### Section/topic | # | Checklist item | Reported on page #
--- | --- | --- | ---
**TITLE**
Title | 1 | Identify the report as a systematic review, meta-analysis, or both. | 1

**ABSTRACT**
Structured summary | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | 4

**INTRODUCTION**
Rationale | 3 | Describe the rationale for the review in the context of what is already known. | 9-17
Objectives | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | 18

**METHODS**
Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | n.a.
Eligibility criteria | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | 18-19
Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | 20
Search | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | 52
Study selection | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | 19-20
Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | 20
Data items | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | 18-19
Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | 20
Summary measures | 13 | State the principal summary measures (e.g., risk ratio, difference in means). | n.a.
Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis. | 21
### RESULTS

**Study selection**
- Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.

**Study characteristics**
- For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.

**Risk of bias within studies**
- Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).

**Results of individual studies**
- For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.

**Synthesis of results**
- Present results of each meta-analysis done, including confidence intervals and measures of consistency.

**Risk of bias across studies**
- Present results of any assessment of risk of bias across studies (see Item 15).

**Additional analysis**
- Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16],).

### DISCUSSION

**Summary of evidence**
- Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).

**Limitations**
- Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).

**Conclusions**
- Provide a general interpretation of the results in the context of other evidence, and implications for future research.

### FUNDING

**Funding**
- Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.
Tab. 2: Reasons for exclusion

| Author and Year     | Reason for exclusion                           |
|---------------------|------------------------------------------------|
| Chennoufi et al., 2004 | Different intervention                        |
| Chan et al., 2018       | Phage OMKO1 and ceftazidime                   |
| Bruttin et al., 2005    | Healthy volunteers                            |
| Bachrach et al., 2002   | Healthy volunteers                            |
| Jikia et al., 2005      | PhagoBioDerm                                  |
| Johnson et al.,         | Animal study                                  |
| Kochetkov et al., 1989  | Only abstract in English                      |
| Lang et al., 1979       | Only abstract in English                      |
| Lazareva et al., 2001   | Only abstract in English                      |
| Leitner et al., 2017    | No results published yet                      |
| Ligonenko et al., 2015  | Only abstract in English                      |
| Marei et al., 2003      | Different intervention                        |
| Markoishvil et al., 2002| PhagoBioDerm                                |
| Miedzybrodzki et al., 2008| Analysis of inflammatory markers            |
| Marza et al., 2006      | Antibiotic and Phage therapy                  |
| Nazari et al., 2011     | $^{99m}$Tc-ubiquicidin 29–41 cationic antimicrobial peptide |
| Rubinstein et al., 2000 | HIV-1 infected patients                      |
| Szelachowska et al., 2014| Phage neutralization                    |
| Slopek et al., 1985     | Method and Intervention unclear               |
| Weber-Dabrowska et al., 1987| Different intervention                        |
### Tab. 3: Summary table of quality assessment of cohort studies (CASP)

| Author          | Focus of Issue | Recruitment acceptable | Accurate measurement of exposure | Accurate measurement of outcome | Identification of all confounding factors | Impact of confounding factors on design/Analysis taken into account | Follow-up of subjects complete | Follow-up long enough | Precise results | Believable results | Applicable to local population | In accordance with other available evidence | Implication for practice | Is the study quality high enough? |
|-----------------|----------------|------------------------|---------------------------------|-------------------------------|----------------------------------------|------------------------------------------------------------------|-----------------------------|---------------------|-----------------|-----------------|-----------------------------|----------------------------------|-----------------------------|----------------------|
| Patel et al., 2019 | X              | O                      | X                               | X                             | X                                      | O                                                               | X                           | X                   | X               | X               | X                           | X                                | X                           | X                     |
| Gupta et al., 2019 | X              | X                      | X                               | X                             | X                                      | O                                                               | X                           | O                   | X               | X               | O                           | X                                | X                           | X                     |
| Dabrowska et al., 2003 | X          | X                      | X                               | O                             | O                                      | O                                                               | X                           | X                   | X               | X               | X                           | X                                | X                           | X                     |

X = yes  
O = no

### Tab. 4: Summary table of quality assessment of randomised controlled trials (CASP)

| Author          | Focus of Issue | Randomisation | Patients accounted for conclusion | Blinding | Homogeneity of groups | Homogeneity of treatment apart from intervention | Significant treatment effect | Precise treatment effect | Applicable to local population | Clinically important outcomes considered | Benefit | Acceptable quality? |
|-----------------|----------------|---------------|----------------------------------|----------|-----------------------|---------------------------------------------|-----------------------------|--------------------------|----------------------------------|----------------------------------------|---------|-------------------|
| Jault et al., 2018 | X             | X             | X                               | O        | O                     | X                                          | O                           | X                       | X                   | X                           | X       | X                 |
| Totté et al., 2017 | X             | X             | X                               | X        | X                     | X                                          | O                           | X                       | X                   | X                           | X       | X                 |
| Wright et al., 2009 | X             | X             | X                               | X        | NS                    | X                                          | X                           | X                       | X                   | X                           | X       | X                 |
| Rhoads et al.,   | X             | X             | X                               | X        | X                     | X                                          | O                           | X                       | X                   | X                           | X       | X                 |
## Attachment 1

**Tab. 5: Summary table of case studies (Joanna Briggs Critical Appraisal Checklist)**

| Author, Year        | Dedrick et al., 2019 | Totté et al., 2017 | Jennes et al., 2017 | Fish et al., 2018 | Schooley et al., 2017 | Fish et al., 2016 |
|---------------------|----------------------|--------------------|---------------------|-------------------|----------------------|-------------------|
| 1. Were patient's demographic characteristics clearly described? | Unclear | Yes | Yes | Yes | Yes | Yes |
| 2. Was the patient's history clearly described and presented as a timeline? | Yes | Yes | Yes | Yes | No | Unclear |
| 3. Was the current clinical condition of the patient on presentation clearly described? | Yes | Yes | Yes | Yes | Yes | Yes |
| 4. Were diagnostic tests or assessment methods and the results clearly described? | Yes | No | Yes | Yes | Yes | Yes |
| 5. Was the intervention(s) or treatment procedure(s) clearly described? | Yes | Unclear | Yes | Yes | Yes | Yes |
| 6. Was the post-intervention clinical condition clearly described? | No | Unclear | N/A | Yes | Yes | Yes |
| 7. Were adverse events (harms) or unanticipated events identified and described? | N/A | Unclear | Yes | Unclear | No | N/A |
| 8. Does the case study provide takeaway lessons? | Yes | Yes | Yes | Yes | Yes | Yes |
| 9. Are the conclusions drawn justified by the results? | Yes | Yes | Yes | Yes | Yes | Yes |
| 10. Are the findings of the study transferable to other settings? | Yes | Yes | Yes | Yes | Yes | Yes |
| Search | Search Terms |
|--------|--------------|
| #1     | enzyme therap*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #2     | bacteriophage*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #3     | intravenous phage therap*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #4     | phage treatment*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #5     | antimicrobial peptide*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #6     | biopharmaceutic*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #7     | enzybiotic*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #8     | endolysin*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #9     | ilysin*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #10    | artilysin*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #11    | engineered endolysin*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #12    | protein engineering.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #13    | engineered phage*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #14    | viral protein*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #15    | phage therap*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #16    | #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 |
| #17    | antibact*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
### Search Terms

| Search | Search Terms |
|--------|--------------|
| #18    | antibiotic*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #19    | antimicrobial*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #20    | antibiotic resistance*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #21    | bacterial infect*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #22    | multidrug resistance*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #23    | drug resistance*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #24    | anti-bacterial therap*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #25    | anti-bacterial treatment*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #26    | antibacterial therap*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #27    | antibacterial treatment*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #28    | intravenous antibiotic*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #29    | #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 |
| #30    | human*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #31    | wound healing*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #32    | reduction of infec*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms], |
| #33    | #31 OR #32 |
| #34    | #33 AND #29 AND #16 AND #30 |

**EMBASE: 540  MEDLINE: 281**