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The use of supplementary immunisation activities to improve uptake of current and future vaccines in low-income and middle-income countries: a systematic review protocol

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Abstract

Introduction: Immunisation coverage data in low-income and middle-income countries (LMICs) suggests more strategies need to be implemented to achieve and sustain optimal vaccine uptake. Among possible strategies to improve immunisation coverage, are supplementary immunisation activities (SIAs). We are therefore interested in conducting a systematic review to assess whether SIAs complement routine immunisation programmes to improve vaccination coverage and prevent disease outbreaks.

Methods: Our systematic review will focus on studies conducted in LMICs. With the help of an information specialist, we will search for eligible studies in PubMed, Web of Science, Scopus, Africa-Wide, Cochrane Library, WHOLIS, CINAHL, PDQ-Evidence as well as reference lists of relevant publications. Additionally, we will contact relevant organizations such as WHO and GAVI. We will screen search outputs, select studies and extract data in duplicate; resolving discrepancies by discussion and consensus.

Discussion: The findings from this systematic review will be discussed in the context of strengthening routine childhood immunisation services, routine adolescent immunisation services, and introduction of future vaccines against tuberculosis and HIV/AIDS.

Background

Infectious diseases are prevalent in low-income and middle-income countries (LMICs). For example, tuberculosis (TB) is a pandemic of great public health concern. In 2011, the World Health Organization (WHO) estimated that 1.4 million people died worldwide from TB [1]. To control the TB pandemic, stakeholders have proposed multipronged approaches; including development of new and more effective vaccines, novel and better drug regimens, faster and more accurate diagnostic tools as well as strengthening of public health systems. Among these approaches, more effective TB vaccines are likely to have the greatest impact [2]. Research and development of new and better TB vaccines has been accelerated. There were twelve new TB vaccines candidates in human clinical trials in the year 2012 [3, 4]. For the effective TB vaccines to achieve the desired impact, vaccination coverage must be optimal.

Uptake of vaccines delivered through routine immunisation programmes remains variable, and often poor in many LMICs [5, 6], suggesting that routine immunisation services alone are insufficient to achieve optimal immunisation coverage in LMICs. Taking into account that TB burden is highest in LMICs [7], it is likely that future effective TB vaccines will not reach desirable vaccination coverage in these settings if delivered only through the routine immunisation services. Therefore, additional strategies will need to be adopted to improve immunisation coverage, including supplementary immunisation activities (SIAs)[8, 9]

SIAs have been successfully used in different disease conditions, including typhoid , measles [10-12], polio [13], human papillomavirus [14] and cholera [15]. The major reported benefits of SIAs are increased immunisation coverage, reduced disease spread and cost-effectiveness [16]. Abu-Raddad *et al* have used a mathematical model to show a significant additive public health benefit in the reduction of TB incidence by incorporating SIAs to other key interventions of neonatal vaccination and better TB treatment and diagnostic tools [2].

However, the use of SIAs to improve immunisation coverage and prevents disease outbreaks in LMICs relative to routine immunisation services remain controversial [8, 17]. To utilise SIAs successfully in the control of TB with future effective vaccines, it is worthwhile to synthesize the current best evidence on the effectiveness of this strategy. A study conducted in South Africa, a middle-income country with a high burden of TB, showed that TB incidence peaks in adolescence and adolescents are the greatest force of *Mycobacterium tuberculosis* (*M.tb)* infection within a population [18]. This study suggests that a new effective TB vaccine would have the greatest impact in the control of TB when targeted to the adolescent population. We propose to conduct a systematic review to assess whether, at present, there exists evidence that SIAs improve immunisation coverage and reduce disease burden in LMICs.

To the best of our knowledge, the most recent comprehensive systematic review

on SIAs was conducted by Dietz and Cutts in 1997 and involved studies published up to 1992 [16]. Since then, there have been many changes, among them, population increase [19], change in disease epidemiology [20], emergence of anti-vaccine groups [21] as well as expanded healthcare infrastructure. These changes may negatively affect the performance of immunisation services in obtaining optimal vaccination coverage. Furthermore, new vaccines continue to be incorporated to the existing Expanded Programme on Immunisation (EPI) [22, 23], adding more logistical and financial pressure to the routine immunisation services.

In the context of these changes that may affect the vaccination coverage, it is rational to hypothesize that at present, the effects of SIAs in complementing routine immunisation services may be different from those reported in the past by Dietz and Cutts in 1997. In support of this hypothesis, some authors reported that SIAs negatively affect the routine immunisation services [24, 25] whereas some studies, report the opposite: SIAs increase immunisation coverage and reduce disease outbreaks [26-29]. Therefore, an up to date systematic review is critical to provide evidence on the relevance of SIAs in the current health systems environment. This evidence will be useful, particularly for LMICs because these settings are the epicentre of vaccine-preventable diseases and (by definition) have limited resources.

Objectives

1) To determine whether SIAs increase vaccination coverage and reduce disease outbreaks in LMICs
2) To describe the lessons learnt during SIAs and how these may guide the introduction of future vaccines (TB, HIV, malaria) in LMICs.

Methods

Types of studies:

We will consider primary studies with the following designs:

- Intervention studies: individually randomised controlled trials (RCTs), cluster-randomised controlled trials (cRCT), non-randomised control trials, interrupted time series (ITS), and controlled before-and-after studies (CBAs)
- Observational studies: cohort studies, case-control studies, and cross-sectional studies.

Review articles will be excluded.

Study settings

Studies conducted in LMICs as defined by the World Bank GDP ranking in July 2013.

Types of interventions

This study will focus on SIAs, also referred to as mass vaccination campaigns. SIAs are defined as immunisation activities whereby a vaccine is taken simultaneously to many residents of a community within a defined short space of time. We will exclude studies of routine immunisation services, that is, immunisation services rendered (at fixed, outreach or mobile sites) regularly throughout the year. In addition, mass campaigns conducted for other purposes other than immunisation, for example, mass information campaigns to educate communities about general health issues will not be included.

Types of outcome measures

Primary outcomes:

- Vaccination coverage achieved during SIAs
- Disease outbreaks
- Disease incidence

Secondary outcomes:

- Routine immunisation coverage

Search methods for identification of studies

A comprehensive search strategy will be developed, including various terms relating to SIAs and LIMCs, for identification of both published and unpublished articles with no language restriction. We will search academic peer-reviewed journals, grey literature (non-published or non-reviewed papers, reports), and

reference lists of relevant publications. The detailed electronic search strategy is provided in appendix 1 while the summary of the search outputs retrieved from different databases is in appendix 2.

Electronic searches

We will search the following electronic databases for primary studies

- Pubmed
- Web of Science
- Cochrane Central Register of Controlled trials (CENTRAL)
- Scopus
- Africa Wide
- PDQ-Evidence
- WHOLIS
- CINAHL

Data collection and analysis

Selection of studies

Two authors will independently screen the search outputs for potentially eligible studies, compare their results, and resolve disagreements by discussion and consensus. The two authors will then independently go through the full text of all potentially eligible studies to assess whether the studies meet the inclusion criteria defined by the study design, setting, intervention and outcomes.

Discrepancies in the list of eligible studies between the two authors will be resolved through discussion and consensus.

Data extraction

A structured and standardised data collection form has been developed for extracting data from the selected studies. The form will capture key study characteristics, including methods, participants and outcomes (appendix 3). Prior to use, the extraction form will be piloted on at least four included studies identified randomly from the list of included studies.

Assessment of risk of bias in included studies

The quality of studies will be assessed using the Cochrane Collaboration's tool for assessing risk of bias [30] for experimental studies and the SIGN checklist for other study designs [31].

Measures of treatment effect

We will express the result of each study as a risk ratio with its corresponding 95% confidence intervals for dichotomous data, or mean difference with its standard deviation for continuous data. We will conduct meta-analysis for the same type of participants, interventions, study designs, and outcome measures where homogeneity of data allows. Heterogeneity will be assessed using the chi-squared test of homogeneity, and quantified using the I-squared statistic [32, 33].

Dealing with missing data

For the recently (2010 onwards) published literature, if any selected study has incomplete or missing data, we will contact the authors for more information. If the authors provide no additional information, a decision will be taken by at least two authors on the inclusion of the study in the final analyses.

Assessment of heterogeneity

We anticipate substantial variation in study results due to differences in the study design, co-interventions, study settings (low-income versus lower-middle-income versus upper-middle-income countries), and risk of bias. We will examine statistical heterogeneity between study results using the Chi-squared test of homogeneity (with significance defined at the alpha-level of 10%), and quantify any statistical heterogeneity between study results using the I-squared statistic [30].

Assessment of reporting biases

A funnel plot will be used to investigate the risk of publication bias by intervention type, provided 10 or more studies are included in the analysis for each intervention type [34, 35]. The funnel plot will be critically examined for asymmetry.

Sensitivity analysis

We will conduct sensitivity analysis to establish if the meta-analysis results are influenced by: the effect of study designs; publication type (peer-reviewed versus grey literature) the geographical settings (low-income versus lower-middle-income versus upper-middle-income countries); and study period (published before 2000 versus published after 2000).

Discussion

This systematic review will establish whether SIAs improves immunisation coverage, prevent disease outbreaks, and have negative impact on routine immunisation services in LMICs. The review will provide an up-to-date evidence base of the benefits and harms of the use of SIAs in the control of vaccine-preventable disease. Additionally, we will discuss how the findings of this review may be applicable in the context of future vaccines against TB, HIV and malaria.

Contributoship Statement

BMK, CSW, SM and GDH conceived the study.

BMK, SM, LHA and EA wrote the protocol with supervision from CSH and GDH
OAU wrote the statistical analysis plan for the study and provided comments to the manuscript.

GDH sourced the funds for the study.

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Appendix 1: Proposed search strategy and search outputs for PubMed database

	Query	Output
#10	#9 AND #3	2464
#9	#4 OR #5 OR #6 OR #7 OR #8	2310098
#8	developing countries[MeSH Terms]	60129
#7	(Low income country OR lower income country OR third world country OR middle income country)	100285
#6	(Angola OR Republic of Angola OR Albania OR Republic of Albania OR Algeria OR The People's Democratic Republic of Algeria OR American Samoa OR Argentina OR Azerbaijan OR Belarus OR Belize OR Bosnia and Herzegovina OR Bosnia-Herzegovina OR Bosnia OR Botswana OR Brazil OR Federative Republic of Brazil OR Bulgaria OR China OR People's Republic of China OR Colombia OR Costa Rica OR Fiji OR Gabon OR Gabonese Republic OR Grenada OR Hungary OR Islamic Republic of Iran OR Persia OR Iran OR Iraq OR Jamaica OR Jordan OR Hashemite Kingdom of Jordan OR Kazakhstan OR Lebanon OR Lebanese Republic OR Libya OR State of Libya OR Macedonia OR Republic of Macedonia OR Malaysia OR Maldives OR Republic of the Maldives OR Maldive Islands OR Marshall Islands OR Republic of the Marshall Islands OR Palau OR Republic of Palau OR Panama OR Republic of Panama OR Peru OR Romania OR Serbia, OR the Republic of Serbia OR Seychelles OR the Republic of Seychelles OR South Africa OR Saint Lucia OR Saint Vincent and the Grenadines OR Suriname OR Thailand OR Kingdom of Thailand OR Tonga OR Kingdom of Tonga OR Tunisia OR Turkey OR Turkmenistan OR Turkmenia OR Cuba OR Dominica OR Commonwealth of Dominica OR The Dominican Republic OR Ecuador OR Mauritius OR Mexico OR United Mexican States OR Montenegro OR Namibia OR Tuvalu OR Ellice Islands OR Venezuela OR the Bolivarian Republic of Venezuela)	1488488
#5	(Armenia OR armenia OR Bhutan OR Kingdom of Bhutan OR Bolivia OR Plurinational State of Bolivia	589800

	OR Cameroon OR Republic of Cameroon OR Republic of Cameroun OR Cape Verde OR Republic of Cape Verde OR Cote D'ivoire OR Ivory Coast OR Republic of Cote D'ivoire OR Djibouti OR Republic of Djibouti OR Arab Republic of Egypt OR Egypt OR El Salvador OR Georgia OR Ghana OR Republic of Ghana OR Guatemala OR Republic of Guatemala OR Guyana OR Co-operative Republic of Guyana OR Honduras OR Republic of Honduras OR Spanish Honduras OR Republic of Indonesia OR Indonesia OR India OR Republic of India OR Kiribati OR Republic of Kiribati OR Kosovo OR Kosovo and Metohija OR Laos OR Lao Lao People's Democratic Republic OR Lesotho OR Kingdom of Lesotho OR Mauritania OR Islamic Republic of Mauritania OR Micronesia, Fed. Sts. OR Federated States of Micronesia OR FSM OR Moldova OR Republic of Moldova OR Mongolia OR Morocco OR Kingdom of Morocco OR Nicaragua OR Republic of Nicaragua OR Nigeria OR Federal Republic of Nigeria OR Pakistan OR Islamic Republic of Pakistan OR Papua New Guinea OR Independent State of Papua New Guinea OR Paraguay OR Republic of Paraguay OR Philippines OR Republic of the Philippines OR Samoa OR Independent State of Samoa OR Sao Tome and Principe OR Democratic Republic of Sao Tome and Principe OR Senegal OR Republic of Senegal OR Solomon Islands OR Sri Lanka OR Democratic Socialist Republic of Sri Lanka OR Sudan OR Republic of the Sudan OR North Sudan OR Swaziland OR Kingdom of Swaziland OR Ngwane OR Yuwatini OR Syrian Arab Republic OR Syria OR East Timor OR Timor-leste OR Democratic Republic of Timor-leste OR Ukraine OR Uzbekistan OR Republic of Uzbekistan OR Vanuatu OR Republic of Vanuatu OR Vietnam OR the Socialist Republic of Vietnam OR West bank and Gaza OR Yemen OR Yemeni Republic OR Zambia OR Republic of Zambia.)	
#4	(Afghanistan OR Islamic Republic of Afghanistan OR Bangladesh OR People's Republic of Bangladesh OR Benin OR Dahomey OR Republic of Benin OR Burkina Faso OR Burkina OR Republic of Upper Volta OR Burundi OR Republic of Burundi OR Cambodia OR Kingdom of	277397

	Cambodia OR Central African Republic OR Chad OR Republic of Chad OR Comoros OR Union of the Comoros OR Democratic Republic of the Congo OR DR Congo OR Congo-Kinshasa OR DRC OR Zaire OR Eritrea OR State of Eritrea OR Ethiopia OR Federal Democratic Republic of Ethiopia OR The Gambia OR Republic of the Gambia OR Guinea OR Republic of Guinea OR Guinea-Conakry OR Guinea-Bissau OR Republic of Guinea-Bissau OR Haiti OR Republic of Haiti OR Kenya OR Republic of Kenya OR North Korea OR Democratic People's Republic of Korea OR Kyrgyz Republic OR Kyrgyzstan OR Liberia OR Republic of Liberia OR Madagascar OR Republic of Madagascar OR Malawi OR Republic of Malawi OR The Warm Heart of Africa OR Mali OR Republic of Mali OR Mozambique OR Republic of Mozambique OR Myanmar OR Burma OR Republic of the Union of Myanmar OR Nepal OR Democratic Republic of Nepal OR Niger OR Republic of Niger OR Rwanda OR Republic of Rwanda OR Sierra Leone OR Republic of Sierra Leone OR Somalia OR Federal Republic of Somalia OR South Sudan OR Republic of South Sudan OR Tajikistan OR Republic of Tajikistan OR Tanzania OR United Republic of Tanzania OR Republic of Tanganyika and Zanzibar OR Togo OR Togolese Republic OR Uganda OR Republic of Uganda OR Zimbabwe OR Republic of Zimbabwe OR Rhodesia)	
#3	#1 OR #2	7923
#2	(Mass immunization OR mass immunisation OR supplemental immunization OR supplemental immunisation OR supplementary immunization OR supplementary immunisation)	7923
#1	"mass vaccination"[MeSH Terms]	1823

Appendix 2: Summary of the search outputs retrieved from different databases using the proposed search strategy

Name of the database	Number of search outputs retrieved	Status of the search process
Pubmed	2464	Completed
Web of Science	274	Completed
Cochrane Central Register of Controlled trials (CENTRAL)	140	Completed
Scopus	2914	Completed
Africa Wide	1042	Completed
PDQ-Evidence	157	Completed
WHOLIS	14	Completed
CINAHL	94	Completed

Appendix 3: Proposed data extraction form

1) Details of person extracting the data

	Description	Comments
Name of researcher completing the form		
Date when form completed (dd/mm/yyyy)		

2) General information

Description of the study	Enter as appearing in the publication	Reference page/table or figure in the study
Study ID based on surname of first author and year (e.g *Hussey 2001*)		
Study reference		
Correspondence author and the contact details:		
Publication type	☐Full text ☐ Abstract ☐Governmental or ☐Book chapter non-governmental reports ☐Other (specify)	
Source of funding and cost of SIA per participant		
References of potentially eligible studies from the reference list		

Notes/Comments	

3) Study eligibility assessment

Characteristics	Tick or describe as appropriate	Reference page/table or figure in article
Primary study	☐Yes (Primary) ☐ No	
Type of study design		
Unit of allocation to the intervention **(*if applicable*)**	☐Individual ☐Household ☐Cluster ☐Other (Specify)	
Informed consent obtained for study (*if applicable*)	☐Yes ☐No ☐Unclear	
Ethical approval obtained for study (*if applicable*)	☐Yes ☐No ☐Unclear	
SIAs conducted in LMIC	☐Yes ☐No	
If yes, category of country or countries	☐Low-income country ☐Lower middle-income country ☐Upper middle-income country	
Name of the country		

Study describes SIAs	☐ Yes ☐ No	
Name of vaccine used in the SIAs		
Disease targeted by the SIAs		
Outcome measures	☐ Yes Vaccination coverage attained by the SIAs ☐ Yes Disease outbreaks ☐ Yes Disease incidence ☐ Yes Routine immunization coverage after SIAs) ☐Other (specify): ☐No	
Final decision on study eligibility	☐ Yes (Include) ☐ No (Exclude)	
Reason(s) for exclusion		

NB: Do not proceed to the next step if the study is excluded from the review

4) Study aims and methods

	Describe as stated in report/paper/book chapter	**Reference page/table or figure in the study**
Aim(s)		

Methods to estimate target population for SIAs		
Methods to estimate SIAs coverage		
Period between SIAs and coverage survey (if applicable)		
SIAs start date		
SIAs end date **(*NB: If SIAs were conducted in more than one phase, duplicate the two rows as appropriate*).**		
Total duration of the SIAs (in days) **(*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).**		
Means of communicating the information about the SIAs to the target population (phase 1) **(*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).**	☐Healthcare facility ☐Door to door ☐Word of mouth ☐Mass media (radio, TV etc) ☐Digital media (text message, emails etc) ☐Other (specify):	

Potential interference of SIA with routine immunization services investigated	☐Yes (explain): ☐No	
Personnel performing the vaccinations during the SIAs	☐Doctors ☐Nurses ☐Volunteers ☐Other (specify)	
Number of personnel performing the vaccinations during the SIAs (if provided)		
Notes:		

5) Participants

Characteristics	**Description**	**Reference page/table or figure in the study**
SIA setting	☐ Rural community ☐ Urban ☐ Displaced ☐ Other (specify)	
Socio-economic status of the target population relative to the general population	☐ Low (L) ☐ Average (A) ☐ Above average (AA) ☐ All (L, A &AA) ☐ Not clear	

Methods used to classify the socio-economic status of the SIAs target population		
Total number of participants enrolled for the SIAs		
Age		
Gender	☐Female ☐Male ☐Both	
Notes (provide any other relevant information on the participants):		

6) Outcome measures

Details of the outcome	**Characteristics of the outcomes**					**Reference page/table or figure in the study**
		F	**M**	**Total**	**Age**	
Participants vaccinated during the SIAs period (***NB: If SIAs were conducted in more than one phase, duplicate as appropriate***).	Targeted					
	Vaccinated					
	Coverage attained					
Routine immunization	Before:					

coverage before and after SIAs (*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).	After:	
Incidence of target disease before and after SIAs (*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).	Before:	
	After:	
Percentage reduction or increase in the routine immunization coverage (NB: specify increase or decrease)		
Notes:		

7) Risk of bias assessment

Type of bias	**Tick appropriately and describe below after the tick.**	**Reference page/table or figure in the study**
Is there selection bias? (Assess	☐Yes ☐No ☐Unclear	

comparability of groups at baseline, confounding and adjustment. For RCTs assess sequence generation and allocation concealment).		
Is there performance bias? (Assess fidelity of the interventions, and quality of the information regarding who received which interventions, including blinding of study subjects and healthcare providers)	☐Yes ☐No ☐Unclear	
Is there detection bias? (Assess whether there was biased and correct appraisal of outcomes, including blinding of assessors)	☐Yes ☐No ☐Unclear	
Is there attrition bias? (Assess the completeness of sample, follow-up and outcome data, reasons for loss to follow up explained)	☐Yes ☐No ☐Unclear	
Is there reporting bias (Assess selective reporting of results)	☐Yes ☐No ☐Unclear	
Other biases (specify)	☐Yes ☐No ☐Unclear	

8) Other relevant information

	Descriptions/figures as stated in report/paper/book chapter	**Reference page/table or figure in the study**
Key conclusions from the authors		

Notes		

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The use of supplementary immunisation activities to improve uptake of current and future vaccines in low-income and middle-income countries: a systematic review protocol

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Competing interests: None declared

Abstract

Introduction: Immunisation coverage data in low-income and middle-income countries (LMICs) suggests more strategies need to be implemented to achieve and sustain optimal vaccine uptake. Among possible strategies to improve immunisation coverage, are supplementary immunisation activities (SIAs). We are therefore interested in conducting a systematic review to assess whether SIAs complement routine immunisation programmes to improve vaccination coverage and prevent disease outbreaks.

Methods: Our systematic review will focus on studies conducted in LMICs. With the help of an information specialist, we will search for eligible studies in PubMed, Web of Science, Scopus, Africa-Wide, Cochrane Library, WHOLIS, CINAHL, PDQ-Evidence as well as reference lists of relevant publications. Additionally, we will contact relevant organizations such as WHO and GAVI. Two authors will independently extract data from eligible studies and independently assess risk of bias by assessing the adequacy of study characteristics. The primary meta-analysis will use random effects models due to expected inter-studies heterogeneity. Dichotomous data will be analysed using relative risk and continuous data using weighted mean differences (or standardised mean differences), both with 95% confidence intervals.

Discussion: The findings from this systematic review will be discussed in the context of strengthening routine childhood immunisation services, routine adolescent immunisation services, and introduction of future vaccines against tuberculosis and HIV/AIDS.

Study strengths: unbiased selection of many studies conducted in different settings. This will strengthen the validity of the review results.

Study limitations: heterogeneity of the study settings of the low-income, lower-middle income and upper-middle income countries as well as heterogeneity in study designs.

Background

Infectious diseases are prevalent in low-income and middle-income countries (LMICs). For example, tuberculosis (TB) is a pandemic of great public health concern. In 2011, the World Health Organization (WHO) estimated that 1.4 million people died worldwide from TB [1]. To control the TB pandemic, stakeholders have proposed multipronged approaches; including development of new and more effective vaccines, novel and better drug regimens, faster and more accurate diagnostic tools as well as strengthening of public health systems. Among these approaches, more effective TB vaccines are likely to have the greatest impact [2]. Research and development of new and better TB vaccines has been accelerated. There were twelve new TB vaccines candidates in human clinical trials in the year 2012 [3, 4]. For the effective TB vaccines to achieve the desired impact, vaccination coverage must be optimal.

Uptake of vaccines delivered through routine immunisation programmes remains variable, and often poor in many LMICs [5, 6], suggesting that routine immunisation services alone are insufficient to achieve optimal immunisation coverage in LMICs. Taking into account that TB burden is highest in LMICs [7], it is likely that future effective TB vaccines will not reach desirable vaccination coverage in these settings if delivered only through the routine immunisation services. Therefore, additional strategies will need to be adopted to improve immunisation coverage, including supplementary immunisation activities (SIAs)[8, 9]

SIAs have been successfully used in different disease conditions, including typhoid , measles [10-12], polio [13], human papillomavirus [14] and cholera [15]. The major reported benefits of SIAs are increased immunisation coverage, reduced disease spread and cost-effectiveness [16]. Abu-Raddad *et al* have used a mathematical model to show a significant additive public health benefit in the reduction of TB incidence by incorporating SIAs to other key interventions of neonatal vaccination and better TB treatment and diagnostic tools [2].

However, the use of SIAs to improve immunisation coverage and prevents disease outbreaks in LMICs relative to routine immunisation services remain controversial [8, 17]. To utilise SIAs successfully in the control of TB with future effective vaccines, it is worthwhile to synthesize the current best evidence on the effectiveness of this strategy. A study conducted in South Africa, a middle-income country with a high burden of TB, showed that TB incidence peaks in adolescence and adolescents are the greatest force of *Mycobacterium tuberculosis* (*M.tb)* infection within a population [18]. This study suggests that a new effective TB vaccine would have the greatest impact in the control of TB when targeted to the adolescent population. We propose to conduct a systematic review to assess whether, at present, there exists evidence that SIAs improve immunisation coverage and reduce disease burden in LMICs.

To the best of our knowledge, the most recent comprehensive systematic review

on SIAs was conducted by Dietz and Cutts in 1997 and involved studies published up to 1992 [16]. Since then, there have been many changes, among them, population increase [19], change in disease epidemiology [20], emergence of anti-vaccine groups [21] as well as expanded healthcare infrastructure. These changes may negatively affect the performance of immunisation services in obtaining optimal vaccination coverage. Furthermore, new vaccines continue to be incorporated to the existing Expanded Programme on Immunisation (EPI) [22, 23], adding more logistical and financial pressure to the routine immunisation services.

In the context of these changes that may affect the vaccination coverage, it is rational to hypothesize that at present, the effects of SIAs in complementing routine immunisation services may be different from those reported in the past by Dietz and Cutts in 1997. In support of this hypothesis, some authors reported that SIAs negatively affect the routine immunisation services [24, 25] whereas some studies, report the opposite: SIAs increase immunisation coverage and reduce disease outbreaks [26-29]. Therefore, an up to date systematic review is critical to provide evidence on the relevance of SIAs in the current health systems environment. This evidence will be useful, particularly for LMICs because these settings are the epicentre of vaccine-preventable diseases and (by definition) have limited resources.

Objectives

1) To determine whether SIAs increase vaccination coverage and reduce disease outbreaks in LMICs
2) To describe the lessons learnt during SIAs and how these may guide the introduction of future vaccines (TB, HIV, malaria) in LMICs.

Methods

Types of studies:

We will consider primary studies with the following designs:

- Intervention studies: individually randomised controlled trials (RCTs), cluster-randomised controlled trials (cRCT), non-randomised control trials, interrupted time series (ITS), and controlled before-and-after studies (CBAs)
- Observational studies: cohort studies, case-control studies, and cross-sectional studies.

Review articles will be excluded.

Study settings

Studies conducted in LMICs as defined by the World Bank GDP ranking in July 2013.

Types of interventions

This study will focus on SIAs, also referred to as mass vaccination campaigns. SIAs are defined as immunisation activities whereby a vaccine is taken simultaneously to many residents of a community within a defined short space of time. We will exclude studies of routine immunisation services, that is, immunisation services rendered (at fixed, outreach or mobile sites) regularly throughout the year. In addition, mass campaigns conducted for other purposes other than immunisation, for example, mass information campaigns to educate communities about general health issues will not be included.

Types of outcome measures

Primary outcomes:

- Vaccination coverage achieved during SIAs
- Disease outbreaks
- Disease incidence

Secondary outcomes:

- Immunisation coverage

Search methods for identification of studies

A comprehensive search strategy will be developed, including various terms relating to SIAs and LIMCs, for identification of both published and unpublished articles with no language restriction. We will search academic peer-reviewed journals, grey literature (non-published or non-reviewed papers, reports), and

reference lists of relevant publications. The detailed electronic search strategy is provided in appendix 1 while the summary of the search outputs retrieved from different databases is in appendix 2.

Electronic searches

We will search the following electronic databases for primary studies: Pubmed, Web of Science, Cochrane Central Register of Controlled trials (CENTRAL), Scopus, Africa Wide, PDQ-Evidence, WHOLIS and CINAHL.

Data collection and analysis

Selection of studies

Two authors will independently screen the search outputs for potentially eligible studies, compare their results, and resolve disagreements by discussion and consensus. The two authors will then independently go through the full text of all potentially eligible studies to assess whether the studies meet the inclusion criteria defined by the study design, setting, intervention and outcomes. Discrepancies in the list of eligible studies between the two authors will be resolved through discussion and consensus.

Data extraction

A structured and standardised data collection form has been developed for extracting data from the selected studies. The form will capture key study characteristics, including methods, participants and outcomes (appendix 3). Prior

to use, the extraction form will be piloted on at least four included studies identified randomly from the list of included studies.

Assessment of risk of bias in included studies

The quality of studies will be assessed using the Cochrane Collaboration's tool for assessing risk of bias [30] for experimental studies and the Scottish Intercollegiate Guidelines Network (SIGN) checklist for other study designs [31].

Measures of treatment effect

We will express the result of each study as a risk ratio with its corresponding 95% confidence intervals for dichotomous data, or mean difference with its standard deviation for continuous data. We will conduct meta-analysis for the same type of participants, interventions, study designs, and outcome measures where homogeneity of data allows. Heterogeneity will be assessed using the chi-squared test of homogeneity, and quantified using the I-squared statistic [32, 33].

Dealing with missing data

The data will be analysed on an intention-to-treat basis as far as possible and attempts will be made to obtain missing data from the original corresponding author. Where missing data is unobtainable, imputation of individual values will be undertaken for the primary outcomes only. For other outcomes, only the available data will be analysed. Any imputation undertaken will be subjected to sensitivity analysis. If studies report sufficient detail to calculate mean differences

but no information on associated standard deviation (SD), the outcome will be assumed to have standard deviation equal to the highest SD from other studies within the same analysis.

Data synthesis

All eligible studies will be summarised and analysed using Stata version 12 for Windows. Two authors will extract the data, the first author will enter all data and second author recheck all entries. Disagreements will be resolved by discussion. If the studies are sufficiently similar, we will combine the data using random-effects model due to anticipated heterogeneity that may result from the difference in methodology and study settings. Where the rating scales used in the studies have a reasonably large number of categories (more than 10) the data will be treated as continuous variables arising from a normal distribution. We will use weighted mean difference (WMD) when the pooled studies use the same rating scale or test, and the standardised mean difference (SMD), the absolute mean difference divided by the standard deviation when the studies use different rating scales or tests. When the rating scales used are fewer than 10 and more than two, we will concatenate the data into two categories that best represent the contrasting states of interest, and treat the outcome measure as binary. Study results for dichotomous data will be expressed as relative risk (RR) and 95% confidence interval (CI). Time-to-event outcomes or generic inverse variance outcomes, such as survival time and time to cure will be expressed as the log hazards ratio and 95% CI.

When studies cannot be combined for meta-analysis due to diversity of interventions, narrative syntheses will be conducted and results of individual studies will be displayed graphically to enable more succinct summary of evidence.

Unit of analysis

All cluster randomised trials that meet the inclusion criteria will be included in the meta-analysis after adjusting for design effect using variation inflation method [34, 35]: design effect = 1 + (M - 1)ICC, where M is the average cluster size and ICC is the intra-cluster correlation coefficient. If the authors did not report the ICC, we will use ICC from a similar published trial. For estimated values of ICC, we will conduct sensitivity analyses using larger and smaller ICCs to determine if the results are robust.

Assessment of heterogeneity

We anticipate substantial variation in study results due to differences in the study design, co-interventions, study settings (low-income versus lower-middle-income versus upper-middle-income countries), and risk of bias. We will examine statistical heterogeneity between study results using the Chi-squared test of homogeneity (with significance defined at the alpha-level of 10%), and quantify any statistical heterogeneity between study results using the I-squared statistic [30].

Assessment of reporting biases

A funnel plot will be used to investigate the risk of publication bias by intervention type, provided 10 or more studies are included in the analysis for each intervention type [36, 37]. The funnel plot will be critically examined for asymmetry.

Sensitivity analysis

We will conduct sensitivity analysis to establish if the meta-analysis results are influenced by: the effect of study designs; publication type (peer-reviewed versus grey literature) the geographical settings (low-income versus lower-middle-income versus upper-middle-income countries); and study period (published before 2000 versus published after 2000).

Discussion

This systematic review will establish whether SIAs improves immunisation coverage, prevent disease outbreaks, and have negative impact on routine immunisation services in LMICs. The review will provide an up-to-date evidence base of the benefits and harms of the use of SIAs in the control of vaccine-preventable disease. Additionally, we will discuss how the findings of this review may be applicable in the context of future vaccines against TB, HIV and malaria.

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Contributorship Statement: BMK, CSW, SM and GDH conceived the study.

BMK, SM, LHA and EA wrote the protocol with supervision from CSH and GDH

OAU wrote the statistical analysis plan for the study and provided comments to the manuscript.

GDH sourced the funds for the study.

Competing Interests: None

Data Sharing Statement: We the authors, declare that this research protocol is original work. Results from the study completed using this protocol will be published in a peer reviewed journal

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Methods: Our systematic review will focus on studies conducted in LMICs. With the help of an information specialist, we will search for eligible studies in PubMed, Web of Science, Scopus, Africa-Wide, Cochrane Library, WHOLIS, CINAHL, PDQ-Evidence as well as reference lists of relevant publications. Additionally, we will contact relevant organizations such as WHO and GAVI. Two authors will independently extract data from eligible studies and independently assess risk of bias by assessing the adequacy of study characteristics. The primary meta-analysis will use random effects models due to expected inter-studies heterogeneity. Dichotomous data will be analysed using relative risk and continuous data using weighted mean differences (or standardised mean differences), both with 95% confidence intervals.

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Background

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Unit of analysis

All cluster randomised trials that meet the inclusion criteria will be included in the meta-analysis after adjusting for design effect using variation inflation method [34, 35]: design effect = 1 + (M - 1)ICC, where M is the average cluster size and ICC is the intra-cluster correlation coefficient. If the authors did not report the ICC, we will use ICC from a similar published trial. For estimated values of ICC, we will conduct sensitivity analyses using larger and smaller ICCs to determine if the results are robust.

Assessment of heterogeneity

We anticipate substantial variation in study results due to differences in the study design, co-interventions, study settings (low-income versus lower-middle-income versus upper-middle-income countries), and risk of bias. We will examine statistical heterogeneity between study results using the Chi-squared test of homogeneity (with significance defined at the alpha-level of 10%), and quantify any statistical heterogeneity between study results using the I-squared statistic [30].

Assessment of reporting biases

A funnel plot will be used to investigate the risk of publication bias by intervention type, provided 10 or more studies are included in the analysis for each intervention type [36, 37]. The funnel plot will be critically examined for asymmetry.

Sensitivity analysis

We will conduct sensitivity analysis to establish if the meta-analysis results are influenced by: the effect of study designs; publication type (peer-reviewed versus grey literature) the geographical settings (low-income versus lower-middle-income versus upper-middle-income countries); and study period (published before 2000 versus published after 2000).

Discussion

This systematic review will establish whether SIAs improves immunisation coverage, prevent disease outbreaks, and have negative impact on routine immunisation services in LMICs. The review will provide an up-to-date evidence base of the benefits and harms of the use of SIAs in the control of vaccine-preventable disease. Additionally, we will discuss how the findings of this review may be applicable in the context of future vaccines against TB, HIV and malaria.

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Appendix 1: Proposed search strategy and search outputs for PubMed database

	Query	Output
#10	#9 AND #3	3578
#9	#4 OR #5 OR #6 OR #7 OR #8	2374619
#8	developing countries[MeSH Terms]	60628
#7	(Low income country OR lower income country OR third world country OR middle income country)	101967
#6	(Angola OR Republic of Angola OR Albania OR Republic of Albania OR Algeria OR The People's Democratic Republic of Algeria OR American Samoa OR Argentina OR Azerbaijan OR Belarus OR Belize OR Bosnia and Herzegovina OR Bosnia-Herzegovina OR Bosnia OR Botswana OR Brazil OR Federative Republic of Brazil OR Bulgaria OR China OR People's Republic of China OR Colombia OR Costa Rica OR Fiji OR Gabon OR Gabonese Republic OR Grenada OR Hungary OR Islamic Republic of Iran OR Persia OR Iran OR Iraq OR Jamaica OR Jordan OR Hashemite Kingdom of Jordan OR Kazakhstan OR Lebanon OR Lebanese Republic OR Libya OR State of Libya OR Macedonia OR Republic of Macedonia OR Malaysia OR Maldives OR Republic of the Maldives OR Maldive Islands OR Marshall Islands OR Republic of the Marshall Islands OR Palau OR Republic of Palau OR Panama OR Republic of Panama OR Peru OR Romania OR Serbia, OR the Republic of Serbia OR Seychelles OR the Republic of Seychelles OR South Africa OR Saint Lucia OR Saint Vincent and the Grenadines OR Suriname OR Thailand OR Kingdom of Thailand OR Tonga OR Kingdom of Tonga OR Tunisia OR Turkey OR Turkmenistan OR Turkmenia OR Cuba OR Dominica OR Commonwealth of Dominica OR The Dominican Republic OR Ecuador OR Mauritius OR Mexico OR United Mexican States OR Montenegro OR Namibia OR Tuvalu OR Ellice Islands OR Venezuela OR the Bolivarian Republic of Venezuela)	1548458
#5	(Armenia OR armenia OR Bhutan OR Kingdom of Bhutan OR Bolivia OR Plurinational State of Bolivia	588621

	OR Cameroon OR Republic of Cameroon OR Republic of Cameroun OR Cape Verde OR Republic of Cape Verde OR Cote D'ivoire OR Ivory Coast OR Republic of Cote D'ivoire OR Djibouti OR Republic of Djibouti OR Arab Republic of Egypt OR Egypt OR El Salvador OR Georgia OR Ghana OR Republic of Ghana OR Guatemala OR Republic of Guatemala OR Guyana OR Co-operative Republic of Guyana OR Honduras OR Republic of Honduras OR Spanish Honduras OR Republic of Indonesia OR Indonesia OR India OR Republic of India OR Kiribati OR Republic of Kiribati OR Kosovo OR Kosovo and Metohija OR Laos OR Lao Lao People's Democratic Republic OR Lesotho OR Kingdom of Lesotho OR Mauritania OR Islamic Republic of Mauritania OR Micronesia, Fed. Sts. OR Federated States of Micronesia OR FSM OR Moldova OR Republic of Moldova OR Mongolia OR Morocco OR Kingdom of Morocco OR Nicaragua OR Republic of Nicaragua OR Nigeria OR Federal Republic of Nigeria OR Pakistan OR Islamic Republic of Pakistan OR Papua New Guinea OR Independent State of Papua New Guinea OR Paraguay OR Republic of Paraguay OR Philippines OR Republic of the Philippines OR Samoa OR Independent State of Samoa OR Sao Tome and Principe OR Democratic Republic of Sao Tome and Principe OR Senegal OR Republic of Senegal OR Solomon Islands OR Sri Lanka OR Democratic Socialist Republic of Sri Lanka OR Sudan OR Republic of the Sudan OR North Sudan OR Swaziland OR Kingdom of Swaziland OR Ngwane OR Yuwatini OR Syrian Arab Republic OR Syria OR East Timor OR Timor-leste OR Democratic Republic of Timor-leste OR Ukraine OR Uzbekistan OR Republic of Uzbekistan OR Vanuatu OR Republic of Vanuatu OR Vietnam OR the Socialist Republic of Vietnam OR West bank and Gaza OR Yemen OR Yemeni Republic OR Zambia OR Republic of Zambia)	
#4	(Afghanistan OR Islamic Republic of Afghanistan OR Bangladesh OR People's Republic of Bangladesh OR Benin OR Dahomey OR Republic of Benin OR Burkina Faso OR Burkina OR Republic of Upper Volta OR Burundi OR Republic of Burundi OR Cambodia OR Kingdom of	281200

	Cambodia OR Central African Republic OR Chad OR Republic of Chad OR Comoros OR Union of the Comoros OR Democratic Republic of the Congo OR DR Congo OR Congo-Kinshasa OR DRC OR Zaire OR Eritrea OR State of Eritrea OR Ethiopia OR Federal Democratic Republic of Ethiopia OR The Gambia OR Republic of the Gambia OR Guinea OR Republic of Guinea OR Guinea-Conakry OR Guinea-Bissau OR Republic of Guinea-Bissau OR Haiti OR Republic of Haiti OR Kenya OR Republic of Kenya OR North Korea OR Democratic People's Republic of Korea OR Kyrgyz Republic OR Kyrgyzstan OR Liberia OR Republic of Liberia OR Madagascar OR Republic of Madagascar OR Malawi OR Republic of Malawi OR The Warm Heart of Africa OR Mali OR Republic of Mali OR Mozambique OR Republic of Mozambique OR Myanmar OR Burma OR Republic of the Union of Myanmar OR Nepal OR Democratic Republic of Nepal OR Niger OR Republic of Niger OR Rwanda OR Republic of Rwanda OR Sierra Leone OR Republic of Sierra Leone OR Somalia OR Federal Republic of Somalia OR South Sudan OR Republic of South Sudan OR Tajikistan OR Republic of Tajikistan OR Tanzania OR United Republic of Tanzania OR Republic of Tanganyika and Zanzibar OR Togo OR Togolese Republic OR Uganda OR Republic of Uganda OR Zimbabwe OR Republic of Zimbabwe OR Rhodesia)	
#3	#1 OR #2	10894
#2	(Mass immunization OR mass immunisation OR supplemental immunization OR supplemental immunisation OR supplementary immunization OR supplementary immunisation OR mass campaigns OR immunisation campaigns OR vaccination campaigns OR immunization campaigns)	10894
#1	"mass vaccination"[MeSH Terms]	1913

Appendix 2: Summary of the search outputs retrieved from different databases using the proposed search strategy

Name of the database	Number of search outputs retrieved	Status of the search process
Pubmed	3578	Completed
Web of Science	1746	Completed
Cochrane Central Register of Controlled trials (CENTRAL)	281	Completed
Scopus	2914	Completed
Africa Wide	1042	Completed
PDQ-Evidence	157	Completed
WHOLIS	14	Completed
CINAHL	194	Completed

Appendix 3: Proposed data extraction form

1) Details of person extracting the data

	Description	Comments
Name of researcher completing the form		
Date when form completed (dd/mm/yyyy)		

2) General information

Description of the study	**Enter as appearing in the publication**	**Reference page/table or figure in the study**
Study ID based on surname of first author and year (e.g *Hussey 2001*)		
Study reference		
Correspondence author and the contact details:		
Publication type	☐Full text ☐ Abstract ☐Governmental or ☐Book chapter non-governmental reports ☐Other (specify)	
Source of funding and cost of SIA per participant		
References of potentially eligible studies from the reference list		

Notes/Comments	

3) Study eligibility assessment

Characteristics	Tick or describe as appropriate	Reference page/table or figure in article
Primary study	☐Yes (Primary) ☐ No	
Type of study design		
Unit of allocation to the intervention **(*if applicable*)**	☐Individual ☐Household ☐Cluster ☐Other (Specify)	
Informed consent obtained for study (*if applicable*)	☐Yes ☐No ☐Unclear	
Ethical approval obtained for study (*if applicable*)	☐Yes ☐No ☐Unclear	
SIAs conducted in LMIC	☐Yes ☐No	
If yes, category of country or countries	☐Low-income country ☐Lower middle-income country ☐Upper middle-income country	
Name of the country		

Study describes SIAs	☐ Yes ☐ No	
Name of vaccine used in the SIAs		
Disease targeted by the SIAs		
Outcome measures	☐ Yes Vaccination coverage attained by the SIAs ☐ Yes Disease outbreaks ☐ Yes Disease incidence ☐ Yes Routine immunization coverage after SIAs) ☐Other (specify): ☐No	
Final decision on study eligibility	☐ Yes (Include) ☐ No (Exclude)	
Reason(s) for exclusion		

NB: Do not proceed to the next step if the study is excluded from the review

4) Study aims and methods

	Describe as stated in report/paper/book chapter	**Reference page/table or figure in the study**
Aim(s)		

Methods to estimate target population for SIAs		
Methods to estimate SIAs coverage		
Period between SIAs and coverage survey (if applicable)		
SIAs start date		
SIAs end date **(*NB: If SIAs were conducted in more than one phase, duplicate the two rows as appropriate*).**		
Total duration of the SIAs (in days) **(*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).**		
Means of communicating the information about the SIAs to the target population (phase 1) **(*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).**	☐Healthcare facility ☐Door to door ☐Word of mouth ☐Mass media (radio, TV etc) ☐Digital media (text message, emails etc) ☐Other (specify):	

Potential interference of SIA with routine immunization services investigated	☐Yes (explain): ☐No	
Personnel performing the vaccinations during the SIAs	☐Doctors ☐Nurses ☐Volunteers ☐Other (specify)	
Number of personnel performing the vaccinations during the SIAs (if provided)		
Notes:		

5) Participants

Characteristics	**Description**	**Reference page/table or figure in the study**
SIA setting	☐ Rural community ☐ Urban ☐ Displaced ☐ Other (specify)	
Socio-economic status of the target population relative to the general population	☐ Low (L) ☐ Average (A) ☐ Above average (AA) ☐ All (L, A &AA) ☐ Not clear	

Methods used to classify the socio-economic status of the SIAs target population		
Total number of participants enrolled for the SIAs		
Age		
Gender	☐Female ☐Male ☐Both	
Notes (provide any other relevant information on the participants):		

6) Outcome measures

Details of the outcome	**Characteristics of the outcomes**					**Reference page/table or figure in the study**
		F	**M**	**Total**	**Age**	
Participants vaccinated during the SIAs period (***NB: If SIAs were conducted in more than one phase, duplicate as appropriate***).	Targeted					
	Vaccinated					
	Coverage attained					
Routine immunization	Before:					

coverage before and after SIAs (*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).	After:	
Incidence of target disease before and after SIAs (*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).	Before:	
	After:	
Percentage reduction or increase in the routine immunization coverage (NB: specify increase or decrease)		
Notes:		

7) Risk of bias assessment

Type of bias	**Tick appropriately and describe below after the tick.**	**Reference page/table or figure in the study**
Is there selection bias? (Assess	☐Yes ☐No ☐Unclear	

comparability of groups at baseline, confounding and adjustment. For RCTs assess sequence generation and allocation concealment).		
Is there performance bias? (Assess fidelity of the interventions, and quality of the information regarding who received which interventions, including blinding of study subjects and healthcare providers)	☐Yes ☐No ☐Unclear	
Is there detection bias? (Assess whether there was biased and correct appraisal of outcomes, including blinding of assessors)	☐Yes ☐No ☐Unclear	
Is there attrition bias? (Assess the completeness of sample, follow-up and outcome data, reasons for loss to follow up explained)	☐Yes ☐No ☐Unclear	
Is there reporting bias (Assess selective reporting of results)	☐Yes ☐No ☐Unclear	
Other biases (specify)	☐Yes ☐No ☐Unclear	

8) Other relevant information

	Descriptions/figures as stated in report/paper/book chapter	**Reference page/table or figure in the study**
Key conclusions from the authors		

Notes		

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	Republic of Cape Verde OR Cote D'ivoire OR Ivory Coast OR Republic of Cote D'ivoire OR Djibouti OR Republic of Djibouti OR Arab Republic of Egypt OR Egypt OR El Salvador OR Georgia OR Ghana OR Republic of Ghana OR Guatemala OR Republic of Guatemala OR Guyana OR Co-operative Republic of Guyana OR Honduras OR Republic of Honduras OR Spanish Honduras OR Republic of Indonesia OR Indonesia OR India OR Republic of India OR Kiribati OR Republic of Kiribati OR Kosovo OR Kosovo and Metohija OR Laos OR Lao Lao People's Democratic Republic OR Lesotho OR Kingdom of Lesotho OR Mauritania OR Islamic Republic of Mauritania OR Micronesia, Fed. Sts. OR Federated States of Micronesia OR FSM OR Moldova OR Republic of Moldova OR Mongolia OR Morocco OR Kingdom of Morocco OR Nicaragua OR Republic of Nicaragua OR Nigeria OR Federal Republic of Nigeria OR Pakistan OR Islamic Republic of Pakistan OR Papua New Guinea OR Independent State of Papua New Guinea OR Paraguay OR Republic of Paraguay OR Philippines OR Republic of the Philippines OR Samoa OR Independent State of Samoa OR Sao Tome and Principe OR Democratic Republic of Sao Tome and Principe OR Senegal OR Republic of Senegal OR Solomon Islands OR Sri Lanka OR Democratic Socialist Republic of Sri Lanka OR Sudan OR Republic of the Sudan OR North Sudan OR Swaziland OR Kingdom of Swaziland OR Ngwane OR Yuwatini OR Syrian Arab Republic OR Syria OR East Timor OR Timor-leste OR Democratic Republic of Timor-leste OR Ukraine OR Uzbekistan OR Republic of Uzbekistan OR Vanuatu OR Republic of Vanuatu OR Vietnam OR the Socialist Republic of Vietnam OR West bank and Gaza OR Yemen OR Yemeni Republic OR Zambia OR Republic of Zambia)	
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	the Comoros OR Democratic Republic of the Congo OR DR Congo OR Congo-Kinshasa OR DRC OR Zaire OR Eritrea OR State of Eritrea OR Ethiopia OR Federal Democratic Republic of Ethiopia OR The Gambia OR Republic of the Gambia OR Guinea OR Republic of Guinea OR Guinea-Conakry OR Guinea-Bissau OR Republic of Guinea-Bissau OR Haiti OR Republic of Haiti OR Kenya OR Republic of Kenya OR North Korea OR Democratic People's Republic of Korea OR Kyrgyz Republic OR Kyrgyzstan OR Liberia OR Republic of Liberia OR Madagascar OR Republic of Madagascar OR Malawi OR Republic of Malawi OR The Warm Heart of Africa OR Mali OR Republic of Mali OR Mozambique OR Republic of Mozambique OR Myanmar OR Burma OR Republic of the Union of Myanmar OR Nepal OR Democratic Republic of Nepal OR Niger OR Republic of Niger OR Rwanda OR Republic of Rwanda OR Sierra Leone OR Republic of Sierra Leone OR Somalia OR Federal Republic of Somalia OR South Sudan OR Republic of South Sudan OR Tajikistan OR Republic of Tajikistan OR Tanzania OR United Republic of Tanzania OR Republic of Tanganyika and Zanzibar OR Togo OR Togolese Republic OR Uganda OR Republic of Uganda OR Zimbabwe OR Republic of Zimbabwe OR Rhodesia)	
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CINAHL	194	Completed

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	Description	Comments
Name of researcher completing the form		
Date when form completed (dd/mm/yyyy)		

2) General information

Description of the study	**Enter as appearing in the publication**	**Reference page/table or figure in the study**
Study ID based on surname of first author and year (e.g *Hussey 2001*)		
Study reference		
Correspondence author and the contact details:		
Publication type	☐Full text ☐ Abstract ☐Governmental or ☐Book chapter non-governmental reports ☐Other (specify)	
Source of funding and cost of SIA per participant		
References of potentially eligible studies from the reference list		
Notes/Comments		

3) Study eligibility assessment

Characteristics	Tick or describe as appropriate	Reference page/table or figure in article
Primary study	☐Yes (Primary) ☐ No	
Type of study design		
Unit of allocation to the intervention (*if applicable*)	☐Individual ☐Household ☐Cluster ☐Other (Specify)	
Informed consent obtained for study (*if applicable*)	☐Yes ☐No ☐Unclear	
Ethical approval obtained for study (*if applicable*)	☐Yes ☐No ☐Unclear	
SIAs conducted in LMIC	☐Yes ☐No	
If yes, category of country or countries	☐Low-income country ☐Lower middle-income country ☐Upper middle-income country	
Name of the country		
Study describes SIAs	☐ Yes ☐ No	

Name of vaccine used in the SIAs		
Disease targeted by the SIAs		
Outcome measures	☐ Yes Vaccination coverage attained by the SIAs ☐ Yes Disease outbreaks ☐ Yes Disease incidence ☐ Yes Routine immunization coverage after SIAs) ☐Other (specify): ☐No	
Final decision on study eligibility	☐ Yes (Include) ☐ No (Exclude)	
Reason(s) for exclusion		

NB: Do not proceed to the next step if the study is excluded from the review

4) Study aims and methods

	Describe as stated in report/paper/book chapter	**Reference page/table or figure in the study**
Aim(s)		
Methods to estimate target population for SIAs		

Methods to estimate SIAs coverage		
Period between SIAs and coverage survey (if applicable)		
SIAs start date		
SIAs end date **(*NB: If SIAs were conducted in more than one phase, duplicate the two rows as appropriate*).**		
Total duration of the SIAs (in days) **(*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).**		
Means of communicating the information about the SIAs to the target population (phase 1) **(*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).**	☐Healthcare facility ☐Door to door ☐Word of mouth ☐Mass media (radio, TV etc) ☐Digital media (text message, emails etc) ☐Other (specify):	
Potential interference of SIA with routine immunization services investigated	☐Yes (explain): ☐No	

Personnel performing the vaccinations during the SIAs	☐Doctors ☐Nurses ☐Volunteers ☐Other (specify)	
Number of personnel performing the vaccinations during the SIAs (if provided)		
Notes:		

5) Participants

Characteristics	**Description**	**Reference page/table or figure in the study**
SIA setting	☐ Rural community ☐ Urban ☐ Displaced ☐ Other (specify)	
Socio-economic status of the target population relative to the general population	☐ Low (L) (AA) ☐ Average (A) ☐ Above average ☐ All (L, A &AA) ☐ Not clear	
Methods used to classify the socio-economic status of the SIAs target population		

Total number of participants enrolled for the SIAs		
Age		
Gender	☐Female ☐Male ☐Both	
Notes (provide any other relevant information on the participants):		

6) Outcome measures

Details of the outcome	**Characteristics of the outcomes**					**Reference page/table or figure in the study**
		F	**M**	**Total**	**Age**	
Participants vaccinated during the SIAs period **(*NB: If SIAs were conducted in more than one phase, duplicate as appropriate*).**	Targeted					
	Vaccinated					
	Coverage attained					
Routine immunization	Before:					

coverage before and after SIAs (*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).	After:	
Incidence of target disease before and after SIAs (*NB: If SIAs were conducted in more than one phase, duplicate this row as appropriate*).	Before:	
	After:	
Percentage reduction or increase in the routine immunization coverage (NB: specify increase or decrease)		
Notes:		

7) Risk of bias assessment

Type of bias	**Tick appropriately and describe below after the tick.**	**Reference page/table or figure in the study**
Is there selection bias? (Assess	☐Yes ☐No ☐Unclear	

comparability of groups at baseline, confounding and adjustment. For RCTs assess sequence generation and allocation concealment).		
Is there performance bias? (Assess fidelity of the interventions, and quality of the information regarding who received which interventions, including blinding of study subjects and healthcare providers)	☐Yes ☐No ☐Unclear	
Is there detection bias? (Assess whether there was biased and correct appraisal of outcomes, including blinding of assessors)	☐Yes ☐No ☐Unclear	
Is there attrition bias? (Assess the completeness of sample, follow-up and outcome data, reasons for loss to follow up explained)	☐Yes ☐No ☐Unclear	
Is there reporting bias (Assess selective reporting of results)	☐Yes ☐No ☐Unclear	
Other biases (specify)	☐Yes ☐No ☐Unclear	

8) Other relevant information

	Descriptions/figures as stated in report/paper/book chapter	**Reference page/table or figure in the study**
Key conclusions from the authors		

Notes		