

Protocol of the scoping review – Biosecurity measures assessment at animal farm level in Africa

ADMINISTRATIVE INFORMATION

Title

A scoping review on biosecurity measures assessment at animal farm level in Africa

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Author contributions

Ronald Vougat Ngom drafted the protocol and all authors provided their input.

Registration

This protocol is archived at Padua Research Archive (handle code: <https://hdl.handle.net/11577/3495042>) and published online with Systematic Reviews for Animals and Food (SYREAF) available at: <http://www.syreaf.org/>. This protocol is reported using the items (headings) recommended in the PRISMA-P guidelines (Moher *et al.*, 2015).

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INTRODUCTION

Rationale

Worldwide, the livestock sector significantly contribute to the economy of many countries and plays an important role for both food security and employment in urban and rural populations (Ochieng et al., 2021; Mngumi et al 2023). The high density of animal production sites and their related contact structures are drivers for infectious animal diseases responsible for morbidity, mortality, and economic losses (Rohr et al., 2019). Animal diseases represent one of the main hindrance (Noguera et al., 2022). In Africa, for example, the lack of effective implementation and enforcement of guidelines on how to deal with infectious diseases and pests, in many cases, has led to the collapse of an industries at local and regional levels. Introduction of infectious agents in a farm may have severe implications beyond the farm level. This results in an increasing antimicrobial usage (AMU) in farms and a possible development of antimicrobial resistance (AMR) that can afterwards be transmitted to humans (Chantziaras et al., 2013; Chantziaras et al., 2014). This is associated with increased impact in population health and economy. Indeed, it is well known that AMU is the main driver of AMR (Dutra et al., 2021). AMR is a serious public health concern (FDA, 2020) with a high death rate recorded in African regions (Murray et al., 2022).

It is therefore of great importance for producers to prevent disease outbreaks rather than to cure them. This prevention should not be achieved through an increased prophylactic use of antibiotics (Eijck and De Wilt, 2009). As a result, biosecurity is a key strategy to reduce the incidence of diseases. The Food and Agriculture Organization of the United Nations (FAO) defines the term biosecurity as ‘a strategic and integrated approach to analysing and managing risks to human, animal and plant life and health, and associated risks to the environment’ (FAO, 2003). The World Organization for Animal Health (OIE) defines biosecurity as “a set of management and physical measures designed to reduce the risk of introduction, establishment and spread of animal diseases, infections or infestations to, from and within an animal population” (OIE, 2021). “At the farm level, biosecurity measures may focus either on reducing the risk of entry of new pathogens (external biosecurity) or on reducing the internal dissemination of pathogens (internal biosecurity)” (FAO, 2010). Good biosecurity practices have been demonstrated to be related to improved performance, quality of animal production, better financial return for farmers, and a low AMU (Rojo-Gimeno et al., 2016; Postma et al., 2017).

Due to the importance of biosecurity, a Progressive Management Pathway approach for terrestrial animal biosecurity (FAO-PMP-TAB) has been developed by FAO to strengthen biosecurity in terrestrial animal production and associated value chains (FAO, 2023). Strengthening biosecurity is one of the key thematic components of the One Health priority programme area of the FAO Strategic Framework's aspiration of "Better Production".

In Europe, a well-known system has been developed and successfully applied in several countries worldwide to assess biosecurity in intensive livestock farming . The Biocheck.UGent™ scoring system was developed by Gent University (Belgium) to assess biosecurity based on a risk assessment approach (Rodrigues da Costa et al., 2019; Chantziaras et al., 2020). This well-established Biocheck.UGent questionnaire aims at describing the complete biosecurity situation at farm level. It has been developed to measure and quantify the level of biosecurity on several intensive livestock farms. Recently, Biocheck.UGent launched additional tools to assess biosecurity in other types of farming (e.g. free-range broilers, free-range layers). It has been used in several European countries (Laanen et al., 2013; Backhans et al., 2015; Postma et al., 2016; Filippitzi et al., 2017; Pandolfi et al., 2018) to assess the level of biosecurity in farm.

This scoring system needs to be adapted in the African context because of differences between production systems. For example in Africa, due to the limited number of veterinarians, these are not farmers' main source of information on animal wellbeing and animal health management (Vougat Ngom et al., 2017). In addition, contrary to other continents, in Africa the livestock sector is mostly represented by extensive and semi-intensive systems. It is well known, as already described in many studies (Higgins et al., 2017; Maye and Chan, 2020), that the implementation of farm biosecurity practices varies widely according to many factors including geographic regions, social groups, farmers' socio-demographic characteristics and attitudes, access to information. The development of sustainable biosecurity management systems in animals in Africa will certainly contribute to One Health and ultimately benefit people, animals and ecosystems (FAO et al., 2022). Then, the question is, what methodologies and tools are used to assess biosecurity in Africa?

Objectives

In line with the recommendation of a recent review to reinforce the concept of farm biosecurity in lower- and middle-income countries (Dhaka et al., 2023), this review aims to provide a comprehensive understanding of the methods and tools used to assess biosecurity at farm level in African countries. Thus, the finding will be translated into practical recommendations relevant to the needs of animal farms.

This scoping review has the following specific objectives:

- To describe the existing literature on biosecurity assessment in animal farms in Africa;
- To identify biosecurity assessment methods and tools and discuss any gaps within this topic;
- To recommend the best way to assess biosecurity in the African context compared to existing standards and frameworks .

The specific PICO elements are:

1. **Population:** Poultry, cattle, pigs, goats and sheep
2. **Interest:** Biosecurity measures assessment at farm level
3. **Context:** African countries

METHODS

Eligibility criteria

Inclusion criteria

Criteria related with the elements of the PICO question (Population, Interest and Context):

1. Language: Publications in English or French.
2. Publication types: Journal articles reporting original research data, fulfilling the study design eligibility criteria (cross-sectional, longitudinal study, case-control study, cohort study)
3. Publication date: no limitation
4. Geographical location of studies: African countries
5. Availability of full-text articles

This review will focus on poultry (broilers, layers, turkeys, ducks), cattle, pigs, goats and sheep due to their relevance in the African context in terms of livestock production (FAOSTAT, 2021).

Exclusion criteria

Articles that explored only farm biosecurity (or management issues) without mentioning the assessment methodology/tools will be excluded. Reviews, editorials, commentaries, and papers published in languages other than English, and French will be excluded.

Information sources

To identify potentially relevant documents, the search will be conducted in five databases: CAB Abstract (Ovid interface), Agricola, Web of Science (WOS), Scopus and PubMed available via the University of Bern (Switzerland).

All the databases of WOS will be used (Web of science core collection, ProQuest™ Dissertation & Theses Citation Index, KCI-Korean Journal Database, Medline, Preprint Citation Index, and SciELO Citation Index) except Arts & Humanities Citation Index (A&HCI), Conference Proceedings Citation Index-Science (CPCI-S), and Conference Proceedings Citation Index-Social Science & Humanities (CPCI-SSH) because their research focus is not within the scope of this review.

Search

The search terms will be the same for all databases, but the formatting of the terms will vary due to different architectures of the databases. The concept of the search strategy will be the following:

[Biosecurity] AND [Farm] AND [cattle or poultry or pigs or sheep or goat] AND [African countries].

The general search strategy to identify studies relevant to the PICO of this review will be the following as partially suggested by Dhaka et al. (2023):

#1 ("biosecurity" or "farm biosecurity" or "animal biosecurity" or "preventive veterinary medicine" or "herd health management")

#2 (Farmer or farm* or "farm-level" or "farm-level*")

#3 (pig* or swine* or pig* or weaner or fattener or sow or piglet* or boar or boars or "*Sus domesticus*" or chick* or poultry* or broiler* or layer* or turkey* or duck* or geese or goose or fowl* or avian* or bird* or hen or hens or "gallus gallus" or flock* or cattle or beef or cow*

or calf or calves or “Bos indicus” or heifer* or bull* or bovine or dairy or zebu or sheep* or caprine or goat* or ovine or ewe, or "small ruminant" or "food-producing animal*" or "food animal*" or " animal husbandry" or "animal farming" or "domestic animal*" or livestock)

#4 (Africa or African or Comoros or Djibouti or Madagascar or Malawi or Seychelles or Cameroon or "Central African Republic" or Chad or Congo or "Equatorial Guinea" or "Atlantic Islands" or Gabon or Morocco or Sudan or Botswana or Lesotho or Swaziland or Benin or "Burkina Faso" or "Cape Verde" or Ghana or Guinea or Mauritania or Niger or Senegal or "Sierra Leone" or Togo or Burundi or Eritrea or Ethiopia or Kenya or Mozambique or Rwanda or Somalia or Tanzania or Uganda or Zambia or Zimbabwe or Angola or Algeria or Egypt or Tunisia or Namibia or “South Africa” or Gambia or Liberia or Mali or Nigeria or “Ivory Cost”)

#1 AND #2 AND #3 AND #4

Selection of Sources of Evidence

All citations retrieved in the literature search will be imported into Zotero and deduplication will be carried out using the de-duplication process. After duplicate removal, the file obtained will be uploaded in Rayyan to facilitate collaboration among reviewers during the study selection process. Indeed, four independent reviewers will perform the screening at each stage of the review to reduce the possibility of excluding relevant reports. Half of the citations will be assigned to two authors and the other half to two others. This will guarantee that each reference is screened by two independent reviewers.

The papers will be screened in two independent stages. To increase consistency among reviewers at each stage, the four reviewers will screen 50 randomly selected papers, discuss and amend the results before beginning the screening process. This calibration exercise will enable discussion and solve disagreements before carrying out the full selection process (Windeyer et al., 2021).

In the first stage of the selection process all the reviewers will screen the titles and abstracts. Conflicts will be resolved by a third reviewer if consensus between two reviewers of a pair will not be reached (Duffett et al., 2013). The studies that meet inclusion criteria will pass to the next phase.

Eligibility of studies will be assessed with the following questions:

1. Does the study concern at least one of the following species: poultry, cattle, pigs, sheep, goats? Yes [Include], No [Exclude], Unclear [Include]
2. Is the study original research? Yes [Include], No [Exclude], Unclear [Include]
3. Does the study take place in at least one African country? Yes [Include], No [Exclude], Unclear [Include]
4. Does the study concern biosecurity assessment? Yes [Include], No [Exclude], Unclear [Include]

Full text screening will be performed for the papers that meet the inclusion criteria in the first phase.

Eligibility of studies will be assessed with the following questions:

1. Is a full text of more than 500 words available? Yes [Include], No [Exclude]
2. Is a full text available? Yes [Include], No [Exclude]
3. Is the full text available in English, or French? Yes [Include], No [Exclude]
4. Does the study concern biosecurity assessment at farm level? Yes [Include], No [Exclude]
5. Does the study provided the total level of biosecurity of the farm? Yes [Include], No [Exclude]
6. Does the study concern biosecurity assessment of the farm related to a specific disease? Yes [Exclude], No [Include]
7. Does the study an observational in design? Yes [Include], No [Exclude]

Data Charting Process

To ensure consistency across reviewers, they will first conduct a calibration exercise by extracting data from five randomly selected papers. Like in the screening phase, four reviewers will independently extract data by using a pre-defined table created in Excel. This data-charting form will be jointly developed by all the authors. The reviewers will independently chart the data, discuss the results and continuously update the data charting form in an interative process (Lenzen *et al.*, 2017). Disagreements for which a consensus between a pair cannot be found will be resolved by a third reviewer. Data extracted will include demographic information, methodology, and other details described below. We will contact the authors to resolve any uncertainties if necessary.

Data items

Data to be extracted from eligible studies will include the following items:

General information

- First author name
- Year of publication
- Duration of study
- Country of study (where the study was conducted). If not stated, contact study authors or use NA if the authors do not reply
- Study design (cross-sectional, longitudinal study, etc.)
- Study citation

Population data

- Animal production type: level 1 (species), cattle, poultry, pigs, sheep, goats; level 2, dairy cattle, calves, heifers, broilers, layer chickens, turkeys, weaners, finishing pigs, adult pig/sows,
- Number of farms
- Farm size

Interest data

- Methods of biosecurity assessment (ie. If survey; type of survey)
- Tools used for biosecurity assessment
- External biosecurity factor scores
- Internal biosecurity factor scores
- External biosecurity factors assess
- Internal biosecurity factors assess

Synthesis of Results

The results of the literature search will be reported, including numbers of citations screened, duplicates removed, and full-text documents screened. A flow diagram that details the reasons for exclusion at the full-text level of screening will also be provided. A narrative synthesis will be provided with information presented as text, diagrams, and maps. Tables to summarize and explain the characteristics, findings and research gaps of the included studies will also be used. Results expressed as a range of score for each assessed biosecurity factor will be presented according to animal species, sub-region, etc. Different tools used to assess biosecurity measure at farm level in Africa will be described.

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