Observations as a way to assess the compliance of veterinary students with biosecurity procedures

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Summary

In veterinary medicine, biosecurity relies on the implementation and respect of procedures that reduce the risk of the introduction and spread of pathogens. The main objective of the study was to assess the usefulness of observations in estimating the compliance of veterinary students with biosecurity measures implemented in the necropsy room of a Faculty of Veterinary Medicine (*n* = 122 observations) and in a private slaughterhouse (*n* = 56 observations) in Belgium, during day sessions of practical work. Checklists compiling the biosecurity rules to apply in both contexts were established (31 rules were considered for the necropsy room and 35 for the slaughterhouse). Observations were performed by a single person to ensure standardisation. The level of compliance with biosecurity rules was intermediate and reached 42% vs. 37% for the necropsy room and the slaughterhouse, respectively. No significant difference was observed between these compliance rates. Increasing staff supervision of students and increasing awareness through education should be encouraged. The follow-up of observations through time could be used to assess the evolution of compliance with biosecurity measures.

Keywords

Awareness – Belgium – Biosecurity – Checklist – Compliance – Duration of activity – Education – Group size – Observation – Procedure – Self-monitoring.

Introduction

In veterinary medicine, biosecurity can be defined as the implementation of measures that reduce the risk of the introduction and spread of disease agents. As stated with respect to H5N1 influenza, it requires the adoption of a set of attitudes and behaviours by people to reduce risk in all activities involving domestic, captive exotic and wild animals and their products, in H5N1's case, birds (1). It greatly relies on respect of the '5 Bs', as developed in (2):

– bio-exclusion (to limit the risk of introduction)

– bio-compartmentalisation (to limit the spread of the pathogen within the same animal facility, e.g. by isolating excreting animals)

– bio-containment (to limit the spread of the disease agent outside the facility)

– bio-prevention (to prevent the risk of human bio-contamination)

– bio-preservation (to prevent any environmental bio-contamination and persistence of the pathogen) (2).

The concept has recently attained great importance in veterinary medicine, especially in veterinary teaching hospitals, with regard to the accreditation processes of Veterinary Education Establishments in Europe; indeed, there is a need for veterinary teaching hospitals to implement standard operating procedures (SOPs) and practices regarding hygiene, biosecurity and infection control

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(3, 4). Furthermore, biosecurity is a key tool in helping to prevent healthcare-associated infections, of which reports have increased in the veterinary environment over recent years (5, 6). Biosecurity relies partly on the implementation of procedures but, above all, on respect for the rules. Such respect may be quantitatively assessed through the estimation of compliance, which can be defined as the ratio of the number of biosecurity measures fulfilled to the number of measures to be applied (7).

The main objective of the present work was to evaluate the usefulness of observations in assessing the compliance of veterinary students with biosecurity measures implemented in the necropsy room of a veterinary school and at a slaughterhouse. These two sectors were selected because the student activities there are of particularly high risk: people are in direct contact with potentially infectious tissues. Furthermore, injuries from contaminated sharps (e.g. scalpel blades at necropsy, or knives at the slaughterhouse or in the necropsy room) increase the risk of exposure to pathogens (8). Zoonotic infections are an important hazard to personnel and students working in veterinary teaching hospitals (4), and both slaughterhouses and necropsy rooms are areas of particularly high risk in terms of the transmission of zoonotic diseases to humans (9).

Materials and methods

Study framework

The assessment was performed by observing sessions of practical work taking place in the necropsy room of a Belgian Faculty of Veterinary Medicine, and by accompanying veterinary students during their practical work of meat inspection at a private slaughterhouse. The observations were made by a single person (and formed the final dissertation of a Master's degree in Biomedicine, with a professional focus on quality assurance), to ensure standardisation, between February and May 2012. Checklists compiling the biosecurity rules to be fulfilled were developed from the Faculty Biosecurity SOPs, based on the measures applied for each specific activity (10).

Students were followed for four weeks (eight half-days, but systematically on the same weekdays) in the necropsy room. The mean size of a group was 15 (range: 14–17). A total of 40 biosecurity rules were included in the checklist specific to the necropsy room (Table I). Nevertheless, only 31 rules were considered for the compliance calculation. Several rules, as indicated in Table I, were not considered as they were: not easy to assess (e.g. when following the instructions provided by the supervisor), evaluated only once (e.g. vaccination against tetanus) and concerned the technical staff only. Furthermore, one rule could not be respected due to the lack of adequate equipment and was thus excluded. Each group was observed twice, as the same students were supposed to attend the necropsy room every morning for one week.

For the slaughterhouse, the observer made six visits during three weeks (two visits per week, on the same weekdays). The groups included an average of 9 students (range: 8–11). Each group was observed twice. The checklist specific to the slaughterhouse comprised 56 rules (Table II). Nevertheless, only 35 rules were considered, for the same reasons mentioned above for the necropsy room: rules concerning the staff, lack of available equipment at the time of the observations (e.g. no disposable cap and apron, no wearing of chainmail gloves when performing meat inspection, no more soap available for hand-washing), not easy to assess, not directly related to biosecurity (e.g. using a knife) and evaluated only once (e.g. vaccination against tetanus).

Evaluation of compliance

The respect paid to the biosecurity measures (compliance) by groups of students was assessed for both activities. The compliance rate was calculated as follows:

$$\text{Compliance (\%)} = \left(\frac{\text{Number of biosecurity measures fulfilled}}{\text{Number of biosecurity measures to be applied*}}\right) \times 100$$

*n = 31 for the necropsy room and n = 35 for the slaughterhouse

A chi-square test was performed to compare the compliance rates of the two activities (necropsy vs. slaughterhouse) (11). A p-value below 0.05 was considered significant.

Definition of an observation

An observation was defined as a day session of practical work for a student (e.g. necropsy room session or slaughterhouse session).

Ethics statement

The European Committee of Veterinary Education (ECOVE) has been mandated by the parent organisations, the European Association of Establishments for Veterinary Education (EAEVE) and the Federation of Veterinarians of Europe (FVE), to act as final arbiter in the European Evaluation/Accreditation System. In February 2010, after evaluation by the EAEVE, the Faculty of Veterinary Medicine (FVM), University of Liege, was approved by the ECOVE. Special emphasis was laid on the Biosecurity SOPs that had been written and developed by the FVM (10). Since

Table I
Biosecurity rules to be followed during activities in the necropsy room (*n* = 31)

General biosecurity rules (*n* = 8)	
	Short nails [a]
	Hair tied back [a]
1	Scalpel blades disposed of in small dedicated containers
2	Hand-washing after removing gloves
3	Hand-washing after handling waste
	Hand-washing procedure:
4	a. Wet hands and forearms
5	b. Add soap to the palm of the hand
6	c. Lather and rub both sides of the hands vigorously to above the wrist, clean between the fingers and under the nails
7	d. Rinse until all soapy residue has been removed
8	e. Dry hands with a single-use paper towel [b]
Biosecurity rules specific to the necropsy room (*n* = 23)	
***Before starting the activity* (*n* = 7)**	
9	Put your boots on
10	Put on white overalls
	Check tetanus vaccination status [c]
11	Keep your personal items in a locker
12	Change clothes
13	Identify the white overalls with a marker pen
14	Cross the air lock to enter the dissection room
15	Put on gloves (full length + disposable gloves) at the entrance to the dissection room
***During the activity* (*n* = 5)**	
16	It is forbidden to bring or consume food (including chewing gum) or drinks into the dissection room
17	It is forbidden to smoke, spit or chew tobacco in the dissection room
	Follow the instructions given by supervisors [a]
18	Pay attention to the floor markings and the different zones: 'disinfection', 'storage', etc.
19	Animals are moved by the staff or under their supervision
20	Equipment must not under any circumstances leave the autopsy room
	In the event of an accident, alert the clinic supervisor [a]
***During and after the activity* (*n* = 1)**	
21	Non-organic waste related to the dissection and the disposable personal equipment should be placed into the yellow bins
***After the activity* (*n* = 10)**	
22	Cadavers are disposed of in the refrigerated bin situated at the exit of the necropsy room to be removed by the rendering plant
23	Leave the dissection equipment in the cleaning and disinfection zone
	After disposing of cadavers, the necropsy room is cleaned by a member of staff [d]
	In the disinfection zone
24	– Boots are washed in the boot wash
25	– Dispose of single-use personal protective equipment in the yellow bin
26	– Hands are washed and disinfected
27	In the exit air lock: walk through the foot bath
	In the Portakabin®
28	– Remove and tidy away yellow boots
29	– On the last day of the clinical week: throw white overalls in the
30	yellow bin
31	– On other days: take white overalls off and hang them on the hook
	– Final hand wash at the sink
	– Pick up your personal items from the locker [e]
***Transport of cadavers* (*n* = 2) [d]**	
	Cadavers must be dropped at the back entrance of the necropsy room
	The container and the Manitou must be cleaned with a pressure washer

a) Biosecurity rules that were not taken into account by the observer, because they were not easy to assess, not applicable or not applicable to every student
b) Biosecurity rules that could not be fulfilled because of the lack of available equipment
c) Biosecurity rules that were not taken into account by the observer, as evaluated only once (before the beginning of activities)
d) Biosecurity rules that concern not the students but the technical staff
e) Rules/procedures not directly related to biosecurity
[a, b, c, d] All these rules/procedures were excluded from the calculations
Shaded rules were not considered for the estimation of the compliance rate, or for statistical analyses, for the reasons mentioned above

2010, the progressive implementation and upgrade of the Biosecurity SOPs have been under the supervision of the *ad hoc* Biosecurity Unit of the FVM. For future accreditation by the ECOVE, regular auditing of biosecurity procedures must be implemented in the FVM, and such observation sessions are part of this implementation. The protocol of observations was thoroughly reviewed and approved by the Biosecurity Unit of the FVM. No informed consent (verbal or written) was required from the students, as an audit is supposed not to be announced (the audit focused on people's behaviour). Nevertheless, before each day session of practical work, the observer explained the objectives of the study to all participants. Furthermore, all data were anonymously recorded and students disregarding the procedures were not penalised. A collaboration agreement between the slaughterhouse and the University of Liege has been signed. The owner's consent was not required as the objective was to audit students, not the work environment (the slaughterhouse itself) or its employees. Indeed, if procedures were disregarded, it was not the slaughterhouse owner's responsibility.

Table II
Biosecurity rules to be followed during activities at the slaughterhouse (*n* = 35)

	General biosecurity rules (***n*** = **5**)
	Hand-washing procedure:
1	a. Wet hands and forearms
2	b. Add soap to the palm of the hand
3	c. Lather and rub both sides of the hands vigorously to above
4	the wrist, clean between the fingers and under the nails
5	d. Rinse until all soapy residue has been removed
	e. Dry hands with a single-use paper towel
Biosecurity rules specific to slaughterhouse activity (*n* = 30)	
	***Before starting the activity* (*n* = 12)**
6	Remove any jewellery, watch, etc.
	Place a plaster over visible piercings [a]
	Have your hair tied back [a]
	Have your nails short [a]
7	Put on a single-use apron
	Take a knife [b]
8	Wear chainmail gloves [c]
	Provide the assistant with a copy of the medical certificate [d]
	Before leaving for the abattoir:
	Inform the assistant of any contagious disease (e.g. gastroenteritis, runny nose, ear problems, skin disorders, etc.) [d]
	Inform the assistant if you have made a farm visit 48 h before visiting an abattoir [d]
	In the student cloakroom:
9	Put any personal items in a locker
10	Put on clean blue or green overalls
11	Put on the pair of white rubber boots provided
	Put on a laminated leather apron [c]
12	Put on a cap
13	Put on a helmet
14	Wounds to the hands must be covered with a clean plaster and a disposable glove
	Before starting any activity:
	Listen to the assistant's instructions [a]
15	Sign the visitors' book, the two 'hygiene' charters and the confidentiality documents [e]
16	Wash your boots [e]
17	Clean, rinse and sterilise the knives before beginning practical work [e]
	***Before and during the activity* (*n* = 4)**
	Wash your hands:
18	– At the entrance/exit to the premises [e]
	– After going to the toilet [a]
	– After blowing your nose [a]
19	– After removing gloves
20	– After touching waste
	– As often as possible
21	Paper towels used to dry hands should be disposed of in the bin provided
	The use of latex gloves does not mean that thorough hand-washing is not required [f]
	***During the activity* (*n* = 5)**
22	It is forbidden to bring or consume food (including chewing gum) or drinks
23	It is forbidden to smoke, spit or chew tobacco on the production sites
	Follow the instructions given by the supervisors as well as those given by the abattoir managers [a]
24	Sterilise the knife between two carcasses or organs from different animals [e]
25	The knife blade must be pointing downwards whenever it is being moved
26	Always respect the flow of movements: clean area => dirty area
	Explain to students in which container they should dispose of waste during the activity [g]
	In the event of an accident [a]
	a. Immediately stop the inspection
	b. Remove gloves
	c. Wash hands in the knee-operated sink
	d. Ask a supervisor to inspect the wound
	***After the activity* (*n* = 9)**
27	Single-use caps and coats must be disposed of in the bin provided
28	Clean knives and chainmail gloves in the knee-operated sink
29	Sterilise knives and chainmail gloves in the immersion steriliser (82°C) situated at the end of the slaughter chain [e]
	In the abattoir student area:
30	Aprons are rinsed in warm water, washed using a disinfectant gel and then rinsed again [c]
31	Remove and dispose of cap
32	Wash boots in the automatic boot wash
33	Clean the helmet in hot water in the knee-operated sink
	In the student cloakroom:
34	Leave the overalls in the student cloakroom [e]
35	At the end of the week, place overalls in a plastic bag for transportation [e]
	Pick up your personal items from the locker [b]
	Wash hands at the knee-operated sink and disinfect them [c]

a) Biosecurity rules that were not taken into account by the observer, because they were not easy to assess, not applicable or not applicable to every student
b) Rules/procedures not directly related to biosecurity
c) Biosecurity rules that could not be fulfilled because of the lack of available equipment
d) Biosecurity rules that were not taken into account by the observer, as they were evaluated only once (before the beginning of activities)
e) Biosecurity rules that were disregarded by all students
f) Not really a biosecurity rule, rather a concept
g) Biosecurity rules that apply to the supervising staff only
[a, b, c, d, e, f, g] All these rules/procedures/concepts were excluded from the calculations
Shaded rules were not considered for estimation of the compliance rate or for statistical analyses, for the reasons mentioned above

Results

Necropsy room

A total of 122 observations were compiled for the necropsy room. Out of the 31 biosecurity rules to be fulfilled, 18 were visibly disregarded during the periods of observation (Table III). The four rules most often disregarded were:

– hand-washing after the removal of gloves (18.5% of all breaches)

– boot-washing (17.2%)

– final hand-washing in the Portakabin® (16.0%)

– hand-washing and further disinfection in the dedicated area (13.3%).

All these rules are considered as bio-containment rules, as they must be fulfilled before leaving the necropsy room. A mean compliance rate of 42% was estimated at the necropsy room level.

Slaughterhouse

The duration of each observation period varied between 2.5 and 4.5 h. Out of 35 biosecurity rules to be fulfilled on site, 22 rules were disregarded by the students (Table IV), eight being disregarded by all students observed (e.g. signing the visitors' register and documents [hygiene charters and confidentiality], boots washed before any activity, knives cleaned and sterilised before starting meat inspection, and hand-washing upon entering and leaving the premises). Excluding the rules disregarded by all students, the three other rules most often disregarded were:

– rinse the helmet with hot water in the knee-operated sink

– point the knife blade downwards whenever it is being moved

– respect the forward movement principle (least contaminated area towards most contaminated zone).

The mean compliance rate reached 37% at the slaughterhouse level.

Table III
Number of biosecurity breaches committed by veterinary students in the necropsy room (*n* = 122 observations [a])

		No. of breaches	% of all breaches
General biosecurity rules			
1	Scalpel blades disposed of in small dedicated containers	2	1.32
2	Hand-washing after removing gloves	28	18.54
3	Hand-washing after handling waste	4	2.65
4	Hand-washing procedure: wet hands and forearms	11	7.28
5	Hand-washing procedure: add soap to the palm of the hand	12	7.95
6	Hand-washing procedure: lather and rub both sides of the hands vigorously to above the wrist, clean between the fingers and under the nails	4	2.65
Biosecurity rules specific to the necropsy room			
11	Keep your personal items in a locker before starting the activity	1	0.66
13	Identify the white overalls with a marker pen before starting the activity	3	1.99
16	It is forbidden to bring or consume food (including chewing gum) or drinks into the dissection room	3	1.99
17	It is forbidden to smoke, spit or chew tobacco in the dissection room	4	2.65
18	Pay attention to the floor markings and the different zones: 'disinfection', 'storage', etc.	10	6.62
21	Non-organic waste related to the dissection and the disposable personal equipment should be placed into the yellow bins	2	1.32
24	After the activity, boots are washed in the boot wash located in the disinfection zone	26	17.22
26	After the activity, hands are washed and disinfected in the disinfection zone	20	13.25
28	After the activity, remove and tidy away yellow boots in the Portakabin®	8	5.30
29	On the last day of the clinical week, after the activity, throw white overalls in the yellow bin in the Portakabin®	1	0.66
30	On other days, after the activity, take white overalls off and hang them on the hook in the Portakabin®	3	1.99
31	Final hand wash at the sink of the Portakabin®	9	15.96
	Total	**151**	**100.00**

a) Day session of practical work for a student, which amounts to one student observed for 3–4 h
No. of breaches = number of times the rule was disregarded
In total, 18 biosecurity rules were disregarded in the necropsy room

No statistical difference was observed between the two activities (chi-square test [1 degree of freedom (df)] = 0.16; *p*-value = 0.69).

Discussion

This study evaluated the compliance of veterinary students with biosecurity rules as implemented in the necropsy room of a veterinary faculty and within the framework of meat inspection performed at a private slaughterhouse. The compliance estimated for both activities should be considered as intermediate, according to a previous study (7): compliance is considered low when the rate is < 25%, intermediate if between 26% and 74%, and good if > 75%. These results are comparable to the estimations reported in human medicine. Haynes *et al.* reported a compliance rate between 33% and 54% for the therapeutic compliance and long-term follow-up of preventive recommendations by patients (7). A more recent study performed among English dentists revealed a very low compliance with hand-washing, although good hand-washing was proven to reduce the nosocomial infection rate (12). Hand-washing was a critical point in the present study also, as it was the measure most often disregarded in the necropsy room.

When necropsies are performed, pathogens can be transmitted through contact, either direct or indirect (via sharps such as scalpel blades and necropsy knives), or by inhalation of contaminant aerosols/droplets. Numerous examples of human contamination when performing a necropsy are reported in the scientific literature. Examples of contamination after direct contact include: Hendra virus

Table IV
Number of biosecurity breaches committed by veterinary students at the slaughterhouse (*n* = 56 observations [a])

		No. of breaches	% of all breaches
General biosecurity rules			
1	Hand-washing procedure: wet hands and forearms	8	1.47
3	Hand-washing procedure: lather and rub both sides of the hands vigorously to above the wrist, clean between the fingers and under the nails	1	0.18
5	Hand-washing procedure: dry hands with a single-use paper towel	8	1.47
Biosecurity rules specific to the slaughterhouse activity			
6	Before starting the activity, remove any jewellery, watch, etc.	3	0.55
9	Before starting the activity, put any personal items in a locker in the student area	2	0.37
10	Before starting the activity, put on clean blue or green overalls in the student area	2	0.37
13	Before starting the activity, put on a helmet in the student area	1	0.18
14	Before starting the activity, wounds to the hands must be covered with a clean plaster and a disposable glove	3	0.55
15	Before starting any activity, sign the visitors' book, the two 'hygiene' charters and the confidentiality documents [b]	56	10.13
16	Before starting any activity, wash your boots [b]	56	10.13
17	Clean, rinse and sterilise the knives before beginning practical work [b]	56	10.13
18	Wash your hands at the entrance/exit to the premises [b]	56	10.31
22	It is forbidden to bring or consume food (including chewing gum) or drinks	1	0.18
23	It is forbidden to smoke, spit or chew tobacco on the production sites	4	0.74
24	Sterilise the knife between two carcasses or organs from different animals [b]	56	10.31
25	The knife blade must be pointing downwards whenever it is being moved	21	3.87
26	Always respect the flow of movements: clean area => dirty area	15	2.76
29	After the activity, sterilise knives and chainmail gloves in the immersion steriliser (82°C) [b]	56	10.31
33	After the activity, clean the helmet in hot water in the knee-operated sink of the student area	26	4.79
34	After the activity, leave the overalls in the student area [b]	56	10.31
35	At the end of the week, place overalls in a plastic bag for transportation after the activity [b]	56	10.31
	Total	**543**	**100.00**

a) Day session of practical work for a student (each student was observed twice per half day)
b) 22 biosecurity rules were disregarded at the slaughterhouse, some of them (*n* = 8) by all students
No. of breaches = number of times the rule was disregarded

infection contracted when handling internal organs of a horse without taking adequate precautions (contact with contaminated body fluids without wearing appropriate personal protective equipment such as gloves) (13), and *Salmonella* Typhimurium after splash exposure (drops of bile splashed onto a pathologist's face; they developed digestive clinical signs three days after performing the necropsy) (14). Inhalation of aerosols/droplets was reported as the main mode of transmission in the case of a veterinarian who performed the necropsy of a mountain lion infected by *Yersinia pestis* in his garage, and contracted primary pneumonic plague (15). Another example is the case of a zoo employee who had attended the necropsy of a tuberculous elephant (16), and developed a positive response to the tuberculin skin test. A veterinary student who handled the brain of a horse which had developed clinical signs of West Nile virus infection became infected by exposure of mucous membranes to contaminant droplets (17).

Pathogens can also be transmitted through indirect contact, for example after cuts with contaminated sharp objects such as scalpel blades, as has been reported for West Nile virus (18), *Mycobacterium bovis* from a tuberculous possum (19), *M. tuberculosis* from a tuberculous dog (20) or *Blastomyces dermatitidis* during necropsy of a dog (21). The implementation of safer biosecurity measures often follows such accidents. A temporary increased awareness of the risks of acquiring infection in a necropsy context is often observed after such accidents, but the fulfilment of rules often reduces with time. The main concern regarding necropsies is bio-prevention, but also bio-containment. Indeed, by disregarding biosecurity measures, professionals performing necropsies on animals could also be responsible for indirect contamination of other live animals, through the unconscious carriage of pathogens on their skin, clothes or shoes. All the above examples illustrate the risk to students and any person participating in veterinary necropsies, but the fulfilment of biosecurity measures is also critical in slaughterhouses. Indeed, abattoir workers are at risk of contamination with many zoonotic pathogens of different aetiologies, due to their close contact with animals/animal tissues (9). Numerous zoonotic pathogens have infected abattoir workers in their occupational environment, including *Coxiella burnetii*, *Streptococcus suis*, group A β-haemolytic *Streptococcus pyogenes*, *Brucella* spp., hepatitis E virus, Nipah virus, *Streptococcus gallinaceus* and *Campylobacter* spp. (22, 23, 24, 25, 26, 27, 28, 29). Abattoir workers, as well as their clothing and equipment, may be a source of contamination for carcasses (30). Hand contamination is, indeed, a well-known source of contamination by food handlers (31). They may act as reservoirs of zoonotic organisms through asymptomatic carriage of *Escherichia coli* or methicillin-resistant *Staphylococcus aureus* (MRSA). The respect of biosecurity measures is thus essential to reduce the risk of further dissemination to the wider community (32, 33, 34).

This study has its own limitations. Indeed, as groups were observed several times, a model for repeated measures should have been used; nevertheless, it was not possible to apply such a model. In order to guarantee the independent character of these observations, the auditor was external and did not know the students personally. The observer clearly explained to the students the reason for his presence, which might have biased their behaviour and led to an overestimation of compliance with biosecurity measures (35). Furthermore, despite homogeneous observation pressure by the same person, it was not possible to report each and every breach committed, as observations were performed in real time; it was sometimes not possible to observe all students at the same time. An alternative could be the use of cameras but, in the Belgian context, this is not permitted by the legislation (36). Other alternatives include observing a lower number of students, or considering a more limited number of biosecurity measures.

The fulfilment of biosecurity rules is essential in the contexts studied, as the risk of contracting an infectious disease in the necropsy room (a necropsy often being performed when the cause of death is not clear) is very high, as it is at the slaughterhouse. Furthermore, the (re)emergence of zoonotic pathogens is an additional risk because their clinical and pathological patterns are not always well known to pathologists and meat inspectors. The implementation of specific biosecurity measures should be justified and clearly explained to students (37, 38). Education is an important part of the success of biosecurity measures. A recent survey carried out in 38 institutions highlighted the limited formal training of personnel, which can lead to an underestimation of risks, and a consequent lack of awareness by students (4). Faculty veterinarians should optimise biosecurity among students (4). Thus, the education of students requires first the education of staff, who are seen by students as setting an example. Staff should be aware of the risk of zoonotic infection resulting from occupational exposures and of cross-contamination risks in the slaughterhouse context. Effective leadership is essential to the success of a biosecurity programme.

Although considered to be intermediate, according to Haynes *et al.*, the compliance rates estimated in this study illustrate a real gap between Biosecurity SOPs and field conditions, indicating that the respect of biosecurity rules is deficient (7). This should pave the way for a series of measures such as increasing the awareness of students through education. Education could be achieved through online modules, for example, which have several advantages such as rapid updating of information (e.g. in relation to the occurrence of disease outbreaks), an unlimited number of people participating simultaneously, and flexibility in terms of location and time, as well as being interactive and attractive to students (39). Biosecurity e-learning platforms should be continuously submitted to a monitoring process

at the global level (4). Concomitant with this study, a biosecurity e-learning platform for veterinary students was implemented in Belgium, at the University of Liege (40). Each part of the curriculum (e.g. ruminants, swine, equines, companion animals or food science) is developed through a chronological scenario, during which students are informed about:

– protective equipment they are allowed to bring and what is provided on site

– requirements before entering the premises

– behaviours they should adopt and avoid

– waste management

– measures upon leaving premises.

The methodology developed in the present study could be a useful tool to assess the evolution of biosecurity compliance through time. A continued evaluation seems imperative, in order to follow the trends in compliance, especially if it is part of a self-assessment plan, and to assess the effectiveness of biosecurity education materials and tools. Objective surveillance data, collected by an independent competent observer, are essential to allow institutions to make informed decisions. Such a continuous programme would highlight the critical points to emphasise through education. Feedback to the participants is also a key point in the improvement of compliance, to keep them aware of critical points. Furthermore, the methodology used in this study could be applied in other contexts such as animal clinics and laboratory activities.

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L'observation en tant que moyen d'évaluer la conformité aux procédures de biosécurité chez les étudiants en médecine vétérinaire

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Résumé

En médecine vétérinaire, la biosécurité repose sur la mise en œuvre et le respect des procédures destinées à réduire le risque d'introduction et de propagation des agents pathogènes. Les auteurs présentent les résultats d'une étude conduite en Belgique dans le but d'évaluer l'utilité des observations pour assurer la conformité de la mise en œuvre des mesures de biosécurité par les étudiants en médecine vétérinaire lors des séances de travaux pratiques effectuées en salle de nécropsie d'une faculté de médecine vétérinaire (*n* = 122 observations) et dans un abattoir privé (*n* = 56 observations). Des listes de vérification compilant les règles de biosécurité à appliquer dans ces deux contextes ont été établies (31 règles prises en compte pour la salle de nécropsie et 35 pour l'abattoir). Les observations étaient effectuées par une seule personne à la fois afin d'assurer leur standardisation. L'étude a révélé une conformité aux règles de biosécurité

de niveau intermédiaire, s'élevant respectivement à 42 % dans la salle de nécropsie et à 37 % à l'abattoir. Aucune différence significative n'a été décelée entre ces deux taux de conformité. Une meilleure supervision des étudiants par le personnel encadrant et une sensibilisation accrue dans l'enseignement devraient être encouragées. Le suivi des observations au fil du temps pourrait permettre d'évaluer l'évolution de la conformité aux mesures de biosécurité.

Mots-clés
Autocontrôle – Belgique – Biosécurité – Conformité – Durée d'activité – Éducation – Liste de vérification – Observation – Procédure – Sensibilisation – Taille d'un groupe.

La observación como método para evaluar el respeto de los procedimientos de seguridad biológica por los estudiantes de veterinaria

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Resumen
En medicina veterinaria, la seguridad biológica depende de la aplicación y el respeto de procedimientos que reducen el riesgo de introducción y propagación de patógenos. Los autores describen un estudio que tenía por principal objetivo determinar la utilidad de la observación como método para evaluar el cumplimiento, por parte de estudiantes de veterinaria, de las medidas de seguridad biológica aplicadas en la sala de disección de una facultad de veterinaria (n = 122 observaciones) y en un matadero privado (n = 56 observaciones) de Bélgica en el curso de jornadas de prácticas. Se elaboraron listas de control que enumeraban las reglas de seguridad biológica que debían respetarse en ambos contextos (se tuvieron en cuenta 31 reglas para la sala de disección y 35 para el matadero). Para asegurar la uniformidad de las observaciones, estas corrieron a cargo de una sola y misma persona. El nivel de cumplimiento de las reglas de seguridad biológica resultó intermedio: de un 42% en la sala de disección y de un 37% en el matadero, sin que entre ambas tasas se observara ninguna diferencia significativa. Conviene alentar una supervisión más estrecha de los estudiantes por parte del personal y un mayor grado de sensibilización a través de la enseñanza impartida. Para evaluar la evolución del cumplimiento de las medidas de seguridad biológica cabría la posibilidad de ir repitiendo las observaciones en el tiempo.

Palabras clave
Autovigilancia – Bélgica – Cumplimiento – Duración de actividad – Enseñanza – Lista de control – Observación – Procedimiento – Seguridad biológica – Sensibilización – Tamaño del grupo.

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