

Publication

An evidence synthesis approach for combining different data sources illustrated using entomological efficacy of insecticides for indoor residual spraying

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 4651595

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Year 2022

Title An evidence synthesis approach for combining different data sources illustrated using entomological efficacy of insecticides for indoor residual spraying

Journal PLoS One

Volume 17

Number 3

Pages / Article-Number e0263446

Mesh terms Animals; Bayes Theorem; Culicidae; Disease Progression; Information Storage and Retrieval; Insecticide-Treated Bednets; Insecticides; Malaria, prevention & control; Mosquito Control; Mosquito Vectors; Prospective Studies

BACKGROUND: Prospective malaria public health interventions are initially tested for entomological impact using standardised experimental hut trials. In some cases, data are collated as aggregated counts of potential outcomes from mosquito feeding attempts given the presence of an insecticidal intervention. Comprehensive data i.e. full breakdowns of probable outcomes of mosquito feeding attempts, are more rarely available. Bayesian evidence synthesis is a framework that explicitly combines data sources to enable the joint estimation of parameters and their uncertainties. The aggregated and comprehensive data can be combined using an evidence synthesis approach to enhance our inference about the potential impact of vector control products across different settings over time. **METHODS:** Aggregated and comprehensive data from a meta-analysis of the impact of Pirimiphos-methyl, an indoor residual spray (IRS) product active ingredient, used on wall surfaces to kill mosquitoes and reduce malaria transmission, were analysed using a series of statistical models to understand the benefits and limitations of each. **RESULTS:** Many more data are available in aggregated format (N = 23 datasets, 4 studies) relative to comprehensive format (N = 2 datasets, 1 study). The evidence synthesis model had the smallest uncertainty at predicting the probability of mosquitoes dying or surviving and blood-feeding. Generating odds ratios from the correlated Bernoulli random sample indicates that when mortality and blood-feeding are positively correlated, as exhibited in our data, the number of successfully fed mosquitoes will be under-estimated. Analysis of either dataset alone is problematic because aggregated data require an assumption of independence and there are few and variable data in the comprehensive format. **CONCLUSIONS:** We developed an approach to combine sources from trials to maximise the inference that can be made from such data and that is applicable to other systems. Bayesian evidence synthesis enables inference from multiple datasets simultaneously to give a more informative result and highlight conflicts between sources. Advantages and limitations of these models are discussed.

ISSN/ISBN 1932-6203 (Electronic)1932-6203 (Linking)

URL doi.org/10.1371/journal.pone.0263446

edoc-URL <https://edoc.unibas.ch/90515/>

Full Text on edoc Available;

Digital Object Identifier DOI 10.1371/journal.pone.0263446

PubMed ID <http://www.ncbi.nlm.nih.gov/pubmed/35324929>

ISI-Number WOS:000780951300009

Document type (ISI) Journal Article