

Hygiene and the use of robotic animals: an exploration

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Abstract. The aim of this study is to synthesize the existing literature on hygiene and robotic animals to provide researchers and professionals that use robotic animals with tools and guidelines regarding the hygienic application of this technology in a hospital environment.

Keywords: Robotic animal, hygiene, review, reduced resistance, pathogenic microorganisms

BACKGROUND

With technology developing at an increasing rate, the use of robots in health care is becoming more and more widespread^{1 2}. This also includes the use of animal shaped social robots that are increasingly used in therapy or as a companion^{3 4}, which has been studied before in multiple populations and seems effective in diverse settings such as a tool for social development of autistic children, social interactions with preschool children and as a companion in elderly care⁵⁻⁷.

Recent studies intend to study the effects of robotic animals in hospitalized children⁸. The application of robotic animals in more diverse settings, including populations with a reduced resistance towards pathogenic microorganisms, raises questions about the hygiene of robotic animals.

Most of these animals are covered with fur or other forms of realistic skin. Little is known about the ways to effectively handle and clean robotic animals to make them in concordance with existing hygiene standards in hospital settings. However, there are studies that have shown that toys can be contaminated with (pathogenic) micro-organisms and therefore may pose a potential risk of infection⁹⁻¹⁵. It seems likely that this is also the case with robotic animals.

Therefore we aim to synthesize literature on hygiene and robotic animals to provide guidelines regarding the hygienic application.

METHOD

We conducted a literature review for publications regarding hygienic measures when using robotic animals with hospitalized children. Databases included: Academic Search Elite, Cinahl, Pubmed, Science Direct, Google Scholar and SpringerLink. The following search terms and combination of terms were used: 'hygiene', 'infection prevention', 'cross infection', 'disinfection', 'decontamination', 'hospital', 'children', 'pediatric', 'oncology', 'healthcare', 'daycare', 'social robot', 'robot animal', 'robotic pet', 'Pleo', 'toys' en 'user manual'. Through the snowball method, the references of relevant studies were also checked.

Unfortunately publications regarding hygiene and robotic animals do not exist yet. Therefore we expanded our search to also include toys in general, other settings such as other healthcare facilities (day care centers, geriatric departments, waiting room general practitioner) and other types of patients (premature infants, elderly, healthy children).

The included studies were analyzed according to a framework that encompassed the following themes: 1) cleaning procedure, 2) cleaning frequency, 3) sharing

RESULTS

We included 17 national and international publications: nine research reports⁹⁻¹⁷, five hygienic guidelines¹⁸⁻²² and three manuals of robotic animals²³⁻²⁵.

1) Cleaning procedure

Robotic animals should be cleaned using a brush or a damp towel. Due to the technological devices in these animals they cannot be cleaned with cleansers or be exposed to excessive water or other liquids²³⁻²⁵.

Toys in general should be cleaned with all purpose cleaner and/or a cloth with (a solution of) disinfectants¹⁸⁻²⁰. The recommendations of how to clean toys are further divided between hard (e.g. plastics) and soft toys (e.g. stuffed animal). Hard toys must be cleaned with water and soap and then be immersed in a disinfectant (bleach, hypochlorite or other disinfectants). After that they must be rinsed with water and be dried in the air^{9 10 12 20 21}. If possible, hard toys should be washed in the dish washer^{20 21}. For soft toys washing in the washing machine is suggested^{9 13 14 20} but opinions about the temperature vary. 48°⁹, 60°¹³ or 80°¹⁴ are suggested.

2) Cleaning frequency

Recommendations regarding the cleaning frequency vary between monthly^{19 22}, weekly^{13 14 16 21}, regularly¹⁰, daily¹⁷ and under certain circumstances (e.g. infectious outbreak or when contaminated with saliva, defecation or vomit) daily^{16 18} or directly after use^{15 18 19 21}.

3) Playing and sharing

Regarding sharing toys, it is generally advised to provide each patient with his or her own toy^{10 14 15}. Especially when patients have an infection that needs preventive measures or are treated in isolation toys should not be exchanged^{14 16 22}.

CONCLUSION

Regarding the cleaning procedure and the cleaning frequency of toys there are no definite answers to be

drawn from the literature. With regard to sharing toys, the literature advised to provide each patient with his/her own toy and to limit the extent of sharing toys. The comparison of the robotic animal manuals and the advices from the literature regarding cleaning raises the question to which extent these can be integrated. The advised cleaning procedures all include extensive use of water and detergents, which robotic animals cannot handle.

DISCUSSION

Due to a lack of suitable studies, we included few on topic publications. Therefore it was impossible to take the differences in hygiene regulations per country into account. Furthermore, the research reports vary greatly in size and comparability which makes it hard to draw definite conclusions which limits the generalizability of this study.

Prevention of infections by robotic animals among patients is a new study domain. To prevent robotic animals from becoming dangerous friends instead of new friends it is necessary to gain more knowledge about this subject. Research should be conducted regarding the risks of infections by robotic animals and the preventive measures that should be taken accordingly before these animals are used in settings with patients that are vulnerable or have diminished resistance.

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