

Low-cost moulage in Healthcare Simulation: Review of its use, utility, and perceptions

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Abstract:

Background: Simulation plays a crucial role in health studies, as it helps medical students apply their theoretical knowledge in real-life situations. Moulage is one of the techniques that helps in making simulation more realistic or high-fidelity. It uses special effects to emulate wounds for a better understanding of what the wound is like visually. Still, moulage is expensive, time-consuming, resource-intensive, and requires the training of staff, which is why we need to find low-cost substitutes for moulage materials.

Method: When searching the database “PubMed” for the terms “Low-cost and Medical moulage”, we retrieved 222 studies, out of which when excluding results not related to low-cost, we obtained 62 studies, from which when removing studies that do not contain information regarding moulage, we found two papers, after referring to citations and cited articles of those papers, we ended up with six studies. Based on the selected articles and additional articles sourced from their reference list, a total of 11 studies were included in the review.

Results: We understand that moulage is a technique that helps make simulations come alive, but the resources required to use it are at times, expensive, which is why we need to find methods to do low-cost moulage, and many studies address that it can be as simple as using homemade ingredients. Students from a previous study have talked about their opinions regarding the realistic component of moulage and whether if it is any different from other moulages. Most of the students agreed that the moulage ranked well in face and content validity. However, further innovations must be introduced in the field to be widely spread and lead to newer opportunities.

Conclusion: Although the research done under moulage is limited, it is accepted that moulage is helpful for simulation-based studies and that low-cost moulage can help make medical studies a better experience for students studying it. Students have a favorable opinion on the realistic aspect of the low-cost moulage applied to them. Newer methods can be introduced to moulage, and it can be implemented in low-income countries.

Keywords: Medical moulage; Low-cost; Healthcare simulation, Simulation-based learning

Introduction

In the current world, Simulation plays an indispensable role in health education. Medical simulation enables the application of clinical skills through intentional practice rather than apprentice-style learning [1]. According to the Miller Pyramid, increased practice and higher simulation fidelity can lead to better students' action, performance, and competency skills [2].

What is meant by simulation? “A situation in which a particular set of conditions is created artificially in order to study or experience something that could exist in reality” [3].

Moulage is one such technique to simulate the atmosphere of a medical workplace. It has a long history in the education of health studies and anatomy studies [4], [5]. The first wax models for moulages were made in Florence at the end of the 16th century. This technique then spread to other parts of Europe. It gained popularity, especially in the second half of the 19th century, when dermatology became internationally recognized [8].

It involves the use of special effects to mimic wounds to achieve a realistic simulation. Studies have shown that moulage has high content and face validity and can aid recall of knowledge and application of clinical skills [6].

In this study, we will discuss that while moulage is an excellent simulation tool, it is often difficult, time consuming, and expensive, as is the cost of hiring and training a person. For this reason, we believe that there is an obvious need for low-cost moulages in regions where resources are limited [7].

The main objectives of this research are to address:

- Why do we need to find inexpensive means of moulage?
- What are the perceptions of medical students studying in resource-limited settings on low-cost moulage?
- Do low-cost moulages have sufficient content and face validity?
- What are the innovations in low-cost moulage?

Method

Based on the keywords related to moulage: medical education, medicine, health studies, low-cost, simulation; We collected the research papers that contained relevant information regarding low-cost moulage, low-cost moulage techniques, their positive impact in a resource-limited environment, and the discoveries in the field of low-cost moulage in the future.

After searching for the keywords "low-cost AND medical moulage" in PubMed, we obtained a total of 222 papers, of which we excluded records not related to the terms “low-cost” or “moulage”, after which we retrieved a total of 2 papers. From these papers, we referred to citations and cited

articles and got a total of 6 papers. Referring to the citations and cited articles of these six papers, we got 11 studies related to low-cost moulage. Multiple studies also state that there is a lack of literature on high fidelity simulators. [8–10]

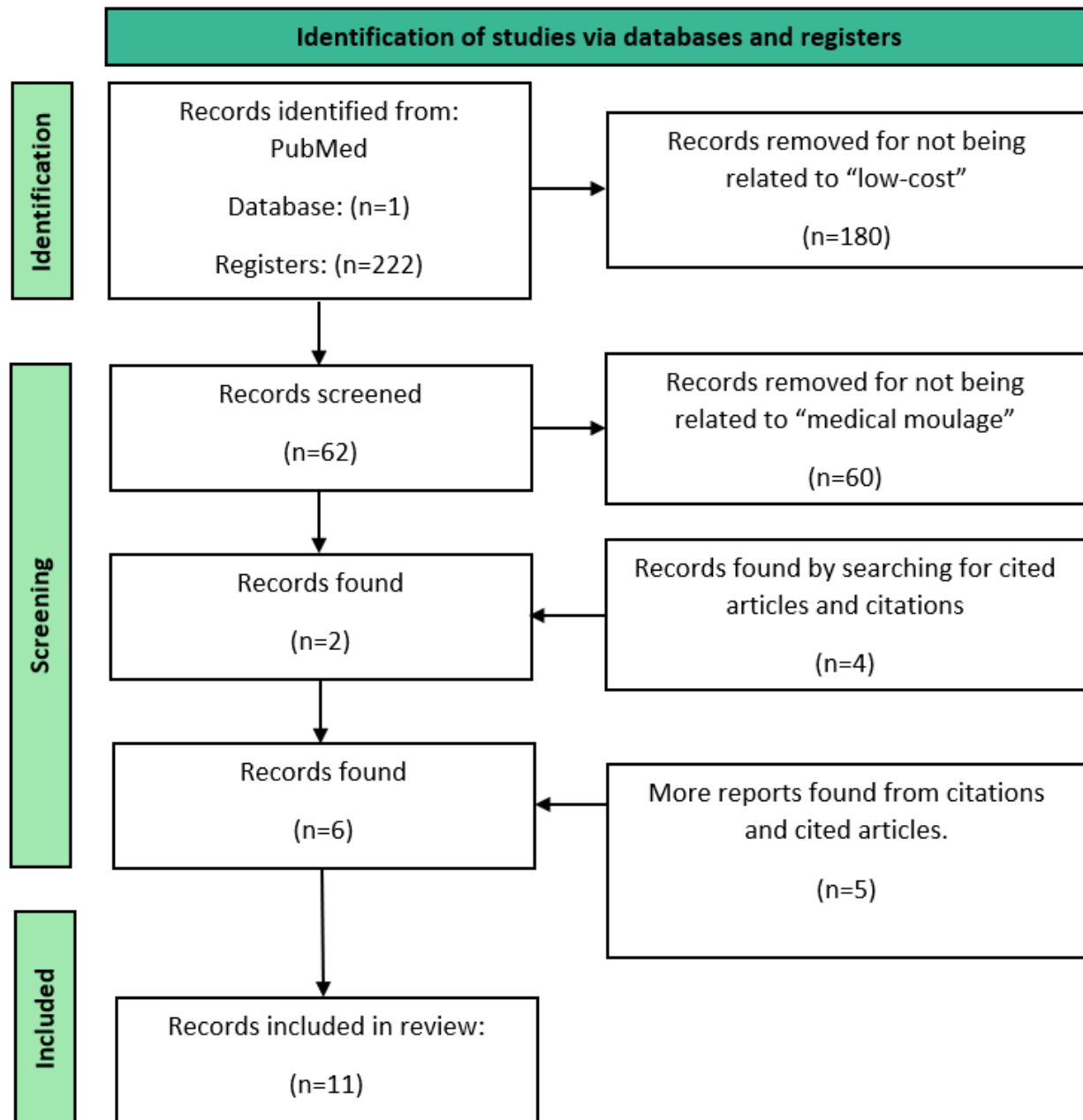


Figure 1. Review of relevant publications following PRISMA guidelines

Results

After organizing the final number of papers under the theme of "low-cost moulage", we categorized the studies into the four objectives of our review. Then, we summarized them into these categories as mentioned.

Why do we need to find inexpensive means of moulage?

Moulage is safe, as reported in several studies. It provides a high-quality simulation for medical school and an excellent practice opportunity for when situations may get unsafe in real life [7], [11]. In addition, it can provide a highly realistic learning experience, and the simulation community places importance on creating realism [7]. But moulage also has its drawbacks. It is costly and resource intensive (4), requiring human resources, time, knowledge, materials, and storage.

Due to these reasons, the question arises: Do the drawbacks outweigh the advantages that come with the high-fidelity simulation that moulage gives us? It is crucial to find low-cost substitutes as cost effectiveness is a priority for several health studies institutions [7].

Although it can be challenging to find sources to learn how to make and use inexpensive moulages, some studies talk about low-cost moulage techniques using tools readily available to teachers [8].

The use of low-cost, homemade moulages is a practical and economically viable means of improving realism in a resource-limited simulation environment. Furthermore, this technique is not constrained to emergency medical care, as many may believe, but can be used in other areas of healthcare simulation [12].

What are the views of medical students studying in resource-limited settings on low-cost moulage?

A 2018 study by Stokes-Parish et al. states that although research in this area is limited, undergraduate and graduate students understand that moulage plays a significant role in realism and student engagement in medical school simulation [13].

The impression that emerges from this is that students also support the idea that moulage is very important in simulation to increase realism, which makes it even more critical to find cost-effective substitutes for moulage and to find out whether trained personnel make a significant difference in the way moulage increases realism [8].

In a study done at the University of Johannesburg, participants were asked about their opinions on self-made, inexpensive moulage and were asked to do a survey. Students responded to the questionnaire, divided into two parts, face and content validity [12].

With regards to face validity, most students agreed that moulage was more realistic than other, more expensive products, and they also felt that the use of moulage was realistic and in line with what they would expect in real life. In addition, almost all students agreed that the moulage was easy to use to enhance the reality of a simulated patient's wound [12].

In terms of content validity, most of the students agreed that the moulage was easy to use, while the others were neutral about it. All the students agreed that using the moulage was an enjoyable experience and that they would recommend using it to improve other students' learning experience [12].

Overall, most students agreed that using inexpensive, self-made moulage was a positive experience.

Do low-cost moulages have sufficient face and content validity?

The likelihood of a moulage working positively to enhance educational outcomes is indicated by two main factors: face validity and content validity. The face validity of a moulage indicates how realistically it corresponds to a situation one would expect in real life. In contrast, content validity talks about how appropriate it is for a given simulated scenario and how it enhances the study outcomes [8].

Measuring face and content validity is extremely important as realism plays an essential part in how simulation impacts student learning [7]. In a study by Makkink and Slabber, Students had a favorable opinion regarding the face and content validity [12].

What are the innovations in low-cost moulage?

Although some tasks that fall under moulage are overwhelming, such as making burns, they are actually easy to accomplish with simple materials such as tissue paper and makeup [14], [15]. This makes it evident that it is possible to make moulage with inexpensive ingredients. 2-D moulage can also be made by using makeup, like grease-, oil-, water-, or alcohol-based colors [16].

In addition, there are newer options, such as 2-D tattoos, which are executed on decal paper. They have the advantage of being highly standardized, easy to apply, limited additional touch-ups after application, and can last a long time [16]. There may be disadvantages, but these are limited compared to the advantages, e.g., it must be a medically accurate visualization of the anatomy and may require non-medical expertise [16].

Suppose mannequins are too expensive for an institution, the alternative could be getting volunteers who could act as simulated patients [14], the moulage could then be applied on these volunteers, and a hybrid simulation can be conducted .

Any inexpensive moulage, if applied professionally, can be high-fidelity, so training is an essential aspect of using moulage [8].

When moulage is not a viable option due to whatever reason, experts suggest written cue cards may be used as substitutes [7]. In other aspects, such as the amount of time spent, practice can help shorten the time. For example, in one study, the time needed for moulage was reduced from 3 hours to only 30 minutes by practice [14].

Discussion

During the reviewing process, it was eminent that most studies talk about the impact that moulage makes on health education. However, less attention was given to low-cost moulage, face and content validity of moulage and moulage procedure.

This review noted that moulage is an excellent technique to use in medical simulations to increase fidelity and lead to better learning outcomes like improving critical thinking and reasoning skills [17]. This is crucial as focusing on learning outcomes is one of the top priorities for medical education [18].

In the results section, we understand that there is a need for low-cost moulage and that if applied accurately, it is just as effective as other moulages. Nevertheless, further innovation is needed to reach the medical students living in low income or resource-limited areas [19]. Most articles lack both qualitative and quantitative data regarding low-cost moulage substitutes for allergic actors, evidence to learn about how moulage affects simulation-based education, the authenticity of low-cost moulage, and further areas for innovation.

Regarding the demand for low-cost moulage, more evidence is needed to demonstrate how it affects simulation in medical education [4]. Many studies and sources have clarified the impact of moulage on medical studies [20]–[23], but many do not mention how low-cost impacts the simulation experience. Most of the studies on moulage are “how-to” guides for dermatology or are about the history of moulage [7].

Research for low-cost moulage should be done while considering low-income countries [7], as it will help to reach out the education of moulage to the population that needs it the most, and in turn, will help flourish the world’s economy [24].

Most studies do not address the authenticity of moulage; hence they do not mention about the face and content validity of medical moulage. Although, the studies that mention this concept are limited to only a small fraction from the other studies [7], research can be extended in this area because it can help enhance learning outcomes.

Although moulage is not familiarized in many places, it can be if innovations are introduced to the field. Innovation helps the company be prompt when dealing with an unconventional situation and helps discover opportunities [25]. In this case, the affordability of the moulage is the obstacle that companies must overcome.

Innovations can be introduced in the field, such as low-cost moulage made for people allergic to it. However, low-cost materials may contain allergens, which is why it can trigger an allergy to the person it has been applied to. Allergies are an obstacle in moulage that has yet to be overcome and is addressed by studies [7] [26], latex allergy [27], Allergies from cosmetics [28], and more.

Conclusion

Moulage is undoubtedly a significant part of simulation-based education, and it helps improve practice and apply theoretical knowledge and improve performance.. Although it has numerable benefits, it can have expensive drawbacks, requiring human resources, physical resources, time, and training. Therefore, we need to find inexpensive substitutes to common costly ingredients used in moulage recipes. On the other hand, many studies mention recipes that are easy to recreate and use simple materials, which shows us that it can be straightforward to use moulage, and it does not have to be an overwhelming task. To find out whether the advantages of medical moulage outweigh the disadvantages, we reviewed several studies through which we learned about students' opinions regarding the usefulness of low-cost moulage in terms of face and content validity. A large fraction of students had a favorable opinion on low-cost moulage. Still unexplored by most low-income countries, innovations like 2-dimensional tattoos and hybrid models may help reach out the knowledge of low-cost moulage to those countries.

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