THE LANCET Infectious Diseases

Supplementary webappendix

This webappendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Guerra FM, Bolotin S, Lim G, et al. The basic reproduction number (R_0) of measles: a systematic review. *Lancet Infect Dis* 2017; published online July 27. http://dx.doi.org/10.1016/S1473-3099(17)30307-9.

Appendix 1: Search strategy

Measles basic reproduction number

Databases:

1. MEDLINE
2. Embase
3. Global Health

Limits:

- Language of publication limit: English
- Date of publication limit: none
- Do not exlude non-research articles (commentaries, letters, erratums, etc.)
- Do not exclude conference abstracts/book chapters/grey literature

Notes:

- Search keywords in all fields (including full text, where possible)

Search strategies:

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1946 to Present

	Searches
1	Measles/
2	Measles virus/
3	Measles Vaccine/
4	Measles-Mumps-Rubella Vaccine/
5	measles.ti,ab,kf.
6	rubeola.ti,ab,kf.
7	morbillivirus.ti,ab,kf.
8	"edmonston virus".ti,ab,kf.
9	or/1-8
10	Basic Reproduction Number/
11	exp Models, Theoretical/
12	Mathematics/
13	exp Stochastic Processes/
14	exp Disease Outbreaks/
15	Epidemiologic Methods/
16	Disease Transmission, Infectious/
17	Endemic Diseases/
18	Public Health Surveillance/
19	Population Surveillance/
20	Sentinel Surveillance/
21	"reproduction number$".ti,ab,kf.
22	"reproductive number$".ti,ab,kf.
23	"reproduction ratio$".ti,ab,kf.

24	"reproductive ratio$".ti,ab,kf.
25	"reproduction rate$".ti,ab,kf.
26	"reproductive rate$".ti,ab,kf.
27	infectivity.ti,ab,kf.
28	infectiousness.ti,ab,kf.
29	transmissibility.ti,ab,kf.
30	contagiousness.ti,ab,kf.
31	"R0".ti,ab,kf.
32	"R(0)".ti,ab,kf.
33	"Ro".ti,ab,kf.
34	"transmission rate$".ti,ab,kf.
35	"infection rate$".ti,ab,kf.
36	"transmission potential".ti,ab,kf.
37	"infection potential".ti,ab,kf.
38	"transmission intensity".ti,ab,kf.
39	"differential transmissibilities".ti,ab,kf.
40	"stuttering chain".ti,ab,kf.
41	"attack rate".ti,ab,kf.
42	model$.ti,ab,kf.
43	math$.ti,ab,kf.
44	stochastic$.ti,ab,kf.
45	dynamics.ti,ab,kf.
46	outbreak$.ti,ab,kf.
47	epidemic$.ti,ab,kf.
48	transmi$.ti,ab,kf.
49	surveillance.ti,ab,kf.
50	or/10-49
51	9 and 50
52	*Measles/tm
53	51 or 52
54	limit 53 to english language
55	limit 54 to yr="2015 -Current"
56	remove duplicates from 55

Embase 1974 to 2016 November 23

Searches	
1	measles/
2	measles virus/
3	measles vaccine/
4	measles rubella vaccine/
5	measles mumps vaccine/
6	measles mumps rubella vaccine/
7	chickenpox measles mumps rubella vaccine/
8	measles.ti,ab,kw.
9	rubeola.ti,ab,kw.
10	morbillivirus.ti,ab,kw.

11	"edmonston virus".ti,ab,kw.
12	or/1-11
13	basic reproduction number/
14	disease model/
15	disease simulation/
16	disease transmission/
17	endemic disease/
18	epidemic/
19	epidemiological data/
20	epidemiology/
21	exp disease surveillance/
22	infection rate/
23	mathematical model/
24	model/
25	nonbiological model/
26	population model/
27	sentinel surveillance/
28	statistical analysis/
29	statistical model/
30	stochastic model/
31	theoretical model/
32	virus transmission/
33	"reproduction number*".ti,ab,kw.
34	"reproductive number*".ti,ab,kw.
35	"reproduction ratio*".ti,ab,kw.
36	"reproductive ratio*".ti,ab,kw.
37	"reproduction rate*".ti,ab,kw.
38	"reproductive rate*".ti,ab,kw.
39	infectivity.ti,ab,kw.
40	infectiousness.ti,ab,kw.
41	transmissibility.ti,ab,kw.
42	contagiousness.ti,ab,kw.
43	"ro".ti,ab,kw.
44	"r0".ti,ab,kw.
45	"r(0)".ti,ab,kw.
46	"transmission rate*".ti,ab,kw.
47	"infection rate*".ti,ab,kw.
48	"transmission potential".ti,ab,kw.
49	"infection potential".ti,ab,kw.
50	"transmission intensity".ti,ab,kw.
51	"differential transmissibilities".ti,ab,kw.
52	"stuttering chain".ti,ab,kw.
53	"attack rate".ti,ab,kw.
54	model*.ti,ab,kw.
55	math*.ti,ab,kw.
56	stochastic.ti,ab,kw.
57	dynamics.ti,ab,kw.
58	outbreak.ti,ab,kw.

59	epidemic*.ti,ab,kw.
60	transmi*.ti,ab,kw.
61	surveillance.ti,ab,kw.
62	or/13-61
63	12 and 62
64	limit 63 to medline
65	63 not 64
66	limit 65 to english language
67	remove duplicates from 66
68	limit 67 to yr="2015 -Current"

Global Health

#	Query	Limiters/Expanders
S57	(S8 AND S54) AND LA English	Limiters - Publication Year: 2015- Search modes - Boolean/Phrase
S56	(S8 AND S54) AND LA English	Search modes - Boolean/Phrase
S55	S8 AND S54	Search modes - Boolean/Phrase
S54	S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53	Search modes - Boolean/Phrase
S53	surveillance	Search modes - Boolean/Phrase
S52	transmi*	Search modes - Boolean/Phrase
S51	epidemic*	Search modes - Boolean/Phrase
S50	stochastic*	Search modes - Boolean/Phrase
S49	math*	Search modes - Boolean/Phrase
S48	model*	Search modes - Boolean/Phrase
S47	TX "attack rate"	Search modes - Boolean/Phrase
S46	TX "stuttering chain"	Search modes - Boolean/Phrase
S45	TX "differential transmissibilities"	Search modes - Boolean/Phrase
S44	TX "transmission intensity"	Search modes -

		Boolean/Phrase
S43	TX "infection potential"	Search modes - Boolean/Phrase
S42	TX "transmission potential"	Search modes - Boolean/Phrase
S41	TX "infection rate*"	Search modes - Boolean/Phrase
S40	TX "transmission rate*"	Search modes - Boolean/Phrase
S39	TX "r(0)"	Search modes - Boolean/Phrase
S38	TX "ro"	Search modes - Boolean/Phrase
S37	TX "r0"	Search modes - Boolean/Phrase
S36	TX contagiousness	Search modes - Boolean/Phrase
S35	TX transmissibility	Search modes - Boolean/Phrase
S34	TX infectiousness	Search modes - Boolean/Phrase
S33	TX infectivity	Search modes - Boolean/Phrase
S32	TX "reproductive rate*"	Search modes - Boolean/Phrase
S31	TX "reproduction rate*"	Search modes - Boolean/Phrase
S30	TX "reproductive ratio*"	Search modes - Boolean/Phrase
S29	TX "reproduction ratio*"	Search modes - Boolean/Phrase
S28	TX "reproductive number*"	Search modes - Boolean/Phrase
S27	TX "reproduction number*"	Search modes - Boolean/Phrase
S26	(ZE "transmission")	Search modes - Boolean/Phrase
S25	(ZE "surveillance")	Search modes - Boolean/Phrase
S24	(ZE "stochastic processes")	Search modes - Boolean/Phrase
S23	(ZE "stochastic models")	Search modes - Boolean/Phrase
S22	(ZE "statistical analysis")	Search modes - Boolean/Phrase
S21	(ZE "simulation")	Search modes - Boolean/Phrase
S20	(ZE "simulation models")	Search modes -

		Boolean/Phrase
S19	(ZE "reproduction")	Search modes - Boolean/Phrase
S18	(ZE "outbreaks")	Search modes - Boolean/Phrase
S17	(ZE "monitoring")	Search modes - Boolean/Phrase
S16	(ZE "models")	Search modes - Boolean/Phrase
S15	(ZE "mathematics")	Search modes - Boolean/Phrase
S14	(ZE "mathematical models")	Search modes - Boolean/Phrase
S13	(ZE "infectivity")	Search modes - Boolean/Phrase
S12	(ZE "estimation")	Search modes - Boolean/Phrase
S11	(ZE "epidemiology")	Search modes - Boolean/Phrase
S10	(ZE "epidemics")	Search modes - Boolean/Phrase
S9	(ZE "disease transmission")	Search modes - Boolean/Phrase
S8	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7	Search modes - Boolean/Phrase
S7	"edmonston virus"	Search modes - Boolean/Phrase
S6	morbillivirus	Search modes - Boolean/Phrase
S5	rubeola	Search modes - Boolean/Phrase
S4	measles	Search modes - Boolean/Phrase
S3	(ZM "measles virus")	Search modes - Boolean/Phrase
S2	(ZE "measles mumps rubella vaccines")	Search modes - Boolean/Phrase
S1	(ZE "measles")	Search modes - Boolean/Phrase

Appendix 2: Adapted Meta Quality Appraisal Tool (MetaQAT) and STROBE for quality appraisal

	Does the study do the following?
Title and abstract	1a. Indicate the study's design with a commonly used term in the title or the abstract.
	1b. Provide in the abstract an informative and balanced summary of what was done and what was found.
Introduction	
Background/Rationale	2. Explain the scientific background and rationale for the investigation being reported.
Objectives	3. State specific objectives, including any pre-specified hypotheses.
Methods	
Study design	4. Present key elements of study design early in the paper (e.g. observational, modeling/simulation).
Setting	5. Describe the:
	Setting
	Locations
	Relevant dates
	Periods of recruitment
	Exposure
	Follow-up
	Data collection
Participants	6a. *Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up. *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls. *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants.
	6b. *Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed. *Case-control study* - For matched studies, give matching criteria and the number of controls per case.
Variables	7. Clearly define all:
	Outcomes
	Exposures
	Predictors

	Potential confounders
	Diagnostic criteria, if applicable
Data sources/ Measurement	8. For each variable of interest (see below), give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group.
	Measles (e.g. laboratory test, case definition, admin data, survey data)
	Country (e.g. place of residence or occurrence)
	Time period (e.g. case report date, rash onset date, outbreak length)
Bias	9. Describe any efforts to address potential sources of bias.
Study size	10. Explain how the study size was arrived at.
Quantitative variables	11. Explain how quantitative and/or categorical (e.g. age groups, time periods) variables were handled in the analyses. If applicable, describe which groupings were chosen and why.
Statistical methods	12a. Describe all statistical methods, including those used to control for confounding, including models.
	12b. Describe any methods used to examine subgroups.
	12c. Explain how missing data were addressed.
	12d. *Cohort study* - If applicable, explain how loss to follow-up was addressed. *Case-control study* - If applicable, explain how matching of cases and controls was addressed. *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy.
	12e. Describe any sensitivity analyses.
Results	
Participants	13a. Report numbers of individuals at each stage of study e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up and analysed.
	13b. Give reasons for non-participation at each stage.
	13c. Consider use of a flow diagram.
Descriptive data	14a. Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders.
	14b. Indicate number of participants with missing data for each variable of interest.

	14c. *Cohort study* - Summarise follow-up time (eg average and total amount).
Outcome data	15. *Cohort study* - Report numbers of outcome events or summary measures over time. *Case-control study* - Report numbers in each exposure category, or summary measures of exposure. *Cross-sectional study* - Report numbers of outcome events or summary measures.
Main results	16a. Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g. 95% confidence interval). Make clear which confounders were adjusted for and why they were included.
	16b. Report category boundaries when continuous variables were categorised.
Other analyses	17. Report other analyses done (e.g. analyses of subgroups).
Discussion	
Key results	18. Summarise key results with reference to study objectives.
Limitations	19. Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.
Interpretation	20. Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.
Generalisability	21. Discuss the generalisability (external validity) of the study results.
Other information	
Funding	22. Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based.
Derived from MetaQAT	23. Were there sources of bias in the following
	a) Study design?
	b) Inclusion/exclusion of participants?
	c) Measurement of exposure, outcome, confounders, predictors?
	d) Data sources?
	e) Analysis?
	24. Are the results conclusive?
	25. Are the results consistent within the study?
	26. Are any discrepancies discussed?

	27. Are the results similar to those in the literature? If not, is this explained?
	28. Was the study approved by an ethics review board?
	Decision (Include/Exclude)
	Rationale

References

1. Rosella L, Bowman C, Pach B, Morgan S, Fitzpatrick T, Goel V. The development and validation of a meta-tool for quality appraisal of public health evidence: Meta Quality Appraisal Tool (MetaQAT). Public Health 2016 Mar 16.

2. Vandenbroucke JP, Von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, Poole C, Schlesselman JJ, Egger M, Strobe Initiative. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. PLoS Med. 2007 Oct 16;4(10):e297.