Healthcare-associated infection in Burkina Faso: an assessment in a district hospital

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Abstract

In developing countries, few data are available on healthcare-associated infections. In Burkina Faso, there has been a failure to take into account risk management and patient safety in the quality assurance program. The main objective of our study was to carry out an assessment of healthcare-associated infection in a first level hospital. We conducted a cross-sectional study in June 2011 in the care units of Ziniaré District Hospital (Ziniaré, Burkina Faso). The hospital has been divided in three components: i) hospital population (care providers, in-patients and patients' guardians); ii) healthcare and services organization; iii) hospital environment. We included: care providers of the clinical services, hospital in-patients and patients' guardians, hospitalization infrastructure and nursing units, and all the documents relating to standards and protocols. Data collection has been done by direct observation, interviews and biological samples taken at different settings. In hospital population, care providers and patients' guardians represented a high source of infection: adherence to hygiene practice on the part of care providers was low (12/19), and no patients' guardian experienced good conditions of staying in the hospital. In healthcare and services organization, healthcare waste management represented a high-risk source of infection. In hospital environment, hygiene level of the infrastructure in the hospital rooms was low (6.67%). Prevalence of isolated bacteria was 71.8%. Urinary-tract catheters infections were the most significant in our sample, followed by surgical-site infections. In total, 56.26% (9/19) of germs were -Lactamase producers (ESBL). They were represented by *Escherichia coli* and *Klebsiella pneumoniae*. Our analysis identified clearly healthcare-associated infection as a problem in Ziniaré district hospital. Hence, a national program of quality assurance in the hospitals should now integrate the risk infectious management of healthcare-associated infections.

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Introduction

The main mission of the health system is care offer, services promotion, prevention, re-establishment and health maintenance.[1] Unfortunately, health services become ever riskier for health as the importance of healthcare-associated infection does not stop growing.[2] Care providers, patients, patients' guardians and visitors represent the principal actors of this major public health problem which nosocomial infections represent today.[3] For the past 20 years, the hospital prevalence of healthcare-associated infections, gathered from national surveys, oscillated between 3.5 and 14.8% in developed countries.[4-17] In developing countries, though, few data are available on this issue.[18] According to few studies, the incidence of healthcare-associated infection in developing countries is 15.5 per 100 patients, thus doubling European rates. In developed countries, energetic actions were undertaken for management and risk control of healthcare-associated infection in hospitals.[19] Most of all, that was essential with the rise of complaints coming from care providers as well as from patients.[20] These last, together with legal claims and compensation costs for users, made the fight against infection risks become a requirement in a hospital-integrated global approach to quality management.[19,20]

Particularly in developing countries and Africa, healthcare-associated infections remain a neglected problem.[21,22] However, this context is marked by more and more active participation of the impoverished populations in health funding. To avoid the maximum morbid and/or lethal risk to be associated to health services frequentation, the management and risk control of healthcare-associated infections should be a priority.[1]

In Burkina Faso, there has been a poor implementation of the quality program developed in 2003.[23] Indeed, this program does not take into account the risk management and patient safety in the hospitals. In 2009, of 383,458 discharges from hospitalization recorded in the 63 health districts of Burkina Faso, 10,937 deaths occurred.[24] Without having been able to identify the contributive part of the patients, some deaths were consecutive to the infections associated with healthcare received. The lack of data on the reasons for hospital mortality makes it very relevant that studies on the problem and the main characteristics of the risk of healthcare-associated infections be conducted. We hypothesize that the hospital environment, the organization of healthcare and services, and the hospital pop-

ulation (patients, care providers and patients' guardians) constitute some risk of infection in healthcare settings. Tackling nosocomial infections will contribute to strengthening the implementation of quality assurance in healthcare facilities and services, and to mainstreaming patient safety in healthcare settings. Hence, our study laid down three objectives i) assess sources of risk of infection in healthcare settings; ii) identify types of risks of infection in healthcare settings; and iii) analyze service users' perception of healthcare-associated infection risks.

Materials and Methods

Study design and site

The present research was a cross-sectional study on the sources and types of risk of healthcare-associated infections. It was carried out in June 2011 in care units in Ziniaré district hospital (Ziniaré, Burkina Faso). This was one of the 3 districts of the area of the *Direction Regional de la santé du plateau central* of Burkina Faso, where a global quality of the care situation analysis was made.

Study population and sampling techniques

With regard to the hospital population, we included: i) care providers who were present the day of the survey in the hospital clinical services; ii) hospital in-patients and patients' guardians present the day of the survey. Care providers, patients and patients' guardians gave their consent to participate in the study.

Regarding the organization of healthcare and services as well as the environment, we included the staff in charge of healthcare waste management (HWM), sterilization, hospitalization infrastructure, nursing units and all documents relating to standards and protocols.

The sample was exhaustive regarding the providers delivering healthcare the day of the survey. It was also convenient as for the patients' guardians and patients who were present in the hospitalization wards of the hospital, and reasoned regarding the choice of nursing units, in-patient units, documents and sampling sites for the identification of germs. This type of sampling was validated by the literature being able to be used to identify the targets for the risks assessment in healthcare services.[25-27]

The biological sampling sites were selected using a validated method.[19] These sites represent potential sources of microbes, namely, the surfaces of the operating theatre suite (n=6), the sterile linen of the operating theatre suite (n=5), water points in the nursing units (n=5), in-patients (n=12) present for more than 48 h and holders of urinary catheters, surgical wounds, drain, and care providers (n=11) in their nostrils and fingernails.

Data collection

We have defined the variables using the combination of WHO standards,[28-31] the 100 recommendations for surveillance and control of nosocomial infections,[32] the certification manual of health institutions and the rating guide.[33] These standards were adapted to our context. The main variable event was risks infectious. Interest variables were those relating to the hospital population, care and services organization, and hospital environment. Thus, we assigned to each criterion for each component (hospital population, healthcare and services organization, and environment) of each variable, the score 0 or 1, which defines the level of compliance or non-compliance. The total of the scores was the basis for assessing each variable and the risk level of each compartment.

For the healthcare-associated infection identification we combined several techniques: non-participatory direct observation, individual interviews, document review and biological testing of samples. For the patients' perception analysis we used individual interviews. Interviews were conducted in a place arranged to this end or at the patient's bedside out of service hours.

For the risks infectious characterization we carried out biological testing of samples. Samples of pus, blood, surfaces, dander, urine, linen were collected according to the protocols in a single day. The samples were transferred and seeded directly in different environments depending on the specific sample (Cleda, BCC, Colombia, GC, PCX, and EMD) in the microbiology laboratory, University Hospital Yalgado Ouédraogo. Culture and identification of bacteria were done on API galleries. The results were expressed as CFU/mL for germs from the patient samples and as CFU/16 cm^2 for surface samples. Antibiograms were performed on patient samples.

Standardized and semi-standardized questionnaires were used for data collection.

An observation checklist for care providers (for the practical barriers practice) included 17 questions divided into two sections: i) professional clothes and sanitation, ii) glove wearing, water-alcohol friction and hand washing.

An observation checklist for patients included 29 questions divided into three sections: i) concerning the patient, ii) the patient's comprehensive hygiene, and iii) the type of disease managed.

A semi-structured questionnaire for patients' perception contained 31 questions divided into three sections: i) knowledge and perceptions of the risks of infection associated with healthcare, ii) the perception of basic sanitation practiced by care providers in the hospital, and iii) the satisfaction on hygiene in the hospital.

Standardized questionnaire for patients' guardian consisted of 15 questions divided into two sections: i) the number of patients' guardians, and ii) the living conditions and hygiene of patients' guardians.

An observation checklist of healthcare waste management (HWM) included 71 questions divided into 12 sections: i) staff, ii) the off-site transport of healthcare waste (HW), iii) the treatment of HW, iv) HW management regulations, v) policy and budget, vi) the production of HW, vii) separation and handling of HW, viii) containers of HW, ix) the storage area of HW, x) collection and transport of HW, xi) final elimination of HW, and xii) sanitation and waste water.

An observation checklist for the disinfection and sterilization system included 24 questions divided into four sections: i) officials, ii) protocols, iii) procedures, iv) processes by care units.

An observation checklist was used for water points facility, water supply system in the structure, air quality, sanitation of the infrastructures.

Data analysis

For the healthcare-associated infection identification, intervals of 0-60%, 60-85%, and ≥85% were used to assess the level of risk. When the calculated percentage was ≥85%, the risk of infection in the compartment studied was considered low. If this percentage was between 60 and 85%, the risk of infection was average. When the percentage was <60%, that corresponded to a high level of risk.

Proportions with CI to 95% were used to present the germs identified, patient knowledge about hygiene at the hospital, the degree of their satisfaction concerning hygiene at the hospital. Data were entered and analyzed with Epi Info version 3.5.1 software.

Ethical considerations

Authorizations from the officials of the *Direction regionale de la santé and the district sanitaire* were granted prior to the study. Data collection, entry, and processing were carried out anonymously.

Results

Characteristics of study participants

Surveys were conducted in eight healthcare wards of the hospital: pediatrics, medicine, surgery, maternity, dentistry, ophthalmology, psychiatry and the laboratory. A total of 19 care providers have been observed including 8 women. The most represented professions were the health assistants (7/19), midwives (4/19)

and nurses (4/19). We included 30 patients in our study. Their mean age was 38.1 (+/-21.8). There were 36.7% (11/30) of patients who were either housewives or farmers. The mean duration of hospital stay was 4.6 days (range 0-17 days). Among the patients, 63.3% (19/30) were non-literate. A total of 63 patients guardians were included. The mean number of guardians per patient was 2.1 (range 1-5). The mean duration of their stay was 4.9 days (range 1-19 days). The patients' guardians were mainly constituted by their sons 27% (17/63), sisters or brothers 19% (12/63), spouses 14.3% (9/63), mothers 9.5% (6/63).

Potential risk sources of healthcare-associated infection

The hospital population

The hospital population was constituted by care providers, patients and patients' guardians. Score of the hospital population was 47.15% (Table 1) Care providers obtained a score of 36.85%. Hygiene practice among care providers was 63.16% (12/19). Hygiene practices among hospital patients was 36.67%. The score of patients' guardian was 34.34%. No patient's guardian experienced good conditions of staying in the hospital. We found that 44.4% (28/63) of patients' guardians were sleeping on mats or cloths in the wards, 41.3% (26/63) in the corridors, and 4.2% (2/63) under the trees in the courtyard of the hospital.

Healthcare and services organization

Score of healthcare and services organization was 35.6% (Table 2). The healthcare waste management score was 27.73%. There were shortage of trained staff and no protocol for the management of HW. The final disposal of household waste was done in an unsecured location in the city (Figure 1). The antibacterial policy in the structure had a score of 36.36%. There was a lack of policy on the use and supply of antibiotics (no list of antibiotics, lack of protocol for the use of antibiotics in clinical services). We found that 27.28% (9/33) of antibiotic prescriptions were unjustified. The sterilization system in the hospital had a score of 50%. There were no protocol, no staff in charge of sterilization in the hospital. The staff was not trained and was not immunized against tetanus and hepatitis B. The analysis of water point facilities for hand washing in 6 healthcare services received a score of 33.33%. Among the six facilities found, no water (manual valve), 3/6 not functional and 4/6 were in remote places away from healthcare location (outside nursing rooms).

The hospital environment

The assessment of the hospital environment included the hospital water supply system, the quality of air in the wards, and the hygiene of the hospital rooms. The score of hospital environment was 35.54% (Table 3). The system of water supply in the hospital received a score of 75%, and the air quality in the rooms a score of 25%. Among the six rooms visited, half were poorly ventilated and contained bad odors. There was mold on the fans of all rooms visited. The level of hygiene of the infrastructure in the hospital rooms was 6.67%. The score of cleanliness of the rooms floor was 66.7%. There were no staff in charge of the hygiene of the infrastructure, no protocol for cleaning, no cleaning program, the staff was not trained and its number was inadequate.

Table 1. Hospital population sources of risks of infection in primary care setting in Ziniaré district hospital, 2011.

Indicators	Scores	Criteria	Level scores No.	%	Total score (%)	Risks level
Care providers						
Professional behavior	0-3	Blouse wearing	16	84.2	63.16	Mean
		Clean blouse	13	81.3		
		Short sleeve blouse	14	87.5		
Gloves wearing	0-1	During care at risks	14	73.7	73.7	Mean
Hands friction	0-6	Hand friction practical	1	5.26	5.26	High
		Technique success	1	5.26		
Hands washing	0-1	Hand washing practical	4	21.1	5.26	High
	0-9	Technique success	1	5.26	36.85	High
Patients						
Age (n=30) (years)	0-1	≤50	20	66.7	66.67	Mean
Nutritional status (n=19)	0-1	Good	14	77.8	77.7	Mean
Hygiene (n=30)	0-6	Clothes cleanliness	20	66.7	36.67	High
		Bath in the 48 h	14	46.7		
Pathology (n=30)	0-1	No infectious disease	0	100	100	Low
					70.26	Mean
Patients' guardian						
Number per patient (n=30)	0-1	1 per patient	9	30	30	High
Hygiene (n=63)	0-2	Clothes cleanliness	46	73	73.02	Mean
		Shoes wearing	60	96.8		
Stay condition (n=63)	0-1	Visitor room	0	0	0	High
					34.34	High

Figure 1. Final disposal of Ziniaré hospital household waste in the city during our study.

Types of hospital risks of infection

We found 28 positive samples out of 39. This corresponded to a prevalence of 71.8% IC95% (55%; 85%). There were 12 bi-microbial samples. In total, 40 micro-organisms were isolated in our study represented by *Staphylococcus epidermidis* 35% (14/40), *Escherichia coli* 25% (10/40), *Staphylococcus aureus/saprophyticus* 12.5% (5/40), *Pseudomonas aeruginosa* or *sp* 10%, (4/40), *Klebsiella pneumoniae* 10% (4/40), and positive *Gram Bacilli* 7.5% (3/40). Among the 30 hospitalized patients, urinary-tract catheters infection represented 16.67% (5/30), followed by surgical-site infection 10% (3/30), and bacteremia 3.33 % (1/30). Among the bacteria identified in patients' samples, we isolated 56.26% (9/19) bacteria producing Extended-Spectrum of Beta Lactamase (ESBL). These enterobacteria were: *Escherichia coli* (6/9), and *Klebsiella pneumoniae* (3/9).

Service users' perception of the risks of infection

Among the 30 patients interviewed about the risks of infection in hospital, none reported having ever heard about healthcare associated-infection. For getting infections, 70.8% (17/24) said that they could be infected in hospital and 50% (15/30) reported that everyone could get these infections. All the patients said that it was important that care providers washed their hands after every move and that wearing gloves was a good thing. Among the patients surveyed, 83.3% (25/30) IC 95% (65.3%; 94.4%) were satisfied with the hygiene of the buildings.

Discussion

Hospital population, healthcare and services organization, and hospital environment represented a high risk of infection in health primary care settings in our study. The prevalence of isolated germs was 71.8%. Urinary-tract catheters infections were the most significant in our sample, followed by surgical-site infection. In total, 56.26% (9/19) ESBL bacteria were isolated. They were represented by *Escherichia coli* and *Klebsiella pneumoniae*. These results support our hypothesis that the hospital population (care providers, patients, and patients' guards), healthcare and services organization, and the hospital environment were sources of infection risks in the hospital.

The cross-sectional method we used is considered to be a good method known in the literature to educate and justify the implementation of a policy in order to reduce the risk of infection that goes with healthcare.[25] It is a method easily reproducible and understandable by health professionals.[26,32] However, this approach has shortcomings which can lead to an underestimation of the importance of risk in healthcare settings.

Hospital population

The care providers and patients' guardians had levels of highest risk of infection, with 36.85% and 34.34% of scores, respectively. Hand hygiene was poor among care providers. In fact, only 21.1% (4/19) practiced hand washing. These results confirm the findings of the African and western literature on non-compliance with hand hygiene by the care providers.[34] Non-compliance with hand hygiene is considered as the major cause of the occurrence of healthcare-associated infections.[35] Hands transmission would be the major mode of transmission of germs from providers to patients, between providers and vice versa. These shortcomings in the practices could be explained by the lack of training on the issue, supportive supervision at the individual and collective levels. We can also mention the lack of hand washing facilities in the healthcare units. Of the six water point facilities found, no water was available (manual valve), 3/6 did not function and 4/6 were located in remote places away from the healthcare units. The management of infection risks should go through the awareness of the first players that care providers represent. There is urgent need to address the issue of healthcare-associated infections in hospitals in relation to the results of biological evidence. Our results are of concern, as in our study sample we isolated 56.26% (9/19) bacteria producing Extended-Spectrum Beta Lactamase (ESBL). These multi-resistant germs constitute a big problem in the care units. Consequences are hospitalization prolongation, hospitalization cost for patients and all the heath system. These hazardous multi-resistant germs are subject to monitoring in a process of risk reduction and patient safety.

Particular attention should be paid to body hygiene and patients' clothes in the hospital. Only 66.7% of the patients had clean clothes and 46% reported having had one bath within 48 hours. Indeed, authors such as Larson and colleagues in the United States believe that nearly 10^6 squama of skin contain viable micro-organisms that fall every day in the immediate environment of patients.[36] We recognize that in such conditions of low hygiene in patients, surgical-site infections and urinary-tract catheters infections come to light. Already carriers of disease during the treatment, the conditions of staying of patients in hospitals should be

Table 2. Healthcare and services organization sources infection risks in primary care setting in Ziniaré district hospital, 2011.

Indicators	Scores	Criteria	Level scores (No.)	(%)	Total score (%)	Risks level
HWM	0-11	HWM responsible	1	100	22.73	High
		HWM protocole	0	0		
		Staff training	0	0		
		Staff immunization	0	0		
		Sort and handling	0.5	50		
		Collection	0	0		
		Storage	0	0		
		Transport	0	0		
		Treatment	1	100		
		Destruction	0	0		
		Assessment	0	0		
Anti-bacteria policy	0-9	Antibiotic prescription conformity to pathology (n=33)	24	72.72	36.36	High
		Antibiotic using policy and provisioning	0	0		
Sterilization system (4 services)	0-10	Sterilization responsible	0	0	50	High
		Disinfection and sterilization protocols	0	0		
		Decontamination	4	100		
		Cleaning	4	100		
		Drying	4	100		
		Disinfection/sterilization	4	100		
		Storage	4	100		
		Staff training	0	0		
		Staff immunization (hepatitis B, tetanus)	0	0		
		Assessment	0	0		
Devices of water points (6 services)	0-1	Water point in treatment room	2	33.33	33.33	High

HWM, healthcare waste management.

Table 3. Hospital environment sources of risks of infection in primary care setting in Ziniaré district hospital, 2011.

Indicators	Scores	Criteria	Level scores No.	(%)	Total score (%)	Risk level (%)
Water supply (6 services)	0-1	Permanent water supply	6	100	75	Mean
	0-1	Running water supply	6	100		
	0-1	Apparent water property	6	100		
	0-1	Water quality control	0	0		
Hospitalization room air quality (6 services)	0-1	Hospitalization room ventilation	3	50	25	High
	0-1	No mould on the ventilators	0	0		
	0-1	No odor in hospitalization room	3	50		
	0-1	Air quality assessment	0	0		
Infrastructure hygiene (6 services)	0-1	Infractructure hygiene responsible	0	0	6.67	High
	0-1	Staff training	0	0		
	0-1	Cleaning protocol	0	0		
	0-1	Cleaning program	0	0		
	0-1	Availability of the material and up keeping products	0	0		
	0-1	Buildings maintenance assessment	0	0		
	0-5	Toilets property	0	0		
	0-5	Room ground property	4	66.67		
	0-1	Traceability of actions allowed	0	0		
	0-1	Traceability of material maintenance	0	0		

accompanied by education on cleanliness, in order to participate in breaking the chain of transmission of germs in hospitals. This should be organized more easily by encouraging their involvement in the process. Indeed, 50% of the patients surveyed were aware of healthcare associated-infections and the consequences of these infections on the hospital population. We also noted the presence of too many patients' guardians in our study. They were permanently in large number at the bedside of the patient, on average two patients' guardians per patient. This entails poor living conditions. Simon and colleagues[3] stressed that the excessive number of family environment in the hospitals was a factor of healthcare-associated infections risks. Their high number in the hospital could explain the bad conditions of staying in the hospital observed. Among the patients' guardians, 44.4% were sleeping on mats or cloths in the wards, 41.3% (26/63) in the corridors, and 4.2% (2/63) under the trees in the courtyard of the hospital.

Healthcare and services organization, and hospital environment

We noted a lack of standardized procedures for the healthcare and services organization and for the hospital environment management. This results in deficiencies in the healthcare waste management, in the sterilization system, in hygiene facilities, and unjustified prescriptions of antibiotics. Healthcare waste management was a specific problem in our study: sort, collection, storage, transportation, waste disposal were insufficient. The level of hygiene of the infrastructure represents a high risk for the hospital population (score 6.67%). Hamza stated that the main germs of hospital settings originate not only from hospital in-patients but also from the immediate work area.[37] Rosenthal and colleagues stated that non-compliance with the protocols was a risk factor for healthcare-associated infections in developing countries.[18] The approach to managing risks of healthcare-associated infections in hospitals in order to improve the quality of healthcare and patient safety must include the development of protocols. The results will be better when patients and care providers will display a behavior that contributes to the building of a culture of hygiene in hospital settings.

The risk of healthcare-associated infections should be integrated in a global and cyclical process of improvement of the competencies of healthcare teams. Professional practices assessment in the peripheral hospitals would be a strategy to solve the risk infectious of healthcare-associated infections and to ensure the patients safety. However, a national study of prevalence of healthcare-associated infections would be necessary to confirm these findings.

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