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The Role of Compliance with Good Hygiene Practices by Medical Staff in the Prevention of Hospital-acquired Infections: Case of Moroccan Hospitals

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Abstract

Compliance with Good Hygiene Practices by healthcare professionals is an essential factor in the fight against nosocomial infections, which represent a global health problem with a high mortality rate. The aim of our study is to assess the extent to which healthcare professionals comply with these practices, namely hand washing and disinfection, wearing and changing gloves, and asepsis precautions. A cross-sectional study was conducted in 2020 at the Sidi Kacem provincial hospital in the Rabat-Salé-Kénitra region of Morocco over a 6-month period. We used a validated questionnaire with Cronbach's Alpha test with a score of 0.731 to collect the participants data. Descriptive statistical analysis was performed using Microsoft Excel version 2016 to determine frequencies and percentages. The Chi-square test was used to compare and correlate categorical variables. Any p-value less than 0.05 was considered statistically significant. A total of 126 healthcare professionals were surveyed, 68% of whom were female and 32% male. 14.3% of healthcare staff did not wash their hands either before or after care, while 62.7% did wash their hands, but not always. 7% of respondents did not use gloves during care, while the majority (79%) used gloves but not always, and 5.6% of staff did not change gloves between patients. Healthcare professionals with more than 10 years' experience comply more with asepsis practices than other categories, with a significant p-value (p= 0.011). For the relationship between the variables: gender and compliance with hand washing, we found that females comply more with hand washing than males, with a p-value of around (p= 0.013). These results show that there is a real problem in the respect of good hygiene practices at hospital level. Several actions must be put in place such as the programming of continuous training, awareness and the availability and good management of means of protection: liquid soap, hydroalcoholic product, etc. in order to prevent and reduce the rate of nosocomial infections.

Keywords: *Good Hygiene Practices, prevention, nosocomial infections*

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1. Introduction

Nosocomial infections (NI) or healthcare associated infections (HAI) are a problem for public hospitals worldwide. Developed countries are suffering from this problem and are only trying to reduce the rate of this infection through preventive actions, because their eradication seems impossible given the multitude of causal factors. It is a matter of international concern, given its serious physical, psychological, social and economic consequences [1]. Several studies on the prevalence of nosocomial infections have been carried out worldwide. According to the WHO, in 2011, 7% of hospitalized patients in developed countries had nosocomial infections, while in developing countries the study showed a prevalence of 15%, and that 10% of patients died as a result of complications from these infections [2].

In France, a survey carried out by the French Institute for Public Health Surveillance (FIPHS) in 2017 showed that 5% of hospital patients contract nosocomial infections, this percentage being almost stable from 2006. The survey also revealed that an average of 4,000 patients died as a result of these infections each year [3]. In the USA, a survey carried out in 2011 by the federal Centers for Disease Control and Prevention (CDC) showed that 4.5% of hospitalized patients develop hospital-acquired infections, with a high mortality rate of around 200 deaths per day or 75,000 patients dying each year as a result of complications from these infections[4].

In Morocco, a study of the prevalence of nosocomial infections carried out in 2018 at the CHU MOHAMED 6 university hospital in Marrakech showed an overall

prevalence rate of 9.5%. In 2010, a survey at the Ibn Sina University Hospital in Rabat showed a prevalence rate of 10.3%. Another study at the Hassan II University Hospital in Fez in 2009 revealed a prevalence rate of 12.4% [5]. The hands of healthcare professionals are in frequent contact with the components of the hospital environment surfaces and medical devices. This environment is considered by several researchers to be an ecological niche for antibiotic-resistant pathogenic bacteria that are likely to cause hospital-acquired infections, so the hands of healthcare workers can play the role of a germ transmission vector if hygiene measures are not taken into account [6]. Compliance with Good Hygiene Practices (GHP) by healthcare professionals and patients is an essential part of the fight against nosocomial infections. These practices can be defined as a set of acts and procedures designed to prevent the appearance and transmission of infection between patients and to protect healthcare staff. These practices include washing and disinfecting hands, wearing gloves, etc [7].

The high prevalence of nosocomial infections in Morocco shows that there is a real problem in terms of compliance with the GHP. Faced with this situation and in the context of reducing the rate of nosocomial infections and improving the quality of care provided to patients, we carried out a cross-sectional study at the Sidi Kacem provincial hospital centre in order to assess the degree of compliance with good hygiene practices by healthcare professionals and its impact on the prevention of nosocomial infections.

2. Materials and methods

2.1) Study design

A cross-sectional study was carried out at the Sidi Kacem provincial hospital centre (CHP) in the Rabat-Salé-Kénitra region over a period of 6 months. The main objective was to assess the degree of compliance with good hygiene practices by healthcare professionals in order to prevent the occurrence of nosocomial infections.

2.2) Study setting and population

The province of Sidi Kacem is one of the largest provinces in the Rabat-Salé-Kénitra region of Morocco, covering an area of around 5,000 km^2. It is located in the center of the region on a strategic axis in relation to the other provinces of Sidi Slimane, Khémisset, Kenitra and Larache, with a population estimated at 730,000 inhabitants according to the last population census in 2017. The provincial hospital center meets all the health needs of this population. Our cross-sectional study was conducted as part of the prevention of nosocomial infections through compliance with good hygiene practices, and was conducted between 1 January 2020 and the end of June 2020 over a period of 6 months. The study population was composed of 126 health professionals, namely doctors, health technicians and nurses from all the hospital departments of the Sidi Kacem Hospital. All these professionals were questioned using a pre-established questionnaire.

2.3) Sampling method

No selection method or criterion was used for the healthcare professionals, because all the doctors and nurses in the hospital departments were recruited for the study in order to ensure that the results were representative and reliable.

2.4) Data collection method and instrument

Data collection was carried out by a survey team consisting of the head nurses of the hospital departments plus the head of hospital hygiene and myself. They all benefited from training organized at the hospital on the survey method. For the data collection instrument, we used a validated questionnaire with Cronbach's Al-pha test with a score of 0.731. The questionnaire is made up of several simple questions grouped under themes, to facilitate the modalities of answers and to collect a maximum of information concerning the respect of GHP by health professionals. This questionnaire is pre-tested in a sample of 5% of the global population.

2.5) Study variables

The population of our study is composed of all the health professionals of the hospital services, therefore the variables of our study are composed on the one hand by the personal characteristics of this population namely: gender, age, seniority in the department and, on the other hand, by the degree of respect for this population in carrying out the GHP namely: hand washing before and after care, hand disinfection using a hydroalcoholic product, wearing and changing gloves, compliance with asepsis procedures. Statistical tests will be used to determine whether there is a significant correlation between these variables.

2.6) Statistical analysis

the results obtained from the questionnaires were processed using SPSS version 20 software, and the qualitative variables were presented as percentages (%). The chi-square test is used to compare and correlate the categorical variables. Any p-value less than 0.05 is considered statistically significant. Some of the tables were produced using Microsoft Excel version 2016.

2.7) Ethical considerations

this cross-sectional study was validated by a hospital committee and written authorization was obtained from the hospital director. Investigators and staff were informed of the objective of the study. Their agreement and participation were solicited and respected. The confidentiality of the data and the anonymity of the participants were ensured. The names of the services will be optional. An informal undertaking was also given by the investigators to scrupulously respect professional secrecy and the security measures for the data collected. Formal consent was drawn up and communicated to healthcare professionals.

3. Results and Discussions

3.1) Results

Personal characteristics: Our questionnaire survey was carried out on a total of 126 health personnel, distributed as follows: 82 nurses (65.07%), 20 doctors (5.87%) and 24 health technicians (19.04%). Gender distribution revealed that 68% of participants were female, while 32% were male. Concerning seniority in the civil service, more than half (50.79%) had more than 10 years' seniority, while 29.36% had between 5 and 10 years, and only 19.84% had less than 5 years. In terms of seniority in the department, 53.96% of

participants have been more than 10 years in the department, 31.74% between 5 and 10 years, and 14.28% have less than 5 years' experience. The survey was organized in such a way as to include all hospital staff, which gave us a 100% participation rate. This probably comes down to the notions of wisdom, respect and responsibility on the part of staff with regard to these surveys, which are evolving for the well-being of the patients. From these results, we can say that more than half of the staff interviewed have more than 10 years' experience in either the civil service or hospital services. This gives us an idea of the maturity of the participants, which has a positive effect on the reliability of the data collected (Table 1).

Aseptic practices: In our survey, more than half of the respondents (56.3%) said that they follow aseptic practices, but 43.7% of participants said that they cannot follow aseptic rules all the time for a number of reasons: 65% of this category said it was because of a workload, while 73% of respondents said there was a lack of equipment such as sterilization equipment in some departments, while 33% said there was a lack of staff, which resulted in a workload. In our study also, almost all the participants (81.7%) said that despite strict compliance with asepsis measures, they were insufficient to prevent the onset of nosocomial infections, while only 18.3% said that these measures were sufficient to eradicate these infections.

Hand washing: In our study, most of the staff questioned (76.2%) said they knew about the different types of hand washing, while 23.8% of participants said the opposite, Concerning hand washing, 23% of healthcare workers said that they always washed their hands before and after each treatment, while 44.4% said that they sometimes washed their hands before and after each treatment, 18.3% said that they rarely did, and 14.3% said that they never did. As for hand washing after contact with objects in the hospital environment, such as surfaces and medical devices, 18.3% of the professionals questioned said it was always, while 52.4% said it was sometimes, 21.4% said it was rarely and 7.9% said it was never (Table 2). According to these results, despite healthcare professionals' knowledge of the importance of hand washing in the fight against nosocomial infections, the majority do not wash their hands until after contact with contaminated objects, or before and after treatment. This is probably due to workload and a lack of training and safety culture.

Concerning the hand-drying procedure: 73% of professionals use towels to dry their hands, while 17% use their gowns to dry their hands, and 10% use air to dry their hands. Drying hands is more important than washing them, because if the drying means is contaminated, washing becomes ineffective and the hands are recontaminated.

Hand disinfection: Concerning the use of hydroalcoholic products for hand hygiene, 29.4% of healthcare professionals surveyed use hydroalcoholic friction to disinfect their hands, while 34.9% of those surveyed do not use these products. On the other hand, 35.7% of professionals do not always use hydroalcoholic products.

Wearing gloves during care: In our survey, 37% of professionals questioned said that they always use gloves during care practices, while more than half of those questioned 51%, use gloves during care but sometimes, while 28% rarely use gloves during care and only 7% said that they never use gloves. From these results, we can conclude that the vast majority of healthcare professionals do not respect standard hygiene precautions by wearing gloves, which probably justifies the large number of patients and healthcare professionals affected by nosocomial infections (Table 3).

Change gloves: The use of gloves is an essential means of preventing the transmission of nosocomial infections, but sometimes they can act as a vector for the transmission of germs between patients, or within the same patient between several care sites, if the carer has not changed the gloves between two acts of care. In our study, 27.8% of the staff questioned said that they changed gloves between two cares, while 52.4% said that they changed gloves occasionally, and 14.3% changed gloves rarely, while 5.6% of staff did not change gloves between two cares. These results explain the high rate of nosocomial infections detected during the study (Table 4).

Relationship between variables: in the context of our study, we carried out several chi-square tests using SPSS software to analyze the relationship between several variables in order to determine whether it is significant or not. To do this, we will only show the variables with a significant relationship with a p value of less than 0.05. For the impact of gender on compliance with hand washing during care, we found that women were more likely to comply with hand washing than men, with a p-value of around (p= 0.013), which probably means that women attach importance to personal cleanliness and clothing. Concerning the relationship between the overall experience of the healthcare professional and compliance with asepsis practices, we note that healthcare professionals with more than 10 years' experience comply more with asepsis practices than other experience intervals, with a p-value of around (p= 0.011). This may probably be due to the maturity and extensive experience of this category of professionals. In terms of the relationship between wearing gloves during care and overall experience, professionals with between 5- and 10-years' experience were more likely to wear gloves than other professionals, with a p-value of around (p= 0.018). This category had probably received ongoing training in care safety.

3.2) Discussion

Nosocomial infections represent an international problem, resulting in several cases of mortality and morbidity. These infections cannot be eradicated because of the multitude of factors involved in their occurrence, including human, organizational, institutional and environmental factors. So, the only way to combat these infections is to prevent them in a number of ways, mainly by ensuring that patients and healthcare professionals comply with hygiene measures [8, 9]. Good hygiene practices (GHP) represent a set of procedures and practices to be considered by individuals in order to minimize the risk of infection transmission, given that the hospital environment is highly contaminated by antibiotic-resistant pathogenic bacteria likely to cause nosocomial infections. In our study, we will limit ourselves to the following practices: washing and disinfecting hands, wearing and changing gloves, and compliance with asepsis practices by healthcare professionals [10, 11].

Hand washing is a key factor in the fight against hospital-acquired infections and the spread of pathogenic germs. The first person to talk about the involvement of

healthcare professionals' hands in the transmission of micro-organisms was Edward Mortimer in 1962, when he justified the transmission of staphylococci to newborn babies [12]. Another study carried out by Didier Pittet in 2000 over a period of 4 years looked at the relationship between hand hygiene and the rate of nosocomial infections caused by methicillin-resistant Staphylococcus aureus. This study showed that the rate of nosocomial infections fell when healthcare professionals regularly practiced hand hygiene using hydroalcoholic products (HAPs) [13]. Other studies have demonstrated the effectiveness of hand disinfection in preventing hand-borne infections. In everyday care practices, washing hands between two patients is difficult and impractical, whereas hand disinfection using hydroalcoholic products is an effective method in terms of results, and more effective than frequent hand washing. It is recommended by a number of health organizations, including the French Society of Hospital Hygiene, the World Health Organization's guide to patient safety and others. On the other hand, several studies have shown that frequent hand washing with soap causes skin irritation with poor tolerance and recommends the use of hydroalcoholic friction (HAF) with an appropriate choice of product for better tolerance. [14]. In our study we found that the majority of healthcare professionals (62.7%) do not always wash their hands before and after each treatment, while 14.3% do not even wash their hands, which can encourage the transmission of infections between patients and carers, and for disinfecting hands with hydroalcoholic products, the study showed that 70.6% of the professionals questioned did not comply with hydroalcoholic friction (FHA) before and after care. Several studies have addressed the problem of non-compliance with hand washing and disinfection and its serious consequences, namely: The study by Matthew and al in 2014 [15] on the global prevalence of hand washing with soap, based on literature data since 1990, revealed that on the basis of 42 studies reporting the prevalence of hand washing with soap, the following results were obtained we estimate that around 19% of the world's population wash their hands with soap after coming into contact with contaminating objects.

The study by Barbara and al [16] in 2004 in the Department of Pediatrics at Queen Mary Hospital Hong Kong, China looked at hand hygiene compliance and hand washing techniques performed by healthcare staff and the detection of any non-compliance factors before and after hand hygiene training. The study showed that overall compliance with hand hygiene increased from 40% to 53% before patient contact and from 39% to 59% after patient contact. The rate of healthcare-associated infections fell from 11.3% to 6.2% per 1000 patient-days. The study by Kanitha and al [17] in 2005 in the intensive care unit at King Chulalongkorn Memorial Hospital (KCMH) in Thailand, which looked at the degree of compliance with hand hygiene by nursing staff, showed that more than 50% of nursing staff did not comply with hand hygiene for several reasons: Forgetfulness (35.7%), skin irritation from hand hygiene products (15.5%) and the perceived priority needs of patients (51.2%) were the most common reasons.

Wearing gloves: When providing care in a hospital setting, it is obligatory for carers to wear gloves, especially when performing invasive procedures that require the use of sterile gloves due to rigorous asepsis, such as surgery, central venous catheterization, vesical and gastric probes, suturing wounds, changing dressings and many other procedures that require the use of sterile gloves. Hand washing and disinfection by hydro-alcoholic friction only reduces the quantity of germs in the hands, not eliminating them completely, and can never replace the use of sterile gloves.

The use of gloves in care is part of good practice in hospital hygiene, and provides twofold protection: it protects patients from germs carried by carers, other patients or the hospital environment, to ensure quality care; and it protects staff by avoiding hand contact with patients' biological fluids, such as blood, pus, urine, faecal matter and saliva, which present a high risk for staff, especially in the event of injury. Despite the use of gloves, carers must wash and disinfect their hands before wearing them, and staff must change their gloves between treatments, even for the same patient, to prevent the transmission of germs between two points of entry, and also gloves must be worn at the moment of care and removed directly after care to prevent contamination of the environment, then hand washing or disinfection is necessary. In some situations, gloves are used to protect healthcare staff from other types of risk, such as chemical risk when handling chemical products such as endoscope sterilization products, chemotherapy products, laboratory reagents, etc. In our study, we found that 79% of the carers surveyed did not always wear gloves during care, while 7% practiced care without gloves. The survey revealed that women were more respectful of wearing gloves than men, with a p-value of around 0.021, which may be due to the fact that women are more aware of the concepts of safety in care. Several studies worldwide have addressed this issue, such as:

The study by Anna and [18] al in 2013 carried out in six departments of three hospitals in the province of Łódź Poland in order to assess, through quasi-observation, the use of protective gloves by nursing staff according to the guidelines issued by the CDC and the WHO. The study showed that the overall level of compliance with the guidelines on glove use was 50%, with some departments using gloves more often and other departments using them significantly less frequently ($p < 0.001$). They are most commonly used for medical procedures (98.6%), changing dressings (81.2%) and drawing blood (78.3%). Our results show that doctors are more likely to use gloves than nurses. The difference is statistically significant with $p < 0.001$. The study by Denat and al [19] in 2021 in the emergency department of a public hospital in the capital of Turkey, aimed to determine the beliefs and practices regarding hand hygiene and the use of gloves by healthcare professionals. The study revealed that $43.71\% \pm 7.57$ use gloves during care, and only $15.17\% \pm 3.88$ are aware of the importance of using gloves. The study by Khatib and al [20] in 1999 on the impact of awareness posters on improving hand washing and glove use in an intensive care unit over a 4-week period, the study showed the following results: the rates of hand washing and glove use were significantly higher in the second period, when labels were affixed to ventilators, compared to the rates in the first period: hand washing, 92% versus 46% ($p < 0.05$); glove use, 92% versus 43% ($p < 0.05$), respectively.

Table 1: Classification of participants by personal characteristics			
Personal characteristics	Category	Number	Percentage
Profile	Nurse	82	65,07%
	Doctor	20	15,87%
	Healthcare technician	24	19,04%
	Total	126	100 %
Gender	Male	40	31,74%
	Female	86	68,25%
	Total	126	100 %
Global experience	less than 5 years	25	19,84%
	between 5 and 10 years	37	29,36%
	More than 10 years	64	50,79%
	Total	126	100 %
Experience in the department	less than 5 years	18	14,28%
	between 5 and 10 years	40	31,74%
	More than 10 years	68	53,96%
	Total	126	100 %

Table 2: Hand washing before and after care					
		Number	Percentage	Valid percentage	Cumulative percentage
Valid	Always	29	23,0	23,0	23,0
	Sometimes	56	44,4	44,4	67,5
	Rarely	23	18,3	18,3	85,7
	Never	18	14,3	14,3	100,0
	Total	126	100,0	100,0	

Table 3: Wearing gloves during care by healthcare workers					
		Number	Percentage	valid Percentage	Cumulative Percentage
Valid	Always	37	29,4	29,4	29,4
	Sometimes	51	40,5	40,5	69,8
	Rarely	28	22,2	22,2	92,1
	Never	10	7,9	7,9	100,0
	Total	126	100,0	100,0	

Table 4: Change of gloves after each care session by carers					
		Number	Percentage	Valid Percentage	Cumulative Percentage
Valid	Always	35	27,8	27,8	27,8
	Sometimes	66	52,4	52,4	80,2
	Rarely	18	14,3	14,3	94,4
	Never	7	5,6	5,6	100,0
	Total	126	100,0	100,0	

Asepsis practices are made up of a number of actions and precautions taken by healthcare staff during the provision of care to prevent the introduction of germs to patients through entry points, such as hand disinfection, the wearing of gloves, the use of sterile equipment, etc. In the field of quality, these are considered to be technical and sometimes regulatory requirements. Failure to comply with these practices can lead to nosocomial infections, with serious consequences such as prolonged hospitalization, lasting after-effects, increased care costs for the establishment, psychological and social problems, etc. Compliance with these asepsis rules is the first pillar of prevention against the risk of infection, but they are still insufficient to eradicate nosocomial infections, which depend on a number of determinants and factors, such as contamination of the hospital environment by pathogenic bacteria likely to cause nosocomial infections outside healthcare practices. In our study, 43.7% of the care workers questioned did not respect asepsis practices at all times when providing care, for several reasons, but mainly because of their workload, in 65% of cases. It was noted that the female sex respected asepsis practices more than the male sex; the chi-square test between these two variables showed a significant p-value of around 0.021. These results are in line with several international surveys: A study carried out by Sonoiki and al [21] in 2020, which looked at the factors influencing nurses' non-compliance with asepsis practices during postoperative care, showed that the main factors were psychological and environmental factors which prevented nurses from complying with asepsis practices. A study carried out by Kabemba and al [22] in 2018 at the general referral hospital in Moba, Democratic Republic of Congo, on compliance with asepsis practices showed several non-compliances and a considerable gap between what is done and what should be done. the presence in the operating theatre of a number of aseptic faults (presence of mobile phones and radiocassettes in the operating theatre during surgery; incorrect wearing of caps, masks and gloves; non-aseptic gestures in the performance of procedures; In the surgical department, more than 62% of nurses did not provide aseptic care to patients, which resulted in surgical site infections accounting for 40.5% of all cases operated on.

The results of our study showed that healthcare professionals do not follow hygiene practices when providing care, such as washing hands and wearing gloves, which can encourage the spread of antibiotic-resistant germs in patients' environments. Plus the occurrence of nosocomial infections, with their harmful repercussions on the physical and emotional state of patients, and other consequences for the establishment and the nursing staff.

Several international studies have shown that this is a widespread problem in hospitals all over the world, because it depends mainly on the state of mind and professional conscience of carers. To combat this phenomenon, a number of measures need to be put in place: permanent availability of hygiene products such as liquid soap and hydroalcoholic products, regular training for carers on hygiene measures and safe care, awareness-raising through posters and other means, supervision visits to motivate carers who respect asepsis practices and the punishment of others.

The limitations of our study are in the choice of our study population we chose only health professionals with the assessment of their compliance with good hygiene practices, so to make a good diagnosis we also need to know the degree of compliance with hygiene measures by hospitalized patients, because despite compliance with asepsis by carers, there may be a high rate of nosocomial infections of environmental origin as a result of non-compliance with hygiene measures by patients

4. Conclusions

This study enabled us to assess the extent to which healthcare professionals comply with good hygiene practices, carried out as part of the prevention of nosocomial infections. The survey revealed significant non-compliance with current standards, with 14.3% of healthcare workers not washing their hands before and after treatment, while 7% did not wear gloves during care and 5.6% of carers did not change their gloves between treatments, the chi-square test showed that women were more likely to wash their hands than men, with a p-value of around (p= 0.013). These results show the importance of planning in-service training courses on hospital hygiene as part of an overall approach to combating nosocomial infections, these results raise awareness of the importance of human factors in the success of the healthcare system. Measures to improve skills and awareness must therefore be put in place to create high-performing healthcare staff who are aware of the importance of preventive measures against the risk of infection.

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Conflicts of Interest
The authors declare that there is no conflict of interests.

Ethical approval
All ethical procedures have been respected and our study has been validated by a provincial ethics commission

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