

INPLASY

Prevalence and outcomes of post-operative infection in children undergoing cardiac surgery: A protocol for a systematic review

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Melbourne.**ADMINISTRATIVE INFORMATION****Support** - None.**Review Stage at time of this submission** - Formal screening of search results against eligibility criteria.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202680001**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 1 August 2026 and was last updated on 1 August 2026.**INTRODUCTION**

Review question / Objective This systematic review will estimate (a) the prevalence of postoperative infection in children undergoing cardiac surgery (primary question) and (b) mortality following a postoperative infection (secondary question).

Rationale Postoperative infection (blood stream, pneumonia, wound, urinary, other) following paediatric cardiac surgery causes significant morbidity and, in many cases, also leads to mortality(1). Reported rates of infection in literature range from 5% to 30% and vary by geographical setting, patient, surgical and treatment related factors(1-3). A previous article in 2017 conducted a systematic review(1) of perioperative infection but did not provide combined estimates of the prevalence of postoperative infection and outcomes following an infection. Such estimates are helpful for (a) understanding the true burden on a global scale, (b) understanding clinical and non-clinical factors associated with development of

infection and (c) planning interventional studies to reduce postoperative infection. This systematic review will aim to address this.

Condition being studied Postoperative infection following paediatric cardiac surgery. Various criteria are used in literature to define/diagnose postoperative infection. This review will consider all such criteria used to diagnose infection.

METHODS

Search strategy 3databases(MEDLINE/Embase/Web of Science). Search dates: 1stJanuary2010-14thJuly2026 without language restrictions. Search will be supplemented with articles from reference lists and scholarly-works recommended by experts. Authors will be contacted to obtain missing data.

MEDLINE:

1 cardiovascular surgical procedures/ or exp cardiac surgical procedures
2 (Fontan or Total-Cavopulmonary-Connection or TPCP or Atrio-Pulmonary or Lateral-Tunnel or

Extra-Cardiac-Conduit or norwood or glenn or hemifontan or ventricular-assist-device* or VAD or arterial-switch or maze-procedure* or cardiomyoplast* or pericardiectomy* or pericardiocentesis* or pericardiotomy*).tw,kf.

3 exp Heart Defects, Congenital/co, su [Complications, Surgery]

4 (1 or 2) and 3

5 ((cardiac or cardio* or coronary or heart or epicardi* or myocardi* or pericardi* or transmyocardi* or thorax or thoracic or aortic* or mitral* or pulmonary or tricuspid) adj3 (reduction or bypass or correction* or operat* or reconstruct* or repair* or surger* or surgical* or surgeon* or lengthen* or procedure* or transfer* or osteotomy* or stabilisation* or stabilization* or graft* or intervention* or implant* or prosthesis* or transplant* or replacement* or revascularisation* or revascularisation*).tw,kf.

6 4 or 5

7 (newborn* or new-born* or baby or babies or neonat* or neo-nat* or infan* or toddler* or preschooler* or preschooler* or kinder or kinders or kindergarten* or kinder-aged or boy or boys or girl or girls or child* or pediatric* or paediatric* or school-age* or schoolage* or schoolchild* or schoolgirl* or schoolboy* or pre-teen* or preteen* or tween or tweens or pre-adolescent* or preadolescent* or pre-puberty or prepuberty or pre-pubescent* or prepubescen* or adolescent* or youth or youths or teen or teens or teenage or ((elementary or primary or secondary or middle or high or grade or year) adj3 student*).tw,kf,hw.

8 (infection* or sepsis* or septic* or bacteraemia* or bacteremia* or pneumonia*).tw,kf,hw.

9 exp cohort studies/ or (longterm or long-term or repeat* or serial or longitudinal* or follow-up or followup or cohort* or retrospective* or prospective*).tw,kf.

10 (risk or risks).tw,kf,hw.

11 9 or 10

12 (prevalence or incidence* or epidemiol* or survey* or rapid-assessment or situation-assessment or situational-assessment or RAR or cohort or surveillance or seroprevalence or seroprevalence or seroincidence* or sero-incidence* or seroepidemiol* or sero-epidemiol* or screening).tw,kf.

13 exp epidemiologic methods/ or exp epidemiologic studies/ or exp population surveillance/

14 (ep or et).fs.

15 (aetiolog* or etiolog*).tw,kf.

16 12 or 13 or 14 or 15

17 6 and 7 and 8 and 11 and 16

18 limit 17 to yr="2010 -Current"

19 (exp animals/ or (animal* or rat or rats or mouse or mice or rodent* or swine or porcine or murine or

sheep or lamb or lambs or pig or pigs or piglet or piglets or rabbit or rabbits or cat or cats or dog or dogs or cattle or bovine or monkey or monkeys or trout or marmoset or marmosets).ti.) not human*.sh.

20 limit 18 to "books and documents"

21 limit 18 to (case reports or clinical conference or conference proceedings or letter or preprint)

22 18 not (19 or 20 or 21)

Embase:

1 cardiovascular surgery/ or exp heart surgery/

2 (Fontan or Total-Cavopulmonary-Connection or TCPC or Atrio-Pulmonary or Lateral-Tunnel or Extra-Cardiac-Conduit or norwood or glenn or hemifontan or ventricular-assist-device* or VAD or arterial-switch or maze-procedure* or cardiomyoplast* or pericardiectomy* or pericardiocentesis* or pericardiotomy*).tw,kf,dq.

3 exp congenital heart malformation/co, su [Complication, Surgery]

4 (1 or 2) and 3

5 ((cardiac or cardio* or coronary or heart or epicardi* or myocardi* or pericardi* or transmyocardi* or thorax or thoracic or aortic* or mitral* or pulmonary or tricuspid) adj3 (reduction or bypass or correction* or operat* or reconstruct* or repair* or surger* or surgical* or surgeon* or lengthen* or procedure* or transfer* or osteotomy* or stabilisation* or stabilization* or graft* or intervention* or implant* or prosthesis* or transplant* or replacement* or revascularisation* or revascularisation*).tw,kf,dq.

6 4 or 5

7 (newborn* or new-born* or baby or babies or neonat* or neo-nat* or infan* or toddler* or preschooler* or preschooler* or kinder or kinders or kindergarten* or kinder-aged or boy or boys or girl or girls or child* or pediatric* or paediatric* or school-age* or schoolage* or schoolchild* or schoolgirl* or schoolboy* or pre-teen* or preteen* or tween or tweens or pre-adolescent* or preadolescent* or pre-puberty or prepuberty or pre-pubescent* or prepubescen* or adolescent* or youth or youths or teen or teens or teenage or ((elementary or primary or secondary or middle or high or grade or year) adj3 student*).tw,kf,hw,dq.

8 (infection* or sepsis* or septic* or bacteraemia* or bacteremia* or pneumonia*).tw,kf,hw,dq.

9 cohort analysis/ or follow up/ or clinical study/ or clinical studies/ or clinical article/ or exp clinical trial/ or exp clinical trials/ or exp longitudinal study/ or major clinical study/ or prospective study/ or retrospective study/ or (longterm or long-term or repeat* or serial or longitudinal* or follow-up or followup or cohort* or retrospective* or prospective*).tw,kf,dq.

10 (risk or risks).tw,kf,hw,dq.

11 9 or 10

12 (prevalence or incidence* or epidemiol* or survey* or rapid-assessment or situation-assessment or situational-assessment or RAR or cohort or surveillance or seroprevalence or seroprevalence or seroincidence* or sero-incidence* or seroepidemiol* or sero-epidemiol* or screening).tw,kf,dq.

13 exp epidemiology/ or exp prevalence/ or exp epidemiological data/ or observational study/ or cohort analysis/ or follow up/ or exp clinical study/ 14 (ep or et).fs.

15 (aetiolog* or etiolog*).tw,kf,dq.

16 12 or 13 or 14 or 15

17 6 and 7 and 8 and 11 and 16

18 limit 17 to yr="2010 -Current"

19 ((animal* or rat or rats or mouse or mice or rodent* or swine or porcine or murine or sheep or lamb or lambs or pig or pigs or piglet or piglets or rabbit or rabbits or cat or cats or dog or dogs or cattle or bovine or monkey or monkeys or trout or marmoset or marmosets).ti. and animal experiment/) or (Animal experiment/ not (human experiment/ or human/))

20 case report/

21 limit 18 to ("clinical trial (clinicaltrials.gov)" or conference abstract or "conference review" or letter or "preprint (unpublished, non-peer reviewed)")

22 18 not (19 or 20 or 21).

Participant or population Children (0-18 years) undergoing cardiac surgery.

Intervention None.

Comparator None.

Study designs to be included Cross-sectional and cohort studies reporting data on post-operative infection. Case-control studies will be considered if they give appropriate information (numerator and denominator) to calculate prevalence.

Eligibility criteria Prespecified eligibility criteria as stated above in this protocol will be used. Studies will be excluded if they restricted their cohort to select groups of patients (eg. those on ECMO, those who have delayed sternal closure, only high-risk patients etc...). Studies reporting only one specified type of infection (eg. surgical site infections alone) will also be excluded. If more than one study reports on the same cohort or on overlapping cohorts, only the most recent or most relevant study will be used.

Information sources MEDLINE, Embase (search terms under search strategy) and Web of Science (search terms below).

Web of Science:

#1 Title/abstract

Fontan or Total-Cavopulmonary-Connection or TCPC or Atrio-Pulmonary or Lateral-Tunnel or Extra-Cardiac-Conduit or norwood or glenn or hemifontan or ventricular-assist-device* or VAD or arterial-switch or maze-procedure* or cardiomyoplast* or pericardiectom* or pericardiocentes* or pericardiotom*

#2 Title/abstract

(cardiac or cardio* or coronary or heart or epicardi* or myocardi* or pericardi* or transmyocardi* or thorax or thoracic or aortic* or mitral* or pulmonary or tricuspid) NEAR/2 (reduction or bypass or correction* or operat* or reconstruct* or repair* or surger* or surgical* or surgeon* or lengthen* or procedure* or transfer* or osteotom* or stabilisation* or stabilization* or graft* or intervention* or implant* or prosthesis* or transplant* or replacement* or revascularisation* or revascularisation*)

#3 #1 or #2

#4 Title/abstract

newborn* or new-born* or baby or babies or neonat* or neo-nat* or infan* or toddler* or pre-schooler* or preschooler* or kinder or kinders or kindergarten* or kinder-aged or boy or boys or girl or girls or child* or pediatric* or paediatric* or school-age* or schoolage* or schoolchild* or schoolgirl* or schoolboy* or pre-teen* or preteen* or tween or tweens or pre-adolescen* or preadolescen* or pre-puberty or prepuberty or pre-pubescent* or prepubescen* or adolescen* or youth or youths or teen or teens or teenage or ((elementary or primary or secondary or middle or high or grade or year) NEAR/2 student*)

#5 Title/abstract

infection* or sepsis* or septic* or bacteraemia* or bacteremia* or pneumonia*

#6 Title/abstract

longterm OR long-term OR repeat* OR serial OR longitudinal* OR follow-up OR followup OR cohort* OR retrospective* OR prospective* OR clinical-stud* OR clinical-article* OR clinical-trial* OR risk or risks

#7 Title/abstract

prevalence OR incidence* OR epidemiol* OR survey* OR rapid-assessment OR situation-assessment OR situational-assessment OR RAR OR cohort OR surveillance OR data-collection OR questionnaire* OR disease-notification OR controlled-before-after OR cross-sectional OR time-series OR historically-controlled OR aetiolog* or etiolog*

#8 #3 and #4 and #5 and #6 and #7

#9 Title/abstract

(Animal OR animals OR rat OR rats OR mouse OR mice OR rodent* OR swine OR porcine OR murine OR sheep OR lamb OR lambs OR pig OR pigs OR piglet OR piglets OR rabbit OR rabbits OR cat OR cats OR dog OR dogs OR cattle OR bovine OR monkey OR monkeys OR trout OR marmoset OR marmosets) NOT (human OR humans OR patient OR patients OR newborn* OR baby OR babies OR neonat* OR infan* OR toddler* OR pre-schooler* OR preschooler* OR kindergarten OR boy OR boys OR girl OR girls OR child OR children OR childhood OR adolescen* OR pediatric* OR paediatric* OR youth* OR teen OR teens OR teenage* OR school-aged* OR school-child* OR school-girl* OR school-boy* OR schoolgirl* OR schoolboy* OR man OR men OR woman OR women OR adult OR adults OR middle-age* OR elderly)

#10 #8 NOT #9

Limited from 2010 onwards

Limited to: article or other or clinical trial or early access or editorial material or unspecified.

Main outcome(s) Postoperative infection and mortality outcome following a postoperative infection after cardiac surgery in children.

Additional outcome(s) Non-mortality outcomes (length of mechanical ventilation, duration of intensive care and hospital stay) may be reported if enough detail is available.

Data management The study screening and selection will be performed independently by two reviewers. Quality of selected studies will be assessed independently by 3 reviewers. Data collection from included studies will be performed by one reviewer. Disagreements between the reviewers will be resolved by discussion between them and if needed, a third researcher will be used to resolve any disagreement

Publication characteristics (author, year, recruitment period, location of study, single centre vs multi-centre, entry criteria into study), type of study, country of study and its economic classification (based on world bank grouping), country region (based on WHO classification), patient demographics, time to infection (after surgery), cardiopulmonary bypass time, cardiac surgery risk category, total number in the study, number who developed infection, type of infection, organisms causing infection, mortality and non-mortality outcomes among those who developed infection. Studies are likely to be highly heterogenous due to varying case definitions used for infection capture, population characteristics,

different country settings, duration of infection capture and reporting methods.

Collection of articles and their organization will be in Endnote reference management software. Excel spread sheet will be used to collect data. Statistical analysis will be conducted in Stata statistical software (StataCorp LP, College Station, TX) version 16 or higher.

Quality assessment / Risk of bias analysis

Results will be reported using PRISMA (Preferred reporting items for Systematic reviews and meta-analysis) guidelines (4). Quality of included studies will be assessed using the Joanna Briggs Institute Critical Appraisal framework for prevalence studies (5,6).

Strategy of data synthesis In assessing the risk of bias in the selected studies, reviewers will make a judgement whether the study reflects the target population of interest. Studies which report prevalence at a patient level and surgery level will be considered for inclusion. The timing of infection after cardiac surgery is variable; studies reporting on infection anytime during the hospital stay will be included. Study level descriptive data will be reported in tabular format. The prevalence of infection and the mortality in those who develop infection will be reported using a random-effects model with Dersimonian-Laird approach to estimate between study variance. Proportions will be transformed using the Freeman-Tukey double arcsine method and estimates will be reported along with 95% confidence intervals. Prevalences are expected to vary across the pooled studies owing to expected differences in geographical location, study period, country level income, eligibility criteria used for selection of children and ways of defining post-operative infection. The overall heterogeneity will be reported using 95% prediction intervals. Forrest plot will be presented to visualize estimates and their 95% CI. Assumptions made for funnel plot and other tests for publication bias (eg-Egger test) are unlikely to hold true in systematic reviews of prevalence studies and hence will not be used; instead this issue will be considered qualitatively(7,8).

Subgroup analysis Where feasible meta-regression will be used to explore causes of variation using study level covariates such as age, sex, cardiopulmonary bypass duration and country level income (according to World Bank Classification <https://ourworldindata.org/grapher/world-bank-income-groups>). Prevalence data will be presented as an overall estimate and by subgroups (high-income vs low-to-middle income regions using World bank classification) and by

WHO regions (if enough studies [at least 2 in each subgroup] are available).

Sensitivity analysis To assess the robustness of pooled estimates, the following sensitivity analyses will be planned: (a) using alternate proportion transformations (e.g., logit proportions) and (b) analysis excluding individual studies (leave one out method).

Language restriction No restrictions.

Country(ies) involved Australia (Royal Children's Hospital).

Other relevant information None.

Keywords Cardiac surgery, children, infection.

Dissemination plans The results of the study will be submitted for publication in a peer-reviewed journal.

Contributions of each author

Author 1 - Siva Namachivayam - Conception, design, coordinating, data collection, data management, analysis of data, interpretation, writing the protocol & review.

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Author 2 - Diana Florian - Design, data collection, protocol review, contribution to analysis, interpretation, review.

Author 3 - Johnny Millar - Design, data collection, protocol review, contribution to analysis, interpretation, review.