

How To Handle Disaster? – Evaluation of a Course for Disaster Medicine and Humanitarian Assistance for Undergraduate Medical Students

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Research Article

Keywords: Disaster medicine, humanitarian assistance, undergraduate medical education, Germany, curriculum, crisis management, survey/questionnaires, medical students, disaster preparedness curriculum

Posted Date: April 16th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-377341/v1>

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Abstract

Background: Disaster medicine is a component of the German medical education since 2003. However, studies have shown some inconsistencies within the implementation of the national curriculum, and limits with the number of students trained over the years. Facing the SARS-CoV-2 pandemic and other disasters, it became much more important to train medical students in disaster medicine on a coordinated basis.

Methods: The University Clinic for Anaesthesiology and Intensive Care Medicine in Tübingen, Germany, expanded the existing curriculum of undergraduate disaster medicine training with fundamentals of humanitarian medicine, integrating the experience with distance learning, interactive teaching and simulation sessions. Survey tools were used to assess participants' previous experiences and interest in the field of disaster medicine, to compare the self-reported degree of knowledge before and after training, and the programme's quality evaluation. A mandatory pre- and post-test of knowledge was also administered to evaluate learner outcomes.

The prospective and cross-sectional study evaluates the pilot course *Disaster Medicine and Humanitarian Assistance* carried out for third-, fourth- and fifth- year medical students over five semesters during the period between 2018 and 2020.

Results: Data was collected from 107 students over five training sessions. Out of a sample of 82 students, the subjective perception of knowledge increased after the course ($t [81] = 24.426, p < .001$), alongside with the interest in engaging in the field of disaster medicine ($t[81$

$] = 7.031, p < .001$). 102 students entered the mandatory knowledge assessment, with the rate of correct answers passing from 73.27% in the pre-test to 95.23% in the post-test ($t [101] = 18.939, p < .001$).

The 93.46% of the medical students ($N = 100$) graded the training received with an excellent overall score (1.01 out of 6).

Discussion: The study indicates a significant increase in students' understanding of disaster medicine through the use of both subjective and objective measures, as well as an increase interest in the field of disaster and humanitarian medicine. The educational programme appears to address the deficiencies documented in previous studies, and possible adaptation with virtual reality approaches could expand access to a larger audience.

Conclusion: The programme offers an effective and comprehensive tool to address the urgent need of quality education for medical students, suggesting integrated strategies to implement disaster medicine training.

Background

Disaster medicine is becoming a more recognizable field in its own right. Its importance and necessity are underlined by both the number and intensity of disasters occurring globally (1, 2). The effects of global warming, overpopulation and industrialisation, on both national and international scale, will require a future generation of healthcare professional capable of practicing in austere and resource-constrained settings (3, 4). The current SARS-CoV-2 (Covid-19) pandemic is highlighting such restrictions, impacting both the daily life as well as the healthcare services provision. The rise of this global emergency caused an exceptional strain on our healthcare systems, emphasizing the need of educational programs to train future professionals to be able to assist in the disaster response (5).

As of 2003, disaster medicine became a component of German medical schools final examinations (6). In 2004 the “World Association for Disaster and Emergency Medicine (WADEM; Madison, Wisconsin USA)” pointed out the need of standards and guidelines for the education and training of all involved professions (7). Consequently in 2006 the German Ministry of Interior (Berlin, Germany), the German Society of Disaster Medicine (Kirchseeon, Germany) and the German Federal Office of Civil Protection and Disaster Assistance (Bonn, Germany) reacted on these recommendations by releasing a curriculum for disaster medicine education at German universities (8). Four years later, a 28 hours course consisting of fourteen modules was published by Pfenninger et al.(9). A nation-wide study published in 2017 however showed that German students were still not well educated in the field of disaster medicine. In addition, the curriculum of 2006 was not implemented as planned and the number of trained students was low (10) .

Methods

Curricular framework

Based on these startling findings, the University Clinic for Anaesthesiology and Intensive Care Medicine in Tübingen, Germany, developed a course based upon the existing curriculum adding the experiences of other international courses for undergraduate medical students (4, 8-14). The forty hours course is designed for medical students in their third to fifth years of medical school. Each of the 14 key modules from the 2006 curriculum are integrated. In addition, the theory and practice required by international disaster medicine in humanitarian emergencies is taught. Students are taught how to maximise the number of casualties saved within limited resource settings through a variety of interactive teaching and learning methods. Students must initially pass a 10 units e-learning course based on the international standards for humanitarian assistance lined out in *The Sphere Handbook in Action (15)*, before progressing to the residential part of the course. The residential part consists of 30 units and a week of training. This is comprised of a written pre-test, a written post-test, a feedback session and 14 theoretical and 13 practical teaching units. Modern teaching methods include computer-based simulations, table top exercises, skills training, role-play and full-scale live simulations. A meet-up on day one includes topical disaster medicine and humanitarian assistance films. A schedule of the residential part is provided in *table 1*.

The course is conducted by three experienced medical doctors from the University Clinic for Anaesthesiology and Intensive Care Medicine Tübingen and supported by the Tübingen centre for patient safety and simulation (TÜPASS), the local emergency services and fire department. The aim of this study is to present and evaluate a modern course for the German disaster medicine curriculum, and to assess its impact on undergraduate medical students.

Study design and population

This prospective and cross-sectional study evaluates the pilot course *Disaster Medicine and Humanitarian Assistance* carried out for a sample of volunteering third, fourth and fifth year medical students over five semesters during the period between 2018 and 2020. The course topics, times and concept as well as the lecturers remained the same over all the five courses.

Survey tool

Three survey tools were used. The first tool used a web-based, purpose-designed pre-course and post-course questionnaire in order to obtain information about the participants' subjective judgment of their increase in knowledge. The questionnaire consisted of five questions relating to previous experiences in the field of disaster medicine and a further 14 items, which were used to measure the self-reported degree of knowledge before and after the course according to the topics relevant in the curriculum. Additionally, four questions assessed the students' future interest in engaging in the field of disaster medicine using a 5-point Likert-Scale. Data was collected with the questionnaire software SurveyMonkey®, Version 2.0 (SurveyMonkey Europe; Dublin, Ireland). Participation was voluntary, anonymous and confidential. The participants signed an informed consent form for participation and publication of the assessed data during the course. Additionally the completion of the questionnaires implied participants' consent giving authors the right of use of the information provided.

The second tool was a compulsory pre- and post-test of knowledge at the beginning and end of the residential part of the course. Both were designed as multiple-choice tests with a single correct answer to each question. The test was used to obtain an objective measure of knowledge increase and course efficacy. It consisted of twenty questions out of the field of disaster medicine and another ten questions relating to Patient Triage. After matching pre- and post-test data, the students' names were removed for statistical analysis and an overall score was calculated for the pre- and post-test separately through addition of correct answers. Overall percentage scores of correct answers were determined and used for further analysis.

The third tool consisted of the anonymous evaluation system of the University of Tübingen, *tuevalon*, which is used to evaluate medical students' courses. The system is completely anonymous and used for all medical school courses in Tübingen. The survey contains ten items evaluating the content of the course, as well as six questions regarding contentedness with the lecturer's performance. For the present study, the content-related items were of greater interest and therefore reported qualitatively. The aim of

integrating this measure was to include information about the medical students' satisfaction with the course, while the previously named tools were performance-based and focused on learning outcomes.

Statistical Analysis

The collected data was exported from SurveyMonkey® to Microsoft Excel®, Version 2019 (Microsoft Corporation; Redmond, Washington USA). All analysis was performed with the dedicated statistics program IBM SPSS, Version 22 (IBM Deutschland GmbH; Ehningen, Germany). For the subjective judgement of knowledge questionnaire, overall pre- and post-test scores were obtained by calculating the mean values of the 14 knowledge-related items. Likewise, overall scores were obtained for the four future interest related items. Paired sample t-tests were conducted for analysis of differences between the overall scores before and after the course regarding medical students' knowledge and interest, including information regarding objective increases in knowledge. The paired sample t-test was used as first choice statistical test considering its robustness, despite slight violation of the normality assumption within the given data. All data generated or analysed during this study are included in this published article [and its supplementary information files].

Results

Subjective Judgment of Knowledge and Interest in Disaster Medicine

Data of $N = 107$ medical students was collected prior to the course. From these, 57% female participants ($n = 61$) answered the questionnaire. Participants were included from all 12 regular semesters with a median of semester 8. Because $n = 22$ participants did not complete the questionnaire after the course, and since the pseudonyms of $n = 3$ participants at the post-test could not be assigned to the corresponding pre-test data, the final sample size comprised $N = 82$ for statistical analysis. Within this sample, the medical students had no previous experience ($m = 1.29$, $SD = .02$) with answers ranging from "strongly disagree" (1) to "disagree" (2).

Statistical significant differences were identified in the participants' subjective perception of knowledge before and after the course ($t[81] = 24.426$, $p < .001$) indicating an increase of knowledge after the course (Figure 1A).

Likewise, students' future interest in engaging in the field of disaster medicine after the course showed a statistically significant increase ($t[81] = 7.031$, $p < .001$), although medical students' interest was already high prior to the course ($m = 3.85$, $SD = .54$), which could explain the small effect size (Figure 1B).

Objective Measurement of Knowledge

A total number of $N = 102$ medical students entered the compulsory pre- and post-multiple choice test of knowledge. Participants' rate of correct answers increased from 73.27% in the pre-test to 95.23% in the post-test, with this difference being statistically significant ($t[101] = 18.939$, $p < .001$) (Figure 2).

Regarding the evaluation system of the University of Tübingen, qualitative data of 93.46% of the medical students (N = 100) who had participated between 2017 and 2020 could be analysed. The course took place on five separate occasions and received an excellent overall grade of 1.01 out of 6 as rated by participants.

Discussion

This prospective and cross-sectional study provides an evaluation of the *Disaster Medicine and Humanitarian Assistance* pilot course over five semesters during 2018 to 2020, attended by third to fifth year medical students of the University of Tübingen, Germany. Changes in the medical students' subjective judgement and actual knowledge before and after their participation on the course, including their satisfaction of the course were assessed using three different tools. The study indicates a significant increase in students' theoretical understanding and practical knowledge in the field of disaster medicine, with both subjective and objective measures. Furthermore, the statistical analyses highlight both a further increase in students' future interest in the field of disaster medicine upon completion of the course including their overall satisfaction regarding the implementation of the course.

Not only are natural and human-caused disasters increasingly threatening the international community, but a severe lack in adequate disaster medicine education has also been identified (2017 published survey (10)). This has led to a rethink and renewal of the disaster medicine curriculum design as a whole. As a result, the *Disaster Medicine and Humanitarian Assistance* pilot course of the University of Tübingen was established, which displays an appropriate response to the "call-to-action requirements" of promoting and enhancing training capacity in the field of disaster medicine. Whereas former studies showed insufficient *objective* knowledge regarding disaster medical practices (10) as well as *subjective* insecurities about their skills and knowledge to deal with disaster scenarios (16), our *Disaster Medicine and Humanitarian Assistance* course overcomes these deficiencies. The training programme prepares future physicians with the fundamentals of analysis and response to disasters, and fulfils the desires of medical students for a comprehensive, wide-ranging and practically relevant course on disaster medicine and its inclusion as a pillar of academic curricula. Our study underlines the importance of the *Disaster Medicine and Humanitarian Assistance* course as a training tool for medical students, especially now, as the spread of a virus threatens the international community and pushes medical care systems to their limits (17). Even 13 years after the WADEM's call for the development of guidelines and training in disaster medicine (7), major deficiencies in the implementation of disaster medicine programmes have been observed in Europe and overseas. Efforts have been made to overcome the lack of training programmes in the past few years through establishment of a variety of courses. Within the published curricula however, great heterogeneity is observed. For example, while the Italian training program of the *Research Center in Emergency and Disaster Medicine (CRIMEDIM)* focuses purely on theoretical lectures (12), or some American approaches particularly address terror scenarios (18, 19), our Disaster Medicine and Humanitarian Assistance course comprehensively combines a multitude of teaching methods,

including use of disaster scenarios and involving ethical and psychological aspects. This variety was proved to be beneficial within this study. The course was delivered in small group sizes and the resulting close supervision of the learning process provided an individualization of the training programme, encouraging immediate feedback with the added benefit of guiding practical modules and enabling deeper learning of topics of special interest. Furthermore, with particular respect to the field of disaster medicine, our course addressed the importance of communication and effective group work with both known and unknown interdisciplinary staff, and how this is crucial to the team functioning and subsequently the achievement of any goals and effectiveness of outcomes. The final practical triage exercise was consistently mentioned to be the medical students' highlight. Although there are existing computer simulations, we designed the triage exercise as a live simulation, so that medical students could apply their theoretical and practical knowledge in an appropriate context, providing a more realistic framework of learning.

Limitations

Although we assessed the increase in knowledge through pre- and post-measurement of objective and subjective learning, we did not evaluate the acquired practical skills. Our results may therefore not be valid regarding the amount of practical application of the gained theoretical knowledge within this course.

We cannot exclude participation bias within our data, as not all medical students completed the post-test regarding their subjective judgement of knowledge. It may be that our data is restricted to those who felt confident about their gained knowledge or who had been satisfied with the course – hence, careful interpretation of these results is required. Noteworthy, was that medical students' interest in working in the field of disaster medicine was high prior to course attendance. This was also reflected in the pre-test's results, where the mean percentage of correct answers was already around 75%, showing a preliminary knowledge on the topics covered in the course.

Conclusion

With its multi-method, comprehensive, well-developed foundation and practical relevance, the *Disaster Medicine and Humanitarian Assistance* course provides an appropriate response to the urgent need for effective disaster medicine training programs, that prepare future physicians with the fundamentals to understand and respond to threats from natural and human-caused disasters. The course increased both subjective and objective levels of medical students' knowledge significantly, and for its strengths received consistently positive feedback. Further effort must be made to develop national and international training programmes, which should be a mandatory component of medical schools' curricula. The development and successful implementation of this pilot course is a first step towards fulfilling disaster medicine education requirements. Future studies should hence include an objective measurement of the medical students' practical performance, which could, for example, be attained during computer or full-scale simulations. Furthermore, the comparison of a broader range of approaches could give an insight in the

efficacy of different disaster medicine training programs in general, and different teaching methods in particular.

As the final full-scale simulation is resource intensive, virtual reality (VR) adaptations could be considered as an alternative to more quickly implement the course to a larger number of medical schools on a national and international level (20). Future studies could focus on the implementation and effectiveness of VR-adaptations in disaster medicine courses.

Nevertheless, it is necessary to further enhance international exchange and interdisciplinary communication in the field of disaster medicine.

Abbreviations

CRIMEDIM Research Center in Emergency and Disaster Medicine

VR Virtual Reality

WADEM World Association for Disaster and Emergency Medicine

TÜPASS Tübingen centre for patient safety and simulation

Declarations

Ethics approval and consent to participate

The local Ethics Committee of the University of Tübingen, Tübingen, Germany, deemed the study exempt from institutional review approval under the project number 751/2019A. The survey followed the ethical directives of the Helsinki declaration. The participants signed an informed consent form for participation and publication of the assessed data during the course.

Consent for publication

The participants signed a consent form for publication of data assessed at the beginning of the course.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

The implementation of the course in disaster medicine and humanitarian assistance was financed by the development fund “PROFILplus” from the medical faculty of the University of Tübingen, Germany.

Author's contribution

RW developed the concept of this study and contributed to all aspects of this manuscript including supervision of the data collection process, interpretation of the results and drafting of the first manuscript. SH contributed substantially to all aspects of this manuscript including data collection, structuring and analyses, interpretation of the results and drafting of the first manuscript. JG developed statistical strategies for data analysis and reviewed the manuscript critically. FW, SA and ES contributed equally and substantially to data collection and data analyses. PR contributed and critical revision of the manuscript. All authors approved the final manuscript.

Acknowledgements

We thank Francesco Babero, RN, MSc. (Queen Mary University of London, Institute of Population Health Sciences, London, Great-Britain) and Jan Griewatz (Competence Centre for University Teaching in Medicine Baden-Wuerttemberg, University of Tübingen, Tübingen, Germany) who carried out the contentual proof reading; Periklis Nikomanis (SLK Kliniken Heilbronn, Heilbronn, Germany) and Eleonora Gorgati (University of Modena and Reggio Emilia, Modena, Italy) the linguistically proof-reading.

Conflicts of interest: none

References

1. Watts N, Amann M, Ayeb-Karlsson S, Belesova K, Bouley T, Boykoff M, et al. The Lancet Countdown on health and climate change: from 25 years of inaction to a global transformation for public health. *Lancet* (London, England). 2018;391(10120):581–630.
2. International Federation of Red Cross and Red Crescent Societies. World Disaster Report 2020, Executive Summary. 2020 [Available from: https://media.ifrc.org/ifrc/wp-content/uploads/2020/11/IFRC_wdr2020/IFRC_WDR_ExecutiveSummary_EN_Web.pdf].
3. McMichael T, Montgomery H, Costello A. Health risks, present and future, from global climate change. *BMJ* (Clinical research ed). 2012;344:e1359.
4. Bajow N, Djalali A, Ingrassia PL, Ragazzoni L, Ageely H, Bani I, et al. Evaluation of a new community-based curriculum in disaster medicine for undergraduates. *BMC Med Educ*. 2016;16(1):225.
5. Ashcroft J, Byrne MHV, Brennan PA, Davies RJ. Preparing medical students for a pandemic: a systematic review of student disaster training programmes. *Postgraduate medical journal*. 2020.
6. Bundesministerium der Justiz [Federal Ministry of Justice]. Approbationsordnung für Ärzte 2013 [Available from: http://www.gesetze-im-internet.de/_appro_2002/BJNR240500002.html].
7. Archer F, Seynaeve G. International guidelines and standards for education and training to reduce the consequences of events that may threaten the health status of a community. A report of an Open

- International WADEM Meeting, Brussels, Belgium, 29–31 October, 2004. *Prehosp Disaster Med.* 2007;22(2):120–30.
8. Schutzkommission beim Bundesminister des Inneren [Ministry of the Interior], DGKM, BBK. Konzept zur katastrophenmedizinischen Ausbildung im studentischen Unterricht an deutschen Hochschulen [Concept for the training of students at German medical schools] 2006 [Available from: http://www.dgkm.org/files/downloads/katastrophenmedizin/Curriculum_Katastrophenmedizin.pdf].
 9. Pfenninger EG, Domres BD, Stahl W, Bauer A, Houser CM, Himmelseher S. Medical student disaster medicine education: the development of an educational resource. *Int J Emerg Med.* 2010;3(1):9–20.
 10. Wunderlich R, Ragazzoni L, Ingrassia PL, Corte FD, Grundgeiger J, Bickelmayer JW, et al. Self-Perception of Medical Students' Knowledge and Interest in Disaster Medicine: Nine Years After the Approval of the Curriculum in German Universities. *Prehosp Disaster Med.* 2017:1–8.
 11. Bajow NA, Alawad YI, Aloraifi SM. A Basic Course in Humanitarian Health Emergency and Relief: A Pilot Study from Saudi Arabia. *Prehosp Disaster Med.* 2019:1–8.
 12. Ingrassia PL, Ragazzoni L, Tengattini M, Carengo L, Della Corte F. Nationwide program of education for undergraduates in the field of disaster medicine: development of a core curriculum centered on blended learning and simulation tools. *Prehosp Disaster Med.* 2014;29(5):508–15.
 13. Ragazzoni L, Ingrassia PL, Gugliotta G, Tengattini M, Franc JM, Corte FD. Italian medical students and disaster medicine: awareness and formative needs. *Am J Disaster Med.* 2013;8(2):127–36.
 14. Back DA, Lembke V, Fellmer F, Kaiser D, Kassermann N, Bickelmayer J, et al. Deployment and Disaster Medicine in an Undergraduate Teaching Module. *Military medicine.* 2018;184(5–6):e284-e9.
 15. Sphere Association. The Sphere Handbook in Action Geneva2016 [Available from: <https://learning.spherestandards.org/>].
 16. Kaiser HE, Barnett DJ, Hsu EB, Kirsch TD, James JJ, Subbarao I. Perspectives of Future Physicians on Disaster Medicine and Public Health Preparedness: Challenges of Building a Capable and Sustainable Auxiliary Medical Workforce. *Disaster Medicine and Public Health Preparedness.* 2009;3(4):210–6.
 17. Verelst F, Kuylen E, Beutels P. Indications for healthcare surge capacity in European countries facing an exponential increase in coronavirus disease (COVID-19) cases, March 2020. *Euro surveillance: bulletin Europeen sur les maladies transmissibles = European communicable disease bulletin.* 2020;25(13).
 18. Cole LA, Natal B, Fox A, Cooper A, Kennedy CA, Connell ND, et al. A Course on Terror Medicine: Content and Evaluations. *Prehosp Disaster Med.* 2016;31(1):98–101.
 19. Wiesner L, Kappler S, Shuster A, DeLuca M, Ott J, Glasser E. Disaster Training in 24 Hours: Evaluation of a Novel Medical Student Curriculum in Disaster Medicine. *J Emerg Med.* 2018;54(3):348–53.
 20. Gout L, Hart A, Houze-Cerfon CH, Sarin R, Ciottoni GR, Bounes V. Creating a Novel Disaster Medicine Virtual Reality Training Environment. *Prehosp Disaster Med.* 2020;35(2):225–8.

Table

Lecture	Time	Monday	Tuesday	Wednesday	Thursday	Friday
Registration	09.45-10.00					
1	10.00 - 10.45	Registration, program, pre-test	Safety and security	Ethics and psychosocial support in disaster settings	Humanitarian assistance in international disasters	Debriefing full-scale exercise
2	10.45 - 11.30	Basics of disaster medicine	Triage in a mass casualty incident	Clinical response in disaster settings	Humanitarian Assistance in international disasters	Post-test
Coffee Break	11.30-11.45					
3	11.45 - 12.30	Terminology and law in disaster medicine	Triage in a mass casualty incident (computer based simulation)	Clinical response in disaster settings (computer based simulation)	The international coordination- and cluster-system of the United Nations	Possibilities for medical students and young doctors in disaster medicine and humanitarian assistance
4	12.30 - 13.15	Preclinical approaches in disaster settings	Triage in a mass casualty incident (computer based simulation)	Clinical response in disaster settings (computer based simulation)	Working with the Sphere Standards in Humanitarian Assistance	Feedback and closure
Lunch Break	13.15-14.15					
5	14.15 -15.00	Preclinical approaches in disaster settings (table-top exercise)	Accidents with CBRN materials and decontamination	First aid in disaster medicine (skill-training parcours)	Humanitarian mission (table-top exercise)	
6	15.00 - 15.45	Preclinical approaches in disaster settings (table-top exercise)	Excursion to the CBRN response unit at fire brigade Tübingen	First aid in disaster medicine (skill-training parcours)	Humanitarian mission (table-top exercise)	
Coffee Break	15.45-16.00					
7	16.00-17.30	Get together (voluntary)	Film about humanitarian assistance (voluntary)	Film about Ebola response (voluntary)		
8	19.00 - 19.45				Disaster response (full-scale exercise)	
9	19.45 - 20.30				Disaster response (full-scale exercise)	
		Seminar		Exercise/ Simulation		Organisational

Table 1: Timetable of the disaster medicine and humanitarian assistance course

Figures

Subjective Ratings

A. Knowledge

B. Interest

Pre-Test
Post-Test

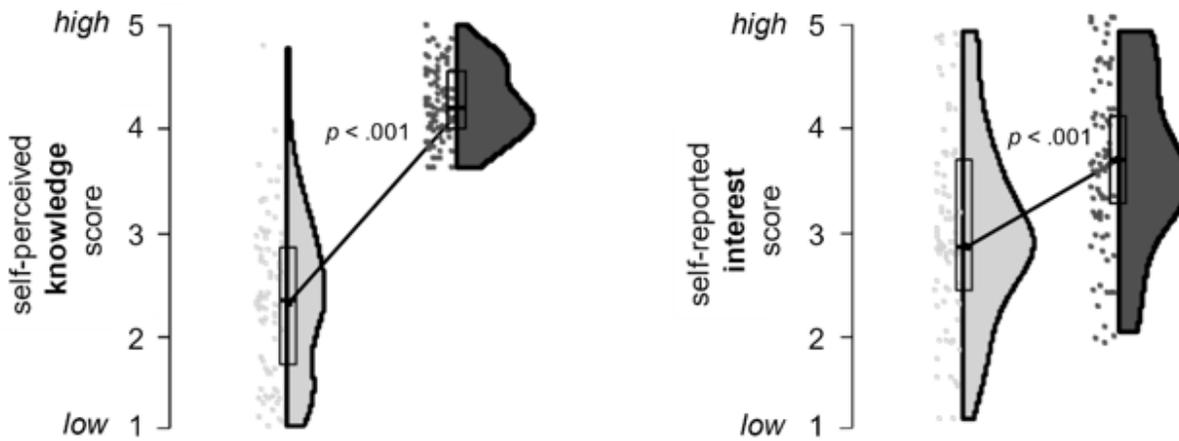


Figure 1

Self-perception of knowledge ratings (1A) and interest (1B) in disaster medicine and humanitarian assistance pre-course and post-course.

Percentage of Correct Answers to the Compulsory Multiple Choice Test of Knowledge

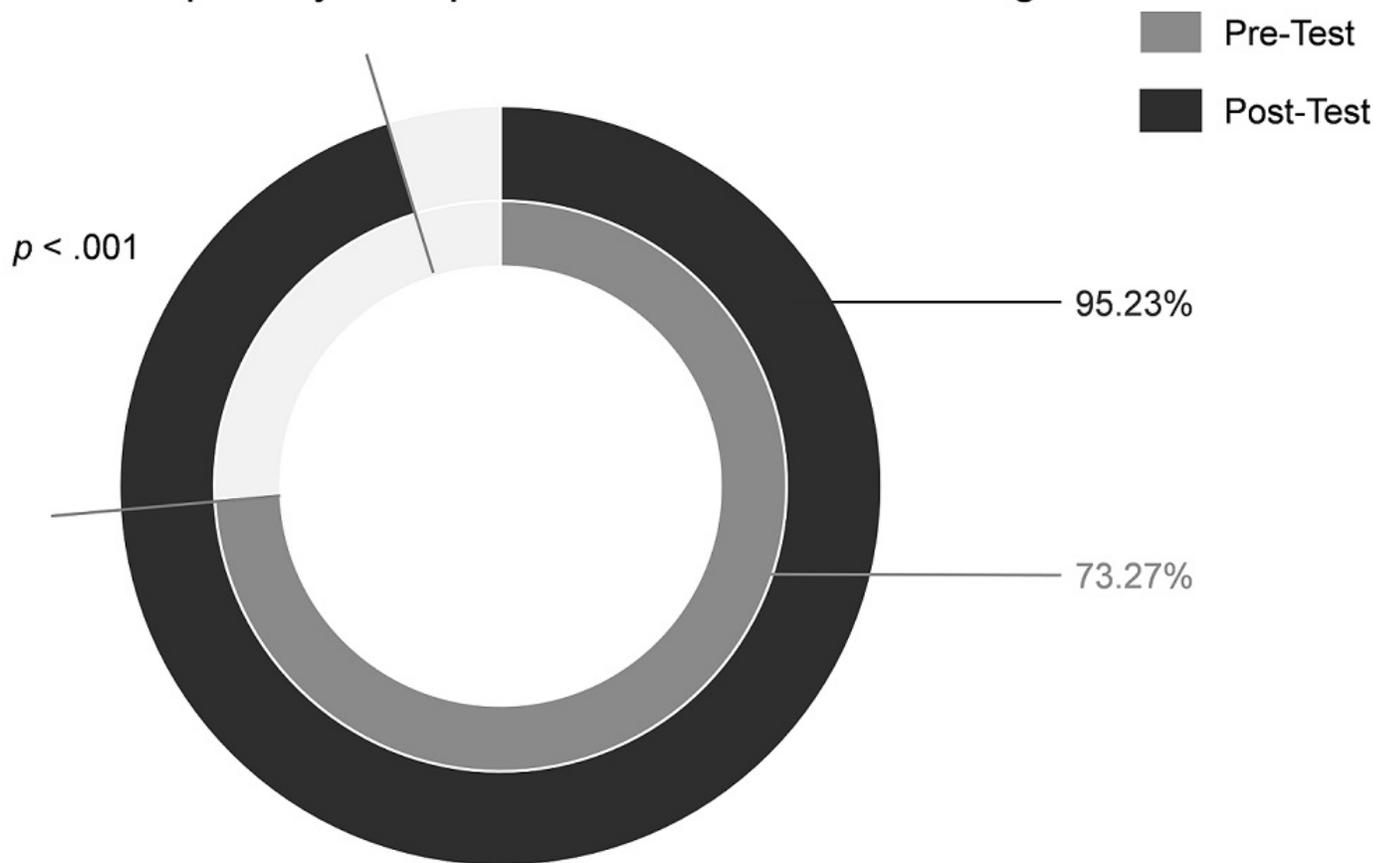


Figure 2

Correct Answers to the Multiple Choice Test of Knowledge in disaster medicine and humanitarian assistance.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [01SubjectiveSelfAssessmentQuestionnaire.pdf](#)
- [02Rawdatasubjectivejudgementofknowledge.pdf](#)
- [03ObjectiveMultipleChoiceTestsGerman.pdf](#)
- [04Rawdataobjectivemeasurementofknowledge.pdf](#)
- [05EvaluationofthecoursewithuniversitysoftwaretuevalonGerman.pdf](#)