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Protocol

A scoping review protocol for the use of luminescent markers as a novel technique for teaching infection control

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ABSTRACT

Background: Globally, infection prevention and control has become a very topical matter with the COVID-19 pandemic. Hence, the need for improved teaching in this area is essential. Fluorescent markers, as a novel visual tooth tool, could be useful in infection control education. The review will focus on scoping 1) the role of luminescent markers in infection control, 2) current products used in the visual observation of contaminant spread, and 3) the use of luminescent markers as an educational tool for infection control.
Methods: This scoping review protocol was created in conformance with the Preferred Reporting Items for Systemic Reviews and Meta-Analyses (PRISMA) guidelines. Medline, CINAHL and Dentistry and Oral Sciences Source electronic database searches will be conducted via EBSCO, while Scopus, Google, and Google Scholar searches will be carried out independently. A narrative description of the synthesised and significant characteristics from the sources in the data chart will be presented. Gaps in the literature will be identified.
Conclusions: This review will provide a broad scoping of information sources on the use of luminescent markers as a novel technique for teaching infection control. It will provide practical implications and identify gaps in the literature which could guide future research.

Keywords: Cross infection, COVID-19 pandemic, Glo germ, Infection control education, Luminescent tagging, Systematic review

INTRODUCTION

Cross infection is the spread and transfer of pathogens, such as bacteria and viruses.[1] This spread of infection can occur through direct or indirect contact between individuals or contaminated surfaces and equipment. The spread of these infections is known to cause multiple health concerns.[2] For example, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is the virus responsible for the COVID-19 disease and pandemic and has brought cross infection to forefront of global issues.[3]

Infection prevention and control is the discipline of ensuring that pathogens and other infectious agents do not spread throughout the environment.[1] Unfortunately, healthcare environments are at greater risk of contracting pathogens and enhancing the spread of infection into the community.[3] Therefore, infection control is key to optimal individual and public health care.

Standard methods of ensuring adequate infection control include disinfecting surfaces and equipment after use, maintaining hand hygiene, and correctly wearing and disposing of personal protective equipment (PPE).[4] However, in order to determine the optimal method of cross infection control, it is necessary to understand the routes of transmission of potential pathogens such as viruses.

COVID-19 can be transmitted in different ways. Most commonly, respiratory droplets from coughs and sneezes can spread the virus to surfaces and individuals within an approximate 1.8-metre range.[5] In addition, indirect transmission occurs when individuals contact a contaminated surface with viable viruses.[5,6] Therefore, infection control must be achieved across all fomites, and there has been a substantial focus on hand hygiene. Finally, touching our faces, especially the mouth and eyes, provides accessible pathways for pathogens to enter the body.[6,7]

Previous research showed that individuals in an office environment touched their faces an average of 16 times per hour over a 3-hour period, whereas medical students touched their faces an average of 23 times per hour.[8,9] These studies indicate that habituated face-touching behaviours present a significant risk of pathogen self-inoculation and contribute to the transmission of pathogens throughout the community. Therefore, it is essential to maintain adequate hand hygiene and wear a face covering in a public environment.[6]

Whilst there are many handwashing and other infection control guidelines, there is limited research about cross infection control of surfaces, especially those in healthcare settings. Additionally, methods of improving the teaching of cross infection control are also necessary to explore, particularly during the COVID-19 pandemic.

Luminescent markers, also known as fluorescent markers or tags, have become a popular method of understanding and teaching cross infection control. Luminescent markers were initially used in forensics and microbiology for various purposes, such as identifying cell surface receptors.[10] A luminescent marker is commonly a protein which binds to specific receptors on the outer membrane of a signalling cell.[10] The luminescent quality allows visual examination of hidden particles, making it easier to identify areas of contamination on surfaces, equipment, and individuals. These products are safe, easy to use and relatively cheap.

Furthermore, fluorescent substances comprise particles ranging from 1 to 5 µm. This corresponds to most airborne viral particles within this size range.[11] The SARS-CoV-2 virus is determined to be approximately 4.7 µm, indicating that the properties of a fluorescent marker are suitable for recognising viral contaminants.[12]

Additionally, this visual aid is a beneficial tool in teaching infection control as it helps individuals picture the spread of pathogens and understand the effectiveness and quality of disinfection necessary in different environments. As healthcare facilities are at significant risk of spreading contaminants, teaching students, clinicians, and healthcare workers about effective infection control is essential. As a result, luminescent markers are a promising area of education, research and practice, especially during the current COVID-19 pandemic.

The current scoping review aims to analyse the literature on luminescent markers as a physical model for teaching infection control of the spread of pathogens in the COVID pandemic era.

METHODS

Study design

The scoping review will follow the PRISMA guidelines for scoping reviews.

Search strategy

The search strategy was developed and reviewed with the assistance of a specialist health liaison librarian. Medline, CINAHL and dentistry and oral sciences source electronic database searches will be conducted via EBSCO, while Scopus, Google, and Google Scholar searches will be carried out independently. All citations will be imported into the web-based end note reference management tool and duplicate citations removed.

The literature search will be conducted to address the following areas of focus: 1) guidelines and recommendations on the role of luminescent markers in infection control, 2) current products used in the visual observation of contaminant spread, and 3) the use of luminescent tagging as an educational tool for infection control. The electronic search terms are available in Table 1.

Eligibility criteria

All study designs are eligible, including experimental, quasi-experimental and non-experimental studies; systematic and non-systematic reviews; qualitative and quantitative methods; and guideline reports. There is no limitation placed on the year of publication. A two-stage screening process will be used to assess the eligibility of studies identified in the search. Articles are eligible for inclusion if they broadly identify the use of a fluorescent marker for infection control or educational purposes. Articles discussing fluorescent markers' benefits or potential uses will also be included. When the same data are reported in more than one publication, only the article reporting the most complete data set will be used. Only sources written in English will be included. Publications will be excluded if the entire article is unavailable or the source is an opinion piece.

Screening

The PRISMA guidelines for scoping reviews will be followed, and a flowchart will present the numbers of sources of evidence identified, screened, assessed for eligibility, and included in the review. Initially, the title

and abstract of citations will be reviewed to preclude the waste of resources in procuring articles that do not meet the minimum inclusion criteria. Two reviewers will independently screen the title and abstract of each citation. Reviewers will not be masked to the author or journal names. Titles for which an abstract is unavailable will be included for subsequent review of the full article if it is available in the data characterisation phase. Reviewers will resolve any disagreements through discussion to achieve mutual consensus.

Data extraction

A comprehensive data chart will collate relevant information from each source included in the scoping review (Table 2). The data chart may be modified if deemed helpful by the researchers.

Scoping review will not carry out a critical appraisal of methodologies or risk of bias assessment as study intends to provide a broad overview of sources of information.

Table 1: Search for EBSCO database.

Search no.	Search strategy
1.	"Cross infection" or "infection control" or "infection prevention"
2.	Virus or pathogen, N3, spread or transmission
3.	"Cross infection" or "infection control" or "infection prevention" and (virus or pathogen) N3 (spread or transmission)
4.	"Luminescent tagging" or luminescence or "glo germ" or germjuice or dazo)
5.	Luminesc* or "glo germ" or germjuice or dazo or bioluminesc* or fluoresc*
6.	"Cross infection" or "infection control" or "infection prevention" and (virus or pathogen) N3 (spread or transmission) and luminesc* or "glo germ" or germjuice or dazo or bioluminesc* or fluoresc*
7.	"Cross infection" or "infection control" or "infection prevention" and (virus or pathogen) N3 (spread or transmission) and luminesc* or "glo germ" or germjuice or dazo or bioluminesc* / fluoresc* (search #3 and #5)
8.	Virus or pathogen) N3 (spread or transmission) and luminesc* or "glo germ" or germjuice or dazo or bioluminesc* or fluoresc*
9.	"Cross infection" or "infection control" or "infection prevention" and luminesc* or "glo germ" or germjuice or dazo or bioluminesc* or fluoresc*
10.	Educat* or learn* or teach* or student*
11.	"Cross infection" or "infection control" or "infection prevention" and educat* or learn* or teach* or student*
12.	"Cross infection" or "infection control" or "infection prevention" and educat* or learn* or teach* or student* and (virus or pathogen or COVID) N3 (spread or transmission)
13.	"Cross infection" or "infection control" or "infection prevention" and educat* or learn* or teach* or student* and (virus or pathogen or COVID) N3 (spread or transmission) and luminesc* or "glo germ" or germjuice or dazo or bioluminesc* or fluoresc*
14.	Luminesc* or "glo germ" or germjuice or dazo
15.	"Cross infection" or "infection control" or "infection prevention" and educat* or learn* or teach* or student* and (virus or pathogen or COVID) N3 (spread or transmission) and luminesc* or "glo germ" or germjuice/ dazo

Table 2: Data chart.

Authors	Author's locations	Year of publication	Title	Type and name of publication	Product used	Type of study	Setting and location	Participants	Findings
-	-	-	-	-	-	-	-	-	-

Data analysis and presentation

A narrative description of the synthesised and significant characteristics from the sources in the data chart will be presented. Gaps in the literature will be identified.

DISCUSSION

Globally, infection prevention and control has become a very topical matter with the COVID-19 pandemic. Hence the need for improved teaching in this area is essential. Fluorescent markers, as a novel visual tool, could be the useful in infection control education. This is first systematic scoping review of the use of luminescent markers as a novel technique for teaching infection control. This scoping review protocol is ensured robustness as it was created in conformance with the PRISMA guidelines.[13]

CONCLUSION

This review will provide a broad scoping of information sources on the use of luminescent markers as a novel technique for teaching infection control. It will provide practical implications and identify gaps in the literature which could guide future research.

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