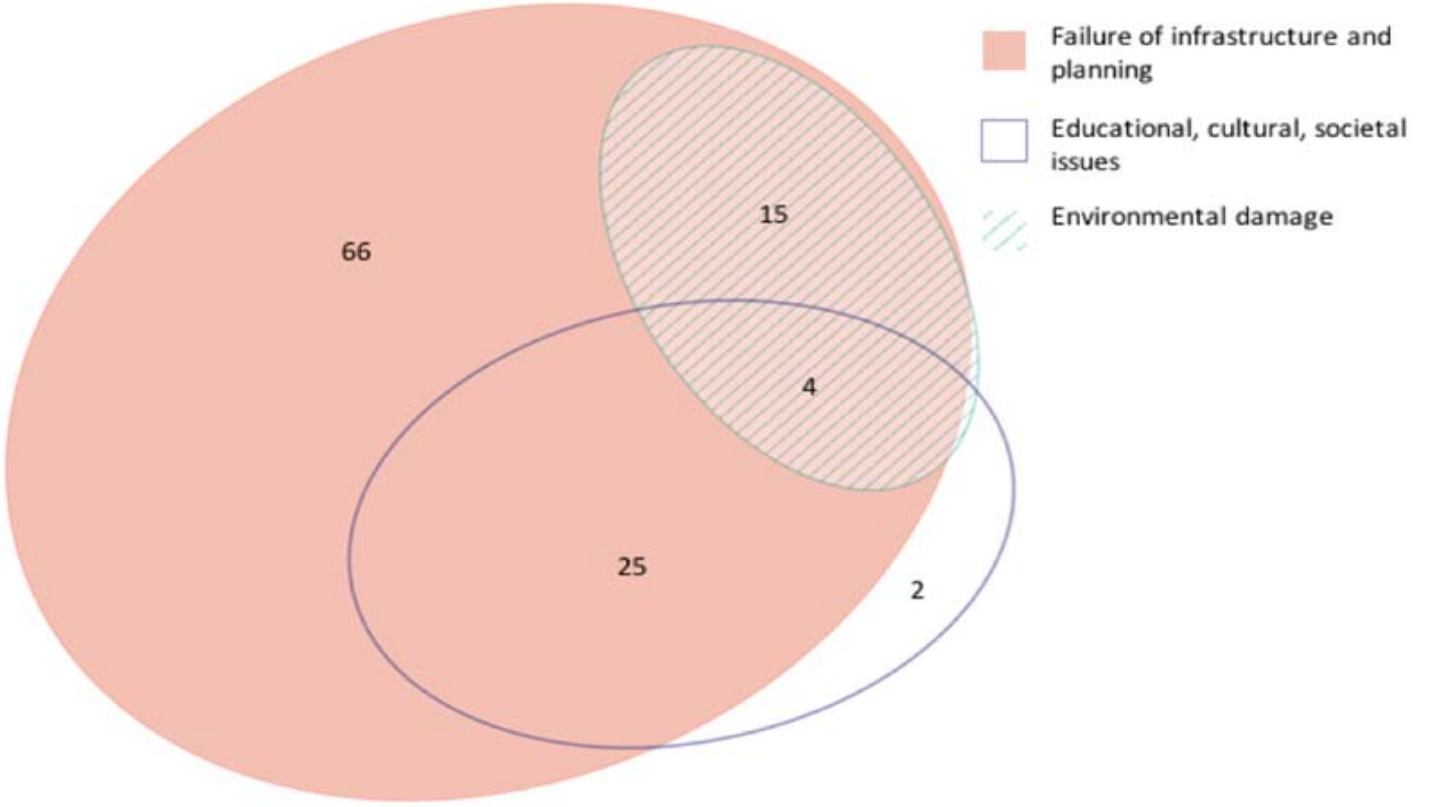
Multidrug-Resistant Outbreaks



Reported Causes for Outbreaks



Risk Factors for Contaminated Water Outbreaks



There were no outbreaks that attributed environmental damage only and no outbreaks that attributed environmental damage and educational, cultural, societal issues

Discussion

- Reported outbreaks overlap the geographical areas that are typhoid endemic
- Contaminated water is the most important cause for outbreak
- Value of monovalent typhoid vaccine in Asia as typhoid and paratyphoid appears to be more common

Limitations

- Outbreaks are author defined, could not verify against WHO definition
- Different health systems have different capacity to identify and report outbreaks- underestimation
- Known typhoid endemic areas may not report outbreaks- underestimation
- Data bases, particularly ProMEDmail may have underreporting bias for LMICs

Conclusion

- Enteric fever outbreak burden remains high in endemic LMICs
- Outbreak data should be taken into account when prioritising resources and public health policies and actions
- Typhoid vaccination should be considered to control outbreaks as recommended by WHO, as well as improving water and sanitation is important
- Need to standardize detection, reporting, and monitoring of outbreaks in a consistent manner

Acknowledgements

- Submitted to CID supplement

- Primary reviewer: Samuel Kim, Imperial College, London

- Co-authors: *Kang Sung Lee, Jean-Louis Excler, Sushant Sahastrabuddhe, Florian Marks, Jerome H Kim*

- Funding: Did not receive any funding for this work. IVI receives core funding from Governments of Korea, Sweden and India

Contact

Vittal Mogasale
vmogasale@ivi.int