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Prevalence and risk factors of adverse birth outcomes in the Pacific Island region: a scoping review protocol

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Manuscript

Prevalence and risk factors of adverse birth outcomes in the Pacific Island region: a scoping review protocol.

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Abbreviations:

CINAHL-cumulative index to nursing and allied health

LBW- low birth weight

LMICs - low- and middle-income countries

PRISMA- preferred reporting items for systematic reviews and meta-analyses

SGA- small for gestational age

Keywords:

Adverse Birth Outcomes

Low Birth Weight

Preterm Birth

Risk Factors

Pacific Island region

ABSTRACT

Introduction

Fetal growth restriction, preterm birth and stillbirth are adverse birth outcomes that are prevalent in low- and middle-income settings such as the Pacific Island region. It is widely accepted that the excess burden of adverse birth outcomes is attributable to socio-economic and environmental factors that predispose families to excess risk. Our review seeks to determine the prevalence and identify the major risk factors of adverse birth outcomes in the Pacific Island region.

Methods

This scoping review will follow the five-staged Arksey and O'Malley's framework and consultation with Solomon Islands' health stakeholders. A preliminary literature review was undertaken to understand the scope of the review. We will use MeSH and keyword terms for adverse birth outcomes to search CINAHL, Medline, Scopus, ProQuest, and Springer Link databases for articles published from 1st January 2000. Subsequent searches will use google scholar and the internet browser to world health organisations and regional health organisation for published and unpublished reports for non-indexed studies. All articles retrieved will be managed with software such as Endnote. Eligible studies will be screened using PRISMA flow chart for final selection. The results will be presented as numerical and thematic summaries that maps risk factors and prevalence to the population and cultures of the Pacific Island region.

Ethics and Dissemination

Formal ethical approval is not required as primary or administrative data will not be collected. The findings of this study will be published in peer-reviewed journals and presented in national and regional conferences.

Article Summary

- This is a protocol for a scoping review on the prevalence and risk factors of adverse birth outcomes in the Pacific Island region

Strengths and limitations of this study

- The prevalence of adverse birth outcomes and their risk factors in the Pacific Island region are not well-established. The review will fill this knowledge gap.
- The review will provide evidence to help inform improvements in perinatal health, set health service priorities, target interventions, and allocate resources to where they are needed.
- Few studies on the topic might not be retrieved due to limited research activity and lack of electronic dissemination of public health information in the region. However, this in itself is an important finding to initiate and publish such research. In addition, a stakeholder consultation stage will be included in the review.

INTRODUCTION

Despite improvements in medical care and technology, the incidence of adverse birth outcomes remains a significant public health issue, particularly in low and middle-income countries (LMICs).^{1,2} Adverse birth outcomes include indicators for early gestation (preterm birth), fetal growth restriction and perinatal mortality. Preterm birth is the most well-accepted benchmark for morbidity attributable to early gestation and is defined as birth before 37 weeks of completed gestation.² In LMICs, fetal growth restriction is indicated by its proxies ascertained at birth.³ These proxies include term low birth weight (LBW); defined as birth weight <2,500 grams from 37 weeks of completed gestation, and small for gestational age (SGA); defined as weight in the lowest 10th centile for gestational age and sex or as a multiple of standard deviations from the sex-specific population mean weight. In LMICs, LBW is also historically used as a proxy for preterm birth given the lack of information on gestational length.^{4,5} Fetal growth restriction is associated with infant mortality and morbidity.^{1,2} Stillbirth is the most commonly investigated mortality-related outcome and is defined as birth without signs of life from 28 weeks of completed gestation.¹ Both preterm birth and fetal growth restriction can significantly impact longer-term physiological complications and wellbeing of children^{6,7} and are major risk factors for stillbirth.

The aetiologies of adverse birth outcomes are multifactorial and not entirely well understood.¹ Evidence from studies conducted elsewhere shows that socioeconomic, health, obstetric and biological factors are linked with adverse birth outcomes in high income countries as well as LMICs.^{2,6,8-10} Moreover, evidence has also shown that environmental (non-genetic) risk factors are relatively more prevalent in LMICs given the higher infant mortality and morbidity in these countries.^{6,7} More than 96% percent of the 32 million LBW infants born globally each year occur in LMICs.⁸ Although adverse birth outcomes are reasonably well documented in some LMICs, such as India,¹¹ studies in the Pacific Island region remain sparse.

The Pacific Island region broadly refers to a group of countries and territories that border the Pacific Ocean.¹² The region, defined here as the LMICs and territories within the Melanesian, Polynesian and Micronesian sub-regions, are culturally and ethnically diverse, with varying degrees of economic development and living standards.¹² The indigenous populations of the region are typically overrepresented in national and global scales for disease burden for both communicable and non-communicable diseases.¹² Health indicators also vary considerably across this region; for example, the infant mortality rate in Papua New Guinea is 50 per 1,000 births compared to 20 per 1,000 births in Fiji.¹³ Similarly, LBW and SGA also vary within and between countries of the region with reported prevalence inconsistent and under-reported.¹⁴ A review in 2013 estimated a period prevalence of 8% for preterm birth, 10% for LBW and 19% for SGA in the broader region of Oceania,¹⁵ but these prevalence are not well-established for the Pacific Island region specifically. Moreover, although it is estimated that 98% of stillbirths occur in LMICs,¹⁶ there are no high-quality estimates for stillbirth prevalence in the Pacific Island region. In the last two decades, there are substantial decline in infant and child mortality by approximately 50% in more than half of the Pacific Island countries and territories.¹⁴ However, the extent of such improvements remains uncertain due to poor data quality and coverage and impacting cultural factors.

Deficiency in the provision of basic health services such as antenatal care and delivery services, infrastructure, telecommunication and transportation are pertinent contributors to the burden of adverse birth outcomes in the Pacific Island region.¹⁷ Notably, more than 60% of the population in the region live in rural areas.¹⁸ Factors such as access to health care, diet and substance use vary considerably. There is some indication that levels of alcohol

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3 consumption, and tobacco, and substance use (including Betel or Areca nut) may be among
4 the highest globally.¹⁹⁻²³
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6 The aim of this scoping review is to synthesise available results from studies on the
7 prevalence and risk factors of adverse birth outcomes in the Pacific Island region. Knowledge
8 of the burden of adverse birth outcomes and key risk factors will provide policy makers and
9 healthcare practitioners working in the region with evidence that can be used to inform
10 strategies to achieve reductions in adverse birth outcomes and improve overall perinatal
11 health. These research findings will help to design targeted interventions and better allocate
12 resources to where they are needed. Additionally, findings of the review will inform future
13 aetiological research on the effect of risk factors of adverse birth outcomes in the region.
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16 **METHODS**

17 This scoping review will follow the Joanna Briggs Institute Reviewers Manual²⁴ derived from
18 Arksey and O'Malley's five-staged methodological Framework²⁵. Briefly, this includes
19 explicit specification of research questions, reproducible methods to identify relevant studies,
20 transparent declarations of inclusion and exclusion criteria, documented collation of data, and
21 standardised summarisation and reporting of results. We will also include an optional stage
22 six of stakeholder consultation for additional insights. Our reporting will also compliant with
23 Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping
24 reviews checklist.²⁴
25
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27 **Stage one: Specification of the research question.**

28 We will first identify the research question. A preliminary literature review was undertaken to
29 understand the extent of literature on exposures of risk factors of adverse birth outcomes in
30 the Pacific Island region. This stage will identify evidence gaps and inform the formulation of
31 the research questions for future studies. The broad research question is *What is the*
32 *prevalence of the adverse birth outcomes and what are the major types of risk factors*
33 *relevant to the selected adverse birth outcomes in the Pacific Island region?* The indigenous
34 population of the region are broadly classified as Melanesian, Polynesian and Micronesians,
35 each with their own diverse historical roots and cultures.¹² Such diversity is accompanied by
36 differences in economic development and living standards causing wide variation in health
37 outcomes between populations.¹² Consequently, this review will also describe the prevalence
38 and risk factors by sub-population group.
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42 **Stage two: Identifying relevant studies**

43 The second stage of the review aims to identify the relevant studies through the eligibility
44 criteria, and search strategies involved. The Arksey and O'Malley's methodological
45 framework²⁵ uses Population-Concept-Context. For this review the Population is defined as
46 all mothers who gave birth in the Pacific Island region and children from these births;
47 Concept is the prevalence and risk factors for adverse birth outcomes; and Context is defined
48 geographically as all 21 countries and territories in the region.
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51 *Inclusion and exclusion criteria*

52 We will include all studies and articles that report risk factors and their associations with one
53 or more of the adverse birth outcomes in the Pacific Island region. We will include studies
54 from the 21 sovereign island states and territories of the region namely: American Samoa,
55 Cook Islands, Easter Islands, Federated States of Micronesia, Fiji, Guam, Kiribati, Mariana
56 Islands, Marshall Islands, Nauru, New Caledonia, Niue, Palau, Papua New Guinea, Samoa,
57 Solomon Islands, Tahiti, Tokelau, Tonga, Tuvalu, Vanuatu and Wallis and Futuna.¹⁴ Both
58 primary and secondary analytical studies published in peer-reviewed journals and grey
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3 literature as government reports will be included. Studies published in English from the year
4 2000 until the present will be included.
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6 *Search Strategy*

7 The search strategy will follow the three-stage search process outlined by the Joanna Briggs
8 Institute.²⁶ The first stage will include an initial search that will be made in CINAHL and
9 Medline to identify MeSH or text terms contained within the titles and abstracts of articles
10 from the key words displayed in Table one. In the second stage of the search, all MeSH terms
11 and/or synonyms will then be applied across the selected databases and combined with
12 Boolean operators, truncations, and wildcards. The following electronic databases will be
13 searched: CINAHL, Medline, ProQuest, SpringerLink and Scopus. In this stage, we will
14 carry out two levels of searches. The first level will use general key MeSH terms and their
15 synonyms of pregnancy risk factors, adverse birth outcomes and Pacific Island region. The
16 general search string will be defined as: (adverse pregnancy outcomes OR poor pregnancy
17 outcomes OR adverse birth outcomes OR poor birth outcomes OR preterm birth OR fetal
18 growth restriction OR low birth weight OR stillbirth) AND (pregnancy risk factors OR
19 pregnancy risk*) AND (Pacific Island* OR Oceania OR South Pacific Island*). Similarly, a
20 specific search with more precise key terms or specific risk factors will narrow the search
21 down for each country. Specific search terms will be identified through the initial literature
22 review to understand the specific risk factors within the population. The specific key terms
23 for risk factors will be defined as: malaria OR anaemia OR substance use OR alcohol OR
24 betel nut OR areca nut OR tobacco. The above specific terms will be combined with a term to
25 identify each individual country within the region. We will also assess the reference list of
26 studies initially retrieved in order to identify any relevant studies which have not been
27 identified by the electronic database searches. Additional searches will also be conducted to
28 identify non-indexed studies and manually searching thesis repositories, Google Scholar and
29 Google for regional health organisation websites.
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34 **Stage three: Study selection**

35 At this stage we will screen and select the studies. During the primary review we will
36 consolidate all studies retrieved, remove all duplicates and remove studies that do not
37 correspond to the Population Concept Context criteria.²⁷ Next, we will screen the titles and
38 abstracts of articles after importing all records retrieved from databases and web-based
39 searches into EndNote. Any uncertainty with the title and abstract will go through full-text
40 review. Any uncertainty reached on any article will be discussed with the broader research
41 team. If consensus is not reached, articles will be excluded from the review. All remaining
42 articles will go through full-text screening, following the PRISMA flow chart²⁸ and final
43 articles will proceed to the final review.
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47 **Stage four: Charting data**

48 Data charting will involve data extraction and documenting from the final articles selected.
49 During the data extraction, all results will be entered into Excel spreadsheets alongside
50 standard bibliographic information that includes author(s), year of publication, origin or
51 country of origin, aims and purpose, study population, methodology, intervention type,
52 intervention duration, outcomes and details and key findings. (Table two outlines the standard
53 bibliographic information) For each article reviewed key information to be retrieved will be
54 risk factors matched to birth outcomes, prevalence to the specific context of the region. The
55 framework will be pilot tested by the reviewers to ensure that it is consistent with data
56 charting and the study aims and objectives. Charting of data will be an iterative process of
57 screening and extracting data that will be done mostly by the principal investigator. Any
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3 arising questions and uncertainty during the process will be discussed research team to reach
4 an agreement.
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6 **Stage five: Collating, summarising, and presenting the results**

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8 In stage five, the results of the scoping review will be presented as a map of data extracted
9 from the selected journals and articles. Findings will be presented quantitatively in
10 aggregated forms as figures, tables and qualitatively as narrative summaries reflective of the
11 study objectives as outlined by Arksey and O'Malley.²⁵ We expect to map a wide range of
12 risk factors, prevalence, and the different adverse birth outcomes against the countries'
13 ethnic, and geographical diversity to provide the first such body of literature for the region.
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16 **Stage six: Stakeholder consultation**

17 A consultation exercise will be conducted online with relevant health professionals in the
18 Solomon Islands including midwives, paediatric nurses, obstetricians, and paediatricians.
19 This stage aims to validate findings from this study and to add additional insights and
20 recommendations from their perspectives. Ten health professionals working with pregnant
21 woman and infants will be consulted. Selection will be done by purposeful and snowball
22 sampling.
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25 **CONCLUSION**

26
27 The Pacific Island region is significantly under-studied compared to other low-income
28 regions of the world. Context-specific benchmark measures of adverse birth outcomes and
29 identification of their risk factors is fundamental to describe population level burden and
30 initiate processes for treatment, antenatal care and prevention. This scoping review will
31 follow a standard reporting guideline and apply a well-established framework to establish the
32 burden on adverse birth outcomes, identify their pertinent risk factors and explore the
33 evidence for their effects on adverse birth outcomes in the Pacific Islands region.
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Appendix

Table 1. Grid of key concepts and terms

Concept 1		Concept 2		Concept 3
Adverse birth outcomes	AND	Pregnancy Risk factors	AND	Pacific Island region

Table 2. Data extraction table

Main category
a) Author(s)
b) Year of publication
c) Origin/country study was conducted
d) Aims/purpose
e) Study population
f) Sample size
g) Methodology
h) Intervention/exposure type (if applicable) and comparison group (if applicable)
i) Duration of the exposure/intervention (if applicable)
j) Outcomes assessment and method to assess associations (if applicable)
k) Key findings that relate to the scoping review question/s

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LMICs - low- and middle-income countries

PRISMA- preferred reporting items for systematic reviews and meta-analyses

SGA- small for gestational age

UNICEF-united nation international children emergency fund

WHO-world health organisation

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ABSTRACT

Introduction

Fetal growth restriction, preterm birth and stillbirth are adverse birth outcomes that are prevalent in low-and middle-income settings such as the Pacific Island region. It is widely accepted that the excess burden of adverse birth outcomes is attributable to socio-economic and environmental factors that predispose families to excess risk. Our review seeks to determine the prevalence of adverse birth outcomes in the Pacific Island region; and to identify the risk factors of adverse birth outcomes in the Pacific Island region.

Methods

This scoping review will follow the five-staged Arksey and O'Malley's framework and consultation with Solomon Islands' health stakeholders. A preliminary literature review was undertaken to understand the scope of the review. We will use MeSH (medical subject heading) and keyword terms for adverse birth outcomes to search CINAHL, Medline, Scopus, ProQuest, and Springer Link databases for articles published from 1st January 2000. The subsequent searches will be undertaken via google scholar and the internet browser to world health organisations and regional health organisation for published and unpublished reports on non-indexed studies. All articles retrieved will be managed with software such as Endnote. Eligible studies will be screened using PRISMA flow chart for final selection. The results will be presented as numerical and thematic summaries that map risk factors and prevalence to the population and cultures of the Pacific Island region.

Ethics and Dissemination

Formal ethical approval is not required as primary or administrative data will not be collected. The findings of this study will be published in peer-reviewed journals and presented in national and regional conferences.

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4 Strengths and limitations of this study

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6 • The review will provide information to help identify knowledge gaps and focal points for
7 further investigation to progress towards this goal.
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9 • A strength of this study will be consultation with stakeholders (health professionals
10 working in maternal and child health services) as they will provide insights into adverse
11 birth outcomes at a community level.
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13 • We may not be able to access studies published in languages other than English.
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For peer review only

INTRODUCTION

Despite improvements in medical care and technology, the incidence of adverse birth outcomes remains a significant public health issue, particularly in low and middle-income countries (LMICs).^{1,2} Adverse birth outcomes include indicators for early gestation (preterm birth), fetal growth restriction and perinatal mortality. Preterm birth is the most well-accepted benchmark for morbidity attributable to early gestation and is defined as birth before 37 weeks of completed gestation.² In LMICs, fetal growth restriction is indicated by its proxies ascertained at birth.³ These proxies include term low birth weight (LBW); defined as birth weight <2,500 grams from 37 weeks of completed gestation, and small for gestational age (SGA); defined as weight in the lowest 10th centile for gestational age and sex or as a multiple of standard deviations from the sex-specific population mean weight. LBW is also historically used as a proxy for preterm birth given the lack of information on gestational length.^{4,5} Fetal growth restriction is associated with infant mortality and morbidity.^{1,2} Stillbirth is the most commonly investigated mortality-related outcome and is defined as birth without signs of life from 28 weeks of completed gestation in LMIC.¹ Both preterm birth and fetal growth restriction can significantly impact longer-term physiological complications and wellbeing of children^{6,7} and are major risk factors for stillbirth.

The aetiologies of adverse birth outcomes are multifactorial and not entirely well understood.¹ Evidence from studies conducted elsewhere show that socioeconomic, health, obstetric and biological factors are linked with adverse birth outcomes in high income countries as well as LMICs.^{2,6,8-10} Moreover, evidence has also shown that environmental (non-genetic) risk factors are relatively more prevalent in LMICs resulting in higher infant mortality and morbidity in these countries.^{6,7} More than 96% of the 32 million LBW infants born globally each year occur in LMICs.⁸ Although adverse birth outcomes are reasonably well documented in some LMICs, such as India,¹¹ studies in the Pacific Island region remain sparse.

The Pacific Island region broadly refers to a group of countries and territories that border the Pacific Ocean.¹² The region, defined here as the LMICs and territories within the Melanesian, Polynesian and Micronesian sub-regions, are culturally and ethnically diverse, with varying degrees of economic development and living standards.¹² The indigenous populations of the region are typically overrepresented in national and global scales for disease burden for both communicable and non-communicable diseases.¹² Health indicators also vary considerably across this region; for example, the infant mortality rate in Papua New Guinea is 50 per 1,000 births compared to 20 per 1,000 births in Fiji.¹³ Similarly, LBW and SGA also vary within and between countries of the region with reported prevalence inconsistent and under-reported.¹⁴ A review in 2013 estimated a period prevalence of 8% for preterm birth, 10% for LBW and 19% for SGA in the broader region of Oceania,¹⁵ but these prevalence are not well-established for the Pacific Island region specifically. Moreover, although it is estimated that 98% of stillbirths occur in LMICs,¹⁶ there are no high-quality estimates for stillbirth prevalence in the Pacific Island region. In the last two decades, there has been a substantial decline in infant and child mortality by approximately 50% in more than half of the Pacific Island countries and territories.¹⁴ However, the extent of such improvements remains uncertain due to poor data quality and coverage and impacting cultural factors.

Deficiency in the provision of basic health services such as antenatal care and delivery services, infrastructure, telecommunication and transportation are pertinent contributors to the burden of adverse birth outcomes in the Pacific Island region.¹⁷ Notably, more than 60% of the population in the region live in rural areas.¹⁸ Factors such as access to health care, diet and substance use vary considerably. There is some indication that levels of alcohol

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3 consumption, and tobacco, and substance use (including Betel or Areca nut) may be among
4 the highest globally.¹⁹⁻²³
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6 The aim of this scoping review is to synthesise available results from studies on the
7 prevalence and risk factors of adverse birth outcomes in the Pacific Island region. Knowledge
8 of the burden of adverse birth outcomes and key risk factors will provide policy makers and
9 healthcare practitioners working in the region with evidence that can be used to inform
10 strategies to achieve reductions in adverse birth outcomes and improve overall perinatal
11 health. These research findings will help to design targeted interventions and better allocate
12 resources to where they are needed. Additionally, findings of the review will inform future
13 aetiological research on the effect of risk factors of adverse birth outcomes in the region.
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16 17 **METHODS**

18 This scoping review will follow the Joanna Briggs Institute Reviewers Manual²⁴ derived from
19 Arksey and O'Malley's five-staged methodological Framework²⁵ and further developed by
20 Levac, et al.²⁶ Briefly, this includes explicit specification of research questions, reproducible
21 methods to identify relevant studies, transparent declarations of inclusion and exclusion
22 criteria, documented collation of data, and standardised summarisation and reporting of
23 results. We will also include an optional stage six of stakeholder consultation for additional
24 insights. Our reporting will also compliant with Preferred Reporting Items for Systematic
25 Reviews and Meta-Analyses extension for scoping reviews checklist.²⁴ A preliminary
26 literature review was undertaken to understand the extent of literature on exposures of risk
27 factors of adverse birth outcomes in the Pacific Island region, to determine an appropriate
28 search timeframe. Thus, the scoping review will be conducted between December 2020 and
29 February 2021.
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33 **Stage one: Specification of the research question.**

34 We will first identify the research question. A preliminary literature review was undertaken to
35 understand the extent of literature on exposures of risk factors of adverse birth outcomes in
36 the Pacific Island region, to determine an appropriate search timeframe. This stage will allow
37 the formulation of the research questions for the study. The broad research questions are:
38 *What is the prevalence of the adverse birth outcomes in the Pacific Island region? What are*
39 *the risk factors of adverse birth outcomes in the Pacific Island region?* The indigenous
40 population of the region are broadly classified as Melanesian, Polynesian and Micronesians,
41 each with their own diverse historical roots and cultures.¹² Such diversity is accompanied by
42 differences in economic development and living standards, causing a wide variation in health
43 outcomes between populations.¹² Consequently, this review will also describe the prevalence
44 and risk factors by sub-population group.
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48 **Stage two: Identifying relevant studies**

49 The second stage of the review aims to identify the relevant studies through the eligibility
50 criteria, and search strategies involved. The Arksey and O'Malley's methodological
51 framework²⁵ uses Population-Concept-Context. For this review, the Population is defined as
52 all women of child-bearing age (15-49 years old) who gave birth in the Pacific Island region
53 and infants from these births; Concept is the prevalence and risk factors for adverse birth
54 outcomes (low birthweight, preterm birth, small for gestational age or fetal growth restriction,
55 stillbirths and miscarriage); and Context is defined geographically as all 21 countries and
56 territories in the region.
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59 *Inclusion and exclusion criteria*

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We will include all studies and articles irrespective of their study design. We will incorporate all studies that report risk factors and their associations with one or more of the adverse birth outcomes in the Pacific Island region arising during pregnancy but observed at the separation of the fetus from the mother or shortly afterwards. We will include studies that will provide estimates of the prevalence rates and risk factors of adverse birth outcomes. That include inferential studies that aimed to estimate the prevalence and identify associated risk factors such as intervention and observational studies. Our review will also include descriptive population-based studies such as the Demographic Health Surveys and other surveys. We will include studies from the 21 sovereign island states and territories of the region namely: American Samoa, Cook Islands, Easter Islands, Federated States of Micronesia, Fiji, Guam, Kiribati, Mariana Islands, Marshall Islands, Nauru, New Caledonia, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tahiti, Tokelau, Tonga, Tuvalu, Vanuatu and Wallis and Futuna.¹⁴ Both primary and secondary analytical studies published in peer-reviewed journals and grey literature as government reports will be included. Studies published in English from the year 2000 to February 2021 will be included.

Search Strategy

The search strategy will follow the three-stage search process outlined by the Joanna Briggs Institute.²⁷ The first stage will include an initial search that will be made in CINAHL and Medline to identify MeSH or text terms contained within the titles and abstracts of articles from the keywords displayed (see table 1). In the second stage of the search, all MeSH terms and/or synonyms will then be applied across the selected databases and combined with Boolean operators, truncations, and wildcards. The following electronic databases will be searched: CINAHL, Medline, ProQuest, SpringerLink and Scopus. In this stage, we will carry out two levels of searches. The first level will use general key MeSH terms and their synonyms of pregnancy risk factors such as adverse birth outcomes and Pacific Island region. The general search string will be defined as; (adverse pregnancy outcomes OR poor pregnancy outcomes OR adverse birth outcomes OR poor birth outcomes OR preterm birth OR fetal growth restriction OR low birth weight OR stillbirth) AND (pregnancy risk factors OR pregnancy risk*) AND (Pacific Island* OR Oceania OR South Pacific Island*). Similarly, a specific search with more precise key terms or specific risk factors will narrow the search down for each country. Specific search terms will be identified through the initial literature review to understand the specific risk factors within the population. The specific key terms for risk factors will be defined as; malaria OR anaemia OR substance use OR alcohol OR betel nut OR areca nut OR tobacco OR maternal obesity OR maternal nutrition. The above specific terms will be combined with a term to identify each individual country within the region. We will also assess the reference list of studies initially retrieved in order to identify any relevant studies which have not been identified by the electronic database searches. Additional searches will also be conducted to identify non-indexed studies and manually searching thesis repositories, Google Scholar and Google for regional health organisation websites. The online sources that we will search include the United Nations International Children Emergency Fund, World Health Organisation, Pacific community and individual countries health websites.

Stage three: Study selection

At this stage, we will screen and select the studies. During the primary review, we will consolidate all studies retrieved, remove all duplicates and remove studies that do not correspond to the Population Concept Context criteria.²⁸ Next, we will screen the titles and abstracts of articles after importing all records retrieved from databases and web-based searches into EndNote. Two reviewers (LK and GT) will be conducting the study selection and data abstraction.²⁶ Any uncertainty with the title and abstract will go through full-text

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3 review. Any uncertainty reached on any article will be discussed with the broader research
4 team. If consensus is not reached, articles will be excluded from the review. All remaining
5 articles will go through full-text screening, following the PRISMA flow chart²⁹ and final
6 articles will proceed to the final review.
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8 9 **Stage four: Charting data**

10 Data charting will involve data extraction and documenting from the final articles selected.
11 During the data extraction, all results will be entered into Excel spreadsheets alongside
12 standard bibliographic information that includes author(s), year of publication, origin or
13 country of origin, aims and purpose, study population, methodology, intervention type,
14 intervention duration, outcomes and details and key findings (see table 2 outlines the standard
15 bibliographic information).²⁷ For each article, reviewed key information to be retrieved will
16 be risk factors matched to birth outcomes, prevalence to the specific context of the region.
17 The framework will be pilot tested by the reviewers to ensure that it is consistent with data
18 charting and the study aims and objectives. Charting of data will be an iterative process of
19 screening and extracting data that will be done mostly by the principal investigator. Any
20 arising questions and uncertainty during the process will be discussed research team to reach
21 an agreement.
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25 **Stage five: Collating, summarising, and presenting the results**

26 In stage five, tabular presentation of the findings will be mapped from data extracted from the
27 selected articles, as outlined, (see table 2) and guided by Arskey and O'Malley.²⁵ Findings
28 will be presented quantitatively in aggregated forms figure and qualitatively as thematic
29 narrative summaries, all of which will reflect the study objectives.²⁵ The results of the studies
30 will not be compared but presented as a body of evidence. We expect to map a wide range of
31 risk factors, prevalence, and the different adverse birth outcomes against the countries'
32 ethnic, and geographical diversity to provide the first such body of literature for the region.
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35 **Stage six: Stakeholder consultation**

36 A consultation exercise will be conducted online with relevant health professionals in the
37 Solomon Islands, including midwives, paediatric nurses, obstetricians, and paediatricians
38 identified through contacts and purposive and snowball sampling. This stage aims to validate
39 findings from this study and to add additional insights and recommendations from their
40 perspectives. Consultation will be undertaken at the completion of the article review. The
41 exercise will involve the collection of quantitative and qualitative feedback from clinicians
42 who work with pregnant mothers and infants to obtain their knowledge and experience of risk
43 factors and birth outcomes in the Solomon Islands from a clinical perspective. Ten health
44 professionals working with pregnant woman and infants will be consulted. Selection will be
45 made by purposeful and snowball sampling.
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49 **Stage seven: Patient and public involvement.**

50 The scoping review will not involve patients and the public as data will be sourced from
51 primary studies. The stakeholder consultation exercise will only be involving doctors,
52 midwives and nurses who work directly with pregnant women. Ethics and consent will be
53 sought to respective authorities and clinicians.
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Contributorship Statement

All authors contributed to the preparation of the manuscript as listed below.

LSKK, GFP, GAT and JJ: study inception, conceptualisation and design, **LSKK:** first draft, literature review, preliminary searches, collating all inputs reiteratively and revision of the manuscript, **GKD:** first edited and framed the manuscript into standard journal format, and **GAT, JJ, HB and GFP:** subsequent revisions, editing and proof reading.

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Competing interests

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Ethics and Dissemination

Since there will be no direct contact with human or patients in the case of the scoping review, no ethics review will be required. Dissemination will be made through regional conferences and publication in peer-reviewed journals.

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Table 1. Grid of key concepts and terms

Concept 1		Concept 2		Concept 3
Adverse birth outcomes	AND	Pregnancy Risk factors	AND	Pacific Island region

Table 2. Data extraction table

Main category
a) Author(s)
b) Year of publication
c) Origin/country study was conducted
d) Study design:
e) Aims/purpose
f) Sampling strategy
g) Study population
h) Sample size
i) Methodology
j) Intervention/exposure type (if applicable) and comparison group (if applicable)
k) Duration of the exposure/intervention (if applicable)
l) Outcomes assessment and method to assess associations (if applicable)
m) Key findings that relate to the scoping review question/s

BMJ Open

Prevalence and risk factors of adverse birth outcomes in the Pacific Island region: a scoping review protocol

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2020-042423.R2
Article Type:	Protocol
Date Submitted by the Author:	16-Mar-2021
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Primary Subject Heading:	Public health
Secondary Subject Heading:	Epidemiology, Reproductive medicine
Keywords:	PERINATOLOGY, EPIDEMIOLOGY, PUBLIC HEALTH

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Manuscript

Prevalence and risk factors of adverse birth outcomes in the Pacific Island region: a scoping review protocol.

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Short Title: Risk factors of adverse birth outcomes

Abbreviations:

CINAHL-cumulative index to nursing and allied health

LBW- low birth weight

LMICs - low- and middle-income countries

PRISMA- preferred reporting items for systematic reviews and meta-analyses

SGA- small for gestational age

UNICEF-united nation international children emergency fund

WHO-world health organisation

Keywords:

Adverse birth outcomes

Low birth weight

Preterm birth

Risk factors

Pacific Island region

ABSTRACT

Introduction

Fetal growth restriction, preterm birth, low birth weight and stillbirth are adverse birth outcomes that are prevalent in low-and middle-income settings such as the Pacific Island region. It is widely accepted that the excess burden of adverse birth outcomes is attributable to socio-economic and environmental factors that predispose families to excess risk. Our review seeks to determine the prevalence of adverse birth outcomes in the Pacific Island region; and to identify the risk factors of adverse birth outcomes in the Pacific Island region.

Methods

This scoping review will follow the five-staged Arksey and O'Malley's framework and consultation with Solomon Islands' health stakeholders. A preliminary literature review was undertaken to understand the scope of the review. We will use MeSH (medical subject heading) and keyword terms for adverse birth outcomes to search CINAHL, Medline, Scopus, ProQuest, and Springer Link databases for articles published from 1st January 2000. The subsequent searches will be undertaken via google scholar and the internet browser to world health organisations and regional health organisation for published and unpublished reports on non-indexed studies. All articles retrieved will be managed with Endnote software. Eligible studies will be screened using PRISMA flow chart for final selection. In the charting phase, we will extract the data into excel spreadsheets. The results will be presented as numerical and thematic summaries that map risk factors and prevalence to the population and cultures of the Pacific Island region.

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Formal ethical approval is not required as primary or administrative data will not be collected. However, we will seek ethics approval for the stakeholder consultation from the Research Office of Curtin University and the Solomon Islands. The findings of this study will be published in peer-reviewed journals, and presented in national and regional conferences and disseminated to stakeholders.

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4 Strengths and limitations of this study

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- The review will provide information to help identify knowledge gaps and focal points for further investigation to progress towards evidenced based maternal health care in the region.
 - A strength of this study will be consultation with stakeholders (health professionals working in maternal and child health services) as they will provide insights into adverse birth outcomes at a community level.
 - We may not be able to access studies published in languages other than English.

For peer review only

INTRODUCTION

Despite improvements in medical care and technology, the incidence of adverse birth outcomes remains a significant public health issue, particularly in low and middle-income countries (LMICs).^{1,2} Adverse birth outcomes include indicators for early gestation (preterm birth), fetal growth restriction and perinatal mortality. Preterm birth is the most well-accepted benchmark for morbidity attributable to early gestation and is defined as birth before 37 weeks of completed gestation.² In LMICs, fetal growth restriction is indicated by its proxies ascertained at birth.³ These proxies include term low birth weight (LBW); defined as birth weight <2,500 grams from 37 weeks of completed gestation, and small for gestational age (SGA); defined as weight in the lowest 10th centile for gestational age and sex or as a multiple of standard deviations from the sex-specific population mean weight. LBW is also historically used as a proxy for preterm birth given the lack of information on gestational length.^{4,5} Fetal growth restriction is associated with infant mortality and morbidity.^{1,2} Stillbirth is the most commonly investigated mortality-related outcome and is defined as birth without signs of life from 28 weeks of completed gestation in LMIC.¹ Both preterm birth and fetal growth restriction can significantly impact longer-term physiological complications and wellbeing of children^{6,7} and are major risk factors for stillbirth.

The aetiologies of adverse birth outcomes are multifactorial and not entirely well understood.¹ Evidence from studies conducted elsewhere show that socioeconomic, health, obstetric and biological factors are linked with adverse birth outcomes in high income countries as well as LMICs.^{2,6,8-10} Moreover, evidence has also shown that environmental (non-genetic) risk factors are relatively more prevalent in LMICs resulting in higher infant mortality and morbidity in these countries.^{6,7} More than 96% of the 32 million LBW infants born globally each year occur in LMICs.⁸ Although adverse birth outcomes are reasonably well documented in some LMICs, such as India,¹¹ studies in the Pacific Island region remain sparse.

The Pacific Island region broadly refers to a group of countries and territories that border the Pacific Ocean.¹² The region, defined here as the LMICs and territories within the Melanesian, Polynesian and Micronesian sub-regions, are culturally and ethnically diverse, with varying degrees of economic development and living standards.¹² The indigenous populations of the region are typically overrepresented in national and global scales for disease burden for both communicable and non-communicable diseases.¹² Health indicators also vary considerably across this region; for example, the infant mortality rate in Papua New Guinea is 50 per 1,000 births compared to 20 per 1,000 births in Fiji.¹³ Similarly, LBW and SGA also vary within and between countries of the region with reported prevalence inconsistent and under-reported.¹⁴ A review in 2013 estimated a period prevalence of 8% for preterm birth, 10% for LBW and 19% for SGA in the broader region of Oceania,¹⁵ but these prevalence are not well-established for the Pacific Island region specifically. Moreover, although it is estimated that 98% of stillbirths occur in LMICs,¹⁶ there are no high-quality estimates for stillbirth prevalence in the Pacific Island region. In the last two decades, there has been a substantial decline in infant and child mortality by approximately 50% in more than half of the Pacific Island countries and territories.¹⁴ However, the extent of such improvements remains uncertain due to poor data quality and coverage and impacting cultural factors.

Deficiency in the provision of basic health services such as antenatal care and delivery services, infrastructure, telecommunication and transportation are pertinent contributors to the burden of adverse birth outcomes in the Pacific Island region.¹⁷ Notably, more than 60% of the population in the region live in rural areas.¹⁸ Factors such as access to health care, diet and substance use vary considerably. There is some indication that levels of alcohol

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3 consumption, and tobacco, and substance use (including betel or areca nut) may be among the
4 highest globally.¹⁹⁻²³
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6 The aim of this scoping review is to synthesise available results from studies on the
7 prevalence and risk factors of adverse birth outcomes in the Pacific Island region. Knowledge
8 of the burden of adverse birth outcomes and key risk factors will provide policy makers and
9 healthcare practitioners working in the region with evidence that can be used to inform
10 strategies to achieve reductions in adverse birth outcomes and improve overall perinatal
11 health. These research findings will help to design targeted interventions and better allocate
12 resources to where they are needed. Additionally, findings of the review will inform future
13 aetiological research on the effect of risk factors of adverse birth outcomes in the region.
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16 17 **METHODS**

18 This scoping review will follow the Joanna Briggs Institute Reviewers Manual²⁴ derived from
19 Arksey and O'Malley's five-staged methodological Framework²⁵ and further developed by
20 Levac, et al.²⁶ Briefly, this includes explicit specification of research questions, reproducible
21 methods to identify relevant studies, transparent declarations of inclusion and exclusion
22 criteria, documented collation of data, and standardised summarisation and reporting of
23 results. The scoping review will not involve patients and the public as data will be sourced
24 from primary studies. However, we will also include an optional stage six of stakeholder
25 consultation for additional insights. The stakeholder consultation exercise will only be
26 involving doctors, midwives and nurses who work directly with pregnant women. Ethics and
27 consent will be sought from respective authorities and clinicians. Our reporting will also
28 compliant with Preferred Reporting Items for Systematic Reviews and Meta-Analyses
29 extension for scoping reviews checklist.²⁴ A preliminary literature review was undertaken to
30 understand the extent of literature on exposures of risk factors of adverse birth outcomes in
31 the Pacific Island region, to determine an appropriate search timeframe. Thus, the scoping
32 review will be conducted between December 2020 and February 2021.
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37 **Stage one: Specification of the research question.**

38 We will first identify the research question. A preliminary literature review was undertaken to
39 understand the extent of literature on exposures of risk factors of adverse birth outcomes in
40 the Pacific Island region, to determine an appropriate search timeframe. This stage will allow
41 the formulation of the research questions for the study. The broad research questions are:
42 *What is the prevalence of the adverse birth outcomes in the Pacific Island region? What are*
43 *the risk factors of adverse birth outcomes in the Pacific Island region?* The indigenous
44 population of the region are broadly classified as Melanesian, Polynesian and Micronesians,
45 each with their own diverse historical roots and cultures.¹² Such diversity is accompanied by
46 differences in economic development and living standards, causing a wide variation in health
47 outcomes between populations.¹² Consequently, this review will also describe the prevalence
48 and risk factors by sub-population group.
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52 **Stage two: Identifying relevant studies**

53 The second stage of the review aims to identify the relevant studies through the eligibility
54 criteria, and search strategies involved. The Arksey and O'Malley's methodological
55 framework²⁵ uses Population-Concept-Context. For this review, the Population is defined as
56 all women of child-bearing age (15-49 years old) who gave birth in the Pacific Island region
57 and infants from these births; Concept is the prevalence and risk factors for adverse birth
58 outcomes (low birthweight, preterm birth, small for gestational age or fetal growth restriction,
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3 stillbirths and miscarriage); and Context is defined geographically as all 21 countries and
4 territories in the region.
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6 *Inclusion and exclusion criteria*

7 We will include all studies and articles irrespective of their study design. We will incorporate
8 all studies that report risk factors and their associations with one or more of the adverse birth
9 outcomes in the Pacific Island region arising during pregnancy but observed at the separation
10 of the fetus from the mother or shortly afterwards. We will include studies that will provide
11 estimates of the prevalence rates and risk factors of adverse birth outcomes. That include
12 inferential studies that aimed to estimate the prevalence and identify associated risk factors
13 such as intervention and observational studies. Our review will also include descriptive
14 population-based studies such as the Demographic Health Surveys and other surveys. We
15 will include studies from the 21 sovereign island states and territories of the region namely:
16 American Samoa, Cook Islands, Easter Islands, Federated States of Micronesia, Fiji, Guam,
17 Kiribati, Mariana Islands, Marshall Islands, Nauru, New Caledonia, Niue, Palau, Papua New
18 Guinea, Samoa, Solomon Islands, Tahiti, Tokelau, Tonga, Tuvalu, Vanuatu and Wallis and
19 Futuna.¹⁴ Both primary and secondary analytical studies published in peer-reviewed journals
20 and grey literature as government reports will be included. Studies published in English from
21 the year 2000 to February 2021 will be included. Table 1 illustrates a summary of the
22 inclusion and exclusion criteria for the study.
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27 *Search Strategy*

28 The search strategy will follow the three-stage search process outlined by the Joanna Briggs
29 Institute.²⁷ The first stage will include an initial search using key concept terms that will be
30 undertaken in CINAHL and Medline to identify MeSH or text terms contained within the
31 titles and abstracts of articles. The key concept terms are adverse birth outcomes, pregnancy
32 risk factors and Pacific Island region. Table 2 outlines the grid of key concepts and terms.
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35 In the second stage of the search, all MeSH terms, key concept terms and their synonyms will
36 be combined with Boolean operators, truncations, and wildcards to generate search strings
37 and will be applied across the selected databases. The following electronic databases will be
38 searched: CINAHL, Medline, ProQuest, SpringerLink and Scopus. As all databases have
39 different search protocols, we will ensure to follow each of their guidelines accordingly. In
40 the second stage, we will carry out two levels of searches. The first level will use general key
41 concept terms and their synonyms combined with MeSH terms identified. An example of
42 general search string designed for CINAHL is as follows; (“adverse birth outcome*” OR
43 “poor birth outcome*” OR “preterm birth*” OR “premature birth*” OR “Poor fetal growth*”
44 OR “fetal growth restriction*” OR “intrauterine growth retardation” OR “growth retardation”
45 OR “small baby*” OR “very small baby*” OR “low birth weight” OR “low birthweight” OR
46 “very low birth weight” OR “very low birthweight” OR “extremely low birth weight” OR
47 “extremely low birthweight” OR “stillbirth” OR “still birth”) OR (MH “pregnancy
48 outcome*” OR MH “infant very low birth weight” OR MH “outcome* of prematurity”)
49 AND (“pregnancy risk factor*” OR “adverse pregnancy outcome*” OR “poor pregnancy
50 outcome*” OR MH “risk factor*” OR MH “pregnancy risk*” OR MH “high risk*” OR MH
51 “pregnancy in adolescence*” OR MH “pregnancy risk*”) AND (“Pacific Island*” OR
52 “Oceania” OR “South Pacific Island*” OR “Pacific Island country*” OR “MH Pacific
53 Island*”).
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58 Similarly, a specific search with more precise key terms or specific risk factors will narrow
59 the search down for each country. Specific search terms will be identified through the initial
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3 literature review to understand the specific risk factors within the population. An example of
4 specific key and MeSH terms and search strings also designed for CINAHL is as follows;
5 (“preterm birth*” OR “premature birth*” OR “Poor fetal growth*” OR “fetal growth
6 restriction*” OR “intrauterine growth retardation” OR “growth retardation” OR “small
7 baby*” OR “very small baby*” OR “low birth weight” OR “low birthweight” OR “very low
8 birth weight” OR “very low birthweight” OR “extremely low birth weight” OR “extremely
9 low birthweight” OR “stillbirth” OR “still birth”) OR (MH “pregnancy outcome*” OR MH
10 “infant very low birth weight” OR MH “outcome* of prematurity”) AND (“malaria in
11 pregnancy” OR “anaemia in pregnancy” OR “substance use” OR “alcohol use” OR “betel nut
12 use” OR “areca nut use” OR “tobacco use” OR “cigarette use” OR “maternal obesity” OR
13 “maternal malnutrition” OR “maternal undernutrition” OR “teenage pregnancy”) AND
14 (“American Samoa” OR “Cook Island*” OR “Easter Island*” OR “Federated States of
15 Micronesia” OR “Fiji” OR “Guam” OR “Kiribati” OR “Mariana Island*” OR “Marshall
16 Island*” OR “Nauru” OR “New Caledonia” OR “Niue” OR “Palau” OR “Papua New
17 Guinea” OR “Samoa” OR “Solomon Island*” OR “Tahiti” OR “Tokelau” OR “Tonga” OR
18 “Tuvalu” OR “Vanuatu” OR “Wallis and Futuna”). Table 3 illustrates a comprehensive
19 search of general and specific search terms combined with MeSH that will be applied to
20 CINAHL database.
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25 In the third stage of the search, we will assess the reference lists of studies initially retrieved
26 in order to identify any relevant studies which have not been identified by the electronic
27 database searches. Additional searches will also be conducted to identify non-indexed studies
28 and manually searching thesis repositories, Google Scholar and Google for regional health
29 organisation websites. The online sources that we will search include the United Nations
30 International Children Emergency Fund, World Health Organisation, Pacific community and
31 individual countries health websites.
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34 **Stage three: Study selection**

35 At this stage, we will screen and select the studies. During the primary review, we will
36 consolidate all studies retrieved, remove all duplicates and remove studies that do not
37 correspond to the Population Concept Context criteria.²⁸ Next, we will screen the titles and
38 abstracts of articles after importing all records retrieved from databases and web-based
39 searches into EndNote. Two reviewers (LK and GT) will be conducting the study selection
40 and data abstraction.²⁶ Any uncertainty with the title and abstract will go through full-text
41 review. Any uncertainty reached on any article will be discussed with the broader research
42 team. If consensus is not reached, articles will be excluded from the review. All remaining
43 articles will go through full-text screening, following the PRISMA flow chart²⁹ and final
44 articles will proceed to the final review.
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48 **Stage four: Charting data**

49 Data charting will involve data extraction and documenting from the final articles selected.
50 During the data extraction, all results will be entered into Excel spreadsheets alongside
51 standard bibliographic information that includes author(s), year of publication, origin or
52 country of origin, aims and purpose, study population, methodology, intervention type,
53 intervention duration, outcomes and details and key findings. Table 4 outlines the standard
54 bibliographic information.²⁷ For each article, reviewed key information to be retrieved will be
55 risk factors matched to birth outcomes, prevalence to the specific context of the region. The
56 framework will be pilot tested by the reviewers to ensure that it is consistent with data
57 charting and the study aims and objectives. Charting of data will be an iterative process of
58 screening and extracting data that will be done mostly by the principal investigator. Any
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3 arising questions and uncertainty during the process will be discussed research team to reach
4 an agreement.
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6 **Stage five: Collating, summarising, and presenting the results**

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8 In stage five, tabular presentation of the findings will be mapped from data extracted from the
9 selected articles, as outlined, (see table 4) and guided by Arskey and O'Malley.²⁵ Findings
10 will be presented quantitatively in aggregated forms figure and qualitatively as thematic
11 narrative summaries, all of which will reflect the study objectives.²⁵ The results of the studies
12 will not be compared but presented as a body of evidence. We expect to map a wide range of
13 risk factors, prevalence, and the different adverse birth outcomes against the countries'
14 ethnic, and geographical diversity to provide the first such body of literature for the region.
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17 **Stage six: Stakeholder consultation**

18 A consultation exercise will be conducted online with relevant health professionals in the
19 Solomon Islands, including midwives, paediatric nurses, obstetricians, and paediatricians
20 identified through contacts and purposive and snowball sampling. This stage aims to validate
21 findings from this study and to add additional insights and recommendations from their
22 perspectives. Consultation will be undertaken at the completion of the article review. The
23 exercise will involve the collection of quantitative and qualitative feedback from clinicians
24 who work with pregnant mothers and infants to obtain their knowledge and experience of risk
25 factors and birth outcomes in the Solomon Islands from a clinical perspective. Ten health
26 professionals working with pregnant woman and infants will be consulted. Selection will be
27 made by purposeful and snowball sampling.
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30 **Stage seven: Patient and public involvement**

31 No patient involved.
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34 **Acknowledgements**

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36 Health Science of Curtin University), the reviewers (BMJ open) and our team of peer
37 reviewers.
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39

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41 LSKK, GFP, GAT and JJ: study inception, conceptualisation and design, LSKK: drafted the
42 first version and conducted the preliminary searches, collating all inputs reiteratively and
43 revision of the manuscript, GAT, JJ, HB, GKD, and GFP: critically reviewed the manuscript.
44 All authors read and approved the final version.
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59
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Ethics and Dissemination

There will be no direct contact with human or patients in the case of the scoping review; therefore, no ethics will be required. However, we will seek ethical approval from the Research Ethics Office of Curtin University and the Health Research and Ethics Committee in the Solomon Islands for stakeholder consultation. Dissemination will be made through regional conferences and publication in peer-reviewed journals.

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Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> -All studies and articles irrespective of their designs -Primary and secondary studies -Population and inferential based studies -Mother and infants' populations -21 Pacific Island countries and territories -Articles published from the year 2000 to current 	<ul style="list-style-type: none"> -Studies on Pacific Islanders living in countries outside the region -Studies on Non-Pacific Islanders living in the Pacific Islands -Studies before the year 2000

Table 2. Grid of key concepts and terms

Concept 1		Concept 2		Concept 3
Adverse birth outcomes	AND	Pregnancy Risk factors	AND	Pacific Island region

Table 3. CINAHL Searches

- Key concepts and terms.

The following key concepts were identified from the topic.

Concept 1		Concept 2		Concept 3
Adverse birth outcomes	OR	Pregnancy risk factors	AND	Pacific Island region

- MeSH and subject headings identified.

Key concept terms	CINAHL
Adverse birth outcomes	MH "Pregnancy outcome*" OR MH "Infant very Low birth weight" OR MH "Outcome* of prematurity"
Pregnancy Risk Factors	MH "Risk factor*" OR MH "Pregnancy risk" OR MH "High risk*" OR MH "Pregnancy in adolescence" OR MH "Pregnancy risk*"
Pacific Island region	MH "Pacific Island*"

- Search strings developed

#1. Key concept and general terms and synonyms search string

("adverse birth outcome*" OR "poor birth outcome*" OR "preterm birth*" OR "premature birth*" OR "Poor fetal growth*" OR "fetal growth restriction*" OR "intrauterine growth retardation" OR "growth retardation" OR "low birth weight" OR "low birthweight" OR "very low birth weight" OR "very low birthweight" OR "extremely low birth weight" OR "extremely low birthweight" OR "stillbirth" OR "still birth") AND ("pregnancy risk factor*" OR "adverse pregnancy outcome*" OR "poor pregnancy outcome*") AND ("Pacific Island*" OR "Oceania" OR "South Pacific Island*" OR "Pacific Island country*")

#2. MeSH terms search string

(MH "pregnancy outcome*" OR MH "infant very low birth weight" OR MH "outcome* of prematurity") AND (MH "risk factor*" OR MH "pregnancy risk*" OR MH "high risk*" OR MH "pregnancy in adolescence*" OR MH "pregnancy risk*") AND ("MH Pacific Island*")

#3. General and MeSH terms combined search string

("adverse birth outcome*" OR "poor birth outcome*" OR "preterm birth*" OR "premature birth*" OR "Poor fetal growth*" OR "fetal growth restriction*" OR "intrauterine growth retardation" OR "growth retardation" OR "small baby*" OR "very small baby*" OR "low birth weight" OR "low birthweight" OR "very low birth weight" OR "very low birthweight" OR "extremely low birth weight" OR "extremely low birthweight" OR "stillbirth" OR "still birth") OR (MH "pregnancy outcome*" OR MH "infant very low birth weight" OR MH "outcome* of prematurity") AND ("pregnancy risk factor*" OR "adverse pregnancy outcome*" OR "poor pregnancy outcome*" OR MH "risk factor*" OR MH "pregnancy risk*" OR MH "high risk*" OR MH "pregnancy in adolescence*" OR MH "pregnancy risk*") AND ("Pacific Island*" OR "Oceania" OR "South Pacific Island*" OR "Pacific Island country*" OR "MH Pacific Island*")

#4. Specific and MeSH terms combined search string

("preterm birth*" OR "premature birth*" OR "Poor fetal growth*" OR "fetal growth restriction*" OR "intrauterine growth retardation" OR "growth retardation" OR "small baby*" OR "very small baby*" OR "low birth weight" OR "low birthweight" OR "very

low birth weight” OR “very low birthweight” OR “extremely low birth weight” OR “extremely low birthweight” OR “stillbirth” OR “still birth”) OR (MH “pregnancy outcome*” OR MH “infant very low birth weight” OR MH “outcome* of prematurity”) AND (“malaria in pregnancy” OR “anaemia in pregnancy” OR “substance use” OR “alcohol use” OR “betel nut use” OR “areca nut use” OR “tobacco use” OR “cigarette use” OR “maternal obesity” OR “maternal malnutrition” OR “maternal undernutrition” OR “teenage pregnancy”) AND (“American Samoa” OR “Cook Island*” OR “Easter Island*” OR “Federated States of Micronesia” OR “Fiji” OR “Guam” OR “Kiribati” OR “Mariana Island*” OR “Marshall Island*” OR “Nauru” OR “New Caledonia” OR “Niue” OR “Palau” OR “Papua New Guinea” OR “Samoa” OR “Solomon Island*” OR “Tahiti” OR “Tokelau” OR “Tonga” OR “Tuvalu” OR “Vanuatu” OR “Wallis and Futuna”)

Filter/limiter used

-Year inclusion 2000-current

-Full-text articles

-English language

-Medical subject headings

Table 4. Data extraction table

Main category
a) Author(s)
b) Year of publication
c) Origin/country study was conducted
d) Study design:
e) Aims/purpose
f) Sampling strategy
g) Study population
h) Sample size
i) Methodology
j) Intervention/exposure type (if applicable) and comparison group (if applicable)
k) Duration of the exposure/intervention (if applicable)
l) Outcomes assessment and method to assess associations (if applicable)
m) Key findings that relate to the scoping review question/s