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Research Article

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Circumstances of Occurrence and Factors Associated with Occupational Exposure to Body Fluids in District Hospitals (Yaoundé, Cameroon)

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Abstract

Background

Though of worldwide occurrence, accidental exposure to body fluids affects developing countries most, especially sub-Saharan Africa. Exposure to body fluids in occupational settings affects the safety and wellbeing of healthcare workers, hindering the quality of healthcare. The aim of the present investigation was to identify the tasks prone to occupational exposure to body fluids and associated risk factors.

Methods

A cross sectional descriptive study was carried out from January to April 2022 in six District Hospitals in Yaoundé. A self-administered questionnaire was addressed to consenting healthcare workers. Data related to exposure to blood and body fluids were analyzed using loglinear model logistic regression on R statistic version 4.2.3. Statistical significance was considered for p-value < 5%.

Results

A total of 217 participants were enrolled in this study. The main circumstances of percutaneous injury were handling needles while providing care (30.9%) and surgical procedures (19.5%). Fatigue related to long working hours (32.9%), stress (22.8%) and lack of personal protective equipment (17.4%) were reported determinants of percutaneous injuries. Poor compliance with standard precautions, such as washing scalpel for reuse (OR = 7.56) were associated with needles stick injuries. Working in the surgical department was associated with exposure to splash (AOR = 4.72) and percutaneous injury (OR=3.11).

Conclusion

Exposure to body fluids involved splashes, needlestick and sharp injuries, occurring mainly in the surgical departments. There is an urgent need to design and implement preventive activities to reduce the risk of infections related to occupational exposure to body fluids among healthcare workers.

Keywords: Circumstance of Occurrence, Risk Factor, Accidental Exposure, Body Fluid, Needlestick Injury, District Hospital, Cameroon

1. Background

Accidental exposure to blood and other body fluids is a major risk factor for the transmission of blood-borne infections to healthcare workers (HCW). Exposures to blood and other body fluids occur mainly via needles stick injuries and splashes, thus increasing the risk of contracting blood-borne pathogens such as the human immunodeficiency virus (HIV), hepatitis B virus. Splashes result in the exposure of muco-cutaneous membranes, eyes, nose or mouth to droplets, blood, amniotic fluids, saliva and other body fluids while percutaneous injuries occur as a result of needlesticks or cuts from sharp contaminated objects [1-4].

Occupational exposure to blood and body fluids affects the safety and wellbeing of healthcare workers, impeding the quality of healthcare delivered. Risks factors that are likely to

cause occupational exposures to blood are related to the work environment, availability of health and security information, training, clinical service, work experience, use of Personal Protective Equipment (PPE) and availability of supplies. While accidental exposure to blood and other body fluids is of worldwide occurrence, developing countries are most affected. Exposure to body fluids is a major cause of emotional distress, fear and anxiety among HCW. Standard precautions have been advocated to reduce occupational exposure and manage potentially infectious materials. Universal precautions include personal hygiene such as hand washing, use of personal protective equipment, management and disposal of sharps and other hospital waste. Accidental exposure to blood and body fluid (AEB) are associated with HCW intrinsic factors, knowledge of the mechanisms of occurrence, institutional and work environment factors [5-7]. The present study aimed to identify circumstances prone to occupational exposure to body fluids and associated risk factors.

2. Methods

We conducted a hospital-based cross-sectional study from January to April, 2022, covering all District Hospitals of Yaoundé, the political capital of Cameroon. The Cameroonian health system is organized around health districts. The District Hospital is the first level of reference in the health system pyramid. It is responsible for providing primary health cares to a standard population of 10 000 people. The study covered all the six District Hospitals of Yaoundé including Biyem-Assi, Cite-Verte, Djoungolo, Efoulan, Mvog-Ada and Nkolndongo District Hospitals. These health facilities cover a population of 3.2 million residents, employ 400 health workers with 330 beds. They offer 153 583 outpatient consultations and 19 092 hospital admissions per annum (Table 1) [8-10].

Hospital	Annual consultations	Beds available	Annual hospital admissions	Patient-Days of admission	Surgical interventions
Biyem-Assi	76 745	117	10 894	54 501	768
Cite-Verte	19 634	66	3 065	6 262	141
Djoungolo	24 193	32	1 649	5 512	320
Efoulan	23 603	68	2 174	8 872	373
Mvog-Ada	7 351	29	760	2 632	32
Nkolndongo	2 057	18	550	1 587	00
Total	**153 583**	**330**	**19 092**	**79 366**	**1 634**
Mean	**25 597**	**55**	**3 182**	**13 228**	**272**

Table 1: Clinical and Functional indicators of Yaoundé District Hospitals (Year 2021)

Study participants were workers who come into contact with patients in their daily tasks, thus potentially exposed to body fluids. They were medical (physician and intern), paramedical (nurse, assistant nurse, midwife, laboratory and dental technician) and hygiene (cleaners, hygiene and sanitation engineer) workers.

The sample size was calculated using the single proportion formula ($n = [z_{\alpha/2}]^2 * [p (1-p)]/d^2$), where $z_{\alpha/2} = 1.96$ and p=37 % was obtained from a similar study in referral hospital in Yaoundé. The standard error was d=5%. Using the above and the correction formula (nf=[ni/(1+ni/N)], where nf = minimum required sample size, ni = reduced sample size and N = total number of respondents. A minimum sample size of 198 was obtained. An exhaustive sampling method was adopted in each clinical department and all consenting personnel were targeted for inclusion [11,12].

The study tool was a self-administered questionnaire that addressed issues related to sociodemographic and professional characteristics, circumstances of occurrence and determinants of accidental exposure to body fluids.

Predictors consisted of sociodemographic characteristics (age, gender, marital status, year of education); **administrative status** (civil servant, contract worker); professional experience (less than 5 years/ 10 years vs others); **vaccination status** (fully vaccinated against hepatis B virus and COVID-19); w**orking environment** (surgical, dental and obstetrical unit, shift working shift); **Knowledge on AEB** (definition and mechanism); **infection control implementation support** (training, disposal of used syringe, recycling and reuse of scalpel blade,); **AEB management and risk perception** (awareness of the availability of AEB register and incident manager); **availability Personal Protective Equipment (PPE)** including gloves, goggles, facial mask.

The two dependent variables included percutaneous and splash exposures over the last 12 months preceding the implementation of the study.

Data were checked, entered, recoded as necessary and analyzed using R Statistics Version 4.2.3. The Fisher's exact test were used to compare proportions. Simple and multiple binary logistic regressions were used to assess the strength of the association between variables. The choice of predictors that best fit the model was done step by step using the Akaike Information Criterion (AIC). Then, the model with the lowest index was selected. A p-value < 0.05 was considered statistically significant [13].

3. Results

A total of 217 HCW returned the completed questionnaire. More than half (54 %) of our participants had experience at least one AEB in the last 12 months. This occupational exposure resulted from percutaneous injury (29.5 %) and splashes (46.5 %) [1,4].

Reported Circumstances of Occurrence

Most needlestick and sharp injuries (NSI) occurred during injections (31%), performing sutures (19 %), blood sample collection (16 %) and recapping (Figure 1).

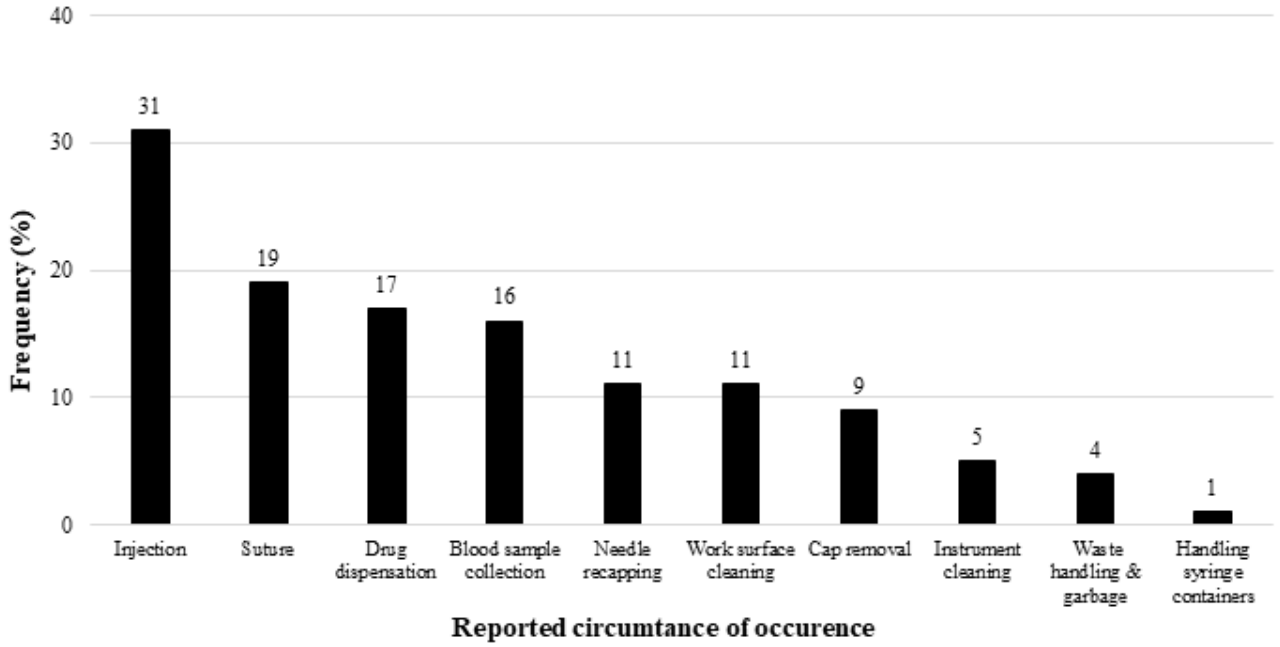

Figure 1: Reported Circumstances of Percutaneous injuries Among Healthcare Workers in Yaoundé District Hospitals, April 2022 (n = 149)

Factors Facilitating Needlestick and Sharp Injuries

Fatigue related to long working hours (33 %), stress (29 %), lack of PEP (17 %), poor lighting (16 %) were reported as main reasons having facilitated percutaneous injuries occurrence (Figure 2).

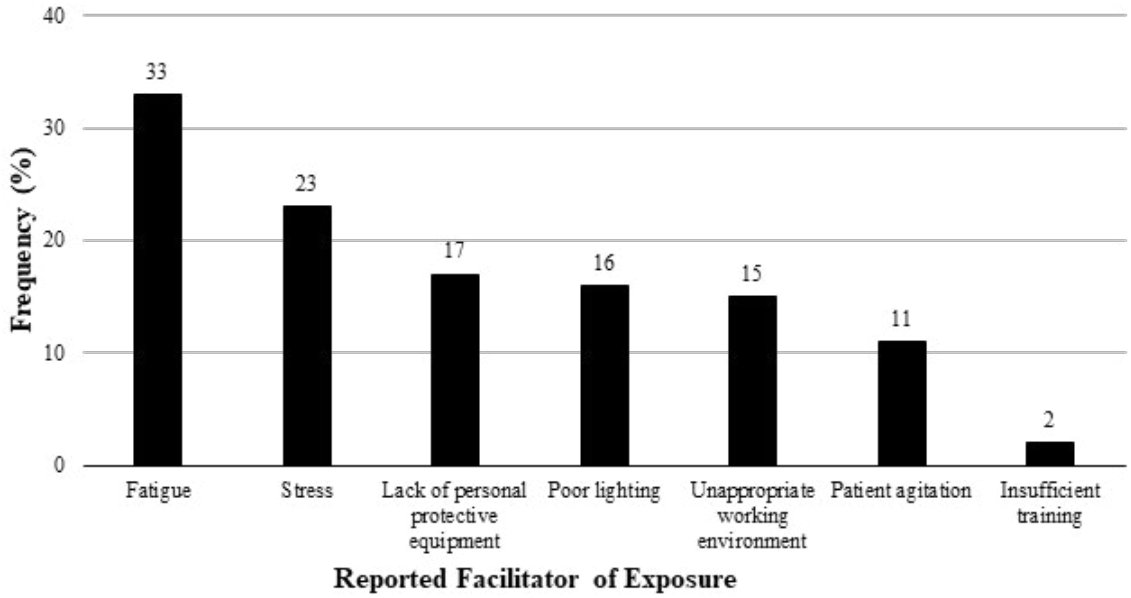

Figure 2: Factors Facilitating Percutaneous Injury Among Healthcare Workers in Yaoundé District Hospitals, April 2022 (n = 149)

Almost half of medical staff (44.0%) sustained percutaneous exposure during surgical procedures (p-value = 0.004). Paramedical and hygiene staff were mostly exposed during blood sampling (p-value = 0.017) and cleaning of work surfaces (p-value < 0.0001) respectively (Table 2).

Circumstance	Professional status			Total	p-value (1)
	Medical n = 25	Paramedical n = 118	Hygiene n = 6		
Performing an injection	8 (32)	38 (32.2)	0	46 (30.9)	0.340
Surgery/suture	11 (44)	18 (15.3)	0	29 (19.5)	0.004
Drug dispensing from vial	3 (12)	22 (18.6)	0	25 (16.8)	0.603
Handling an uncooperative patient	2 (8)	23 (92)	0	25 (16.8)	0.272
Blood sampling	0	24 (20.3)	0	24 (16.1)	0.017
Needle recapping	1 (4)	16 (13.6)	0	17 (11.4)	0.404
Work surface cleaning	1 (4)	10 (8.5)	5 (83.3)	16 (10.7)	<0.0001
Needle cap removal	2 (8)	12 (10.2)	0	14 (9.4)	0.999
Instruments cleaning	2 (8)	6 (5.1)	0	8 (5.4)	0.735
Garbage handling	1 (4)	4 (3.4)	1 (16.7)	6 (4)	0.273

(1) : Fisher exact test

Table 2: Reported Circumstances of Occurrence of Percutaneous Injuries Among Healthcare Workers in Yaoundé District Hospitals, April 2022 (n = 149)

Factors Associated with Needlestick and Sharp Injuries

Exposure to NSI varied among healthcare institutions. HCW from Nkolndongo District Hospital were at greater risk (7.25 times) of percutaneous injury than those from Cite-Verte (p-value = 0.0009). The excess risk was also significant for Djoungolo (OR=3.28) and Mvog-Ada (OR=3.4) District Hospitals (Table 3).

Hospital	Percutaneous Exposure n (%)		OR	95% CI limit		*p*-value
	Yes	No		Lower	Upper	
Cite-Verte	5 (12.8)	34 (87.2)	1	—	—	
Nkolndongo	16 (51.6)	15 (48.4)	7.25	2.37	25.7	**0.0009**
Mvog-Ada	10 (33.3)	20 (66.7)	3.40	1.05	12.3	**0.0469**
Djoungolo	14 (32.6)	29 (67.4)	3.28	1.11	11.2	**0.0401**
Efoulan	11 (28.9)	27 (71.1)	2.77	0.89	9.69	0.0883
Biyem-Assi	8 (22.2)	28 (77.8)	1.94	0.58	7.06	0.2876

OR: Odds Ratio, CI: Confidence Interval,

Table 3: Binary Logistic Regression Parameters of Percutaneous Exposure Risk Among Healthcare Worker in Yaoundé District Hospitals, April 2022 (n = 217)

Multivariate analysis revealed that washing scalpel for reuse (AOR = 7.56) and working in the surgical ward (AOR=3.11) were factors significantly associated to percutaneous exposures (Tableau 4).

Predictor	Percutaneous Exposure n (%)		AOR	95% CI	*p*-value
	Yes	No			
Age (year)					
30 +	52 (30.8)	117 (69.2)	1	-	
Less than 30	12 (25.0)	36 (75.0)	0.41	0.15 - 1.02	0.0603
35 +	30 (25.6)	87 (74.4)			
Less than 35	34 (34.0)	66 (66.0)	2.37	1.09 - 5.22	0.0294
Year of educational					

12 +	58 (31.4)	127 (68.6)	1	-	
Less than 12	6 (18.8)	26 (81.2)	0.34	0.11 - 0.91	0.0447
Department					
Others	45(27.3)	120(72.7)	1	-	
Surgical unit	16 (47.1)	18 (52.9)	3.11	1.33 - 7.38	0.009
Dental service	3 (16.7)	15 (83.3)	0.35	0.07 - 1.37	0.1611
Shift working					
No	28 (25.5)	82 (74.5)	1	-	
Yes	36 (33.6)	71 (66.4)	1.69	0.87 - 3.36	0.127
Temporal staging of used needles on bench					
No	42 (27.6)	110 (72.4)	1	-	
Yes	22 (33.8)	43 (66.2)	1.66	0.82 - 3.34	0.1546
Risk-free injection recycling					
No	38 (32.5)	79 (67.5)	1	-	
Yes	26 (26.0)	74 (74.0)	0.57	0.29 - 1.10	0.0954
Infection control guide available					
Yes	42 (33.9)	82 (66.1)	1	-	
No	22 (23.7)	71 (76.3)	1.96	0.99 - 3.94	0.0552
Scalpel blade recycling					
No	53 (26.5)	147 (73.5)	1	-	
Yes	11 (64.7)	6 (35.3)	7.56	2.44 - 25.9	0.0007

AOR= Adjusted Odds Ratio, CI: Confidence Interval

Table 4: Multiple Binary Logistic Regression of Factors Associated with Percutaneous Injuries Among Healthcare Workers in Yaoundé District Hospitals, April 2022 (n =217)

Factors Associated with Splashes

Taking the Cite-Verte District Hospital as reference, health staff from the Mvog-Ada (OR=3.27), Efoulan (OR=2.78) and Nkoldongo (OR=2.73) District Hospitals were at greater risk of splash exposure (Table 5).

District Hospital	Splash Exposure n (%)		OR	95% CI limit		*p*-value
	Yes	No		Lower	Upper	
Cite-Verte	12 (30.8)	27 (69.2)	1	—	—	
Mvog-Ada	18 (60.0)	12 (40.0)	3.37	1.27	9.42	0.0169
Efoulan	21 (55.3)	17 (44.7)	2.78	1.11	7.24	0.0318
Nkolndongo	17 (54.8)	14 (45.2)	2.73	1.04	7.46	0.0447
Djoungolo	21 (48.8)	22 (51.2)	2.15	0.88	5.43	0.0980
Biyem-Assi	12 (33.3)	24 (66.7)	1.12	0.42	2.99	0.8121

OR: Odds Ratio, CI: Confidence Interval

Table 5: Simple Binary Logistic Regression for Splashes in Yaoundé District Hospitals, April 2022 (n = 217)

Healthcare workers of the surgical (AOR = 4.73) and the obstetrical (AOR = 3.16) departments were at greatest risk of splashes than those from other units (Table 6).

Predictor	Splash Exposure n (%)		AOR	95% CI	*p*-value
	Yes	No			
Age (year)					
30 +	81 (47.9)	88 (52.1)	1	-	
Less than 30	20 (41.7)	28 (58.3)	0.37	0.15 - 0.91	0.0327
35 +	50 (42.7)	67 (57.3)			
Less than 35	51 (51.0)	49 (49.0)	2.11	1.01 - 4.53	0.0509
Year of educational					
12 +	92 (49.7)	93 (50.3)	1	-	
Less than 12	9 (28.1)	23 (71.9)	0.26	0.09 - 0.70	0.0100
Gender					
Female	87 (49.4)	89 (50.6)	1	-	
Male	14 (34.1)	27 (65.9)	0.48	0.20 - 1.09	0.0856
Department					
Others	59(38.8)	93(61.2)	1	-	
Surgical unit	22 (64.7)	12 (35.3)	4.72	1.95 - 12.3	0.0009
Obstetrical service	20 (64.5)	11 (35.5)	3.16	1.30 - 8.13	0.0133
Knowledge on AEB occurrence mechanism					
No	52 (50.5)	51 (49.5)	1	-	
Yes	49 (43.0)	65 (57.0)	0.51	0.27 - 0.96	0.0393
Refresher training on infection control					
Yes	30 (37.5)	50 (62.5)	1	-	
No	71 (51.8)	66 (48.2)	2.88	1.48 - 5.82	0.0023
Fully vaccinated against HVB					
No	28 (38.4)	45 (61.6)	1	-	
Yes	73 (50.7)	71 (49.3)	6.47	2.25 - 20.5	0.0008
Scalpel blade washing for reuse					
No	89 (44.5)	111 (55.5)	1	-	
Yes	12 (70.6)	5 (29.4)	5.80	1.84 - 21.0	0.0041

AOR= Adjusted Odds Ratio, CI: Confidence Interval

Table 6: Multiple Logistic Regression Parameters of Factors Associated with Splash Exposure Among Healthcare Workers in Yaoundé District Hospitals, April 2022 (n =217)

4. Discussion

Nearly a third of o NSI exposures while using hollow needles in delivering care to patients (31%). Conversely, most of the affected staff were nurses (43%). Syringe needles are the devices most used in administering care to patients. Similarly, nurses are the professional group most involved in delivering care. Surgical procedures are the leading causes of occupational injuries. Some 11.4 % of healthcare workers had experienced accidental exposure to blood during needle recapping. Recapping of needles, including bimanual, has been reported as the main circumstance of percutaneous exposure to blood. Needlestick injuries are exacerbated by the excessive use of injections, pre-empted switch to second-line injectable treatments among healthcare workers. The use of syringes containing an injury protection device (SIP device), has been recommended [6,14-20].

Reasons explaining percutaneous injuries were fatigue related to long working hours, work related stress, lack of PPE, ... This indicates an urgent need for decision-makers at the institutional and policy levels to set up a monitoring and early response system to prevent healthcare related infections, targeting improved working conditions and better healthcare environment. The present findings corroborate observations in other low-income settings of Ethiopia and Laos. The shortage of PPE inclusive of gloves, mask, goggles, … and workload were associated with medical errors, exposure to blood and body fluids [21–25].

Percutaneous injuries were associated with professional status and medical staff were disproportionally affected. Medical staff are at the forefront during both minor and major surgeries [14,17].

Staff involved in blood collection procedures, laboratory and

nursing activities take blood samples in their daily activities [17,26]. Where these tasks are performed by interns as is the case in China, such groups are the most exposed [14].

Hygiene workers got their percutaneous exposure mainly while cleaning work surfaces. Needles left on the floor or in garbage cans were often involved in these accidental stings. This observation corroborates findings in both Low and High-Income Countries (eg China) [14,17]. The horizontal variation in percutaneous exposures among health facilities of the same hierarchical level indicates that structural and intrinsic characteristics of each hospital, the management style of decision-makers should be considered in implementing remedial options. The mastery of these health hazards is necessary to improve the safety and quality of healthcare for HCW, patients and visitors.

The reported recycling of scalpel blades for reuse is a risk-taking activity, that reveals the poor adherence to standard precautions which prescribe their disposal in safety boxes. The fact that the surgical department was the most affected is in line with the invasive procedures performed therein. This finding corroborates observations in Kenya, Iran and China [21,27-31].

Staff less than 30 years old were less likely to undergo percutaneous exposure than their older counterparts. Older workers may develop routine, observe standard precautions less , loose awareness, particularly the systematic wearing of PPE [32].

Staff with less than 12 years of academic training had a lower risk of needlestick and sharp injury than their higher level counterparts, corroborating observations in Cameroon, Iran and Kenya [21,25,33]. Less educated HCW are less implicated in technical intervention, assigned to the monitoring of patients, cleaning activities, that expose to lower risk of exposure to needlestick and sharp injuries.

Interest in the control and prevention of infection in healthcare facilities was revamped with the unset of SARS-Cov 2 pandemic. There was enforcement in the supply of protective medical devices, PPE such as face masks and goggles/visors. With the withdrawal of COVID-19 as a medical emergencies, such recommendation has relaxing in the observance of standard and additional precautions among HCW [4,34,35].

HCW from the surgical and obstetrical wards were most likely to be exposed to splashes than workers from other departments. Splashes being associated with the amniotic fluids in the delivery rooms [35-38].

Conclusion

Occupational exposure to body fluids, involving needlesticks and splashes affects more than half of the health workforce of the Yaoundé District Hospitals. There was a horizontal variation in exposure across health facilities. Risk factors included age, working in surgical and obstetrics departments and poor observance of standard precautions. Factors favoring exposure to blood included fatigue, stress and lack of PPE. There is a need to set up further education on occupational safety to tackle the transmission of healthcare associated pathogens.

Declaration

Author's Contribution

Drafting of the study protocol, data collection, analysis and interpretation, drafting and editing of manuscript: F.Z.L.C.; Critical revision of protocol, critical revision of manuscript: E.E.L., J.H.N., and M-K. F-X.; Conception, design and supervision of research protocol and implementation, data analysis plan, revision, editing and final validation of the manuscript: I.T.

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Ethical Approval Statement: The protocol was reviewed and approved by the Regional Human Health Committee of the Centre (CRERSH - Ce) and the ethical clearance: CE N° 2245/ CRERSHC/2021 issued.

Declaration of Interests: All authors declare no conflict of interest and have approved the final article.

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