



(RESEARCH ARTICLE)



## Level of involvement of patients and accompanying persons in the management of biomedical waste in Benin

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GSC Advanced Research and Reviews, 2022, 12(02), 101-114

Publication history: Received on 15 July 2022; revised on 17 August 2022; accepted on 21 August 2022

Article DOI: <https://doi.org/10.30574/gscarr.2022.12.2.0219>

### Abstract

**Introduction:** The Management of Biomedical Waste (MBW), needs the involvement and the action of professional or social entities in relationship with health facilities. This study aims to assess the involvement level of Patients and their Accompanying persons (PA) in the MBW.

**Methods:** It was a cross-sectional and analytic study made on 409 PA hired by their commodities, in six health facilities in Benin. Data were collected through a survey on sociodemographic characteristics, type of waste, knowledge and perception of PA on the MBW, the access to storage places and perceptions on health and environment in link with the MBW. The data were entered and treated by Epidata and the software R 4.1.1.1. The proportions were compared with the Chi-square test.

**Results:** At the univariate analysis, the health facility, the gender and the knowledge of the storage place were associated to the involvement of PA in the MBW. The access to the storage places were associated to the health facility, the profession and the knowledge of storage places. The PA that knew the storage place of BW were more than seven times at risk of been involved in the MBW compared to the others.

**Conclusion:** 26.9 % of PA have access to the storage place of BW. Regarding the potential infectious risk that could induct this practice for PA, it is necessary to improve the management system of BW and sensitize the PA.

**Keywords:** Management of biomedical waste; Level of involvement; Patients; Accompanying persons; Benin

### 1. Introduction

The Biomedical Wastes (BW) mean wastes issued from care activities in hospital, in medical facilities or research or that are also produced when realizing public health campaigns such as vaccination campaigns [1]. They are the main causes of some problems such as hospital-acquired infections or health workers infections as well as its harmful effect on health workers and population health [2]. Indeed, the number of patients in hospitals increases from year to year related to the galloping demography, environment, and lifestyles.

In Africa, the infection prevalence in link with healthcare activities varies between 10 % and 60 %, in Mali 14 %, in Senegal 10.9 %, in Ivory Coast 12 % [3]. In Benin it was at 9.8 % at the Centre National Hospitalier Universitaire Hubert

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Koutoukou Maga, CNHU, (National Teaching Hospital Hubert Koutoukou Maga), 14.4 % at the Centre Hospitalier et Universitaire de Zone d'Abomey-Calavi/So-Ava – CHU AS- (Teaching Hospital of Abomey-Calavi/So-Ava District) and at the Centre Hospitalier de Zone de Cotonou 5 – CHZ Cotonou 5 [4, 5]- Teaching hospital of Cotonou 5 District). This high prevalence is largely related to the bad quality of hospital hygiene, as well as a poor manipulation and elimination BW [6].

Indeed, when these BW are poorly managed, they could lead to a change in the microbial ecology and the spreading of antibiotic resistance with its infectious corollaries on the personal, patients or their accompanying person [7]. The patient's relatives are important members of health care teams; they are important resource persons for their sick parents [8, 9]. Usually, a family member is assigned to stay with the patient till the moment he gets out from hospital [10, 11]. This support brought to the patient makes the patients/accompanying person's key actors of the management system of biomedical waste.

However, one knows few on the problematic related to the impact of the management of biomedical waste on the patients or their accompanying persons in Benin and their perceptions on sanitary and environmental concerns in link with the management of biomedical waste. It is therefore in this mind that the current study has been undertaken in six health facilities of Benin in order to contribute to the improvement of practices.

## 2. Material and methods

### 2.1. Framework for the study

The study has been conducted in the south of Benin in the health facilities with functional incinerators. It focused on the three levels of the health pyramid of the country. Based on the available resources, six facilities were comprised by the work of which two central, one intermediate and three peripheric. At the central level, it was the Centre National Hospitalier Universitaire (CNHU) Hubert Koutoukou Maga, Centre Hospitalier et Universitaire de la Mère et de l'Enfant Lagune (CHU-MEL) and the Hôpital d'Instruction des Armées, Centre Hospitalier Universitaire (HIA-CHU) of Cotonou selected between the four randomly chosen. At the intermediary level, the only departmental level having a functional incinerator in the study level has been selected. It is the Centre Hospitalier Départemental Mono-Couffo (CHD-MC). At the peripheric level, a random choice has served to choose the three structures: Hopital de Zone Ouidah-Kpomassè-Tori (HZ-OKT), Centre de Santé (CS) Cotonou1-4 ET La Croix Hospital (HLC) of Zinvié.

### 2.2. Type and study period

It was a cross-study and analytic study conducted from October 2020 to June 2021.

### 2.3. Study population

The population study was made up of patients, medical guards or accompanying person that attended the six health facilities. The patients or their accompanying person present in the health facilities, having at least 18 years old and that have given their free and informed consent during the survey period have been included in the study. All the patients that were in the disability to answer to the questions were excluded.

### 2.4. Sample size

The global size has been calculated by the Schwartz formula adapted to cross studies [12]:  $N = (Z)^2 * p * (1-p) / d^2$ . By considering the risk alpha of 5 %, a precision of 5 % expected for results and considering a maximum proportion of 50 % of patients/accompanying person involved in the management of biomedical waste in the absence of data for this specific target, the minimum size expected was 396. The sample size within each health facility is proportional to the number of patients that attended those different structures in the first trimester of 2020.

### 2.5. Variables

Information related to the health facility, to socio-demographic characteristics, the different types of waste produced, the knowledge and perceptions of patients and their accompanying person on the management of biomedical waste their involvement, the access to storage places and the perceptions on health and environmental issues in link with the management of biomedical waste were collected. In order to better understand the problem two dependent variables were selected. The first dependent variable, which is the "involvement of patients/accompanying person in the management of biomedical waste" is defined by the fact to be requested at least once during the stay in the department to throw wastes or if sometimes they notice other patients/accompanying persons picking up their BW. The second

dependent variable is the « access to BW storage places » has been defined by the visit of BW storage site of the hospital by the patient/accompanying person or if they see some other patients/accompanying persons having access to them.

## 2.6. Data collection techniques and tools

Data were collected par direct interview structured in a face-to-face mode using a questionnaire.

## 2.7. Data treatment and analysis

An input mask conceived on Epidata has been used to enter collected forms. The quantitative variable age has been described by the median and the interquartile ranges. The proportions were compared with the chi-square test with a significative limit of 0.05. The data analysis has been done with the software R 4.1.1. A logistic regression step-to-step descending has been used to identify associated factors to the involvement of patients/accompanying person in the management of BW or the access to the BW storage site. The Initial model was made up of all the independent variables that has a value of lesser than 20 % at the univariate analysis.

## 3. Results

### 3.1. Respondent distribution by health facility

428 patients or accompanying persons in total have been investigated on the 396 initially expected. Nineteen refused to take part, making an answer rate of 95.6 %. The observed size distribution according to the health facility shows that 34 %; 23.7 % respectively of patients or accompanying persons have been investigated at CHU MEL and OKT district hospital (table I).

**Table 1** Sample size expected, observed size and distribution within the six health facilities, Benin

Health facilities	Predict ed Size (a)	Number of responde nts (b)	Observ ed size €	Distribution in % of the observed size	Participation rate in % (b)/(a)	Answer rate in % €/(b)
CHD-MC	25	27	27	6.6	108.0	100.0
CHU-MEL	138	150	139	34.0	100.7	92.7
CS Cotonou 1-4	27	29	28	6.8	103.7	96.6
HIA-CHU	80	86	86	21.0	107.5	100.0
HLC of Zinvié	36	39	32	7.8	88.9	82.1
HZ-OKT	90	97	97	23.7	107.8	100.0
Total	396	428	409	100.0	103.3	95.6

### 3.2. Sample characteristics

**Table 2** Characteristics of patients and accompanying persons investigated in six health facilities, Benin

	Effect	Percentage
<b>Departments</b>		
Medicine and medical specialities	198	48.4
Surgery and surgical specialities	104	25.4
Medical Imaging	25	6.1
Laboratory and Blood bank	35	8,6
Urgency	37	9.0
Vaccination	10	2.4

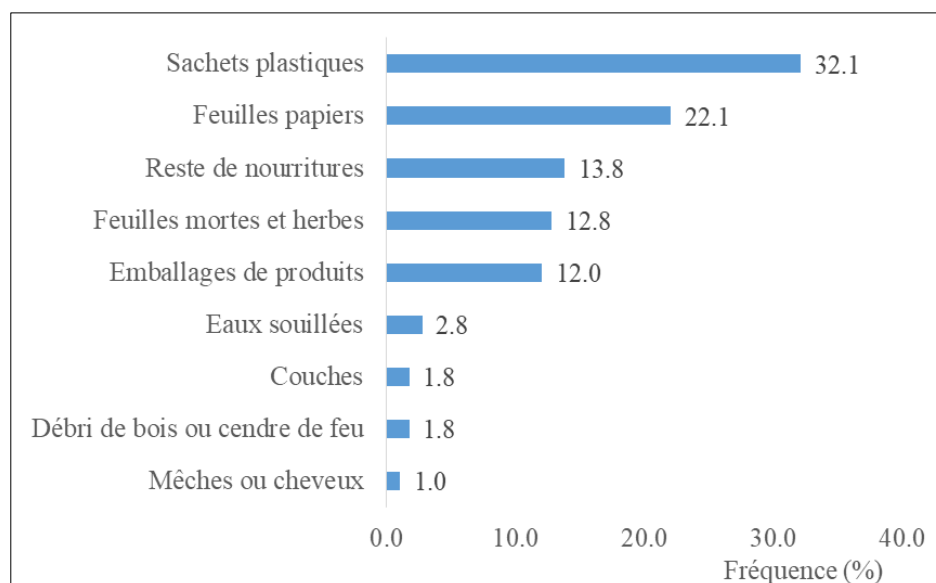
<b>Age range (years)</b>		
18-27	137	33.5
28-37	148	36.2
38-47	75	18.3
48-58	31	7.6
57-68	14	3.4
68-77	2	0.5
78-87	2	0.5
<b>Sex</b>		
Male	163	39.9
Female	246	60.1
<b>Study level</b>		
No education received	77	18.8
Primary	73	17.8
Secondary	168	41.2
University	88	21.5
Other	3	0.7
<b>Profession</b>		
Student	54	13.3
Civil servant	57	13.9
Trader	68	16.6
Housewife	108	26.4
Pensioner	10	2.4
Liberal profession	112	27.4
<b>Religion</b>		
Catholic	216	52.8
Celest	59	14.4
Evangelic	68	16.6
Islam	38	9.4
Animist	23	5.6
Other	5	1.2
<b>Respondent profile</b>		
Patient	220	53.8
Accompanying persons	189	46.2

Almost one patient/accompanying person over two were investigated in the medicine department and specialties. The age varies from 18 to 87 years old with a median of 32 years (interquartile range: 25 and 39 years old); 36.2 % had from 28 to 37 years old. The sex-ratio man woman was of 0.66 and 41.1 % educated till secondary education. On the other hand, 26.4 % were housewives and 52.8 % were from the catholic religion.

The table II summarizes the information on the socio-demographic characteristics of patients/accompanying persons investigated.

### 3.3. Wastes produced by patients/ accompanying persons

The wastes produced by the patients or their accompanying person were mainly Non-Infectious Medical Wastes (NIMW) (399 subjects being 97.6 %). But, for 10 being 2.4 % wastes produced were the remaining of pharmaceutical products that have been bought. The NIMW nature reported by the patient/accompanying person were most frequently plastic bags, paper sheets, remaining foods (figure1). However, according to the majority of patients/accompanying persons (379 subjects (92.7 %)), they had no idea on the management mode of wastes they produce.



**Figure 1** Patients/accompanying persons distribution according to the NIMW nature produced in six health facilities in Benin (N=399)

### 3.4. Knowledge and perceptions of the management of the BM

**Table 3** Knowledge of patients and accompanying patients on the management of care wastes in six health facilities, Benin

		Size	Percentage
<b>1.</b>	<b>Perception on management of biomedical wastes</b>		
	Good management enables to sanitize the environment	11	2.7
	Necessity to manage well in respecting management standards	23	5.6
	Necessity to be well protected	2	0.5
	Current bad management in health facilities	58	14.2
	Current good management in health facilities	76	18.6
	Poor management impacts health	28	6.8
<b>2.</b>	<b>Knowledge on biomedical waste management</b>		
	Burnt and incinerated waste	7	1.7
	Waste stored in halls	1	0.2
	Waste thrown in the dustbin	2	0.5
	Manually treated waste	1	0.2

	Waste is sorted	2	0.5
	Incineration pollutes the environment	1	0.2
	Avoid garbage mix	1	0.2
	Dustbin cleared every day	1	0.2
	NGO comes to collect	1	0.2
	Necessity to respect the coding	1	0.2
	Waste recycling	2	0.5
<b>3.</b>	<b>Perception on the material and resources for the management</b>		
	Unavailability of dustbins	5	1.2
	Having a qualified staff	1	0.2
	Existence of a legal management framework	1	0.2
<b>4.</b>	<b>Does not know something</b>	184	45.0
	Total	409	100.0

The patients/accompanying person's knowledge on the management of health wastes cover several axes of management. According to 5.6 % of respondents, the good management of care wastes is a necessity for hospitals that enables to sanitize the environment from 2.7 %. The poor management could also impact health workers, patients, visitors according to 6.8 %. According to 14.2 %, the management of care wastes done in health facilities is poor.

In relation to the management mode/pattern, care wastes are burnt or incinerated according to 1.7 % of respondents.

Furthermore, patient/accompanying persons has also mentioned the noticed unavailability of dustbin management, the necessity to have qualified personnel and the respect of the legal context of management of care wastes.

Table III describes the knowledge and perception of patients/accompanying persons on the management of care wastes.

### 3.5. Involvement of patients or their accompanying persons in the management of BW

**Table 4** Involvement of patients/ accompanying persons in the management of biomedical waste in six health facilities, Benin

	Size	Percentage (%)
<b>Been solicited in departments to throw BW</b>		
Yes	32	7.8
No	377	92.2
<b>Patients accompanying persons, children pick sometimes BW</b>		
Yes	74	18.1
No	335	81.9
<b>Perception of patients/ accompanying persons on their involvement in the management of BW(n=67)</b>		
Sources of diseases (diarrhea, infections, emesis, other diseases)	53	79.1
Poor practice	12	17.9
Good practice	2	3.0
<b>Involvement of patients/ accompanying persons in the management of BW</b>		
Yes	92	22.5
No	317	77.5

According to 7.8 % of patients/accompanying persons, they have been solicited to throw biomedical waste and 18.1 % saw patients/ accompanying persons picking up biomedical waste. This practice has been considered by 79.1 % as source of various diseases.

On the 409 patients/ accompanying persons, 92 were involved in the management of BMW in health facilities, been a frequency of 22.5 % [CI 95 %: 18.6 %-26.9 %]. Table IV shows a brief description of the sample size according to the involvement modalities in the management of BW.

### 3.6. Access to BW storage points by patients/ accompanying persons

The storage place of BW in health facilities was known by 7.8 % of patients/ accompanying persons. On the other hand, 33.0 % know the storage place of wastes they produce and 22.7% had access to those places.

Of the 409 patients/ accompanying persons, 110 patients/ accompanying persons (26.9%) [CI 95 %: 22.7-26.9 %] had access to the storage place of BW in health facilities (table V).

**Table 5** Access to storage points of BW by patients/ accompanying persons in six health facilities, Benin (N=409)

	Size	Percentage (%)
Knowledge of places where BW were thrown	32	7.8
Access to the BW storage place	23	5.6
Knowledge of the storage place of wastes produced by patients/ accompanying persons	135	33.0
Access to the waste storage produced by patients/ accompanying persons	93	22.7
Access of patients/ accompanying persons to the storage points of BMW	110	26.9

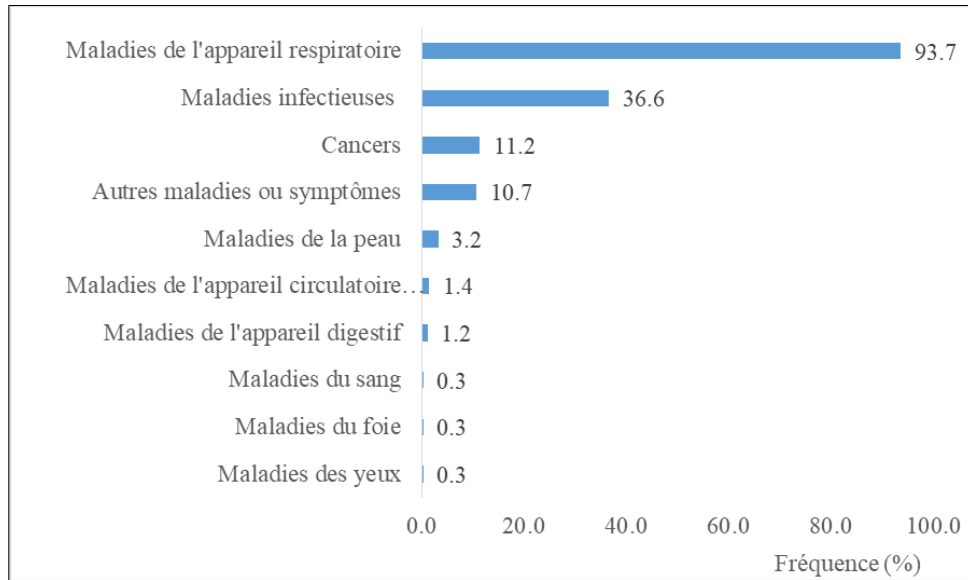
### 3.7. Patients or accompanying persons perception on sanitary and environmental issues in link with the management of BW

**Table 6** Perception of patients/ accompanying persons on sanitary and environmental issues in link with the management of BMW in six health facilities, Benin (N=409)

	Effect	Percentage (%)
<b>Sensitivity level to questions related to environmental issues</b>		
Not at all sensitive	14	3.4
Somehow sensitive	79	19.3
Sensitive	316	77.3
<b>Perception on air pollution</b>		
Yes	352	86.1
No	57	13.9
<b>BW incineration can pollute environment</b>		
Yes	383	93.6
No	26	6.4
<b>Can air pollution make ill</b>		
Yes	394	96.3
No	15	3.7
<b>Knowledge of diseases related to air pollution</b>		
Yes	347	84.8
No	62	15.2

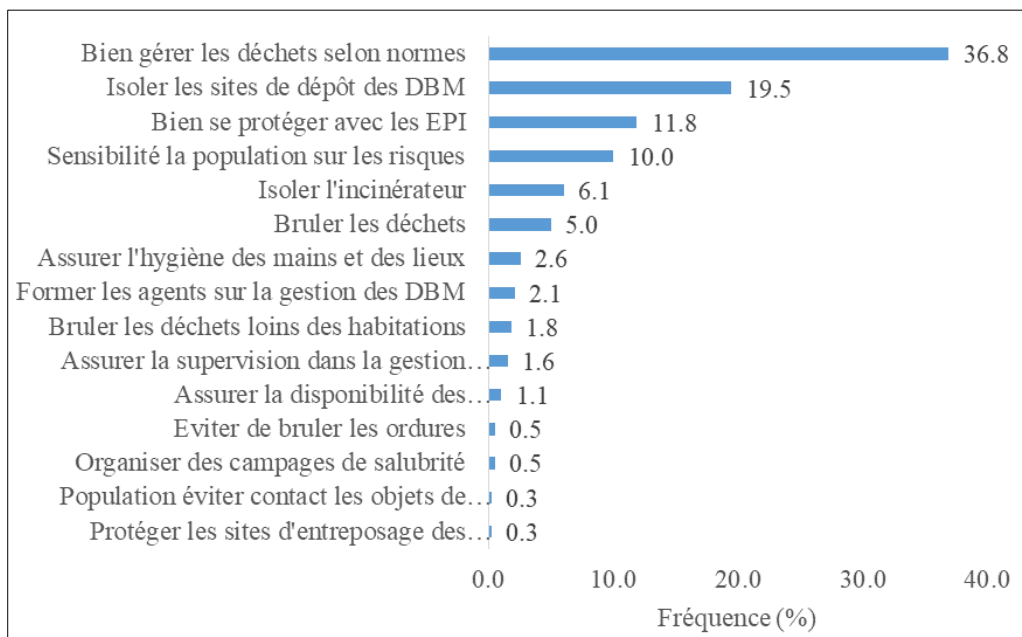
Almost seven patients/ accompanying persons over nine were sensitive to questions relative to environmental issues and 86.1 % think that the air is polluted. For most of them, respectively 93.6 %, 96.3 % BW incineration could pollute the environment and air pollution could induce illnesses. Approximately 85 % had knowledge on illnesses in link with air pollution (table VI).

The main diseases related to air pollution mentioned were the respiratory system diseases such as lower ARI, upper ARI, asthma, sinusitis (93.7%), infectious diseases (36.6 %) and cancers (11.2 %). Figure 2 shows the distribution of patients/ accompanying persons according to diseases related to air pollution mentioned.



**Figure 2** Distribution of patients/ accompanying persons according to diseases related to air mentioned in six health facilities, Benin (N=347)

To limit sanitary and environmental risks related to BW management, patients/ accompanying persons suggested a BW management according to current standards by isolating the BMW storage site and by protecting themselves with PPE (figure 3).



**Figure 3** Distribution of patients/ accompanying persons according to proposed measures to limit sanitary and environmental risks related to a poor management of BW in six health facilities in Benin (N=347)



### 3.8. Related factors to patients/ accompanying persons involvement in the BW management and the access to the BW storage place

**Table 7** Related factors to the involvement of patients/ accompanying persons in the management of BMW, and the accessibility to the BMW storage places to patients/ accompanying persons, Benin, Univariate analysis

	I	Implications in the management of BMW			Accessibility to the storage place of BMW		
		N (%)	Ora [95%CI]	p	N (%)	Ora [95%CI]	p
Health facilities				0,001			<0,001
CHU-MEL	139	25(17.99)	1		70(50.36)	7.7[3.8-17.0]	<0.001
CHD-MC	27	12(44.44)	3.6[1.5-8.8]	0.004	4(14.81)	1.3[0.4-4.4]	0.661
CS Cotonou 1-4	28	6(21.43)	1.2[0.4-3.4]	0.669	5(17.86)	1.7[0.5-5.2]	0.400
HIA-CHU	86	22(25.58)	1.6[0.8-3.0]	0.175	10(11.63)	1	0.397
HLC de ZINVIE	32	12(37.50)	2.7[1.2-6.3]	0.018	7(21.88)	2.1[0.7-6.1]	0.165
HZ-OKT	97	15 (15.5)	0.8[0.4-1.7]	0.612	14(14.4)	1.3[0.5-3.1]	0.575
Department				0.323			0.105
Medecine and specialities	198	44(22.22)	1		45(22,73)	1	
Surgery and surgical specialities	104	29(27.88)	1.3[0.8-2.3]	0.275	35(33.65)	1.7[1.0-2.9]	0.040
Medical Imaging	25	5(20.0)	0.9[0.3-2.5]	0.800	6(24.0)	1.1[0.4-2.8]	0.886
Laboratory/Blood bank	35	9(25.71)	1.2[0.5-2.8]	0.650	6(17.14)	0.7[0.3-1.8]	0.461
Urgency	37	4(10.81)	0.4[0.1-1.3]	0.114	14(37.84)	2.1[1.0-4.3]	0.052
Vaccination	10	1(10.0)	0.4[0.05-3.1]	0.36	4(40.0)	2.3[0.6-8.4]	0.209
Age range (Years old)				0.146			0.568
18-30	194	46(23.71)	1		53(27.32)	1	
31-50	179	34(18.99)	0.7[0.5-1.2]	0.267	50(27.93)	1.0[0.6-1.6]	0.894
>50	36	12(33.33)	1.6[0.7-3.5]	0.222	7(19.44)	0.6[0.3-1.5]	0.323
Gender				0.044			0.382
Male	163	45(25.61)	1.6[1.01-2.6]		40(24.54)	0.8[0.5-1.3]	
Female	246	47(19.11)	1		70(28.46)	1	
Level of study				0.142			<0.001
Not educated	77	15(19.48)	1		19(24.68)	1	
Primary	73	20(27.40)	1.6[0.7-3.3]	0.252	17(23.29)	0.9[0.4-2.0]	0.842
Secondary	168	44(26.19)	1.5[0.8-2.8]	0.254	33(19.64)	0.7[0.4-1.4]	0.371
University	88	12(13.64)	0.6[0.3-1.5]	0.311	40(45.45)	2.4[1.3-4.9]	0.005
Other	3	1(33.33)	2.1[0.2-24.3]	0.556	1(33.33)	1.5[0.1-17.8]	0.734
Profession				0.174			<0.001
Civil servant	57	8(14.04)	1		19(33,3)	1	
Student	54	11(20.37)	1.6[0.6-4.2]	0.376	24 (44.4)	1.6 [0.7-3.5]	0.231
Trader	68	12(17.65)	1.3[0.5-3.5]	0.583	32 (47.1)	1.8 [0.9-3.7]	0.121
Housewife	108	24(22.22)	1.7[0.7-4.2]	0.206	13 (12.0)	0.3 [0.1-0.6]	0.001

Pensioner	10	3(30.0)	2.6[0.6-12.3]	0.209	1 (10.0)	0.2 [0.01-1.3]	0.167
Liberal profession	112	34(30.36)	2.7[1.1-6.2]	0.02	21 (26.9)	0.5 [0.2-0.9]	0.037
Knowledge of the storage place							<0.001
Yes	32	17 (53.13)	4.6[2.1-9.7]		96(71.11)	5.3[2.5-11.6]	
No	377	75 (19.89)	1		14(5.11)	1	
Investigated Profile				0.801			<0.001
Patients	220	51 (23.2)	1		36 (16.4)	1	
Accompanying persons	189	41 (21.7)	0.9[0.6-1.5]		74 (39.2)	3.3 [2.1-5.3]	

**Table 8** Related factors to the patients/ accompanying persons implication in the management of BMW, and the accessibility of the BW storage places to patients/ accompanying persons, Benin, Multivariate analysis

	Implications in the BMW management		Accessibility to the BMW storage place	
	Ora [95%CI]	p	Ora [95%CI]	p
Health facilities		<0.001		<0.001
CHU-MEL	1		13.9 [5.8-36.9]	<0.001
CHD-MC	4.7 [1.9-11.4]	0.001	1.8 [0.4-6.9]	0.412
CS Cotonou 1-4	1.2 [0.4-3.3]	0.734	2.7 [0.6-10.9]	0.175
HIA-CHU	1.8 [0.9-3.5]	0.089	1	
HLC de Zinvié	3.3 [1.4-7.8]	0.006	3,6 [1.0-12.7]	0.044
HZ-OKT	0.7 [0.3-1.5]	0.416	2,0 [0.7-6.0]	0.173
Department				0.003
Medecine and specialties	-	-	1	
Surgery et surgical speciality	-	-	1.6 [0.8-3.3]	0.172
Medical Imagery	-	-	1.0 [0.3-3.3]	0.971
Laboratory/Blood bank	-	-	0.5 [0.1-1.4]	0.211
Urgency	-	-	3.6 [1.4-9.9]	0.011
Vaccination	-	-	0.8 [0.1-4.5]	0.790
Profession				<0.001
Civil servant	-	-	1	
Student	-	-	2.3 [0.9-6.1]	0.101
Trader	-	-	1.8 [0.7-4.6]	0.208
Housewife	-	-	0.3 [0.1-0.7]	0.006
Pensioner	-	-	0.2 [0.01-1.8]	0.223
Liberal profession	-	-	0.6 [0.2-1.5]	0.268
Knowledge of the storage place		<0.001		0.001
Yes	6.5 [3.0-14.5]		6.8 [2.7-18.5]	
No	1		1	
Investigated profile				0.001
Patient			1	
Accompanying persons			2.7 [1.5-4.8]	

At the univariate analysis, the health facility, the gender and the knowledge of the storage place were associated to the involvement of patients/ accompanying persons the management of the BW. In addition, the access to the BW storage places by patients/ accompanying persons is associated to the health facility, the level of study, the profession and the knowledge of the storage place (table VI).

At the multivariate analysis, after the adjustment on the patients/ accompanying person's characteristics, the health facility and the storage place are the factors independently associated to the management of BW. The patients/ accompanying persons investigated at the CHD-MC (Ora=4, 7), at the HCZ (Ora=3, 3) were more at risk of being involved in the management of BW than the ones of CHUMEL taken as reference. With identical characteristics, the patients that know the BW storage place were 7 times more at risk of being involved in the management of BW compared to the others.

The access of patients/ accompanying persons to the storage places of BW were independently associated to the health facility, the department, the profession and the knowledge of the storage place. All other things being equal, CHU-MEL patients/ accompanying persons or those met in the Urgency department (OR=5, 1) had a great risk of access to the storage place of BMW (OR=17, 2). In addition, patients/ accompanying persons that knew the storage places of BMW had 7 times more risk of having access à those places compared to others (table VII).

#### 4. Discussion

The aim of this study is to assess the implication level of patients/ accompanying persons in the management of biomedical waste and their perception on sanitary and environmental issues related to the BW in Benin.

Non-Infectious Medical Waste (NIMW) were the main waste produced by patients or their accompanying persons and 2.4 % of waste produced was made up of remaining pharmaceutical product bought. The NIMW nature reported also comprises the remaining food. Wastes generated par the patients/ accompanying persons contribute more and more to the waste diversity noticed in the health facilities. Many studies have shown their important role in the care activities waste (CAW). According to Tchakpa C. at Agbagnizoun in Benin in 2021, the greatest part of BW produced by the municipality were made up of general waste (38 %) [13], the danger lies in the quality of the sorting of hospital waste. Likewise, at El Hajeb in Morocco in 2020, wastes produced by health facilities are mainly general wastes (72,7 %) such as waste paper and food waste [14]. Furthermore, as in our study, more and more wastes related to drug and food waste are reported in the health environment. These wastes do not only have, social and environmental implications but also sanitary with regard to the care optimization due to the noncompliance with treatment and the global satisfaction of patients that these practices may hide. [15, 16].

Most of the patients/ accompanying persons did not have an idea on the management mode of waste they produce as well as waste from care activities with infectious risks. The health facilities must manage appropriately according to regulations, domestic waste products represent the major part of waste produced by patients/ accompanying persons. In addition, as suggested by Barnett-Itzhaki and al, other models could be expected such as the addition of specific instructions concerning for the disposal of medicines, in the label and in the leaflet [17], the sensitization on the type of dustbin adapted to domestic waste.

Moreover, according to patients/ accompanying persons, BW must be well managed according to the current regulations in Benin. Indeed, the decree N° 2002-484 of the 15 November 2002 establishes the legislative framework for the sound management of biomedical waste in the Benin Republic, but the operationalization of this decree is not effective or entire in all health facilities. According to Dieng and al, Senegal has ratified many international treaties mainly the Bâle, Stockholm and Bamako convention to improve BW management. But according to authors, the recent data show a disconnection between numerous legal and politic commitments and their efficient implementation, with great barriers attributed to the lack of financial resources and a low rate of law application [18]. It is important to raise more important investments to answer to inherent needs in application to the decree in order to fight efficiently the environmental contamination, patients/ accompanying persons exposure, and the productivity loss induced par by the bad management of BW.

We found that 22.5 % of patients/ accompanying persons were involved in the BW waste management. According to 97 % this is a bad practice that can be a source of disease for 79 %. The patients/ accompanying persons implication represents a very infectious source due to the handling disposal of BW often unsecured by these [19]. Indeed, wastes produced during these cure activities present a high infectious risk and injuries than other type of wastes [10, 20]. However, the results of a study lead within the patient relatives in India show that most of the subjects (80 %) had an average knowledge to ensure the maintenance of cleanliness in the nursing room with good practice expressed [21]. If

the patient involvement in management of BW is unorthodox, the one of accompanying persons could be favored by the role they play at the side of patients. They bring a daily help to patients to go to toilets, empty the sputum, urine, faeces and all other body discharges [22]. Even if, the accompanying person do not ensure the care, they although have a prime position in the treatment prescribed by the physician [23].

The frequency of access of patients/ accompanying persons to the storage place of BW was of 26.9 %. This accessibility may be favored on one hand by the implication of patients/ accompanying persons in the BW management and on the other hand by the easy access of storage places. Two studies conducted in Togo in 2017 and 2021, show that even if 30 % to 67 % of health facilities have storage places, under 20 % of these places meet international requirements [24, 25]. According to the WHO guidelines, non-harmful healthcare wastes must always be stored on separated sites from those where infectious/harmful wastes are stored to avoid contamination. The storage waste site must not be located near food storage facilities or kitchen and its access must be restricted to the authorized staff. It must also be easy to clean, have a good lighting and a good ventilation and designed so as to not allow rodent, insects and birds enter [26]. Other studies have indicated harmful waste storage practices using waste separation containers parked around department corridor [27]. This practice less hygienic and less safe, is a danger, given that this places accessibility to patients/ accompanying persons, added to this, the bad smell and the development of insects [28].

We observed that there was a significative difference between health facilities and the level of implication of patients/ accompanying persons in the management of BW or the access to the storage places. CHU-MEL, because of the low implication level of patients in the management of BW, had on the other hand, a high risk to the accessibility of storage places. In view of its character of reference hospital in the area of child and mother health, the BW management in the departments is the exclusive responsibility of nursing assistants. On the other hand, the regulation of visiting hours and the access of accompanying persons to the medical rooms can well limit their implication in these tasks. In contrast, the closeness of health services storage places may favor this high accessibility risk. The patients that know the storage places were more susceptible to be involved in the management of BW or to have access to storage places. The isolation of these storage places may deeply limit their accessibility.

The patients/ accompanying persons of the urgency department were more at risk to have access to the storage site compared to investigate patients in the departments of medical specialties. The urgency department represents the main entry gate of patients in the health facilities, and therefore represents quasi-mandatory passage for patients before their admission in most of hospital services [29]. The constraints and dysfunctions that meet urgency departments in terms of availability of staff to ensure the management of BW on one hand and the visitor's affluence that increase the quantity of waste produced can bring the accompanying persons to throw the wastes themselves.

### *Study limitations*

This study is conducted following a representative sample size of patients/ accompanying persons in six health facilities chosen following their different levels in the sanitary pyramid. Data collected by speech in the study may be subject to desirability bias due to the patients/ accompanying persons worry of an influence of given answers and their care. This could also lead to an under estimation of the implication level or the level of access of patients/ accompanying persons in the management of BMW in the study. To limit this bias, patients/ accompanying persons have reassured of the study independence and the care they receive. The study is limited in the south and cannot give a view of the problematic in the other health facilities of Benin

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## **5. Conclusion**

The current study proposed itself to explore the implication level, the sensitivity level of patients/ accompanying persons in the management of hospital waste. Almost 26.9 % of patients/ accompanying persons have access to the storage place of BW and 22.5 % were involved in the management of BW even if the majority finds this practice poor for their well-being. There was a significative difference depending on the health facility, the departments, the investigated profile and the level of implication in the management, the access to the storage place of BW.

In view of the potential infectious risk that can induce this practice for patients/ accompanying persons, it is necessary to improve the management system of wastes by patients or their relatives and health professionals on the tasks that are theirs.

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## Compliance with ethical standards

### *Acknowledgments*

The research team thanks all the participants to the current study and especially the manager of health facilities.

### *Disclosure of conflict of interest*

The authors declare no conflict of interest.

### *Funding*

The current work has received the funding of the Chaire pol CRDI 107347 projects.

### *Statement of ethical approval*

This study obtained the approval Comité Local d’Ethique pour la Recherche Biomédicale de l’Université de Parakou (CLERB-UP) (local ethics committee for biomedical research) in Benin, under the number N°0321/ CLERB-UP/P/SP/R/SA the 09 October 2020. The study has also been approved by the Ministry of Health through the letter N° 1342 /MS/DC/SGM/DRFMT/SA of the 10<sup>th</sup> March 2020. The participation to this study was volunteer after the explanation and the informed consent. Anonymity and confidentiality of investigated persons were respected.

### *Statement of informed consent*

Informed Consent was obtained from all the study participants.

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