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Through the eyes of researchers: A thematic trajectory analysis of intervention programmes to improve biosecurity in livestock

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Biosecurity measures aim to prevent the introduction and spread of infectious diseases within animal farms, which in turn can influence antimicrobial use and animal welfare. However, there remains significant scope for improving the implementation of these measures. This can be enhanced through social interventions:

- **One-to-one interventions (OI)**: Facilitating personal and professional development through self-awareness and goal setting by means of guided support and reflection.
- **Group interventions (GI)**: Strengthening social connections through key activities and resources within groups to enhance their performance.
- **Community interventions (CI)**: Addressing shared problems through collective solutions within a defined group, either geographically, relationally, or both.

The implementation of these interventions by researchers involves various challenges and useful elements, which may ultimately shape their intended purpose. In this regard, this study focuses on the *journey* undertaken by researchers engaging with these interventions. It explores newly introduced approaches (e.g. participatory methods focused on farmers) while also delving deeper into those previously applied (e.g. quantitative methods focused on veterinarians).

> The aim of this study is to explore the challenging and useful elements influencing researchers' *journey* in carrying out social interventions over time, in order to inform the development of future interventions.

Diary entries:
- Facilitate the integration of **multimodal** data (text, audio, and images).
- Record events and experiences in their **natural context** and in **real time**.
- Foster **participants' agency** by giving them a voice in the research.
- Connect **phenomena** through **emerging** and **established patterns**.
- Capture the **complexity** and **nuances** of social interactions.
- Examine **changes** and the **evolution** of processes over time.
- Enable **critical reflection** and **participant reflexivity**.

Thematic trajectory analysis:
- Organises and categorises qualitative data to identify **trends** and **relationships**.
- Compares data across **different levels** (micro, meso, and macro), enabling a structured evaluation of phenomena.
- Represents **changes** and the **evolution** of themes over time under **different conditions**, allowing for **graphical representation**.
- Examines **patterns** within a **single case** (intra) or across **multiple cases** (inter).

Diary entries were collected from **20 researchers** from April 2024 to the present, comprising a total of **76 texts** (28,252 words), **17 audio** (101.28 minutes), and **5 images**.

The main elements/feelings identified from the analysis can be seen in the tables and relate to features that were seen as challenging or useful/positive or negative. The quotes are numbered according to the main element/feeling they represent. The graphs were generated based on the number of participants who referenced elements/feelings of each specific theme in a given month.

2. "We haven't really started yet with the study […] but haven't really started recruitment on a large scale yet […]. We did ask our contacts in the veterinary field on suitable farms, but we were not ready to send out recruitment emails" (Participant 1, C-OI, August)

2. "Due to the availability of the farmers we had to delay the visit by 10 days" (Participant 2, C-OI, December)

7. "The combination of expertise from *name 1* and myself worked very well although it is really important to follow the instructions from *name 1* and *name 2* to keep the discussion focused, dynamic and efficient" (Participant 3, U-CI, April)

7. "I am supposed to be present during farmer meetings in order the maintain the discussion with farmers because of my experience in biosecurity in *animal* farms, so I would define it as a mediation task somehow. Also, I am here to channel the discussions so that we do not forget to address some points of interest" (Participant 4, U-CI, January)

Design phase
Challenging elements
1. Limited participation of the research team
2. Delays in intervention planning and execution
3. Problems with data collection tools
4. Excessive time spent on data collection
5. Issues and redesigns in initial intervention approaches
6. Travel-related difficulties
Useful elements
7. Researchers' valuable skills
8. Adaptability and flexibility in intervention approaches
9. A comfortable environment during the intervention
10. Initial engagement with participants
11. Involvement of external agents in interventions
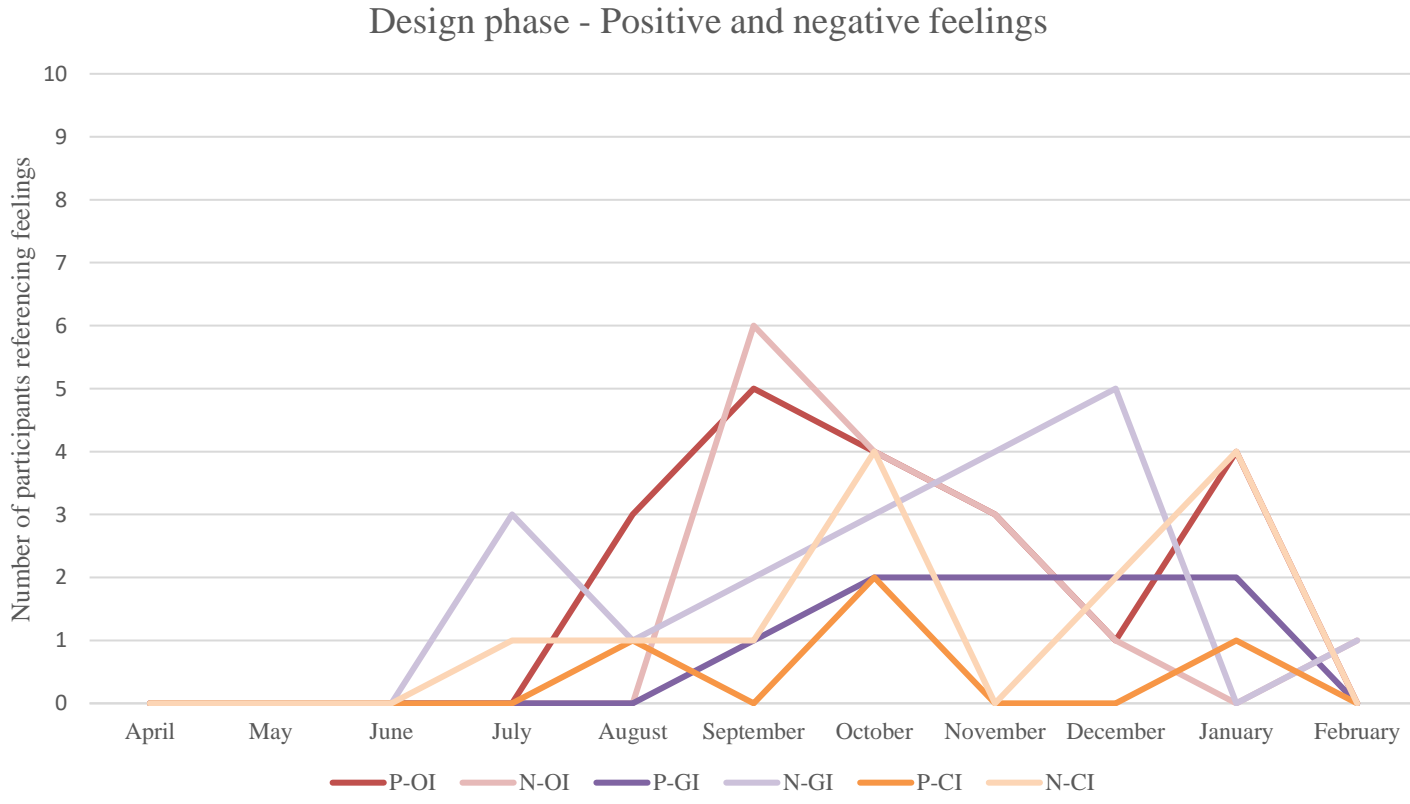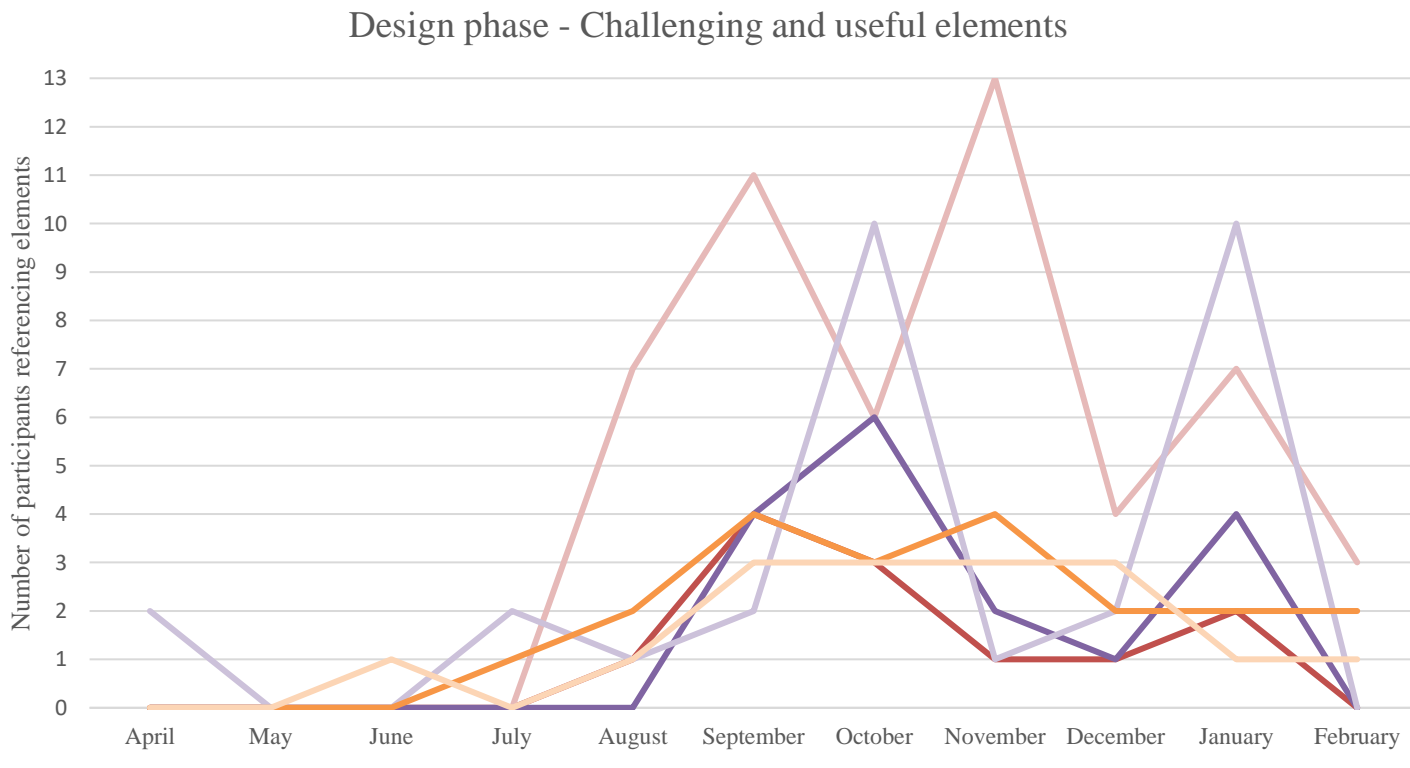
Intervention phase
Challenging elements
12. Limited opportunities for participants to engage in discussions
13. Hierarchical differences among participants
14. Participants' specific areas of interest
15. Power differences between participants and researchers
16. High expectations from participants
17. Language barriers between participants and researchers
18. Slow progress in achieving intervention outcomes
Useful elements
19. Clear explanation and understanding of interventions
20. Providing inputs or materials to participants
21. Prior acquaintance between participants and researchers
22. Greater participant engagement
23. Adherence to agreed intervention planning
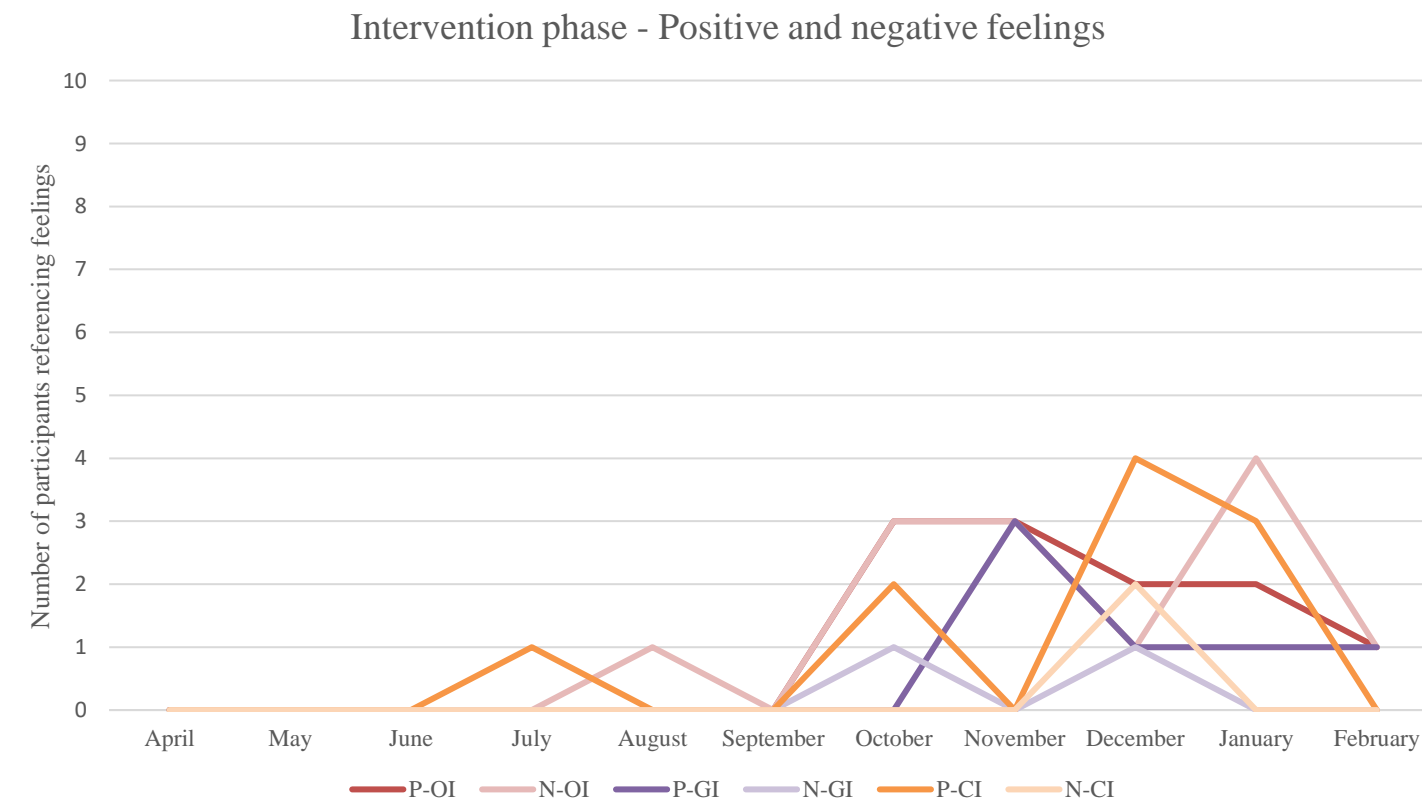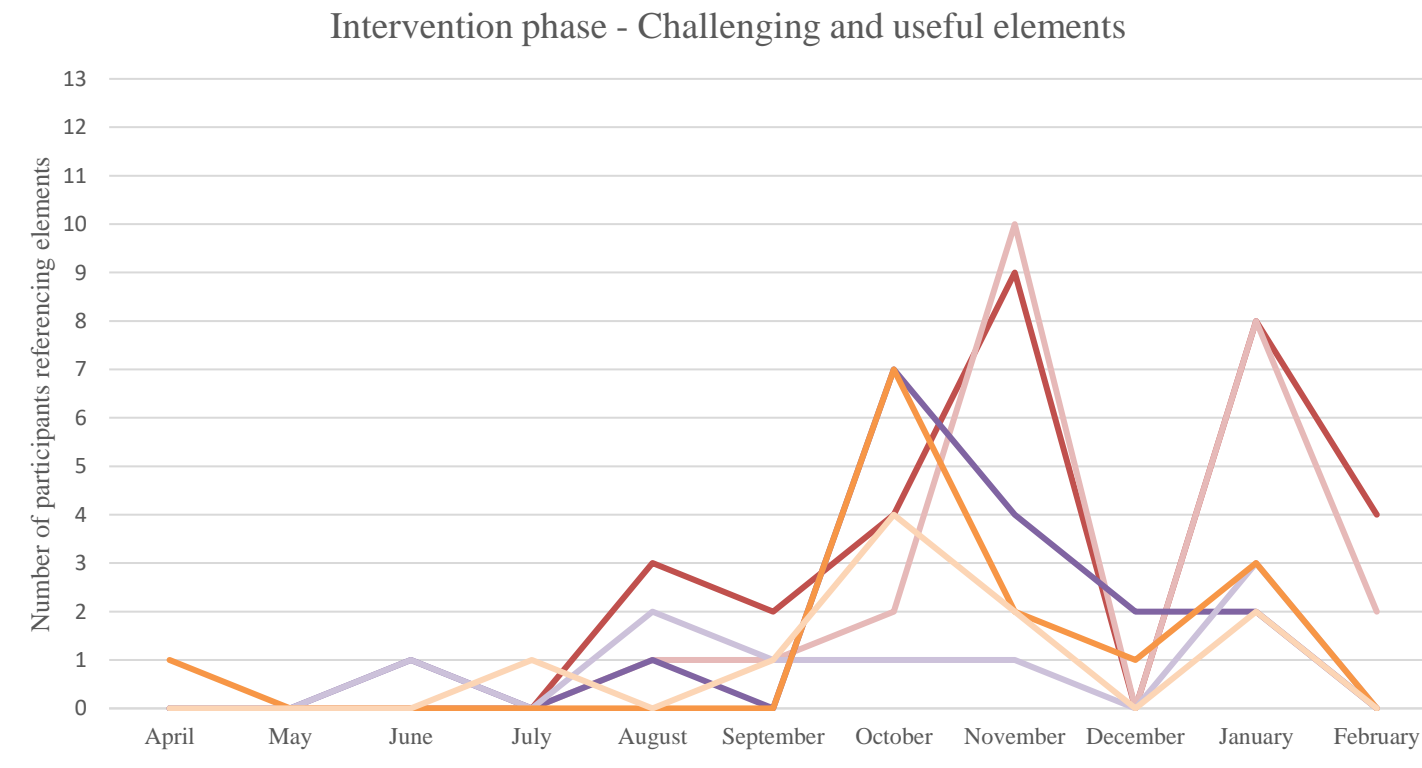
14. "Some *participants* didn't think it was relevant to them; 'I don't have to look after calves, so it's not something I should participate in', or 'I only drive a tractor, so infection control is not relevant to me'" (Participant 5, C-GI, June)

14. "We'll try to move a bit around biosecurity related to the topic that they (participants) choose. So, for instance, they could be like a problem with growth of the calves, which may be more related to feeding than biosecurity. But then we could perhaps have some session on how is biosecurity important relate to feeding or is there something here that could be caused by a bad biosecurity" (Participant 5, C-GI, October)

14. "But *(the intervention process)* also very time consuming, because we also have to focus on finding the area of interest for the *participants*" (Participant 5, C-GI, December)

Design phase - Challenging and useful elements

Intervention phase - Challenging and useful elements

Design phase - Positive and negative feelings

Intervention phase - Positive and negative feelings

Take-home messages:
- This study introduces a **novel approach** that emphasises **temporality**, enabling the identification of key elements across different phases of social interventions over time. These elements can be **strengthened** or **enhanced** to improve the implementation of biosecurity measures. Furthermore, studying social interventions over time not only helps identify **critical moments** but also **contextualises** them within the **conditions** in which researchers engage.
- During the **design phase**, **one-to-one interventions** tend to incorporate more **useful elements**, while community interventions also present some, though to a lesser extent. During the **intervention phase**, **one-to-one interventions** face more **challenging elements**, followed by community and group interventions.
- **Group interventions** are associated with a greater occurrence of **negative feelings** during the **design phase**, whereas **community interventions** generate more **positive feelings** during the **intervention phase**.