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Evaluation of occupational factors influencing the experience of an autopsy demonstration

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Abstract

Background: Autopsy demonstrations have been an integral part of medical school, medical and nonmedical education for many decades; however, a direct comparison of the experience of an autopsy demonstration of different groups of participants is missing so far. In this study, the experience of such a situation by the different professional groups was analyzed and discussed in order to improve future dissections for the participant groups.
Methods: Evaluations of 54 autopsy demonstrations were performed at the Institute of Legal Medicine of the University Hospital Halle (Saale) and the branch office in Magdeburg in the period 2017–2020. A total of 794 questionnaires were answered and statistically analyzed. Participants rated the autopsies in various question categories and, if applicable, provided reasons for discontinuation of the demonstration on their part (e.g., circulatory dysregulation). To analyze the results the Kruskall Wallis test, the Mann-Whitney U-test and the χ^2-test were applied.
Results: Findings showed that the professional background has a significant influence on the experience and the dropout rates from an autopsy. Furthermore, the professional groups have different areas of interest and expectations of an autopsy.
Conclusion: The results require customized preparation of an autopsy demonstration as well as differentiation of knowledge transfer to different groups of participants to optimize their benefit.

Keywords
Legal medicine · Questionnaire · Dropout · Teaching · Professions

Background

The performance of autopsy demonstrations is a traditional component of the practical training of medical students in the compulsory curriculum of forensic medicine [11, 12, 21]. Such courses are also offered or even mandatory for other students (exempli gratia, medicine-ethics-law or law studies) and professional groups (e.g., police recruits and officers, nurses, paramedics) [16, 24, 25].

In social discussion and the medical literature, it is repeatedly emphasized that autopsies are an important instrument in medical teaching and quality assurance as well as for ensuring legal certainty [2, 10, 17, 30]. In recent years, a number of modern didactic methods have been integrated into teaching of legal medicine. These include teaching, learning and examination methods, such as e-learning modules, skills lab stations, OSCE examinations, mostly accompanied by corresponding evaluations [1, 6, 13, 14, 26, 27].

Availability of data and material
The data that support the findings of this study are available from the corresponding author upon reasonable request.

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When conducting and planning such autopsy demonstrations, several factors have to be taken into account, such as the prior level of knowledge, motivation, learning objectives and possible vulnerable aspects of the corresponding target group; however, the available resources must also be taken into account, such as the availability of suitable cases and the valences of time and personnel. To continuously enhance the quality of such courses, their systematic evaluation is helpful.

Although autopsy demonstrations as part of this process have been an important tool to ensure practical relevance and sustainable learning success for decades, there are currently only isolated accounts in the pathology and forensic medicine literature of participants' reflections on such courses, whereas several studies are available on emotional and ethical aspects of the cadaver dissection course in anatomy among medical students [3, 5, 22, 23, 29]; however, systematic studies on this topic are largely lacking so far.

Material and method

Evaluations of 54 forensic autopsy demonstrations were performed at the Institute of Legal Medicine of the University Hospital Halle (Saale) and the branch office in Magdeburg for the period 2017–2020. Evaluation items and parameters were selected and compiled based on the authors' previous experience with such courses and the limited information in the literature. Exclusion criteria for the autopsy demonstrations were autopsies of children, severe polytrauma, and cadaveric decomposition. Immediately after each autopsy demonstration, the performing physicians were requested to provide baseline information and all participants were asked to complete an anonymized evaluation. Thereafter, the case documentation of the autopsy physicians was merged with the evaluations in each case.

The participants were explicitly reminded of the obligation to maintain confidentiality, also with respect to ongoing investigative proceedings.

The following information was requested from the physicians:
- Autopsy identification number
- Age of the deceased
- Group size (< 10 participants, 11–20 participants, > 20 participants)
- Percentage dropout rate
- Cause of death group (trauma, natural death, further clarification required)
- Type of introduction (short or detailed)

The following data were collected from participants during the evaluation:
- Age group
- Gender
- Occupational group or course of study (including semester)
- First time or repeated participation in a postmortem examination

The questionnaire was structured in 9 items in the section "Motivation to participate" and 11 items in the section "Evaluation of the autopsy", as well as 6 additional items in the section "Reasons for discontinuation". These 6 items were to be filled in explicitly only in the case of an unambiguous dropout from the autopsy on the part of the participants. Participants could answer a maximum of 26 items (20 items when excluding dropout-related questions) on a Likert scale (5: fully agree, 4: mostly agree, 3: neither agree nor disagree, 2: mostly disagree, 1: disagree). Further feedback could be entered in a free-text field.

The proportion of complete and predominant agreement (Likert scale 5 and 4) was summarized for the evaluation.

The total cohort was first described and analyzed statistically using the IBM SPSS v24.0 (IBM, Armonk, NY, USA) program for Windows 10. For the recording of differences between the professional groups and study courses, several selected items were combined into complexes which most closely reflected the motivation and reflection of the participants: "personal motivation" (Questions 3–6), "comprehensibility of the autopsy" (Questions 10–14) "positive expectations" (Questions 15, 16, 18 and 19), "reasons for dropping out" (Questions 21–26). The scores of the respective Likert scales were summed and tested for significance using the Kruskall-Wallis test. Finally, the significance was corrected by means of Bonferroni correction, by comparing the results of the occupational groups and study programs. The tendency was described by the mean values of the sums from the maximum score. Significance testing of the relative dropout rates in the different occupational groups and programs was performed using the χ^2-test. Of further interest was a comparison between participants in the medical sector (medical students and medical assistants) and the nonmedical sector. The corresponding significance test was performed using the Mann-Whitney U-test. The significance level was set at $p < 0.05$.

Results

Description of the total cohort

Out of 54 autopsy demonstrations, 794 results from 921 participants were included in the evaluation. Thus, the response rate was 86.2%.

The most frequent participants were police recruits and officers (30.6%), followed by 3rd semester medical students (24.4%) and 8th semester medical students (18.1%). The percentage of lawyers, law clerks and law students was 15.6%. Furthermore, 6.4% of the participants were from the medical assistant professions. No information on the professional or educational group was available from 2.9%. Thus, considering the complete data sets only 49.6% were from the medical sector and 50.4% from the nonmedical sector.

Of the participants 31.5% were 20 years old or younger. Of the questionnaires evaluated 47.0% of the participants were taking part in an autopsy for the first time, while 15.2% had already participated (37.8% did not provide any information).

For participants in the 8th semester of medical studies, the demonstration was mandatory as part of the legal medicine lectures. For police recruits, participation was partly voluntary or mandatory. For all other professionals, the demonstrations were a voluntary part of the training.

In 44 autopsies (81.4%) a brief orienting introduction was provided before entering the autopsy room and 28.3% of the autopsies took place with up to 10 participants. In 35.8% of the autopsies, 11–20 participants were present. In 35.8% the number of participants was over 20.

Natural death due to diseases were most frequently diagnosed in 41.5% of

Table 1 Motivation to participate in autopsy demonstrations with the percentage of complete or predominant agreement

Motivation to participate	Complete or predominant agreement (%)
1. Participation was a mandatory event	47.5
2. If I could have avoided it, I would not have participated	6.9
3. I participated out of personal curiosity	80.1
4. I participated to test my anatomical knowledge	40.8
5. I participated because it is a unique opportunity	71.0
6. I participated because I wanted to know if I could "handle" it	37.0
7. I felt sufficiently professionally prepared	64.5
8. I felt sufficiently emotionally prepared	70.1
9. It was important for me to touch the body/prepared organs	21.5

Table 2 Evaluation of the autopsy with percentage of complete or predominant agreement

Evaluation of the autopsy	Complete or predominant agreement (%)
10. The explanations of the question on the occasion of the autopsy were understandable	96.6
11. The explanation of the process/methods was sufficient	93.7
12. The presentation of the anatomy was understandable	94.1
13. The presentation of the findings was understandable	93.3
14. The explanation of the evaluation of the findings (presentation of the content of the expert opinion) was sufficient	91.2
15. The handling of the body met my expectations	77.9
16. My positive expectations were met	83.0
17. My negative expectations were fulfilled	14.2
18. I see a dissection as a necessary medical measure	92.7
19. I would volunteer to participate in observing a postmortem examination again	76.6
20. Even if there is an official need, I would try to avoid participation	7.2

Table 3 Reasons for discontinuation with percentage of complete or predominant agreement

Reasons for discontinuation ($n = 66$)	Complete or predominant agreement (%)
21. I have "problems" with deceased/dead people in general	11.7
22. I am frightened by the measures (opening of the body)	26.7
23. I realized from the case that my life is also finite and thus have problems	16.7
24. My circulation is "collapsed", I don't know why	57.4
25. I do not consider the measures taken to be an adequate way of dealing with deceased persons	6.7
26. My fears/negative expectations were exceeded	18.6

the autopsies (mainly cardiovascular diseases, gastrointestinal diseases, malignancies). In 18.9%, death occurred as a result of traumatic injury. In 39.6%, no definite cause of death could be verified after the macroscopic findings, because additional examinations (e.g., toxicological examination) were required. The overall dropout rate of the autopsies was 9.5%.

There were no dropouts in 45.3% of the autopsy demonstrations. Only those cases were counted as a discontinuation where this was clearly indicated by the evaluation forms. At 26.0%, dropouts occurred significantly more frequently for traumatological causes of death than compared to the other two categories. The items on motivation to participate (**Table 1**) showed that a large proportion of participants felt sufficiently prepared both professionally and emotionally.

Only a few participants would have turned down the opportunity.

In the evaluation of the autopsy (**Table 2**), the explanation of the occasion, the procedure, and the methodology of the autopsy were rated positively, as were the presentations of the anatomy and the findings. Negative expectations were met only occasionally. There was a high level of agreement for the necessity of dissection.

Circulatory collapse was one of the main reasons for discontinuation of the autopsies (**Table 3**).

Recording differences between occupational groups and study programs

There were significant differences between the individual occupational groups or courses of study with respect to personal motivation and comprehensibility of the autopsy as well as positive expectations. Thereby, personal motivation was significantly lower ($p < 0.01$) among medical students of higher semesters (8th semester) than among police recruits and officers, medical students of the 3rd semester, but also compared to medical assistant professions. The latter two groups also showed significantly higher motivation compared to lawyers, law clerks, law students, police recruits and officers (**Table 4**). The comprehensibility of the autopsy was rated significantly better ($p < 0.05$) by the medical assistant professions than by the 3rd semester medical students and police recruits and officers. Positive expectations were met significantly more often ($p < 0.05$) by 3rd semester medical students and medical assistant professions than by lawyers, law clerks and law students, while no significant differences were found between groups in the reasons for dropping out of an autopsy.

Dropout rates

A comparison of dropout rates showed highly significant differences ($p < 0.01$) (**Fig. 1**).

Table 4 Mean values of summation of Likert scales for recording differences between occupational groups and study programs

	Personal motivation (20[a])	Comprehensibility autopsy (25[a])	Positive expectations (20[a])	Reasons for termination (30[a])
Medical students 3rd semester	15.59	22.66	17.56	16.71
Medical students 8th or higher semester	12.48	23.08	17.26	6.00
Lawyers/law clerks/law students	13.37	23.00	16.51	13.54
Police recruits and officers	14.01	22.69	17.11	12.31
Medicine-ethics-law course	14.13	22.92	18.43	14.00
Medical assistant professions	16.00	24.18	17.91	12.50
Other	14.39	21.86	17.05	18.00

[a]Maximum sum of points to be achieved

When comparing the individual items between participants from the medical and nonmedical sectors, which showed a similar distribution compared to the entire field of participants, some significant differences were evident (**Table 5**).

The reasons for discontinuing the dissection did not reveal any significant differences.

In the medical group, 16 cases (4.8%) discontinued the autopsy for various reasons; in contrast, participants from the nonmedical sector left the autopsy more often, at a highly significant level of 14.1% ($n = 50$).

Discussion

In the present study, for the first time a comprehensive systematic investigation was carried out on the evaluation of autopsy demonstrations in forensic medicine in various professional groups or courses of study.

In terms of motivation to participate, the overall cohort showed a high rate of approval based on personal interest. The majority of the participants also estimated that they had been sufficiently prepared professionally and emotionally. High personal motivation was shown by the medical assistant group, where participation was rarely (11.7%) mandatory. In this group, an autopsy demonstration is by no means regularly offered in the training or professional activity and mostly only once [9]. Thus, a favorable opportunity for clarification of comprehension issues and presentation of real anatomical conditions arises for the medical assistant professions compared to other forms of teaching and learning, such as atlases, textbooks, and computer programs [2, 8, 18, 20]. In contrast, personal motivation was lower among lawyers, law clerks and law students, with participation being mandatory in only about one third (34.1%). Consistent with this, only the motivation of "coping" was more pronounced in the nonmedical groups compared to the medical groups. The observed differences can most likely be explained by the fact that in the medical group knowledge of human anatomy and pathophysiological mechanisms are more important for training and professional activities [28].

Assessments by the medical assistant professions showed the highest approval rates. One of the possible reasons could be that forensic physicians are more accustomed than other medical specialties to the presentation of medical findings in a simple, clear, comprehensible form [15]. With the group of police recruits and officers, this advantage could not be exploited to the same extent, so that within the framework of future courses, more attention needs to be paid to these specific characteristics of the group (including medical laypersons, criminological orientation). Likewise, the corresponding wishes of medical students in the 3rd semester (e.g.,more detailed presentation of anatomical structures) should be considered more precisely, which were also listed in the open answer entries. Furthermore, the difference between an anatomical dissection and a goal-oriented forensic autopsy should be explained in more detail to medical students in the 3rd semester at the beginning of the learning event in the future. Another reason for the somewhat lower ratings in the two groups may have been the significantly higher numbers of participants in the police recruits and officers (47.1% of dissections with more than 20 participants) and 3rd semester medical students (85.7% of dissections with more than 20 participants). In the open answer entries data, poor visibility and hearing conditions were also mentioned in this context. A strict limit of no more than 20 participants could be helpful in addressing this issue.

In terms of positive expectations, the overall cohort still showed a clear preponderance of approving assessments; however, these did not reach the level of the assessments on the comprehensibility of the dissection. For example, potential for improvement was still evident in the handling of the corpse. Significant differences were also evident in this category, both between the individual occupational groups and study courses. It was found that positive expectations were met more frequently in the medical groups, as were negative expectations in the nonmedical groups. The most critical evaluation was found among lawyers, law clerks and law students. According to Martyn et al., participation in an autopsy demonstration involves confrontation with one's own mortality and the inevitability of death [19]. It is possible that this group was confronted with the problem for the first time to such an extent, while medical groups have previous experience, such as the anatomy course or even their own experience of patients dying.

Among the 66 autopsy discontinuations in the total cohort, the perception of a circulatory derailment and consternation about the measures taken to open the body were the most prominent, and unpleasant odors were also more frequently reported in the free-text statements.There were significant differences in the dropout

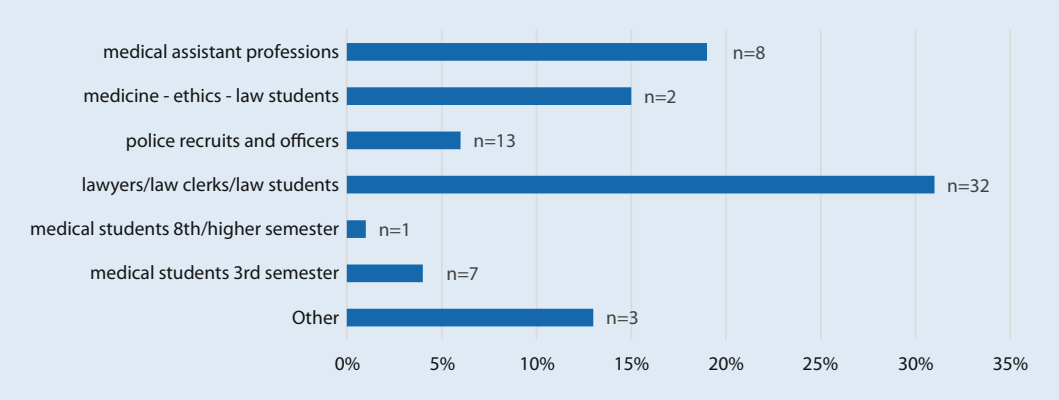

Fig. 1 ◀ Representation of the number and percentage of dropouts within the occupational groups

rates between medical and nonmedical groups as well as between the individual occupational groups or courses of study. The lowest dropout rates were found among students of human medicine, consistent with the findings of Prayson [23]. Overall, participants from the nonmedical groups showed higher dropout rates than the medical professional groups, although differences were also evident among nonmedical professionals. In this respect, a relatively high rate of 15.4% was seen among participants from the postgraduate medicine-ethics-law program, which is mainly composed of lawyers. The dropout rates of lawyers, law clerks and law students were even more than twice as high as the average dropout rates of the other participating groups. So far, there are no systematic studies in the literature on the reflections of these professional groups on medicolegal autopsy demonstrations. It is possible that this is due to the fact that they often largely avoid the subject in their daily work. In contrast, depending on the area of deployment, this avoidance strategy was less common among police recruits and officers, which could have contributed to the significantly lower dropout rates.

Conclusion

Medicolegal autopsy demonstrations represent an important tool in the education, training, and further education of a wide variety of professional groups; however, autopsies should be carefully and sensitively integrated into the training programs [7]. For future physicians, these teaching sessions are an important preparation for the communication that will later be required between postmortem examiners, clinically active physicians, and the relatives of the deceased [30]. Medical assistants also benefit from a better understanding of anatomy, as well as learning medical and surgical nursing concepts [9]. Despite increased dropout rates and lower motivation, it was an important event for participants with a legal background, as it represents an insight into medicolegal practice and how it works [25].

The predominantly positive and very positive evaluations indicate that the basic concept of autopsy demonstrations in legal medicine can be maintained or, where not yet in place, introduced. This is in line with the results of Bamber et al., according to which autopsy demonstrations are highly appreciated by students and the knowledge gained there can be applied to many different medical specialties and skills [4]; however, this requires careful preparation and organization of autopsy demonstrations to maximize potential educational benefits and reduce negative emotional impacts. From the differences found between medical and nonmedical participants as well as between the individual professional groups and courses of study, it is evident that, depending on the structure of the participant group, there is still room for improvement.

For example, the highly developed personal motivation of medical students in early semesters can be further enhanced in the introduction by more detailed explanations of the difference between anatomical dissection and forensic autopsy and in the execution by going into more detail about anatomical structures. For medical students from higher semesters, there should be a stronger focus on forensic aspects, emphasizing the distinction from anatomical and pathological postmortem examinations. Furthermore, it could be helpful if the courses were to focus more on the communication between postmortem examiners, clinically active physicians and relatives that is required in later professional life. The markedly high personal motivation of the medical assistant professions is most likely to be maintained by optimizing a readily understandable form of the autopsy demonstration and addressing aspects specific to the profession. In the case of police recruits and officers, future autopsy demonstrations should emphasize a presentation that is understandable to medical lay personnel and emphasize criminological aspects. Autopsy demonstrations for participants with a legal background pose a particular challenge. With this group, it could prove beneficial if the motivation of testing physical and mental limits is placed more in the background. This can be made possible, for example, by a specifically designed introduction, in which a sensitive introduction to the topic of mortality is made, among other things, with suitable visual material. In addition, it could be helpful to avoid cases with traumatological causes of death in this group, if possible. Furthermore, the present study showed that, in principle, a manageable number of participants should be aimed for (e.g., a maximum of 20) and that the potential for improvement in the sensitive handling of the corpse is exhausted. Of course, these recommendations can only ever be implemented in consideration of the availability of suitable cases as well as time and personnel resources. As the scientific examination of this sensitive topic to date has been more marginal, further

Table 5 Comparison between participants in the medical and nonmedical sectors with full and predominant agreement

Question	Medical sector $n = 389$ (in %)	Nonmedical sector $n = 395$ (in %)	p value
1. Participation was a mandatory event	37.0	58.6	< 0.001
2. If I could have avoided it, I would not have participated	4.4	9.6	0.003
3. I participated out of personal curiosity	83.8	76.6	0.003
4. I participated to test my anatomical knowledge	53.8	28.4	< 0.001
5. I participated because it is a unique opportunity	72.3	69.6	0.659
6. I participated because I wanted to know if I could "handle" this	30.7	43.6	< 0.001
7. I felt sufficiently professionally prepared	77.8	51.4	< 0.001
8. I felt sufficiently emotionally prepared	74.4	65.6	0.280
9. It was important for me to touch the body of the deceased person/the prepared organs myself	23.7	15.8	< 0.001
10. The explanation of the question on the occasion of the autopsy was understandable	97.0	96.3	0.215
11. The explanation of the process/methods was sufficient	93.8	93.7	0.193
12. The presentation of the anatomy was understandable	94.9	93.4	0.200
13. The presentation of the findings was understandable	95.3	91.4	0.019
14. The explanation of the evaluation of the findings was sufficient	93.4	89.3	0.001
15. The handling of the body met my expectations	74.7	81.2	0.059
16. My positive expectations were met	87.7	78.6	0.024
17. My fears/negative expectations have been met	9.9	18.7	0.001
18. I see a dissection as a necessary medical measure	93.4	92.6	0.671
19. I would volunteer to participate in observing a postmortem examination again	84.7	68.9	< 0.001
20. Even if there is an official need, I would try to avoid participation	4.7	9.0	< 0.001

studies are needed [23]. For this purpose, longitudinal observations of the same cohort in different semesters or a comparison of several sites, for example, could provide further insights.

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Declarations

Conflict of interest. P. Panusch, S. Heide, R. Lessig, C. Richter, D. Stiller, D. Medenwald, U. Schmidt and M. Weber declare that they have no competing interests.

Ethical standards. For this article no studies with human participants or animals were performed by any of the authos. Alls studies mentioned were in accordance with the ethical standards indicated in each case and its later amendments or comparable ethical standards. Approval was granted by the Ethics Committee of the University, Martin Luther University Halle-Wittenberg (09/24/2019/2019-142). Informed consent was obtained from all individual participants included in the study.

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