

Healthcare-related infections within nursing homes (NHS): A qualitative study of care practices based on a systemic approach

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Abstract

Background: Infectious events, often related to healthcare practice, occur frequently within Nursing Homes (NHs), representing one of the main causes for morbidity, hospital admissions and mortality. The aims of this study are the analysis of care delivery problems and contributory factors of healthcare-related infections in a sample of NHs. This research could help identify organizational, technological and behavioural aspects, to implement improvement actions and reduce the impact of infections in long-term care.

Methods: The study is a qualitative research with a systemic approach, based on the analysis of interactions in real practice between human factors, technologies and organizational structure and processes in 7 NHs in Tuscany (Italy), through extensive and structured observations of daily practices. The collected data were analyzed by applying clinical and ergonomic competences, comparing the data collected with established safe practices. The study was conducted by a nurse and a psychologist

Results: From the data several problems related to infection control emerge. Buildings are often not suitable for confined spaces, room ventilation, natural light and rapid emergency response. Hand washing is not sufficient, use of antibiotics is usually not adequate. The microclimate is often not adequate, hygienic procedures are not always flawless. Staff members are in small numbers.

Discussions: This study highlights high risk of contracting infections related to NHs. The study shows that dedicated infection prevention guidance are needed, to develop a local plan integrated with hospital setting, customized to needs of guests and characteristics of long-term care facilities, supported by a deep understanding of daily practices.

Keywords

Infection control, nursing homes, human factors, risk management, patient safety

Risk of Infection Within Nursing Homes (NHs)

Infectious events, often related to healthcare practice, occur frequently within Nursing Homes (NHs);¹ for example, in USA 1.13–2.68 million infections occurred NHs during 2013. These events represents one of the main causes for morbidity, hospital admissions and mortality,² becoming a priority for patients' safety research.³ These findings should not come as a surprise, considering that these patients are normally frail and prone to infections.^{4,5} There are many microorganism responsible of these infections and many of these are multidrug-resistant, which is why the prevention of their transmission is essential.⁶ The infection can be

contracted at different times and settings⁷ making infection control approaches a criticism in these structures.⁸ However, even if the prevention intervention are easy-to-do⁸ and cost-effective,⁹ this phenomenon still remains in focus. In Italy in 2016/2017 there is an infection rate of up to 3.9% (compared

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to 3.3% in 2013).¹⁰ Despite these data and characteristics, overall compliance is still poor.¹ Furthermore the diagnosis of infections is much more difficult compared to hospital setting for a series of factors related to the type of patients (i.e. the symptoms are silent or delayed and patients often have difficulty in communication), staff (it is often insufficient or inadequately trained, the figure of the doctor or nurse is not always present) and the presence of services for specialist and laboratory investigations.¹¹ The aim of this study is the analysis of care delivery problems and contributory factors of healthcare-related infections in a sample of NHs. This research could help identify organizational, technological and behavioural aspects, to implement improvement actions and reduce the impact of infections in long-term care, by providing exemplar of problems and improvement actions as well as a methodology to observe and analyse daily practices with a systemic approach.

Methods

Tuscany Region with 2 resolutions^{12,13} allocated funding to observe the quality and safety levels of care in 10 NHs (of which 7 were observed), in agreement with the NHs managers, maintaining the privacy of patients and workers. The inclusion criteria were defined by study group, to select a sample that was representative of the average NHs present in the Region. The inclusion criteria are: public property, country or city location, different areas of Tuscany, quality levels that can be found in the accreditation assessments (some high-performance NHs, some low-performance NHs), number of beds (20 to 100) and with at least one dementia core. It's a qualitative research with a systemic approach, based on the analysis of interactions in real practice between human factors, technologies and organizational structure and processes.¹⁴ Two experienced observers (a nurse and a psychologist) conducted observations of daily practices. An original semi-structured guidance¹⁵ [Table 1] is used for the NHs with themes and observation units elaborated according to the WHO quality and safety dimensions.^{16,17} The data were collected through field observations conducted with the least possible interaction of observers to ensure as much as possible the neutrality of the observation.¹⁸ The field observation method is widely used in qualitative research^{19,20} and has been chosen to observe people and events to discover behaviors and interactions in natural environments.^{21–23} The sampling of the people observed was random following the natural course of the routine daily activities. The observations were performed at peak hours of work in NH, during the morning and afternoon shift for about 12 h in each NH. The raw data were collected by writing the observed actions on paper, in a second moment the data related to the infectious risk were reorganized and selected.²⁴ Then data were evaluated independently by observers and two expert reviewers (a nursing manager

and a patient safety manager with background in ergonomics and human factors). The observed behaviors and situations were analyzed by applying clinical and ergonomic competences, comparing the data collected with established safe practices,^{25,26} recognized within the regional accreditation requirements of Tuscany and by the regional Centre for patient safety and clinical risk management,²⁷ in order to appraise exemplar of care delivery problems as well as elements of good practice.

Results

Data were collected between June 2018 and February 2020, just before the beginning of Covid-19 pandemic. Reported data were selected for frequency, severity consequences and potential to identify risk factors related to the observed event (e.i. no hand washing - transmission of pathogen- risk cross-infections). Data have been categorised following themes with high impact on both infection control and patients' quality of life. All original data and statements were explicitly transcribed in italics in the article to limit the researcher's interpretation bias and to more explicitly represent data collected as observed during the study. For reasons of brevity not all data collected in the article have been reported, only the most representative ones.

Buildings

Data shows that living spaces are often small, many bedrooms have many beds, and many patients use a shared bathroom. These conditions impact on risk of infections due to overcrowding of rooms and bathrooms, the minimum distance between individuals and the risk of transmitting pathogens from interpersonal contacts and actions of healthcare professional: *"Bedrooms are small and with at least 3 beds each with only one bathroom", "Opposite the dining area I've noticed a big room with... 10 bed space, separated only by a partition"*. Occasionally, beds are made straight after service users got up, other times the windows are opened first, to aerate the room. These assistance issues affect the risk of infection as they do not guarantee a correct change of air in the living environment: *"Beds are made as soon as service users get up, but windows are opened and doors are closed"*. In some NHs natural light is favoured, whereas in others patients are constantly surrounded by artificial lights: *"neon lights are cold and strong, they also keep on the ones above the beds"*. In one of the NHs, sinks and personal items have been noticed inside the bedrooms. Especially for frail patients it is very important to minimize infections to adopt individual objects and to have adequate stations for washing patient's hands and objects. *"Here there are two service users in a vegetative state, single room, each with a sink, soap and personal items"*. Also, bedrooms are often far away from nursing stations, occasionally on

Table 1. Field observations framework.

<i>Dimensions of Quality (OMS, 2006) [40]</i>	Nursing Homes Themes	Observations Units
Safety of Care. Delivering health care which minimizes risks and harm to service users.	Falls	- Handling of assisted persons (presence and use of aids, etc.) - Orientation to mobilization (how much lodging is avoided) - Promotion of physical activity (even minimal) - Internal / external routes order (absence of obstructions especially in the most frequent routes) - Lighting quality - Floor maintenance and quality status, timing and alert mode during cleaning - Fall risk assessment - Management of the consequences of the fall - Appropriateness of restraints - Identification of patients at risk
	Drugs	- Drugs storage and equipment control methods - Therapy registration (completeness and traceability of therapeutic acts – see Single Therapy Folder requirements) - Frequent drug reconciliation - Allergy record - Awareness of the characteristics of the drugs and the purpose of their use (especially for chronically ill patients with cardiorespiratory problems, diabetes and mental health) - Procedures for the management of high-risk drugs - Reporting of adverse events and reactions - Use of methodologies for the prevention of therapeutic error (7 G, LASA and FALA ..) - Management tools (computerized file, procurement ...)
	Infections	- Awareness of how infections are prevented (what is done here to prevent infections) and early identification - Physical spaces and materials (location of bathrooms, availability of soap and hydroalcoholic gel, hand washing and compliance control) - Presence of communication tools for washing - Antibiotic therapy management (something is done for) - Infected person management (isolation, supportive therapy, etc.) - Adequate device management (cv, cvp, tracheostomies, peg, sng ...) - Correct use of PPE - Microclimate and seasonal protocols - Correct patient and environment hygiene
	Pressure Ulcers	- Presence of handling and hygiene aids and procedures for patients to prevent PUs - Risk assessment and risk factor detection - Presence of materials for dressing - Continuity of care for complex injury management
	Risk of escapes	Presence of safeguards to avoid escapes

(continued)

Table 1. Continued.

Dimensions of Quality (OMS, 2006) [40]	Nursing Homes Themes	Observations Units
Behavior disorders		Protocols and monitoring of the surveillance of patients Adoption of strategies for the prevention of escapes and removal Pharmacological management of behavioral disorders Non-pharmacological management of behavioral disorders Adoption of a therapeutic environment
		Risk of suffocation and airway obstruction Adequate staff training Dysphagia monitoring Postural protocols in patients at risk (during meals and in sleep) Procedures and forms for dysphagia management Ad hoc diets and speech therapy and phoniatric consultancy
		Nutritional and dehydration risk Monitoring scales and assessment of nutritional risk and dehydration Attention and care during meals and hydrations Accessibility to water Water balances in patients at risk Forms for reporting the amount of food and water taken Presence of parenteral reliever therapy in case of no food or water intake
Patient Centeredness	Respect for basic needs (hygiene and nutrition)	Methods of preparation, distribution and consumption of meals
Delivering health care which takes into account the preferences and aspirations of individual service users and the cultures of their communities		Cleaning and care of private and community environments inside and outside the structure Attention to the seasonality and variety of foods, to the requests of the assisted persons and the possibility of preparing meals independently and / or with the support of staff Presence of personalized diets Food quality monitoring Care of the person's clothing and appearance Spaciousness and quality of common areas and private spaces Possibility of customizing the rooms Ability to customize patient activities through their involvement Technological equipment to support rehabilitation and play activities Internal and external recreational and socio-educational program Care of relations with family members Care of relations with the surrounding community (neighborhood, school, associations, etc.)
Accessibility	Physics	Comfort and quality of private and common areas
Delivering health care that is timely, geographically reasonable, and provided in a setting where skills and resources are appropriate to medical need;		Paths that are effectively accessible to reach all areas inside and outside the structure Characteristics of the beds, armchairs, chairs and tables used in daily activities Characteristics of the rooms dedicated to the cleaning (bathroom) of the person Clear and understandable communications to the assisted persons, both verbal and written, regarding daily care and activities
Cognitive		

(continued)

Table 1. Continued.

Dimensions of Quality (OMS, 2006) [40]	Nursing Homes Themes	Observations Units
Equity Delivering health care which does not vary in quality because of personal characteristics such as gender, race, ethnicity, geographical location, or socioeconomic status	Organizational	Participation support even for the most fragile people or with very limited autonomy Activities aimed at maintaining basic cognitive functions (memory, attention, reasoning) Clarity of the roles and functions of the operators Knowledge of the methods of exit / access to the structure for the assisted persons and for guests Relations with the outside world
Effectiveness Delivering health care that is adherent to an evidence base and results in improved health outcomes for individuals and communities, based on need	Respect and appreciation of cultural, religious and social differences	Attitude towards foreign guests or guests not belonging to the local community Respect for religious practices Prevention of discrimination against the weakest subjects from a social and relational point of view
	Adequacy and appropriateness of care with respect to the health needs of the person	Emergency management in case of deterioration of the clinical condition of the person due to illness or injury Collaboration between internal staff, family doctors and health company specialists Participation in chronic disease management programs Management of transitions in the event of hospital admissions and / or specialist visits and / or periods of return home. Pain management, monitoring Use of systematic scales for pain monitoring
Efficiency Delivering health care in a manner which maximizes resource use and avoids waste	Ability to use human, technological and organizational resources available in the facility and in the community	Observed quantity of work dedicated to care vs administrative activities Effective use of available equipment for rehabilitation and educational purposes Relations with the community for recreational and cultural activities Staff training and updating
	Ratio of benefits / waste for assisted persons, operators and the owner entity	Adequate management of special and non-special waste Survey of any obvious waste (eg. Unused spaces or tools, personnel with overload or under workload, failure to enhance the specific skills of the staff, etc.)

different floors and difficult to access, making regular observations time consuming and compromising the possibility of a quick intervention in case of emergency *“some of the bedrooms are at the bottom of the corridor, very far from the nursery”*.

Environment hygiene and microclimate

The environment is often found to be cold. Only on one occasion a seasonal protocol was in place. *“It is cold and doors are rarely closed”*, *“During personal care round the doors are opened”*. Only once a comfortable temperature was documented *“There is a comfortable temperature and smell of food in the air”*. Environment appears mainly clean, but in few occasions *“The trolley used for personal care looks a bit dusty”*. Only one of NHs was found to have mosquito nets in every room.

Personal care

Patients' personal care are often provided only in the morning with, sometimes, a quick wash at night *“...personal care are not provided at night, unless there is faecal incontinence”*. At times, these are provided appropriately, other times increasing the risk of cross contamination.

“The care assistant indeed starts from the mouth, then neck and so on in the meantime communicates with the patient”, “They provide personal care to the service user who has been incontinent of faeces (they only wash his anus but not the rest of his private area), then they put the water bowl on the bed-side cabinet, they touch clean pants with the gloves they were wearing underneath the dirty ones, they throw the dirty laundry on the floor”

According with our observations, oral hygiene is rarely provided: *“Oral hygiene not observed”*, *“...noted service user's mouth very dry and with suspected mycosis”*; the same can be said for hand hygiene *“None of the service users receives hand hygiene before dinner”*. Staff members are often very few in proportion with the number of service users, they are therefore required to carry out their tasks quickly and at times disrupting patients' circadian rhythm *“Personal care are provided around 5am and then patients will get up at 10 am [...]”*

Hands hygiene

Hands hygiene is not carried out as often as it should be, hand-washing stations are rarely available and sometimes there is lack of alcohol gel: *“I can't see alcohol gel anywhere”*, *“nobody ever washes hands or use alcohol gel, they just use double gloves”*, *“Before meals patients don't receive hands hygiene”*. In other structures we can see a managerial commitment to the culture of hand

washing: *“On the wall there are educational posters for good practice (hand hygiene, oral hygiene...)”*, *“On the wall there is alcohol gel for hands hygiene”*.

Equipment contamination

Cross contamination is often an issue during delivery of personal care *“During personal care in the morning, bin trolleys are taken in the room. The bag with the wastage is put on the bed”*. Sometimes service users can themselves contaminate the environment *“During dinner one of the ladies touches her leg ulcers making them bleed. Then, with blood still on her hands, she picks some litter up from the floor and take it to the kitchen (the door is left open) and leave it on a small table [...]”*. In some instances, a correct practice to avoid contamination has been noticed *“When she needs to cough, she uses her arm rather than her hand”*.

Medical devices management

Several patients need medical devices. There are issues to maintain urinary catheters' closed system and the bags are drained several times within the 24 h period, without following sterile techniques. Sometimes contamination through contact with the floor has been observed, or others DIY strategies to avoid contact with the surrounding environment have been identified. *“Bladder catheters' bags are kept into especially designed cotton bags”*, *“A patient with urinary catheter has only 300 ml in the bag...”*. Some patients need oxygen therapy *“An oxygen mask is on the floor...”*. On one occasion we have observed the removal of a PICC-line. Service users with Percutaneous endoscopic gastrostomy (PEGs) and nasogastric (NGs) tubes need endotracheal aspiration

“Every time endotracheal aspiration is performed, the aspiration tube is then disposed of. The nurse give water and drugs through PEG with no gloves and without washing her hands”, “A young nurse washes his hand accurately. Whilst he is performing the procedure, someone talks to patient and distracts him. He administers crushed medications through PEG and then washes the residual medications from the syringe.”

At times, the risk of contamination is due to the patient's position during enteral nutrition *“Patient with PEG laying completely flat during personal care, nutrition still running...”*

Hydration

Water is always available in the common rooms. However, some problems of dehydration and accessibility to water emerged from the data collected. *“There is water on the bedside tables but it is not always within the reach of*

patients, a lady has a very dry tongue ... “At dinner time the patients are left completely alone, some do not have water on the bedside tables” Sometimes hydration is provided parenterally “We are entering the bedrooms of bed-ridden patients; many have intravenous fluids because oral hydration is insufficient”.

Antibiotics and other treatments

Treatments for infections are mainly empiric, with no microbiologic tests for the choice of the antibiotic. In some of the NHs, positive efforts towards functional rehabilitation and promotion of individual autonomy have been observed.

“We move to another patient who has a severe vaginal inflammation and has already been taking Levofloxacin for 10 days. The service user takes the tablets independently”, “We meet the nurse who tells me the patient with tracheostomy and PEG tube has an infection and they are treating it with Prulifloxacin 600mg, urinary catheter has been removed and he is passing urine in the pad with no issues. Another patient had her PEG tube removed to re-start oral nutrition, she is more lethargic and the septic screen reveal that the chest x-ray is worsening.”

Signs of infection

In one occasion it has been observed how an important urinary tract infection (UTI) sign was neglected “The bladder catheter is not visible, it is only noted on the bed once the patient is uncovered, there is a very small amount of urine inside, which is very concentrated and dark”. On another occasion, a vaginal infection/UTI was rapidly detected “The lady complains of a burning feeling in her vagina. Care assistants check her and find redness. They positioned a bed pad and left the lady without pad to avoid further irritation.” In most of NHs observed, patient’ skin is regularly checked and moisturised with appropriate products “The sacrum area is red and Sofargen is applied, there was major urine incontinence.” During some observations, not enough attention was given to skin care “A lady has red feet, but the nurse doesn’t notice it”. In the last care home observed (02/2020) a protocol for the monitoring of New Delhi and Covid-19 was implemented, but no management or isolation protocols were yet in place.

Isolation measures

During our observations, we encountered patients with confirmed infection, who were therefore isolated. These are rare events, therefore the management appears poor and relatives don’t seem to be appropriately educated.

“[...] We move to lady M. to perform aspiration, the back of bed is inclined on 35° and she is in isolation due to Klebsiella infection. The nurse enters the room with no apron and reports that suspect another patient to have Clostridium Difficile, but laboratory tests are not yet available and therefore the patient is not yet isolated”, “I notice that in many rooms there are PPE available for isolation purposes, however, relatives are in the rooms and are not wearing any. In the same rooms, infected and non-infected patients are mixed together [...]”

Conclusions

This study could help to represent the scenario of infections risks in NHs before Covid-19 pandemic, showing some exemplar of care delivery problems and contributory factors. It could help to support changes both in terms of structure, procedures and management. The main strength of this research is certainly the innovative systemic approach applied to study infections risks within NHs. The main weaknesses are attributable to the limit of the sample and subjectivities of observers. The facilities are often not fit for purpose, especially regarding isolation, environment aeration, lights, quick and efficient intervention in case of emergency, infection control and confidentiality.^{28,29} There is a need to redesign the spaces, larger and possibly single, with a personal bathroom for self-sufficient patients and a care station with individual aids. This aspect is important to reduce the risk of contagion between patients themselves (especially in the case of isolation) and cross-contamination brought by staff members, who work in narrow and promiscuous environments. The data show that isolation procedures are performed, although often ineffective, and relatives are not sufficiently educated on how to avoid contamination. The study shows that there is often a lack of activity and elements that have the ability to stimulate the immune system and fight infections (exposure to natural light, physical activity, outdoor activities).^{30–32} Furthermore, it would be important that each room had an external access to allow ventilation of the environment.^{33,34} The staff members are in small numbers in proportion to the number and complexity of care of patients^{35,36} and it would be important to ensure higher quality and safety. Patients are rarely informed before a procedure is carried out, while it would be essential to involve and educate guests and caregivers for improve compliance and care process. Moreover personal care is not performed adequately, too often neglecting some aspects, such as oral, hands and feet hygiene. Patients’ hydration is monitored, although often delegated to staff members due to difficult access to water for patients. For this it would be necessary to implement stations to have access to water.^{37,38} Hand washing disinfection with alcohol gel is less frequent than, which is not effective on spores;³⁹ both practices are not

compliant with the WHO 5 moments for hand hygiene^{40,41} (before touching patient and starting procedure, after risk contact with body fluids, after touched surfaces around to patient, after touching patient). None of the Nhs observed had a seasonal protocol in place. It felt often as if the environmental temperature was set to accommodate staff members perception, rather than be appropriate for patients.⁴² Many patients need invasive medical devices which increase risk of infection; these are managed with domestic practices, without specialistic consultation. A reduction to use and devices as much as possible, especially in chronic patients to prevented for example catheter related infections and ensure correct management.⁴ The use of antibiotics is not frequent, but prescriptions are mainly based on clinical judgement and at times not adequately.^{43,44}

Discussion

In the light of what has emerged, dedicated infection prevention guidance are needed, to develop a local plan integrated with hospital setting, customized to the needs of guests and characteristics of long-term care facilities, supported by a deep understanding of daily practices. More in general, NHs should establish a risk management function, adopting the most suitable tools (for example with safety rounds by the management with routine observation of daily practices) and guaranteeing adequate training of nurses and allied professionals. Training is also important for to be able to better identify early signs of infection, guarantee a quick response and referral to the hospital.^{35,36,45–47} The Italian law on patient safety was approved in 2017 and addresses all healthcare and social health-care organization, requiring to systematically identify, analyse and prevent risks for patient safety.⁴⁸ Some actionable interventions and sound investments in patient safety should lead policy makers, managers and professional's agenda to fully apply the law, especially in this time of pandemic where the importance of infection preventions and controls is dramatically clear.

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Ethical Consent

The structures joined the study on a voluntary basis, being aware of the purpose and function of the study. Field observations were conducted in accordance with direction and involved observed facilities and staff. The study is not based on clinical cases but random observations of care practices, ensuring the anonymity of patients and workers.^{12,13} This research was an early step of a wider program to improve patient safety at nursing homes, funded

by the Tuscany Region department of health and conducted through a cooperation between three regional public bodies: center for patient safety, center for critical human relations and agency for Healthcare services. Nursing homes were invited to voluntarily participate after a selection according to the criteria mentioned in the article. The research team presented the project to the director and to the workers with a meeting in presence. Nursing homes guests and their families were informed of the improvement program and the preliminary observational study. Another team also had a meeting with guests and families to collect data about user experience. Both the involved structures and workers agreed to participate without any obligation. Observational data were collected without any reference to personal information of workers and guests. These type of programs and observational studies are routinely performed by the above-mentioned regional bodies, given that health service research and development is part of their institutional duties.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. Giulia Lefosse declares that she has no conflict of interest in relation to study. Laura Rasero declares that she has no conflict of interest in relation to the study. Tommaso Bellandi declares that he has no conflict of interest in relation to the study. Paulo Sousa declares that he has no conflict of interest in relation to the study. Giulia Lefosse is the author appointed as guarantor for the work. The guarantor accepts full responsibility for the work and the conduct of the study, had access to the data, and controlled the decision to publish.

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