

Undergraduate medical education in Germany

Medizinstudium in Deutschland

Abstract

The purpose of this article is to give international readers an overview of the organisation, structure and curriculum, together with important advances and problems, of undergraduate medical education in Germany. Interest in medical education in Germany has been relatively low but has gained momentum with the new "Regulation of the Licensing of Doctors" which came into effect in 2003. Medical education had required substantial reform, particularly with respect to improving the links between theoretical and clinical teaching and the extension of interdisciplinary and topic-related instruction. It takes six years and three months to complete the curriculum and training is divided into three sections: basic science (2 years), clinical science (3 years) and final clinical year. While the reorganisation of graduate medical education required by the new "Regulation of the Licensing of Doctors" has stimulated multiple excellent teaching projects, there is evidence that some of the stipulated changes have not been implemented. Indeed, whether the medical schools have complied with this regulation and its overall success remains to be assessed systematically. Mandatory external accreditation and periodic reaccreditation of medical faculties need to be established in Germany.

Keywords: undergraduate medical education, Germany, reform

Zusammenfassung

Dieser Artikel soll internationalen Lesern einen Überblick über die Organisation, die Struktur und das Curriculum des Medizinstudiums sowie über wichtige aktuelle Fortschritte und Probleme in der medizinischen Ausbildung in Deutschland geben. Das Interesse an der Qualität der medizinischen Ausbildung war vor der 2003 in Kraft getretenen neuen Approbationsordnung (AppOÄ) relativ gering. Das Medizinstudium war reformbedürftig, insbesondere in Bezug auf die Verbindung von theoretischen Inhalten und praktisch-klinischer Lehre sowie die interdisziplinäre Vermittlung von Kerninhalten. Das Medizinstudium dauert sechs Jahre und drei Monate und wird in drei Abschnitte unterteilt: Vorklinik (2 Jahre), Klinik (3 Jahre) und „Praktisches Jahr“. Auch wenn die durch die neue AppOÄ notwendigen Reformen an vielen Stellen hervorragende Lehrprojekte hervorgebracht haben, gibt es dennoch Hinweise darauf, dass die geforderten Veränderungen nicht überall umgesetzt werden konnten. Eine systematische Evaluation zur Umsetzung der neuen AppOÄ durch die medizinischen Fakultäten steht noch aus. Eine verpflichtende externe periodische Evaluation der medizinischen Fakultäten muss in Deutschland erst noch etabliert werden.

Schlüsselwörter: Medizinstudium, Deutschland, Reform

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Table 1: German medical schools
(URLs see Attachment 1)

City	University
Aachen	Rheinisch-Westfälische Technische Hochschule*
Berlin	Freie Universität Berlin/Humboldt-Universität*
Bochum	Ruhr-Universität Bochum*
Bonn	Rheinische Friedrich-Wilhelms-Universität
Dresden	Technische Universität Dresden
Düsseldorf	Heinrich-Heine-Universität
Erlangen-Nürnberg	Friedrich-Alexander-Universität
Essen	Universität Duisburg-Essen
Frankfurt am Main	Johann Wolfgang Goethe-Universität
Freiburg	Albert-Ludwigs-Universität
Gießen	Justus-Liebig-Universität
Göttingen	Georg-August-Universität
Greifswald	Ernst-Moritz-Arndt-Universität
Halle-Wittenberg	Martin-Luther-Universität
Hamburg	Universität Hamburg
Hannover	Medizinische Hochschule Hannover
Heidelberg	Ruprecht-Karls-Universität*
Heidelberg-Mannheim	Universität Heidelberg/Medizinische Fakultät Mannheim
Jena	Friedrich-Schiller-Universität
Kiel	Christian-Albrechts-Universität
Köln	Universität zu Köln*
Leipzig	Universität Leipzig
Lübeck	Universität zu Lübeck
Magdeburg	Otto-von-Guericke-Universität
Mainz	Johannes Gutenberg-Universität
Marburg	Philipps-Universität
München	Ludwig-Maximilians-Universität
	Technische Universität München
Münster	Westfälische Wilhelms-Universität
Regensburg	Universität Regensburg
Rostock	Universität Rostock
Saarbrücken/Campus Homburg	Universität des Saarlandes
Tübingen	Eberhard-Karls-Universität
Ulm	Universität Ulm
Witten/Herdecke	Universität Witten/Herdecke*
Würzburg	Julius-Maximilians-Universität

* Faculties offering an experimental curriculum

Background

In Germany, lectures in medicine were first given in 1388 in Heidelberg. The latest medical faculty was founded in Witten-Herdecke in 1992. Medical education in this country was once praised as a role model e.g. for American medical education by Abraham Flexner [1]. Nowadays, however, the German medical faculties are looking towards the United States [2], Canada, and other European countries such as the United Kingdom and the Netherlands for good examples to follow.

Germany has about 80,000 medical students studying in 36 medical faculties (Table 1, list with URLs see Attachment 1) [3]. Each year 10,000 new students start medical education and about 6000 students graduate every year. Geographic distribution of medical faculties in Germany reflects historic developments rather than population density (Figure 1).

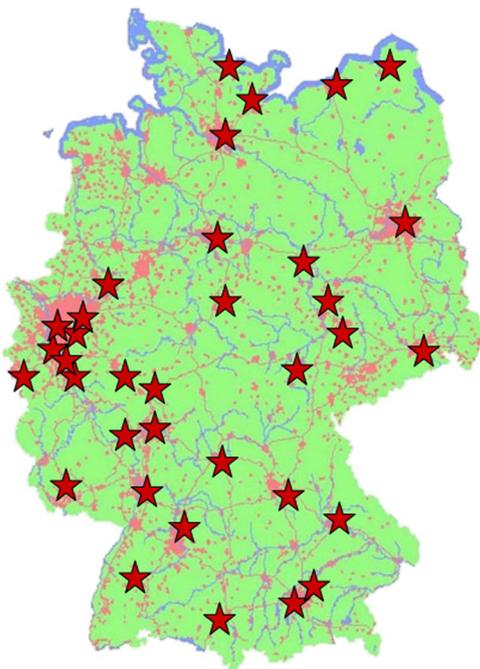


Figure 1: Medical faculties in Germany

It is estimated that 180,000 Euros are required to cover the cost of teaching for each graduating medical student in Germany [3]. This compares to 260,000 Euros in the United Kingdom [4]. All but one medical faculty (Witten-Herdecke) are state universities, and until recently higher (undergraduate) education was free – now a few states charge up to 500,- € tuition per semester which is low in comparison to fees required for example in the United States [5]. Grants and student loans are available [6]. Given this background, the aim of this article is to provide international readers with an overview of the organisation, structure and curriculum of undergraduate medical education in Germany following the introduction of the new "Regulation of the Licensing of Doctors". This narrative review is based on data available from official organisations, relevant German medical journals generally not listed in Medline or EMBASE, and on personal experience. It is therefore likely to serve as a reference for reports of research in medical education in Germany and could also help international medical staff seeking to assess medical students taught in Germany who are applying for elective clerkships abroad.

Structure and curriculum of medical education

The new regulation of the licensing of doctors

German Medical Education has not been described in international journals since the new "Regulation of the Licensing of Doctors" [*Approbationsordnung für Ärzte* (AppOÄ)], which came into effect in 2003 [7], [8], [9]. This

structural reform became necessary when reports from governmental and non-governmental institutions concluded that medical education in Germany did not meet actual requirements in medical care or stipulations from the European Union [10], [11]. While interest in medical education in Germany was relatively low compared to e.g. The Netherlands or the United Kingdom, it has now gained momentum with the new AppOÄ, which required substantial changes in the curriculum. The main changes are [8]:

- Incorporation of the changed requirements in medical care
- Linkage of theoretical and clinical instruction
- Extension of interdisciplinary and topic-related instruction
- Improvement of bedside training, reduction of lectures
- Reform of examinations
- Strengthening of General Practice
- Evaluation of teaching
- Improving pain management and palliative care

Although of limited importance to medical faculties, for graduating medical students the most tangible change represented the abolishment of the lowly paid 18-month internship [*Arzt im Praktikum* (AiP)] before obtaining the full license to practise medicine [12].

In the following description of the medical curriculum and in the discussion, the main goals of the new AppOÄ will be referred to.

Admission criteria for medical students

With few exceptions, the General Certificate of Aptitude for Higher Education [*Abitur*] is a prerequisite for admission to higher education in a university. It usually requires 12 or 13 years of schooling. Roughly 39% of all school children will obtain the *Abitur* [13]. The *Abitur* cannot be compared to a high school diploma in the United States; it is closer to the associate degree of US colleges. Secondary school diplomas obtained inside the European Union are mutually recognised; however students with diplomas obtained outside the European Union have to apply for a certificate of equivalence. Undergraduate education e.g. preparatory classes for medical school, prevalent in some countries, do not exist in Germany. Therefore, the term undergraduate or graduate education does not apply in the strict sense.

In Germany, the average age of medical students is 21.4 years when they start medical school [14]. There are several reasons for this. Germany still has mandatory service of nine months for men either in the military or an alternative civilian service [*Zivildienst*] for conscientious objectors. Additionally due to waiting time or professional training in other areas, a significant proportion of students are older. Although there is no formal regulation, an age of 40 years is considered the upper limit for entering medical school. Similar to many other countries, the number of women studying medicine has increased steadily and is now exceeding the proportion of male

students [15]. This however is not yet reflected in higher academic ranks.

Selection of medical students

The number of applicants to medical schools largely exceeds the number of available places; therefore admission is subject to restrictions [*numerus clausus*]. On average four to five prospective students apply for each place, however there are large differences between the faculties. In Germany, application to medical schools is administered by a federal organisation, the Central Office for the Allocation of Places in Higher Education [*Zentralstelle für die Vergabe von Studienplätzen (ZVS)*] [16]. Criteria for admission are the overall Abitur grade, which is roughly comparable to the American Grade Point Average (GPA), and waiting time. The Abitur is considered the best predictor for successful completion of the curriculum [17]. Each student can rank and apply to 6 medical schools at once. The majority of medical students (80%) used to be admitted by this process and there is a quota for foreign medical students and the military.

The proportion of students who are selected by the medical schools themselves is supposed to increase to 60%. Usually students apply with a letter of motivation to medical schools. After screening the applications a few are invited for interview [18]. However the process is time consuming and sometimes the number of applicants is overwhelming. Therefore faculties find it difficult to motivate faculty members to participate in the selection process. There is also often no consensus on the criteria that should be used to select future doctors. Given this situation, the nationwide medical admission test [*Test für Medizinische Studiengänge (TMS)*], which had been abandoned in 1997, has been reintroduced by some faculties [19]. The TMS is comparable to the American Medical college admission test (MCAT) [20]. The TMS is not mandatory but allows students to improve their score and their chance of being selected to come for an interview.

Structure of the curriculum

In Germany, medical education is structured, not in years like many other countries, but in semesters or in a few instances, trimesters (Hamburg, Hannover). It takes six years (12 semesters) and three months to complete the curriculum, however on average, students require 6.8 years [3]. The curriculum is divided into three sections (Table 2):

- Basic science (2 years)
- Clinical science (3 years)
- Clinical year (1 year)

The majority of medical students follow this track. Some medical faculties have chosen to offer an experimental curriculum [*Modellstudiengang*] which offers an alternative process to becoming a doctor (Table 1) [21].

Basic science [Vorklinik]

The content and structure of the basic science section (also preclinical science) has remained largely unchanged. The main topics are anatomy, physiology, biochemistry and social sciences (Table 2). Courses are usually not graded beyond pass or fail. The distinction between clinical and basic science has been criticised and graduate students have rated large parts of the curriculum as clinically irrelevant [22]. Therefore there are increased efforts to place basic science in a clinical context [23], [24]. A three month nursing stage is a mandatory part of the basic science section to ensure first patient contact. However private institutions are increasingly offering additional preparatory classes, which might indicate the failure of the faculties to provide the necessary skills and knowledge to pass the state medical licensing examinations.

Clinical science [Klinik]

The clinical science section covers 21 medical specialties as listed in Table 2. Previously each subject was taught separately. Now subjects are often taught in interdisciplinary teaching modules e.g. a “head module” combining Ear, Nose & Throat Medicine with Ophthalmology [25]. Additionally 12 new interdisciplinary teaching modules [*Querschnittsbereiche*] have been introduced (Table 3). Usually the first year is dedicated to the introduction of the clinical sciences with basic skill training in history taking and physical examination, general pathology, general microbiology, general pharmacology and laboratory medicine. Traditionally the clinical science section consisted mainly of lectures and seminars with limited patient exposure. To strengthen clinical experience, mandatory clerkships [*Blockpraktikum*] have been introduced in Internal Medicine, General Surgery, Paediatrics, Obstetrics & Gynaecology and General Practice. It is notable that a clerkship in Psychiatry, which is considered a core subject in many countries, is not mandatory. Clinical skills labs have been newly established in most faculties [26]. Additionally students have to complete four one-month elective clerkships, traditionally called *Famulatur* [*famulus* latin: servant]. One clerkship has to be completed in the ambulatory setting. It is very popular to perform at least one elective outside Germany with a preference for English speaking countries.

Clinical year [Praktisches Jahr: PJ]

The final year is divided into three full-time clinical rotations, each lasting about 4 months (Table 2). Rotations in Internal Medicine and Surgery are mandatory and one rotation can be freely chosen from all the clinical specialties. Previously, the final year had been restricted to hospital based training sites. The new AppOÄ made it possible for the first time to complete a clinical rotation in an ambulatory setting, e.g. in General Practice [27].

Table 2: Overview of the general structure of undergraduate medical education in Germany

Semester	Section	Courses	Clerkship/stages
1	Preclinical basic sciences	<ul style="list-style-type: none"> ▪ Anatomy ▪ Histology ▪ Biology ▪ Chemistry ▪ Biochemistry ▪ Physiology ▪ Psychosocial sciences ▪ Terminology 	<ul style="list-style-type: none"> ▪ 3-months nursing stage ▪ Basic live support training/ first aid
2			
3			
4			
first part of the medical licensing examination (Physikum)			
1	Clinical sciences	<ul style="list-style-type: none"> ▪ Anaesthesiology ▪ Occupational medicine & social medicine ▪ Ophthalmology ▪ General practice ▪ General surgery ▪ Dermatology ▪ Obstetrics & gynaecology ▪ Ear, nose and throat medicine ▪ Medical genetics ▪ Hygiene, microbiology & virology ▪ Internal medicine ▪ Paediatrics ▪ Clinical chemistry & laboratory medicine ▪ Neurology ▪ Orthopaedic surgery ▪ Pathology ▪ Pharmacology & toxicology ▪ Psychiatry ▪ Psychosomatic medicine ▪ Forensic medicine ▪ Urology ▪ Elective courses ▪ Interdisciplinary modules (Table 3) 	<p>Mandatory clerkships*</p> <ul style="list-style-type: none"> ▪ Internal medicine ▪ General surgery ▪ Paediatrics ▪ Obstetrics & gynaecology ▪ General practice <p>*duration not specified</p> <p>Elective clerkships</p> <ul style="list-style-type: none"> ▪ Four one-month clerkships
2			
3			
4			
5			
6			
Final year	Clinical year	Internal medicine	
		General and/or orthopaedic surgery	
		Clinical specialty at the choice of the student	
second part of the medical licensing examination			

Table 3: Interdisciplinary teaching modules [*Querschnittsfächer*]

1. Epidemiology, medical biometry and medical informatics
2. History, theory, ethics of medicine
3. Health economy, health system, public health services
4. Infectious diseases & immunology
5. Pathology rounds
6. Environmental medicine
7. Medicine of aging and elderly (Geriatrics)
8. Emergency medicine
9. Clinical pharmacology & pharmacotherapy
10. Prevention and health promotion
11. Imaging techniques, radiotherapy & radioprotection
12. Rehabilitation, physical medicine & complementary and alternative medicine

Students usually assume more responsibilities gradually during the final year, comparable to a sub-internship. Legal issues regarding delegation and liability limit students' opportunity to gain hands on experience [28]. Hospitals often rely on the work accomplished by the final year students [PJler]. Unfortunately, taking blood samples and inserting intravenous lines, which is done by auxiliary nurses in most other countries, keeps PJ students busy [29]. It is generally taken for granted that students learn skills on the job, but the degree of supervision and instruction varies widely [30]. Multiple projects to improve the quality of teaching in the clinical year have been presented and only a few can be cited here [31], [32].

As the German-speaking region of Switzerland offers a basic remuneration to final year students, there is a debate as to whether students should be paid. With the increasing shortage of physicians, some teaching hospitals are known to make special efforts to retain some students for postgraduate training.

Examinations

Until the new AppOÄ, the achievements of medical students in courses and clerkships were evaluated simply with a pass or fail. Only state licensing examinations were graded. From the faculties perspective the most radical changes with the new regulations for medical education were 1. the requirement to grade each course and clerkship and 2. the reduction of the number of licensing examinations from three to two. Grades are given on an ordinal scale ranging from 1 (excellent) to 5 (fail).

Strengthening the responsibility of faculties had mixed effects. Previously faculties invested only a minimal effort with respect to examinations. This was left to the centrally organised state licensing examination administered by state authorities [Landesprüfungsamt]. Students received certificates [Scheine] with little or no formal assessment in each of the subjects required in order to register for the licensing examinations. Most often physical attendance during the course was sufficient to obtain the course certificate. Only a few subjects such as anatomy required time consuming oral examinations. Previously, on the final licensing examination certificate only one summative grade of the written multiple choice exams and the final oral examination appeared on the diploma.

Now each subject must be graded and appears on the final diploma. On the one hand this has led to the introduction of modern assessment tools to evaluate practical skills like the objective structured clinical examination (OSCE) in several faculties [33]. On the other hand time and staff consuming examinations turned out to be a burden especially for smaller departments. For example psychosocial sciences in the preclinical section had to stop administering oral exams exceeding their staff capacities.

The new licensing examination consists of a written test with multiple choice questions (MCQs) and an (unstructured) oral examination. The administration and development of MCQs continues to be organised by the Institute

for medical and pharmaceutical examination questions [Institut für Medizinische und Pharmazeutische Prüfungsfragen (IMPP)] [34]. Although each medical faculty has its own curriculum, the IMPP has a catalogue of topics covered by the written exams [Gegenstandskatalog].

The first part of the medical licensing examination [Erster Abschnitt der Ärztlichen Prüfung], traditionally called "Physikum", is the first hurdle students have to take. In order to proceed to the clinical section, this examination must be passed. The average initial failure rate is roughly 20%. The examination can be repeated twice; about 5% of all students never pass. This exam is not equivalent to the USMLE step 1 (United States Medical Licensing Examination).

The new second part of the medical licensing examination [Zweiter Abschnitt der Ärztlichen Prüfung] of the clinical year has colloquially been termed "Hammerexamen" which can roughly be translated as "monster exam". It has replaced three previously separate examinations and covers the entire spectrum of the clinical sciences. It consists of a written exam and a combined oral and practical exam. This exam lives up to its nickname since the previously low failure rate associated with the written part rocketed from 2% to 9%. Only a few students fail the oral and practical examination, which is only one of several reasons that this exam format has been criticised [35]. It is also felt that final year students are less well prepared than previous generations who took the last written examination before entering the clinical year. It is suspected that students focus on preparing for the "monster exam" and are distracted from clinical practical work and learning [36]. It had been hoped that the tendency of the IMPP to create multiple choice questions around rare syndromes would be abandoned in favour of more interdisciplinary and clinically relevant topics. Although the new case-based format still consisting of multiple choice questions is considered a significant improvement, remembering medical oddities and irrelevant facts still remains important [37].

Ranking of medical faculties

Ranking of faculties is rather new in Germany and, as elsewhere, dependent on the selection criteria. The German Academic Exchange Service has ranked medical faculties in various topics including research, infrastructure and student evaluation [38]. Ranking based on students' performance in state licensing examination is also available [39]. Adjustment for differences in allocation of resources per capita or the proportion of foreign medical students has a significant impact on ranking.

Title

A student who passes the final licensing examinations is awarded a license to practice medicine [Approbation als Arzt], but does not receive an academic degree with an academic title [40]. Graduates are authorised to use the German professional title *Arzt/Ärztin* (Physician), but are

generally addressed informally with the honorary title "Dr." [*Doktor*]. As in other countries, writing a dissertation/thesis is an option required to obtain the academic degree "Dr. med.". It is estimated that 70% of all graduates will eventually complete a dissertation, which is perceived to be important for career promotion and to attract patients [41].

Discussion

Implementation of reforms in medical education

Excellent doctors are the result of an excellent medical education. The new "Regulation of the Licensing of Doctors (AppOÄ)" has certainly fostered important improvements in the education of medical students in Germany. The increased interest in medical education is documented by the dynamic development of the German Society for Medical Education [*Gesellschaft für Medizinische Ausbildung*] [42] and the introduction of the first post-graduate Master of Medical Education (MME) programme in Germany in 2005 [43]. Previously the only German-speaking MME-program was offered by the University of Bern in Switzerland.

It is uncertain if the goals of the new AppOÄ have been achieved as there are no official reports available. However, some professional organisations have conducted surveys.

Strengthening the role of General Practice in the face of an anticipated shortage of general practitioners was one of the multiple goals of the reform. Although some faculties have founded new Departments of General Practice, more than half of all faculties have no such department [44]. Similarly the stipulated strengthening of palliative care and pain management has also not yet been achieved in all faculties [45]. A national survey of teaching in Geriatrics, which had not previously been a component of the curriculum but is now covered by a mandatory interdisciplinary teaching module "Medicine of aging and the elderly", revealed that less than half of all medical faculties provide teaching in this topic [46].

Mandatory evaluation of teaching was also among the aims of the AppOÄ. The main purpose of evaluation is quality control but also distribution of funds [47]. The last national survey on the evaluation of medical teaching in Germany was performed in 2000 before the reform [48]. Multiple evaluations of courses have been reported (selected examples [49], [50]) however there is no national standard and reporting bias is likely.

Unlike other university programmes awarding degrees to students, medical faculties in Germany are not subject to formal mandatory accreditation and reaccreditation procedures, since the final degree is a license awarded by the state. Although the German Council of Science and Humanities [*Wissenschaftsrat*] [51] has evaluated medical faculties, it is left to the discretion of the states as to

how to ensure compliance with the stipulated requirements [52]. So far only one faculty has been on probation in 2005. It is conceivable that the states, which are responsible for funding medical faculties, have a conflict of interest given that external accreditation might reveal deficiencies due to under-funding.

Barriers to the implementation of stipulated reforms

Enacting the new AppOÄ was a pure administrative act and unfortunately was not provided with a budget to ensure its implementation [53]. Medical faculties are facing incredible difficulties to fulfil all the new requirements. The reduction in the number of lectures and rise in bedside teaching has increased the need dramatically for both clinical teachers and available patients. Although lip service is paid to the commitment for medical education, young academics are not rewarded for their efforts, and teaching, which must compete with research and patient care, is sometimes considered a lost cause [54]. At the same time, virtually all university hospitals to which medical schools are attached are in serious financial crisis, partly due to a new invoicing system and budget cuts [55]. Some of the previously state-owned university hospitals have been privatised (e.g. Giessen and Marburg) or transformed into foundations (e.g. Göttingen). This has increased the already pressing need for separate accounting of patient care financed by hospital revenues and teaching, and research covered by state grants or third-party funds. This has turned out to be extremely difficult since a significant proportion of the faculty is actively involved in both [56]. Only a few medical faculties (e.g. Kiel/Lübeck, Dresden/Leipzig) are administered completely separately from university hospitals [57]. The funding of medical education has been described in more detail elsewhere [58].

European perspective

In 1999, the Education Ministers from 29 European countries including Germany adopted the Bologna declaration [59]. The principal goals of this were to permit easily readable and comparable university degrees within Europe and to introduce a system essentially based on two main cycles, undergraduate and graduate, thus increasing mobility within Europe. In fact the mobility of medical students is already hampered at a national level by the multitude of non-compatible curricula although the Bologna declaration should also theoretically apply to medical education. However, this idea is neither encouraged by the German Medical Association nor some other medical associations [60]. The main reason to reject the implementation of the Bologna declaration for medical training is the fear of introducing a fast track "bare-foot doctor".

Conclusion

Improving and adapting education of medical students to the health needs of the population is a continuous process. The new "Regulation of the Licensing of Doctors (AppOÄ)" in Germany has stimulated multiple excellent projects to help future doctors meet these needs, but there is evidence that some of the stipulated changes have not been implemented. This review is an initial attempt to assess the compliance with the requirements of the AppOÄ and the success of the changes stipulated therein. Unfortunately it has not been possible to do justice to the educational activities in all 36 faculties, and while it is recognised that only a few selected projects have been discussed here, it is clear that mandatory external accreditation and periodic reaccreditations of medical faculties needs to be established in Germany [61].

List of abbreviations used

- AppOÄ: Approbationsordnung für Ärzte [Licensing Law for Medical Doctors]
- GPA: grade point average
- IMPP: Institut für Medizinische und Pharmazeutische Prüfungsfragen [Institute for medical and pharmaceutical examination questions]
- MCAT: Medical College Admission Test
- MCQ: multiple choice questions
- PJ: Praktisches Jahr [final year in medical school]
- TMS: Test für Medizinische Studiengänge [Test for medical education]
- USMLE: United States medical licensing examination
- ZVS: Zentralstelle für die Vergabe von Studienplätzen [Central office for the allocation of places in higher education]

Notes

Competing interest

I am a general practitioner working part-time in academia and part time in private practice which has influenced my review.

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Attachments

Available from
<http://www.egms.de/en/gms/2009-7/000061.shtml>

1. GMS-Chenot-Attachment1.pdf (46,16 KB)
 List of German medical schools with URLs

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