



## Profile of accidents with biological material at a dental school

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**ABSTRACT.** Current research characterizes the epidemiological profile of accidents with biological material (BM) that occurred in a government-run dental school and identifies the post-exposure behavior taken by the injured subjects. The cross-sectional retrospective study comprises professors, students and technical-administration personnel who worked in the laboratory from 2001 to 2008 (n = 566). An electronic questionnaire, prepared by software developed for this purpose, was sent to subjects between May and August 2008 for data collection. Ninety-one (34.2%) out of 266 participants reported some type of exposure to BM. There was no difference between the occurrence of accidents according to the subjects' category (p = 0.496) and sex (p = 0.261). Most of the subjects reported cutaneous exposure (76.9%) comprising saliva (68.1%) and blood (48.3%). The fingers were the body members most affected. Accidents occurred mostly during clinical (34.1%) and surgical (30.8%) procedures. Although the use of protection equipments was high (82.9%), only 26.4% of subjects reported the accident and only 28.6% sought immediate help. Most of the injured subjects failed to report the accidents and did not comply with the guidelines. Others trivialized basic behavior such as the interruption of the procedure to seek medical assistance.

**Keywords:** exposure to biological agents, security measures, dentistry, dental students.

## Perfil de acidentes com material biológico em uma instituição de ensino odontológico

**RESUMO.** Caracterizar o perfil epidemiológico dos acidentes com material biológico (MB) ocorridos em uma instituição pública de ensino odontológico e identificar as condutas pós-exposição adotadas pelas vítimas constituíram-se objetivos deste trabalho. Estudo transversal retrospectivo, cujos sujeitos da pesquisa foram os docentes, discentes e técnico-administrativos, exerceram atividades clínicas ou laboratoriais no período de 2001 a 2008 (n=566). Entre maio e agosto de 2008, por meio do envio de questionário eletrônico, utilizando um software desenvolvido para esse fim ocorreu a coleta de dados. Dos 266 participantes, 91 (34,2%) referiram algum tipo de exposição a MB. Não houve diferença entre a ocorrência de acidentes conforme a categoria (p = 0,496) e o sexo (p = 0,261) do participante. A maioria dos acidentados reportou exposição percutânea (76,9%) com envolvimento de saliva (68,1%) e sangue (48,3%), e a área corporal mais atingida foram os dedos. Os acidentes ocorreram, predominantemente, durante procedimentos clínicos (34,1%) e cirúrgicos (30,8%). A adesão aos equipamentos de proteção recomendados apresentou-se alta (82,9%), entretanto apenas 26,4% notificaram o acidente e 28,6% procuraram ajuda imediata. A maioria dos acidentados não notificou os acidentes, inviabilizando as condutas recomendadas e muitos banalizaram condutas consideradas fundamentais, como a interrupção do procedimento e busca de atendimento médico.

**Palavras-chave:** exposição a agentes biológicos, medidas de segurança, odontologia, estudantes de odontologia.

### Introduction

During the last decades several studies evaluated the occupational risk of exposure to biological material (BM) among health professionals, with special focus on dentistry teams (ALMEIDA; BENATTI, 2007; SILVA et al., 2009; SPAGNUOLO et al., 2008; TEIXEIRA et al., 2008). A study undertaken among professors, undergraduates and technicians of a dental clinic showed that biological risk (BR) may be highlighted by 44.8% among the occupational risks in dentistry practice (MUROFUSE et al., 2008).

BR is the probability of getting in contact with BM, blood or other organic fluids that may be borne by pathogenic biological agents that jeopardize people's health (BRASIL, 2010). BR is highly relevant for health professionals (HP), including dentistry teams, where exposure may be confirmed by the team and by the patients (ALMEIDA; BENATTI, 2007; FARIAS et al., 2006).

The short distance between the dental surgeon and the patient, the small visualization field, invading procedures with cutting, sharp and pointed tools and high rotation and ultrasonic instruments makes the

subjects liable to exposure to several microorganisms present, particularly in the patients' blood, saliva and upper aerial pathways (BRASIL, 2006; YOUNAI, 2010).

Greater risks exist in professionals with low clinical experience and in undergraduates whose abilities are still being developed. These factors contribute towards high frequency and gravity rates of exposures (SILVA et al., 2009; HENDERSON, 2010) to the skin, mucus of the eyes, nose and mouth, and by biting (YOUNAI, 2010).

The implementation of Standard Precautions (SIEGEL et al., 2007) within this context interrupts the transmission chain of infectious agents with a subsequent safety for the patient and for the dentist team ... (CARNEIRO; CANGUSSU, 2009). However, accidents may occur even though such preventive measures are undertaken. Post-exposure prophylactic measures are highly relevant (GARCIA; BLANK, 2008; HENDERSON, 2010; KUHAR et al., 2013). Monitoring, follow-up and the establishment of epidemiological profile are tools that contribute towards the implementation of educational and administrative activities.

It is our belief that the admittance of nurses within the milieu of teaching institutions and dentistry services has come to stay in Brazil. The authors of current paper have contributed for more than 10 years in infection prevention and control, especially within the context of administering biological risk in a dental school run by the government.

Current investigation characterizes the epidemiological profile of exposures to BM in a dental school of a government institution and identifies the post-exposure behavior by the injured subjects.

## Material and methods

Current study consists of a cross-section and quantitative analysis developed in a dental school of a government-run institution in Goiânia GO Brazil. Population comprised professors, students and technicians. Inclusion criteria were students who read a practical discipline and provided direct or indirect (clinical or laboratory) assistance to patients between October 2001 and July 2008; technicians or professors that worked in the clinic and laboratory of the institution between October 2001 and July 2008.

Data collection was undertaken by a previously evaluated and tested questionnaire with open and closed questions on the occurrence of accidents involving BM during activities, the profile of such accidents, motives for notification and preventive measures. A software Distance Administration and Evaluation System (DAES) was developed to send the

questionnaire by electronic means. Students' electronic addresses were asked for personally in the classroom and those of former students were retrieved by the course coordination and the Regional Dentistry Council of the state of Goiás, Brazil. The administration office of the institution provided the list of electronic addresses of technicians, managers and teachers. DAES enrolled all participating members in the study. The Ethics Committee in Research of the Federal University of Goiás (Protocol 58/2006) approved the experiment and data on the subjects enrolled in the DAES were retrieved between May and August 2008. Deadline for questionnaire replies was set at the 22<sup>nd</sup> August 2008. The first page of the DAES showed the free consent term and filling of the questionnaire only occurred on the subject's acceptance of the term.

After data collection, descriptive statistical analysis was undertaken by frequency and inference analysis was performed by the chi-square test at 5% significance level ( $\alpha = 0.05$ ).

## Results and discussion

Different factors in dentistry practice may engender the transmission of pathogenic agents. They comprise a restricted and highly colonized working environment, short distance between the dentist and the patient's mouth, constant use of cutting and perforating instruments and rotation equipments that produce spattering and aerosols (BRASIL, 2006; YOUNAI, 2010).

Further, out of 566 subjects (comprising 300 former students; 180 enrolled undergraduates; 55 professors; 31 technicians), 266 (46.9%) took part in the research. Ninety-one (34.2%) admitted some type of exposure to BM, or rather, below the number reported in other studies among dental professionals, with indexes at 70.9% (MACHADO-CARVALHAIS et al., 2008) and at 73.0% (TEIXEIRA et al., 2008). Table 1 shows the subjects' profile and accident frequency.

Accident occurrences with BM in the three groups, undergraduates/former students, technicians and professors, was not significant ( $p = 0.496$ ) and demonstrates that the categories have similar risks even though each has different types of activities and experiences.

Although professors have more experience and expertise than undergraduates, the former work within stressing conditions and involve themselves in several procedures for the students' benefit. On the other hand, current analysis did not evaluate the exposure time of each group. Probably professors and technicians were exposed much more to BM.

**Table 1.** Participants' characteristics and accident occurrences with biological material in a dental school between 2001 and 2008. Goiânia, Goiás State, Brazil, 2008.

Characteristics	Biological accident	No biological accident	Total	p
Category				
Undergraduates and former students	68 (36.2)	120 (63.8)	188	0.496
Professors	15 (31.9)	32 (68.1)	47	
Technicians	8 (25.8)	23 (74.2)	31	
Gender				
Female	62 (36.7)	107(63.3)	169	0.261
Male	29 (29.9)	68 (70.1)	97	
Total	91	175	266	

In their study on serological and risk factors related to hepatitis B virus in Goiânia, Goiás State, Brazil, Paiva et al. (2008) reported that logistic regression analysis demonstrated that the exercise of dentistry for more than 20 years was significantly associated with infection rates (OR = 10.4; CI = 4.82 – 21.78) (PAIVA et al., 2008).

Although dentistry technicians do not work directly in the patients' assistance, sometimes they help in procedures by handling contaminated sharp and cutting tools. They may thus expose themselves to risks in acquiring pathogens. To make matters worse, their lack of knowledge on pathogen transmission has also been reported, a fact that requires updating of the personnel (MUROFUSE et al., 2008).

Females were predominant in biological accidents, with 68.1%, without any significant statistical difference. Similar data for dentistry professionals, reaching up to 97.1%, were found in another study (TEIXEIRA et al., 2008). Although accidents were more frequent among females, the fact is not significant ( $X^2 = 1.26$ ,  $p = 0.261$ ) since the population is largely female.

Within the context of 91 subjects exposed to accidents with BM, only 24 (26.4%) formally notified the authorities on the fact, whereas 67 (73.6%) failed to do so. In fact, the period under analysis is characterized by an under-notification of accidents in the dental school. If the prophylactic implications of notification for people exposed to BM are taken into account, it is a very high index, very similar to rates reported in a study among health professionals' exposure to BM (RAPPARINI et al., 2007).

Forty-eight (52.7%) out of 91 subjects referred to only a single accident; 28 (30.8%) to two or three accidents; 2 (2.2%) to four to five accidents; three (3.3%) to more than 5 accidents and 10 (11.0%) did not inform the number of exposures. The above numbers are very similar to those by another study in a different dentistry institution (MACHADO-CARVALHAIS et al., 2008).

In the case of biological accidents with students (68/74.7%), exposure to BM was more prevalent in the third (48.3%) and fourth (42.8%) year of the 5-year dentistry course. Accident predominance among 3<sup>rd</sup> and 4<sup>th</sup> year students was different from that reported in another study, which showed higher accident rates among more advanced students (MUROFUSE et al., 2008). However, some reported more than one exposure, with 125 accidents of which 44 (35.2%) occurred during the 3<sup>rd</sup> year, 39 (31.2%) during the 4<sup>th</sup> year and 23 (18.4%) during the 5<sup>th</sup> year.

It should be highlighted that in the last years of the course, there is an increase in the number of dentistry attendance by students. This fact may have favored the occurrence of accidents with BM. Further, last-year students have had greater risk exposures, which may have contributed towards a decrease in awareness with regard to the accident's seriousness. On the other hand, there has been an increase in capacities and dominion of techniques by students and this fact would have contributed towards a decrease in the number of accidents. The above hypothesis should be further investigated.

Ribeiro et al. (2007) stated that the great probability of exposure to BM among students and professionals during training was due to bad formation and lack of capacity.

The surgery theatre for practical lessons in surgery, periodontia and endodontia (Clinical II) was the place in which most accidents with BM occurred (35/38.5%). Clinic I in which lessons on dentistry, pediatrics, orthodontics and semiology are held, and Clinic III in which integrated clinics 1 and 2 are provided, had the same accident index, featuring second place, with the highest number of occurrences (29/31.9%). Accidents with BM also occurred in other sectors, such as the Urgency Clinic (4/4.4%), Post-graduate Clinic (3/3.3%), Material and Sterilization Center (2/2.2%), Mouth Disease Center of Goiás (1/1.1%) and the Pathology Laboratory (1/1.1%).

Practical activities of the 3<sup>rd</sup> and 4<sup>th</sup> academic year, precisely the years of the dentistry course with the highest number of accidents, are held in Clinic II. On the other hand, during these years a deepening in teaching on accidents occurs. The post-exposure attendance schedule is discussed at the end of the 2<sup>nd</sup> year, prior to the start of clinic lessons.

Procedures and time of occurrence of accidents with BM were classified as before, during and after attendance to patients (Table 2). When the accident profiles are characterized, only rarely the sum of the variable under analysis corresponds to total subjects

referring to the accident (n = 91). The above shows that the subject related the characteristics of more than one accident.

**Table 2.** Conditions and time of occurrence of accidents with BM among undergraduates/former students, technicians and professors (n = 91\*) in a dental school, between 2001-2008. Goiânia, Goiás State, Brazil, 2008.

Time of accident	N %	
Prior to procedures	2	2.2
Preparation of tools	2	2.2
During procedures	65	71.4
Executing clinical procedures	31	34.1
Executing surgery procedures	28	30.8
Reflow of saliva ejector	4	4.4
Patient's sneeze	1	1.1
Working on macroscopy	1	1.1
Posterior to procedures	46	50.5
Cleaning of instruments	30	33.0
Disposing of sharp and cutting wastes	5	5.5
Disposing of wastes	5	5.5
Re-wrapping needles	3	3.3
Cleaning the place	3	3.3

\*More than one alternative could be mentioned.

High accident occurrence took place during the execution of procedures (65/71.4%), which corroborated another study featuring a 67.2% rate (DAMASCENO et al., 2006). Further, 46 (50.5%) accidents occurred after procedures, with 30 (33.0%) during cleaning of instruments. MUROFUSE et al., (2008) provided a close percentage (41.0%) to the above in their study on the same issue. A still recurring problem in the dental school should be highlighted, or rather, the semi-centralized system of the Material and Sterilization Center. The first procedure stage or cleaning of tools is done by the undergraduates in the clinics' cleansing room. The above fact has made difficult the standardization and supervision of procedures and may be contributing towards the occurrence of biological risks within the processing stage.

The dynamics of the dental school under analysis requires that students execute clinical activities with the help of a course colleague (called a four-hand procedure) so that an undergraduate takes the auxiliary role whilst the other has the main one. These roles are inverted in the next attendance. It is expected that, due to the undergraduates' lack of practice, such policies make viable the experience of different types of knowledge required for academic formation and contribute towards safety in attendance.

Questions were asked on attendance conditions at the time of the accident to evaluate the influence of the task developed by the subject who suffered the accident and that of the colleague. Five (5.5%) students reported they were alone when attending the patient; 58 (63.7%) said they had a colleague with them; 16 (17.6%) were helpers; 40 (43.9%) suffered accidents in other

circumstances, namely, preparation of instruments, cleansing and other laboratory activities. Most exposures to BM (74/81.3%) occurred during attendance with a helper since it was actually the type of attendance complied with during clinical activities in the dental school under analysis.

The influence of the helper in accident prevention among dentistry undergraduates was assessed. Results show that there were more exposures to BM (83.0%) when undergraduate worked alone than when they were with an assistant (STEWARDSON et al., 2002), featuring a statistically significant factor ( $p < 0.01$ ). The authors stated that, in spite of the recommendations of the General Dental Council, namely, undergraduates should work with an assistant, a practical problem ensued due to the lack of dental assistants during academic formation. On the other hand, they questioned the importance that undergraduates develop abilities without an assistant since in their profession they would have very similar situations.

Taking into consideration the accident profile, most exposure to BM referred to the skin (70/76.9%); the body area most affected comprised the hands and the fingers (72/82.4%), predominantly by exposure to saliva (62/68.1%) and blood (44/48.3%) (Table 3).

**Table 3.** Profile of accidents with BM among undergraduates/former students, technicians and professors in a dental school, between 2001 and 2008. Goiânia, Goiás State, Brazil, 2008.

Characteristics	N (91*) %		
Type of exposure			
Skin	70	23	76.9
Spatters on intact skin	22	2	25.3
Spatters on mucus	1		24.2
Spatters on non-intact skin			2.2
Bites	39		1.1
Body area exposed	33		
Fingers, dominant	18		42.8
Finger of the hand, non-dominant	15		36.3
Eyes	3		19.8
Face	1		16.5
Hands	1		3.3
Nose	1		1.1
Feet			1.1
Back	62		1.1
Biological matter involved			
Saliva	0		68.1
Blood	8		48.3
No matter involved			10.9
Unknown			8.8
Pus	1		1.1

\*More than one alternative could be mentioned.

Most accidents (70/76.9%) occurred on the skin and corroborated other studies among health personnel, including dentistry teams (CHIODI et al., 2007; TEIXEIRA et al., 2008). Dentistry procedures actually take place in very close environments for the movements of the surgeon-dentist to reach the teeth and other highly difficult, narrow periodontia spaces. The handling of long and pointed instruments contaminated with BM is very common and necessary

but increases occupational health risks (MUROFUSE et al., 2008; YOUNAI, 2010).

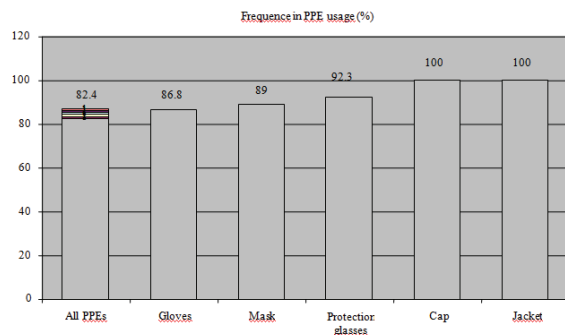
Aerosol-producing equipments and apparatuses in dentistry may contribute towards contacts with the ocular, nasal or mouth mucus by pathogen-contaminated particles in places not covered by personal protective equipment or even in the environment (YOUNAI, 2010). Spatter on intact skin (23/25.5%) and mucus (22/24.4%) were second and third places in exposures to BM. Similar data (77% and 36% respectively) were found in a study undertaken among dentistry students (DAMASCENO et al., 2006).

A single (1.1%) biting accident with an X-ray technician occurred in current study. A similar event was also reported in a study on a radiological clinic (DANDA et al., 2005).

Hands (43.3%, fingers, non-dominant; 36.6% fingers, dominant) comprised the part of the body most exposed to BM, followed by eyes with 20.0% and face with 16.6%. Above results were similar to those with health personnel including dentistry teams (CHIODI et al., 2007; RIBEIRO et al., 2007).

In most accidents, the BM consisted of saliva with 68.1% and blood with 48.3%. Although such data were expected since the dentist-surgeon task focuses on the patients' mouth, accidents referring only to saliva may also include blood, imperceptible to the naked eye. Consequently, the subject may underestimate blood-transmitted risks.

Figure 1 shows the personal protective equipments used by the subjects at the time of the accident.



**Figure 1.** Use of personal protective equipments among undergraduates/former students, technicians and professors at the time of the accident with biological matter in a dental school, between 2001 and 2008. Goiânia, Goiás State, Brazil, 2008.

Most subjects (75/82.4%) stated that they wore all PPEs (gloves, cap, mask, protection glasses and jacket) recommended during procedures at the time of the accident. Although all wore cap and jacket, 16 (17.6%) subjects discarded some PPEs, or rather, 12 did not wear gloves (five failed to wear thick gloves for cleansing of instruments); 10 did not wear any

mask; 7 failed to use protection glasses. Concern is high due to the above data on PPEs. In fact, skin exposure and splattering had the highest index and all accidents occurred at the time the subjects developed activities with great risks in exposure to BM. Negligence in PPE usage has also been reported in another study in another dental school (MUROFUSE et al., 2008).

The subjects were also asked on their reactions at the time of the accident. Answers referred to calmness (56/61.5%), fear (24/26.4%), concern (18/19.8%), anger (02/2.2%) and others. The same reactions and feeling have been reported in another study (DAMASCENO et al., 2006). Table 4 shows that 43.9% of subjects continued to attend the patient and only 28.6% sought immediate help.

**Table 4.** Behavior after exposure accident to biological material by undergraduates/former students, technicians and professors in a dental school between 2001 and 2008. Goiânia, Goiás State, Brazil, 2008.

Types of behavior	N (91*)	% (100)
Continuation of attendance	40	43.9
Source patient identified	27	29.7
Immediate help sought	26	28.6
Tests on source patient taken	26	28.6
Notification service sought	24	26.4
Professor in charge notified	22	24.2
Underwent blood tests	20	22.0
Attendance interrupted	18	19.8
Private physician sought	5	5.5
Chemioprophylaxis employed	4	4.4

\*More than one alternative could be mentioned.

It is believed that awareness and previous knowledge of each subject determine the reactions to such situations. Calmness after an accident with BM does not necessarily imply in risk awareness and in attitudes that should be taken. It may be associated with a non-valorization of the occurrence. It may be expected that, on the occurrence of accidents with BM, measures are taken for the compliance to recommended behavior (with regard to environments, notification, evaluation, blood tests in the source and in the injured person), which aim at decreasing contamination risks by potentially infectious agents (BRASIL, 2006; BRASIL, 2010). Basic behavior should also be taken to see whether post-exposure immuno- or chemio-prophylaxis is required. Notification and the seeking of attendance by specialized service were very low. In fact, they should be highlighted in processes of continuous education and biological risk management at the dental school.

Since, in occurrences of exposure to BM, 43.9% of the subjects continued attendance on the patient, the fact should be a source of concern and it is expected that a change in attitudes would occur. The

role of activities, correct or incorrect, experienced during student formation and their consequences in the life of the future health professional is highly relevant. The dental school should commit itself to enhance daily correct practices in the management of biological risk within the teaching milieu. These practices will surely influence positively the adhesion of future professionals in the development of a culture in individual and collective safety.

## Conclusion

There was no significant difference in the occurrence of accidents among students, technicians and professors. Cutaneous accidents involving saliva and blood were the most frequent and fingers were the most involved within the body area.

Most subjects failed to notify the accidents involving exposure to BM and this fact frustrated recommended behavior. Some subjects even trivialized basic behavior such as interruption of procedures and seeking medical help. Results show the importance of enhancing the items mentioned above among which is the propagation of the dental school's official protocol on post-exposure behavior.

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