

Self-Perception of Medical Students' Knowledge and Interest in Disaster Medicine: Nine Years After the Approval of the Curriculum in German Universities

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Abbreviations:

EMDM: European Master in Disaster Medicine
EMS: Emergency Medical Service
WADEM: World Association for Disaster and Emergency Medicine

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Abstract

Background: Following the recommendations of the World Association for Disaster and Emergency Medicine (WADEM; Madison, Wisconsin USA) to develop standards for training the undergraduates in disaster-relevant fields (2004), a German curriculum was approved in 2006. This paper aims to describe the level of training and interest of medical students nine years later.

Problem: The aim of this study was to assess the self-perception of medical students' knowledge and interest in disaster medicine nine years after the implementation of a standardized disaster medicine curriculum in German medical schools.

Methods: This prospective, cross-sectional, observational study was conducted with medical students in Germany using a web-based, purpose-designed questionnaire consisting of 27 mandatory and 11 optional questions.

Results: Nine hundred ninety-two students from 36 of 37 medical schools in Germany participated. More than one-half of medical students were aware of the field of disaster medicine. One hundred twenty-one students undertook training internally within their university and 307 undertook training externally at other institutions. Only a small content of the curriculum was taught. A difference in self-perception of knowledge between trained and untrained participants was found, despite the level of training being low in both groups. Participants were generally highly motivated to learn disaster medicine in a variety of institutions.

Conclusion: German students are still largely not well educated regarding disaster medicine, despite their high motivation. The curriculum of 2006 was not implemented as originally planned and the number of trained students still remains low as the self-perception of knowledge. Currently, there is no clear and standardized training concept in place. A renewal in the agreement of implementation of the curriculum at medical schools should be targeted in order to follow the recommendation of WADEM.

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Introduction/Background

The recent terror attacks of Brussels (Belgium) in March 2016 and Paris (France) in November 2015, along with the huge number of refugees fleeing from Syria to Europe, have increased a growing awareness of the necessity to think about disaster response and disaster medicine, not only in the medical community. The severity of the effects of disasters are increasing with the growth of global population.¹ According to the United Nations Office for Disaster Risk Reduction (UNISDR; Geneva, Switzerland), from 2000 to 2012, disasters have caused approximately \$1.7 trillion (US) of economic damage,

directly affected 2.9 billion people, and caused an estimated 1.2 million fatalities.² In 2004, the World Association for Disaster and Emergency Medicine (WADEM; Madison, Wisconsin USA) underlined the need for the professionalization of the health response to disasters. WADEM recommended the development of standards and guidelines, even for undergraduate students, of all the relevant fields related to health in disasters,³ when additional knowledge is required due to the typical disproportion among the number of casualties and the available resources.^{4,5} Many governments, scientific institutions, and universities across the world assessed the required expertise for dealing with disasters, and designed different solutions for including disaster medicine education in their training of different medical personnel.⁶⁻¹⁴ Medical students were also noted to take part in disaster responses at different events.^{15,16} Since 2003, a specific knowledge in disaster medicine forms a constituent of the final state examination of medicine in Germany.¹⁷ Therefore, a specific curriculum was created in 2006 by the Protection Commission at the German Ministry of the Interior (Berlin, Germany), the German Society for Disaster Medicine (Kirchseeon, Germany), and the Federal Office of Civil Protection and Disaster Assistance (Bonn, Germany), and then was given to the Deans of the German medical universities for acknowledgement and implementation.¹⁸ The resulting course was published by Pfenninger and colleagues and consisted of 14 modules composed of two-hour units, including one examination part.¹⁹ To the best of the authors' knowledge, after the approval of the disaster medicine curriculum in German medical schools, no evaluation has taken place to show the level of its implementation across the country and the status of the perceived knowledge and interest of German medical students in this field. The aim of this study was to assess the self-perception of medical students' knowledge and interest in disaster medicine nine years after the implementation of a standardized disaster medicine curriculum in German medical schools.

Methods

Study Design, Population, and Administration

The study was a prospective, cross-sectional, observational study of medical students in Germany using a web-based, purpose-designed questionnaire. Data were collected with the questionnaire software SurveyMonkey, Version 2.0 (SurveyMonkey Europe; Dublin, Ireland). An invitation e-mail with a link to the questionnaire was sent to the German student councils of all 37 universities with medical faculties. Each student council was asked to deliver the e-mail to all the affiliated medical students of all semesters and genders. The participation was voluntary, anonymous, and confidential. The completion of the questionnaire implied participants' consent to give the authors the right to use the information provided. The Research Center in Emergency and Disaster Medicine (CRIMEDIM), in Novara, Italy, coordinated this work as a master thesis of the European Master in Disaster Medicine (EMDM). As all data were identified and reported in aggregate, the local Ethics Committee of the Università del Piemonte Orientale, Novara, Italy, deemed the study exempt from institutional review approval.

Survey Tool

The data collection was accomplished by using a questionnaire containing 27 mandatory and 11 optional questions about disaster medicine, which were multiple-choice and closed (Appendix 1; available online only). The questionnaire was short,

straightforward, and in clear language to make a five-minute completion possible. It was designed in German and in English to allow participation of foreign students residing in Germany. The questions were grouped into four sections placed between introduction and closing remarks:

1. General Data and Demographics of the Respondents.
2. Previous Disaster Medicine Educational Experiences of the Participants. In this section, optional questions were included to assess the contents and type of training in greater depth.
3. Self-Perception of Knowledge Base in Disaster Medicine. The participants were asked to self-evaluate their knowledge of Pfenninger's curriculum contents through rating the level of agreement with statements using an anchored 5-point Likert scale (0 = "strongly disagree;" 1 = "disagree;" 2 = "neutral;" 3 = "agree;" and 4 = "strongly agree"). The following topics of the 13 modules, recommended by Pfenninger, were assessed: (1) terminology, type, and legal aspects of disasters; (2) tactics and leadership; (3) special aspects of disaster medicine; (4) disaster management in hospitals; (5) previous disaster assistance experiences; (6) mass-casualty triage; (7) evacuation; (8) primary health care in disasters; (9) specific health care in disasters; (10) accidents with radioactive material and decontamination; (11) transport and accidents of chemical material and decontamination; (12) ethical basics and quality management in disaster medicine; and (13) diseases triggered by disaster stress and procedures of psychosocial support.
4. Students' Attitude about Disaster Medicine in the Training System. The answers to this section were also assessed with the same 5-point Likert scale as used above.

Validation and Pilot Study

The questionnaire was validated by five members of the faculty of the EMDM. The study was piloted with alumni students from the summer academy of the German Institute for Disaster Medicine (Tübingen, Germany).

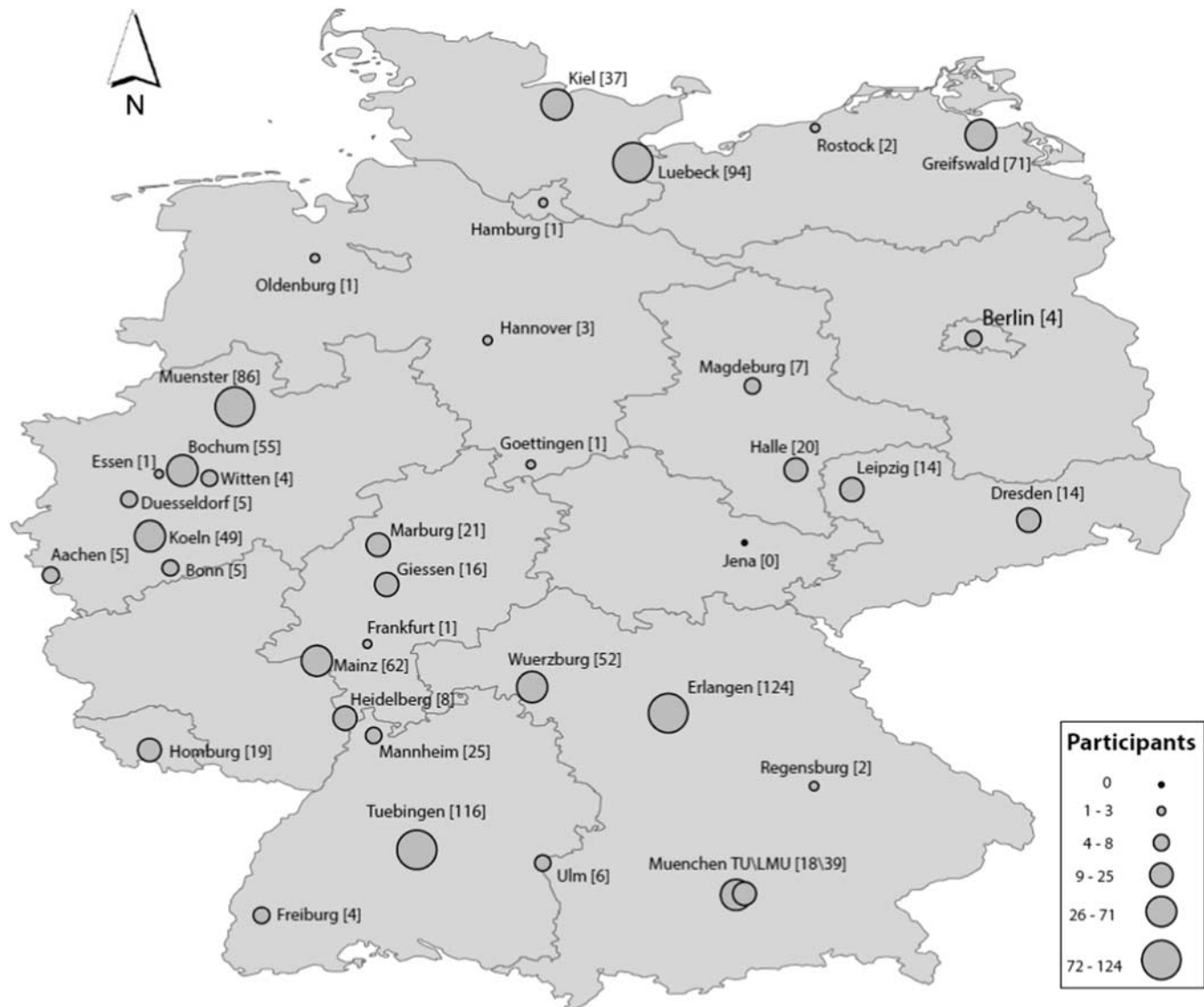
Analysis

The collected data were exported from SurveyMonkey to Microsoft Excel, Version 2013 (Microsoft Corporation; Redmond, Washington USA). All analyses were performed with the dedicated statistics program IBM SPSS, Version 22 (IBM Deutschland GmbH; Ehningen, Germany). General descriptive statistics (25% quartile, median, 75% quartile, and count) were obtained for all the mandatory questions of the first section (demographics and level of training). The 5-point Likert scale used in section two was considered an ordinal scale. The median, the 25% quartile, and 75% quartile were used for the description of the ordinal-scaled variables.

Non-parametric tests were used for the analysis of differences between subgroups of the study population. McNemar-Test was used to compare two associated nominal-scaled samples. Mann-Whitney-U-Test was used to compare two independent samples. A P value <.05 was considered statistically significant for both tests.

Results

A total number of 1,105 people answered the questionnaire. From these, 29 participants were not medical students and were excluded. A further 84 participants who did not complete all



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Figure 1. Geographical Distribution of Participants.

Note: The map was created with Esri ArcGIS (Esri; Redlands, California USA) on the basis of an open data set of the German Federal Office of Cartography and Geodesy.²⁰

questions were not included. Therefore, the final number of participants was 992.

Demographics

Out of the participants, 618 (62.3%) were female and 374 (37.7%) were male, with an average age of 24.4 years. Participants were included from all 12 regular semesters with a median of semester seven. A group of 234 (23.6%) participants had already finished a post-secondary education to work within the German Emergency Medical Service (EMS) system.

The participants belonged to 36 of the 37 medical schools within Germany. The distribution of respondents across the country is shown in Figure 1.

Previous Disaster Medicine Training

More than one-half ($n = 535$; 53.9%) of the participants were already aware of the medical specialty “disaster medicine” and 401 (40.4%) attended courses on this.

One hundred twenty-one (12.2%) attended courses on the specialty at their university. Most participants (48 [41.0%]) were taught in the year 2014 and received an average of 10 hours of training. The training was delivered as elective course in 53.7% of the cases. Responders stated that the three most commonly taught subjects from Pfenninger’s curriculum were: primary health care in disasters (59.4%), mass-casualty triage (45.3%), and previous disaster assistance experiences (38.3%). Twenty (16.5%) out of those students who attended courses in their university had completed an EMS post-secondary education before starting medical school.

Three hundred and seven (30.9%) participants attended lectures in disaster medicine at other institutions outside their university. The year when most (59 [20.8%]) participants were taught at these institutions was 2012, and they were trained an average of 49 hours. These lectures were elective for 57.7% of participants and mandatory for 42.3%. The majority of lectures were part of courses run by the fire brigade or volunteer organizations

Content of the Curriculum	At Home University n (%)	At Other Institution n (%)
Terminology, Typology, and Legal Aspects	32 (25)	149 (48)
Tactics and Leadership	45 (35)	202 (65)
Special Disaster Medicine	22 (17)	86 (28)
Disaster Management in Hospitals	34 (27)	92 (30)
Practical Examples of Disaster Medicine	49 (35)	167 (54)
Pre-clinical and Clinical Triage	58 (45)	218 (70)
Evacuation	11 (9)	84 (27)
Primary Health Care in Disasters	76 (59)	252 (81)
Specific Health Care in Disasters	15 (12)	97 (31)
Accidents with Radioactive Material and Decontamination	12 (9)	113 (36)
Transport and Accidents of Hazardous Material and Decontamination	4 (3)	133 (43)
Transport and Accidents of Hazardous Material and Decontamination	29 (23)	89 (29)
Transport and Accidents of Hazardous Material and Decontamination	32 (25)	113 (36)
Transport and Accidents of Hazardous Material and Decontamination	12 (9)	16 (5)
Total Answers	128	311

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Table 1. Subjects Taught to the Participants

(eg, the German Red Cross; Berlin, Germany). One hundred fifty-seven (51.1%) of these attendees had completed an EMS post-secondary education before entering the medical school. Analysis of the lecture content identified that “primary health care in disaster” was the most common subject (81.0%), followed by “preclinical and clinical triage” (70.1%) and “tactics and leadership” (65.0%). A complete breakdown is listed in Table 1.

Self-Perception of Medical Students' Knowledge

As shown in Table 2, in 10 out of 13 topics, the median knowledge perceived by students was “1,” in two contents “2,” and in one content “3.”

The perceived knowledge in 11 out of 13 topics of those participants who did the training at their university was higher compared to those participants without any training. This difference was statistically significant ($P < .001$).

Likewise, there was also a statistically significant difference ($P < .001$) between the perceived knowledge of those participants who received the lessons in other institutions compared to those participants without any prior training.

Students' Attitude about Disaster Medicine in the Training System

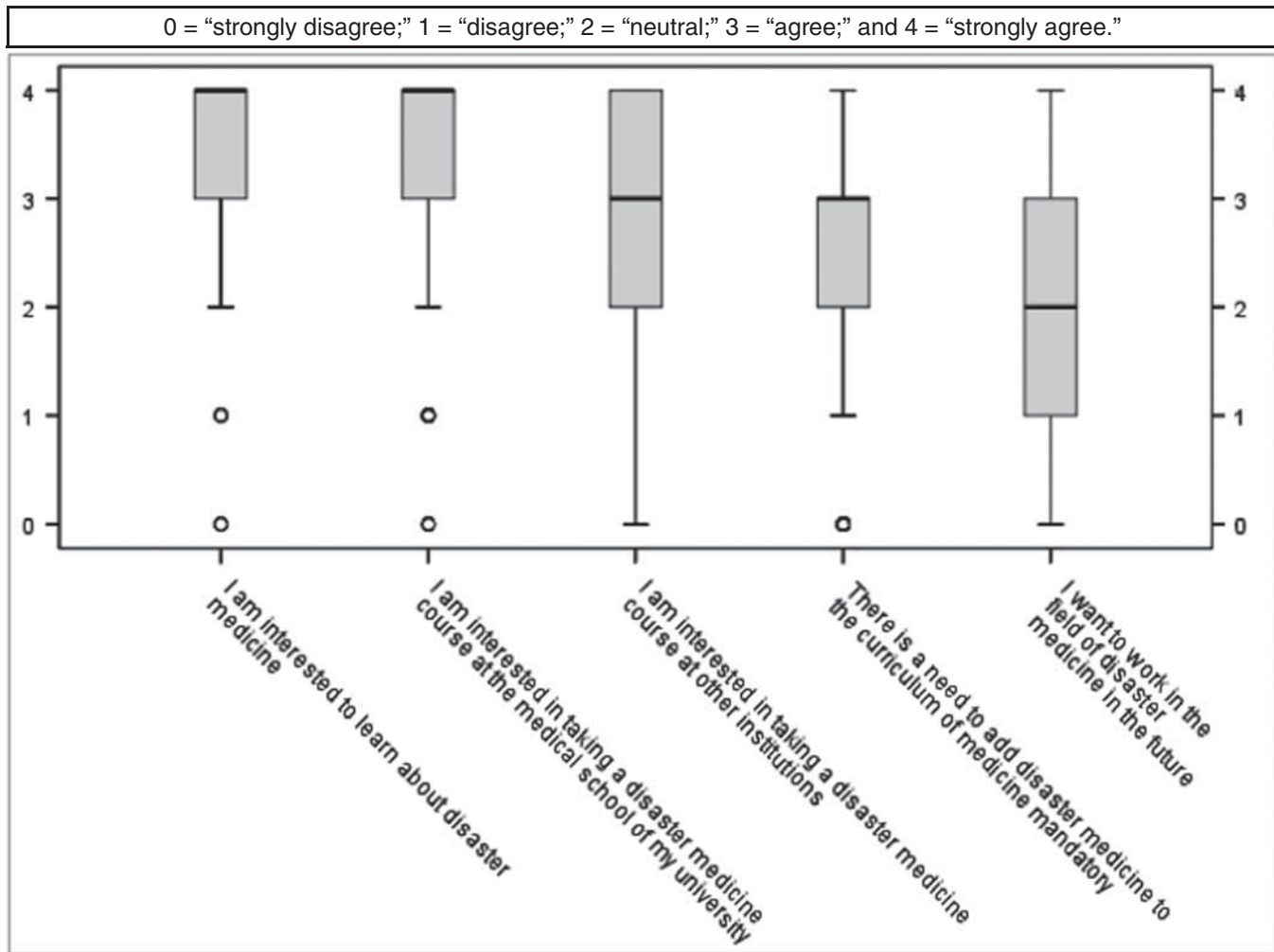
The participants strongly agreed (“4”) with the statement “I am interested to learn about disaster medicine.” They also strongly agreed (“4”) with the statement “I am interested in taking a disaster medicine course at the medical school of my university.” They agreed (“3”) with the statement “I am interested in taking courses about disaster medicine outside my university.” The necessity to add a compulsory specialty “disaster medicine” in the medical curriculum in Germany was agreed (“3”). The overall

response of participants was neutral (“2”) with regards the statement “I want to work in the field of disaster medicine in the future.” Details are listed in Figure 2.

Discussion

This study assessed the self-perception of medical students' knowledge and interest in disaster medicine nine years after implementation of a standardized disaster medicine curriculum in German medical schools. It shows a dichotomy between the interest of the students in the topic and the application of the suggestions given by WADEM and by the curriculum suggested by Pfenninger and colleagues in contrast with the implementation at the academic level nationwide.

The survey indicates that the Pfenninger curriculum of disaster medicine was poorly implemented in the last nine years. In fact, only the minority of respondents had attended a curricular course on the topic, which in the majority of cases was delivered in other institutions out of the university and as an elective option. Although professionalization of the health response is an actual concern, still several studies show that disaster medicine has rarely been included in medical school curriculum either in Europe or overseas. The Netherlands has no disaster medicine programs in their medical school.²⁰ In Italy, elective courses are delivered in several medical universities, but on a voluntary basis and as strong action of a motivated local medical student association.²¹ Belgium has a limited introduction of such an educational program in few universities.²² Only a small percentage of US medical schools currently incorporate disaster medicine in their core curriculum.²³ In China, disaster medicine has not been included either in the undergraduate curriculum of medical schools nor in the continuing medical education.²⁴



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Figure 2. Students' Attitude about Disaster Medicine in the Training System.

In addition, the amount of dedicated time devoted to disaster medicine highlights the insufficient attention German medical schools are posing to the professionalization of future physicians in disaster and major incident management. The poll indicates that is less than one-half of that recommended in the German disaster medicine curriculum. Moreover, only students who engage in volunteer work benefit from training since the training courses are proposed, in the majority of cases, as an elective option either when lectures are delivered in university or in other institutions.

Findings from the responses to the section on specific disaster topics covered indicate poor compliance with the German disaster medicine curriculum. Uniformity in training plays a vital role in the recognition of a profession. In fact, standard curricula seek to homogenize terminology, methods, procedures, and organization in order to achieve appropriate consensus about common objectives.²⁵ The study shows that the knowledge level of disaster medicine was not satisfactory among German students. This is consistent with study results of medical students' knowledge of major incident and disaster conducted by Kaiser and colleagues, where few of them believed that they were receiving adequate education and training and only one-half of them felt they were sufficiently skilled to respond to a natural disaster or pandemic influenza.²⁶

Nevertheless, the sub-group of German students who had received lectures at their universities or in other institutions stated a higher self-perception of knowledge in nearly all categories.

To ensure that health care systems operate efficiently in the setting of a disaster or mass-casualty event, future physicians must begin to develop an understanding of their role in the context of a local or national response. The German students seem to be aware of this situation; most of the respondents find it necessary to add disaster medicine in their regular curriculum as a mandatory course.

The perception of the importance of disaster education and training among medical students has already been widely documented.^{24,26,27} In the Netherlands, 51% of surveyed students considered that disaster medicine should absolutely be taught in the regular medical curriculum,²⁰ and in Italy, 91.4% would welcome the introduction of a course on disaster medicine in their core curriculum.²⁸

It is a societal imperative to prepare all future physicians with the fundamentals to understand and respond, if needed, to the increasing threats from natural and human-caused events. Promoting and enhancing the training capacity in the field of disaster medicine is one of the "call-to-action requirements" requested by the international community. This study provides a necessary and timely window into the current disaster education

situation in Germany and facilitates a reflection about the actual implementation of the German disaster medicine curriculum, suggesting a renewal of the agreement between the German Ministry of Interior and universities.

Limitations

Since the survey was distributed widely through the student councils in Germany, it may be that the students who accepted to participate were those with a pre-existing interest in disaster medicine. It was not possible to control how many people received the questionnaire and if they participated or not. However, after the approval of the disaster medicine curriculum in German medical schools, this is the first comprehensive study that evaluates the level of its implementation across the country and the status of the perceived knowledge and interest of German medical students in this field. In addition, almost all universities with medical faculties were reached (36 out of 37). Nevertheless, the results have to be interpreted carefully, and the conclusions cannot be extrapolated to every medical student in Germany.

The authors recognize the potential presence of participation bias, which is likely to depend on numerous factors, including some of which the authors have no control. Since the diffusion of the invitation e-mail took place through the German student councils of the universities with medical faculties, correction for such bias in the analysis was not possible without relevant information on non-participants. However, the authors are aware that studies with lower participation rates can in some situations result in less bias.²⁹ Moreover, the demographic data of the

participants is similar compared to the total potential study population.³⁰

Another limitation was the use of dichotomous-choice questions, as opposed to a Likert scale. However, this was necessary to make the survey respondent-friendly and to simplify data collection and interpretation. Still, the opinion of this research group is that the study is promising, showing the needs of medical students in this unique bottom-up approach.

Conclusion

The results from this study provide a glimpse into the status of disaster medicine education in German medical schools and the degree of implementation of the proposed Pfenninger curriculum. No significant steps have been taken since the hand-over of the curriculum from the expert group to medical schools in Germany nine years ago. To date, only a small percentage of students have received various non-standardized training, and German medical students are inefficiently equipped to deal with disasters due to an overall lack of training on the subject matter. Despite this, the great majority of students believed that a mandatory course on disaster medicine should be part of the academic curriculum. These findings should alert university curricula designers and national authorities to do more in disaster education and training at the national level.

Supplementary Material

To view supplementary material for this article, please visit <https://doi.org/10.1017/S1049023X17000280>

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	Self-Perception of the Total Study Population			Self-Perception of Students with Lectures at Their Home University			Self-Perception of Students without Lectures at Their Home University			Self-Perception of Students with Lectures at Other Institutions			Self-Perception of Students without Lectures at Other Institutions		
	25%	med	75%	25%	med	75%	25%	med	75%	25%	med	75%	25%	med	75%
1. I know the terminology of disaster medicine, legal aspects, as well as the disaster classification.	0	1	2	0	1	2	1	2	3	0	1	1	1	2	3
2. I know the organization and leadership to deal with a large number of casualties.	0	1	3	0	1	3	1	2	3	0	1	2	2	3	3
3. I know how to deal with a number of patients, which is exceeding the normal capacity of the medical system.	0	1	3	0	1	3	1	2	3	0	1	2	2	3	3
4. I know how the basics about alarm and evacuation of hospitals in case of an external disaster.	0	1	1	0	1	1	0	1	2	0	0	1	1	1	2
5. I can evaluate the practicability of medical disaster response in practical examples.	0	1	2	0	1	2	1	1	2	0	1	1	1	2	3
6. I can use the principles of Triage in a pre-clinical and clinical setting.	0	1	3	0	1	3	1	2	3	0	1	2	2	3	3
7. I know the principles and the procedures of a necessary evacuation.	0	1	2	0	1	2	1	1	2	0	1	1	1	2	3
8. I know the basics of primary health care under disaster circumstances (life-saving procedures, treatment of shock).	3	3	4	2	3	3	3	3	4	2	3	3	3	3	4
9. I know the basics of specific health care under disaster circumstances (surgical emergency procedures, procedures after thermal damage).	1	2	3	1	2	3	1	2	3	1	1	2	2	3	3
10. I am aware of the medical management after accidents with radioactive materials and the decontamination of these.	0	1	2	0	1	1	0	1	2	0	0	1	1	2	2
11. I am aware of the management of transports of hazardous material and accidents as well as the management of mass intoxications with chemicals and decontamination.	0	1	1	0	1	1	0	1	2	0	0	1	1	2	3
12. I know the basics of ethical action in disaster medicine and the quality management in disaster response.	0	1	2	0	1	2	1	2	3	0	1	2	1	2	3
13. I know the basics of diseases triggered by disaster situations and the actions of psychosocial support in disaster situations.	1	2	3	1	1	2	1	2	3	0	1	2	1	2	3

Table 2. Self-Perception about the Knowledge of the Disaster Medicine Curriculum

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