

The future of clinical anatomy

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SUMMARY

Attitudes of medical students to the teaching of anatomy in a clinical context and their knowledge of clinical medicine when first entering their medical courses were assessed in a cohort of students at Paris (n=280) and two cohorts at Cardiff (n = 300) using questionnaires that included Thurstone and Chave attitude analyses. The findings indicate that, in their early years of training, medical students prefer anatomy to be made explicitly relevant to clinical needs, although there was no strong belief that the teachers should be clinically qualified. Furthermore, while the students appreciated the value of using clinical examples/scenarios or case histories in the teaching, their use in assessments drew ambivalent responses. The results of the surveys also showed that, in terms of musculoskeletal, cardiovascular and respiratory medicine, many students come with a significant knowledge of medicine before they commence their education and training at medical school. This finding suggests that educational benefit can be obtained by encouraging medical students to impart their existing knowledge and by them recounting the “narratives” whereby their knowledge of medicine was obtained. The results highlight the perceived importance of anatomy, both as a scientific and a clinical discipline, and relates to issues concerned with the understanding of the culture of medicine in terms of understanding health and disease.

Key words: Anatomy – Anatomy teaching and learning – Clinical anatomy – Clinical relevance – Attitudes – Medical students – Medical education

INTRODUCTION

There remains considerable controversy regarding the most effective way of teaching anatomy in a medical course (reviewed by Pabst, 2009). In previous work, we have reported that both professional anatomists (whether “traditionalists” or “modernists”) and medical students put a high value on the importance of anatomy to medicine, would prefer anatomy be taught through the use of dissection by the students and believe that anatomy should be a separate, easily identified, component of the medical course (Patel and Moxham, 2006, 2008; Moxham and Plaisant, 2007; Moxham and Moxham, 2007). Earlier, Pabst and Rothkötter (1997) reported that practising physicians believed that gross anatomy had the highest clinical relevance, this view being subsequently affirmed by Cottam (1999) and Hofer *et al.* (2006). More recently, the conclusions of Patel and Moxham (2006, 2008), Moxham and Plaisant (2007) and Moxham and Moxham (2007) have been supported by the research of Kerby, Shukur and Shaloub (2010) and, by means of a qualitative study, Regan de Bere and Mattick (2010) concluded that “anatomical practice as it is applied to medicine requires multiple layers of capability

that extend beyond learning anatomy as a subject in itself... practical knowledge, and aesthetic appreciation,... being absolutely central to scientific excellence". It is clear from their analyses that anatomy "distinguishes doctors from other scientists" and, while requiring clinically-relevant teaching, is best not subsumed into other disciplines.

Whatever changes have occurred to the methods of teaching anatomy (Patel and Moxham 2006, 2008; Pabst 2009), or to the time given in the medical curriculum to the subject (Lockwood and Roberts, 2007), it has become a truism that gross anatomy should be taught to medical students as clinical anatomy (see Pabst, 2009; Regan de Bere and Mattick, 2010). However, while this has become a shibboleth for virtually all anatomists, medical educationalists, and authors (hardly any textbook of anatomy is without the word "clinical" in its title), there is little agreement about what should be included (or excluded) from an anatomy course or what might be appropriate clinical scenarios. It is therefore crucial that anatomists and clinicians should define core anatomical knowledge in a clinical context. The Anatomical Society of Great Britain and Ireland commissioned its educational committee to develop a core anatomical curriculum for a medical course (McHanwell *et al.*, 2007). This core curriculum has recently been drawn to the attention of medical course directors by the United Kingdom's General Medical Council in its advisory document "Tomorrow's Doctors" (2009). Nevertheless, such a core curriculum has yet to achieve common acceptance; indeed, anatomical terminologies (e.g. Terminologia Anatomica, 1998) have yet to gain general approval across anatomical and clinical spheres. If these matters are problematic in deciding on issues relating to clinical relevance and acceptability, we have yet to gauge the attitudes of students towards the teaching of clinical anatomy and assume that they require such an approach. Therefore, the prime purpose of the present study is to assess students' attitudes to the teaching of anatomy in a clinical context and to test the hypothesis that, in their early years of training, medical students prefer anatomy to be made explicitly relevant to clinical needs (both in terms of the teaching and of the assessment of anatomy).

A further issue relating to the teaching of anatomy as clinical anatomy stems from an

appreciation that medical students could already have a reasonable knowledge of medicine before they enter medical school. If so, then this would enable teachers to build on such knowledge and tailor their teaching and learning strategies accordingly. However, medical schools usually make the assumption that a new medical student is a *tabula rasa* and has little or no knowledge of clinical medicine. Consequently, students are taught medicine *de novo* and without an understanding of the knowledge of medicine that they bring with them. Indeed, it is now becoming commonplace to argue that until a student has experience of the clinic she/he cannot appreciate the significance of studying anatomy or any other basic science. Thus, early, and generous, exposure to the clinic is advocated long before exposure to anatomy and the basic sciences. Therefore, to complement the prime purpose of the present study, we have assessed newly recruited medical students' knowledge of medicine to test the hypothesis that students have a significant knowledge of medicine before they commence their education and training at medical school.

MATERIALS AND METHODS

A total of nearly 580 newly recruited medical students at the universities of Paris Descartes and Cardiff completed confidential questionnaires (available in French and English versions) that were distributed, and completed, during timetabled classes. The sessions were supervised in order to answer queries and to ensure completion of the questionnaires without the students conferring. The students studying at the University of Paris Descartes were in the academic session 2008/09. The students studying at Cardiff University were in the academic sessions 2007/08 and 2008/09. All questionnaires were approved by ethical committees and authorities at the universities at Paris and Cardiff.

To assess the attitudes of students towards the importance of teaching clinical anatomy, we devised a questionnaire in three sections. The first section consisted of questions to obtain personal (but confidential and anonymous information). In line with the principles of Thurstone and Chave (1951), the second section consisted of a matrix of 20 statements (Table 1) that covered a range of attitudes towards the importance of anatomy in clinical

Table 1

Statements in the questionnaire used to assess students' attitudes to the importance of anatomy in medicine according to the method devised by Thurstone and Chave (1951). Note that the "attitude values" deemed appropriate by the "judges" are included here but were not provided in the questionnaire distributed to potential respondents.

TICK BOX	TICK BOX
Although Anatomy is interesting, the subject needs selective understanding in the clinic (7)	It is impossible to conceive of good medical training without a major Anatomy component (2)
Anatomical terminology is the vocabulary of Medicine (2)	It is not possible to make a reasonable medical diagnosis without Anatomy (2)
Anatomy is a useful tool for satisfactory medical practice (3)	Medicine could not exist without Anatomy (1)
Anatomy is a "necessary evil" in Medicine (7)	Most medical conditions do not require a great knowledge of Anatomy (8)
Anatomy is of some use in the clinic, but its importance may be exaggerated (8)	Of all the basic sciences, Anatomy is the most clinically relevant (3)
Anatomy is only of benefit in certain medical specialities (7)	Only a limited anatomical knowledge is required for satisfactory medical practice (7)
Anatomy is so old-fashioned that it has no importance in contemporary Medicine (11)	Rather than learn Anatomy, medical students should concentrate on clinical sciences (9)
Anatomy is time wasted in the medical curriculum (11)	The principles of Medicine are not founded on anatomical knowledge (9)
Anatomy needs to modernise if it is going to be really useful in Medicine (6)	Without a knowledge of Anatomy, the doctor is of limited effectiveness (3)
Every doctor must have a good knowledge of Anatomy (2)	
If alternative and Eastern Medicine can do without Anatomy, so can Western Medicine (10)	

medicine. Statements within the questionnaire were randomly arranged. The students were requested only to "tick" those statements with which they were in full agreement. Prior to distributing the questionnaire, a group of 50 independent persons acted as "judges" (comprised of biomedical students and academics that did not participate further in the study). These judges ascribed a value to each statement of between 1 and 11 (1 being extremely favourable to the attitude that anatomy is essential for clinical medicine, 11 extremely unfavourable). The median of the judges estimates thus provided, for each statement, a quantitative evaluation and enabled us to ascertain that the statements in the questionnaire covered the whole range along the attitude continuum. This method of quantitatively assessing attitudes is described as the "Equal Appearing Interval Scale" (Thurstone and Chave, 1951; Lemon, 1973; Rajeci, 1990). Once the student had completed the questionnaire then the mean value for the statements that he/she had ticked provided a quantitative assessment of that student's attitude. The third section of the questionnaire consisted of a series of 11 statements or questions that students were required to respond to, primarily using 6-point Likert scales.

To assess the knowledge of medicine of newly recruited medical students, a questionnaire was devised that investigated their knowledge and understanding of musculoskeletal medicine and cardiovascular/respiratory medicine. The questionnaire consisted

of a section that used Thurstone and Chave (1951) analyses, similar in format and concept to that shown in Table 1, to assess the students' attitudes towards the importance of these branches of medicine. The second section consisted of a series of statements or questions to which students were required to respond using 6-point Likert scales. The final section of the questionnaire provided a series of Extended Matching Questions (EMQs), standard set to a level appropriate for final year medical students, and a list of medical conditions in musculoskeletal medicine and cardiovascular/respiratory medicine that students had to recognise and categorise.

RESULTS

A total of 579 responses were received that correctly completed the questionnaire (equating to 64% and 52% of the classes for Paris and Cardiff respectively).

Figure 1 shows a histogram displaying the results of assessing the attitudes of medical students to anatomy and its clinical relevance using Thurstone and Chave (1951) analyses. As "attitude scale values" below 7 are considered favourable to the view that anatomy is important for clinical medicine, the mode of 3 (with very few students above 5) indicates that the students highly favour anatomy and recognise its importance in clinical medicine.

Figures 2 to 4 feature the responses to questions that essentially place anatomy as a

separate course at the start of medical education and training. In response to the request to evaluate whether anatomy should be taught as a “foundation subject” *before* commencing clinical studies, 52% of respondents agreed (Figure 2). Figure 3 shows that, in support of this view, only 29% agreed that anatomy is only useful as a complement to the study of clinical medicine. Furthermore, 77% of students agreed that anatomy is a scientific discipline forming the basic knowledge of the human body before it can be utilised in a clinical situation (Figure 4). Figure 5 displays the responses to questions that support integration of anatomy with the clinic; on being asked whether anatomy should be taught in an integrated way with clinical medicine, 75% of medical students supported this view. Figures 6 to 8 feature questions about the use of clinical examples/scenarios/case histories during anatomy teaching. 91% of medical students agreed that these provided good motivational devices (Figure 6) and only 18% believed that they were best left for the teaching of medicine later in the course (Figure 7). However, the use of clinical examples/scenarios/case histories for assessment of anatomy produced ambivalent results; only 49% approving of their use in assessments (Figure 8). It might be expected that, if students wished to integrate scientific parts of their course with the clinic, they would indulge in secondary reading of the clinical literature. However, Figure 9 shows that 66% of students do not undertake such reading. In response to asking when in the medical course anatomy should be taught (Figure 10), 61% still chose for it to front-end the medical course, 20% believe that it should be taught throughout the course, and 18% don't know or have no opinion. Finally, only 35% of medical students agreed with the view that anatomy can only be taught by clinicians (Figure 11).

Figures 12 and 13 show histograms that display the importance of musculoskeletal medicine and cardiovascular/respiratory medicine perceived by the newly-recruited medical students. In both cases, attitudes were positive on the “attitude scales” with few students recording values above 6 (mode of 4 for musculoskeletal medicine; mode of 5 for cardiovascular/respiratory medicine). Figures 14

and 15 indicate that 96% and 92% of students recognise that musculoskeletal medicine and cardiovascular/respiratory medicine respectively are important or very important. In terms of interest (Figures 16 and 17), 72% of students are interested in musculoskeletal medicine (only 24% very interested) and 82% are interested in cardiovascular/respiratory medicine (31% very interested).

In terms of the newly-recruited medical students' knowledge and understanding of medicine, 70% rated their knowledge of musculoskeletal medicine as poor or very poor with only a very small percentage claiming to have good knowledge (Figure 18). For cardiovascular/respiratory medicine, 54% rated their knowledge as poor or very poor with again only a very small percentage claiming to have good knowledge (Figure 19). Figure 20 shows the results of asking the students to recognise medical conditions relating to musculoskeletal medicine. Here, the students again were not willing to admit knowledge of such conditions, only 15% of disorders being recognised with confidence. Similarly for cardiovascular/respiratory medicine, only 20% of disorders could be confidently recognised and categorised (Figure 21). However, this assessment of their knowledge and understanding was not so clear from our tests of their knowledge. The EMQs results showed that 33% of students scored over 40% for the musculoskeletal knowledge test with 5% scoring over 60% and only 8% getting less than 20% (mode 30 to 39% scores for the EMQs) (Figure 22). Figure 23 shows the categories of musculoskeletal topics and indicates that the scores were particularly high for sports injuries and were lowest for joint and connective tissue disorders. For cardiovascular/respiratory medicine, the EMQs results showed that 39% of students scored over 40% for the knowledge test with 7% scoring over 60% (Figure 24). The mode scores were between 40 to 49%. However, 14% scored less than 20%. Figure 25 shows the categories of cardiovascular/respiratory topics and indicates that the scores were highest for disorders of the peripheral circulation and for congenital cardiovascular disorders and were lowest for heart disorders.

Figure 1. Histogram showing the attitudes of responding medical students towards clinical anatomy (using Thurstone and Chave analyses, 1951). A low score indicates the attitude that clinical anatomy is perceived as being highly relevant to clinical medicine, while a high score indicates that clinical anatomy is perceived as having low relevance.

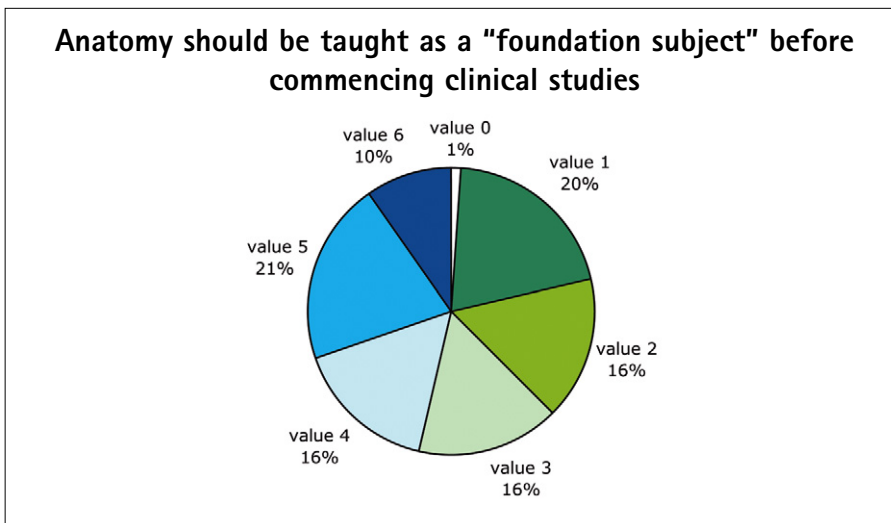
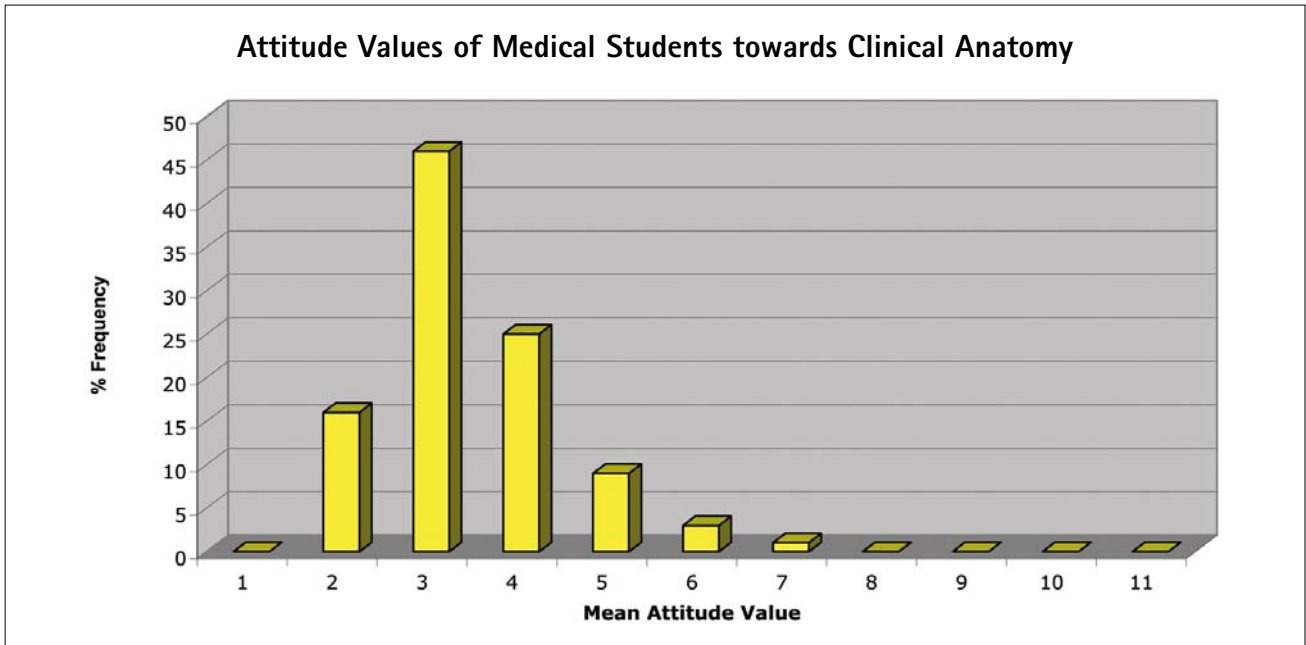


Figure 2. Pie chart showing medical students' opinion as to whether "anatomy should be taught as a 'foundation subject' before commencing clinical studies". Using Likert scales, value 0 = don't know, value 1 = very favourable opinion, value 6 = very unfavourable opinion.

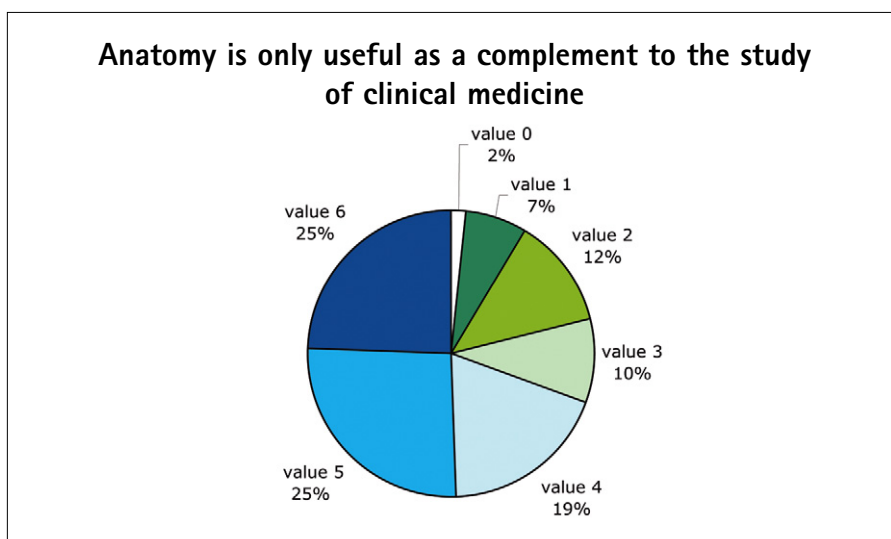


Figure 3. Pie chart showing medical students' opinion as to whether "anatomy is only useful as a complement to the study of clinical medicine". Using Likert scales, value 0 = don't know, value 1 = very favourable opinion, value 6 = very unfavourable opinion.

Anatomy is a scientific discipline forming our basic knowledge of the human body before it can be utilized in a clinical situation

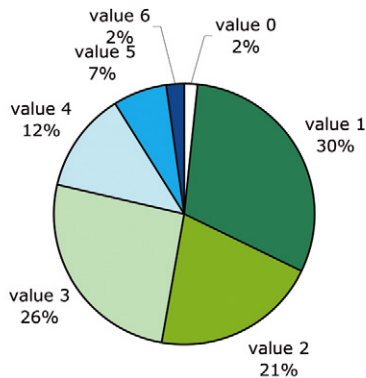


Figure 4. Pie chart showing medical students' opinion as to whether anatomy "is a scientific discipline forming the basic knowledge of the human body before it can be utilized in a clinical situation". Using Likert scales, value 0 = don't know, value 1 = very favourable opinion, value 6 = very unfavourable opinion.

Anatomy should be taught in an integrated way with clinical medicine

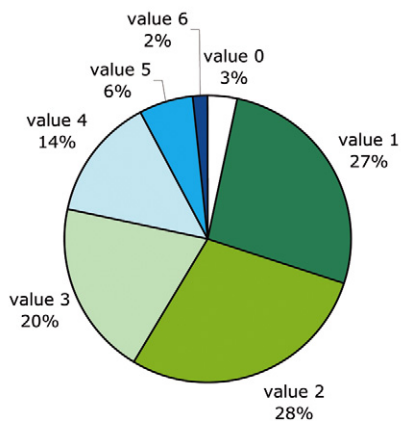


Figure 5. Pie chart showing medical students' opinion as to whether "anatomy should be taught in an integrated way with clinical medicine". Using Likert scales, value 0 = don't know, value 1 = very favourable opinion, value 6 = very unfavourable opinion.

Providing clinical examples/scenarios/case histories during anatomy teaching is a good motivational device

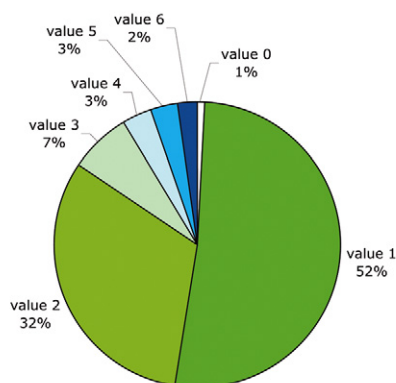


Figure 6. Pie chart showing medical students' opinion as to whether "providing clinical examples/scenarios/case histories during anatomy teaching is a good motivational device". Using Likert scales, value 0 = don't know, value 1 = very favourable opinion, value 6 = very unfavourable opinion.

Clinical examples/scenarios/case histories are best left for the teaching of clinical Medicine later in the course

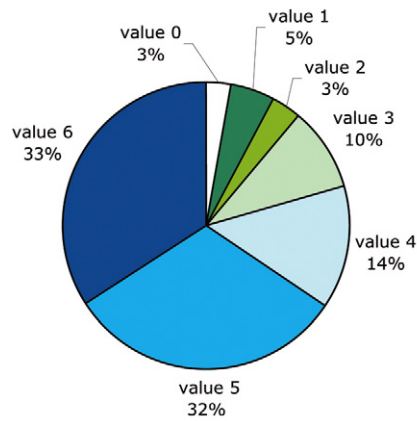


Figure 7. Pie chart showing medical students' opinion as to whether "providing clinical examples/scenarios/case histories are best left for the teaching of clinical medicine later in the course". Using Likert scales, value 0 = don't know, value 1 = very favourable opinion, value 6 = very unfavourable opinion.

Using clinical examples/scenarios/case histories should not be used when anatomical knowledge is assessed/examined

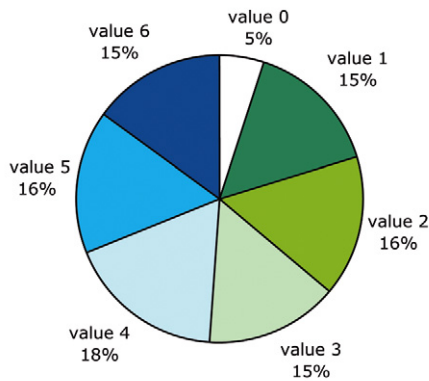


Figure 8. Pie chart showing medical students' opinion as to whether "using clinical examples/scenarios/case histories should not be used when anatomical knowledge is assessed/examined". Using Likert scales, value 0 = don't know, value 1 = very favourable opinion, value 6 = very unfavourable opinion.

Percentage of medical students involved with medical-related reading additional to recommended texts

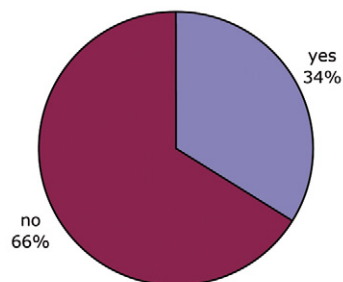


Figure 9. Pie chart showing "percentage of medical students involved with medical-related reading additional to recommended texts".

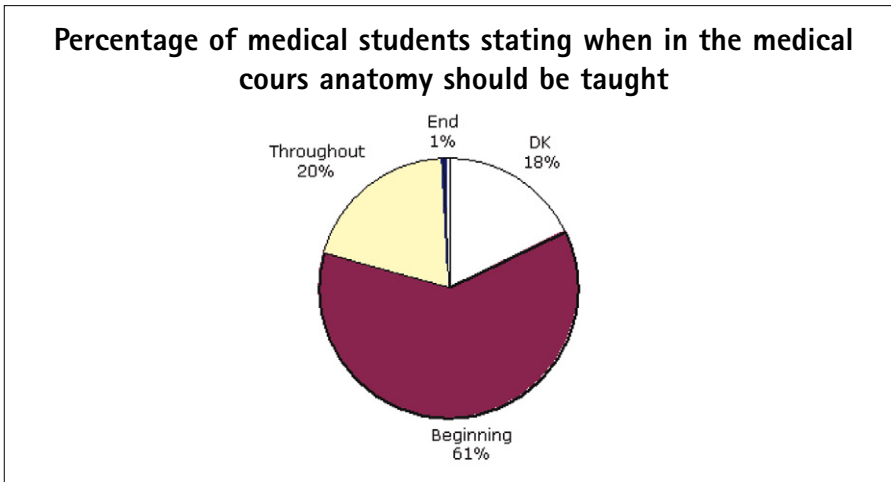


Figure 10. Pie chart showing “percentage of medical students stating when in the medical course anatomy should be taught”. DK = don’t know.

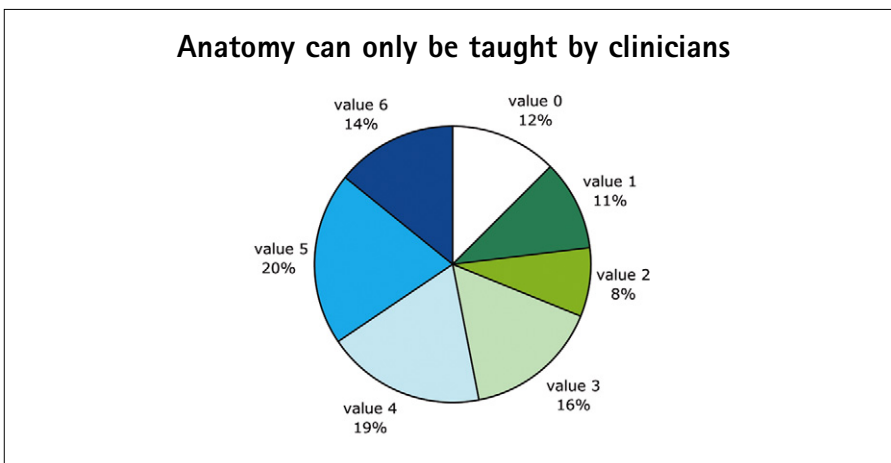


Figure 11. Pie chart showing medical students’ opinion as to whether “anatomy can only be taught by clinicians”. Using Likert scales, value 0 = don’t know, value 1 = very favourable opinion, value 6 = very unfavourable opinion.

Figure 12. Histogram showing the attitudes of responding first year medical students towards understanding musculoskeletal medical disorders (using Thurstone and Chave analyses, 1951). A low score indicates the attitude that musculoskeletal medical disorders are perceived as being highly relevant to clinical medicine, while a high score indicates that musculoskeletal medical disorders are perceived as having low relevance.

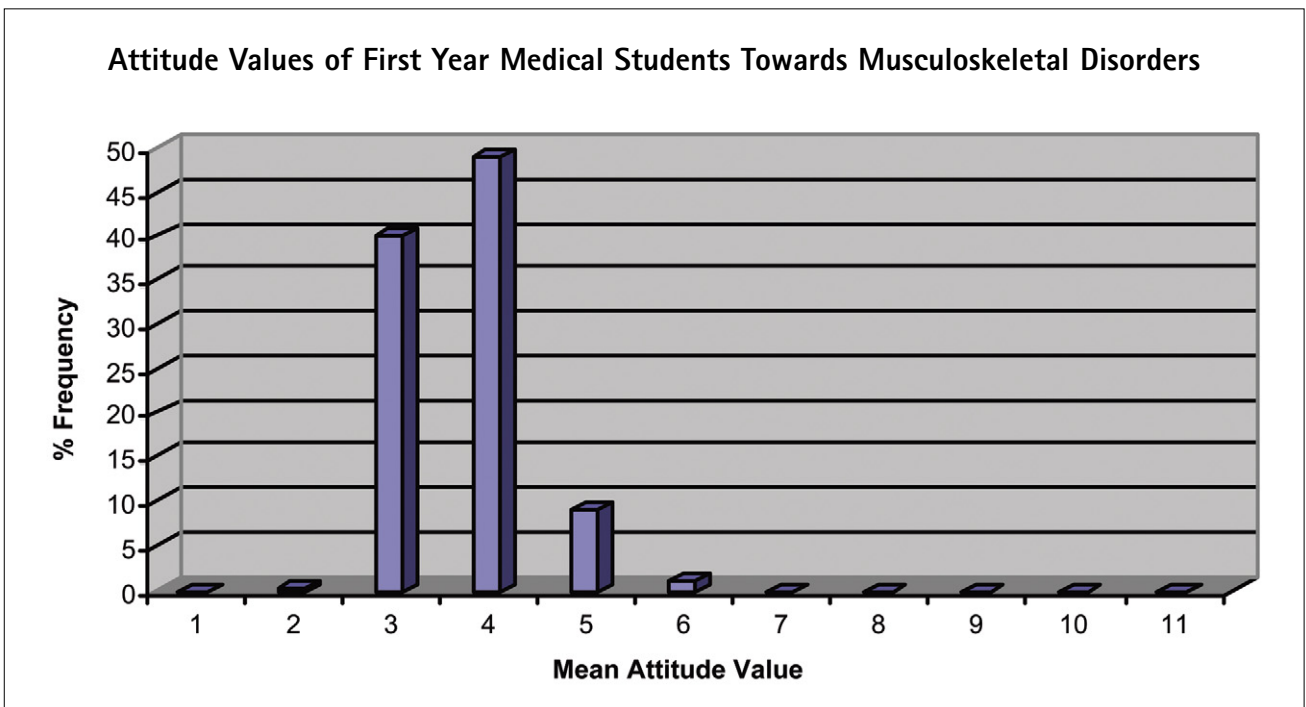


Figure 13. Histogram showing the attitudes of responding first year medical students towards understanding cardiovascular and respiratory medical disorders (using Thurstone and Chave analyses, 1951). A low score indicates the attitude that cardiovascular and respiratory medical disorders are perceived as being highly relevant to clinical medicine, while a high score indicates that cardiovascular and respiratory medical disorders are perceived as having low relevance.

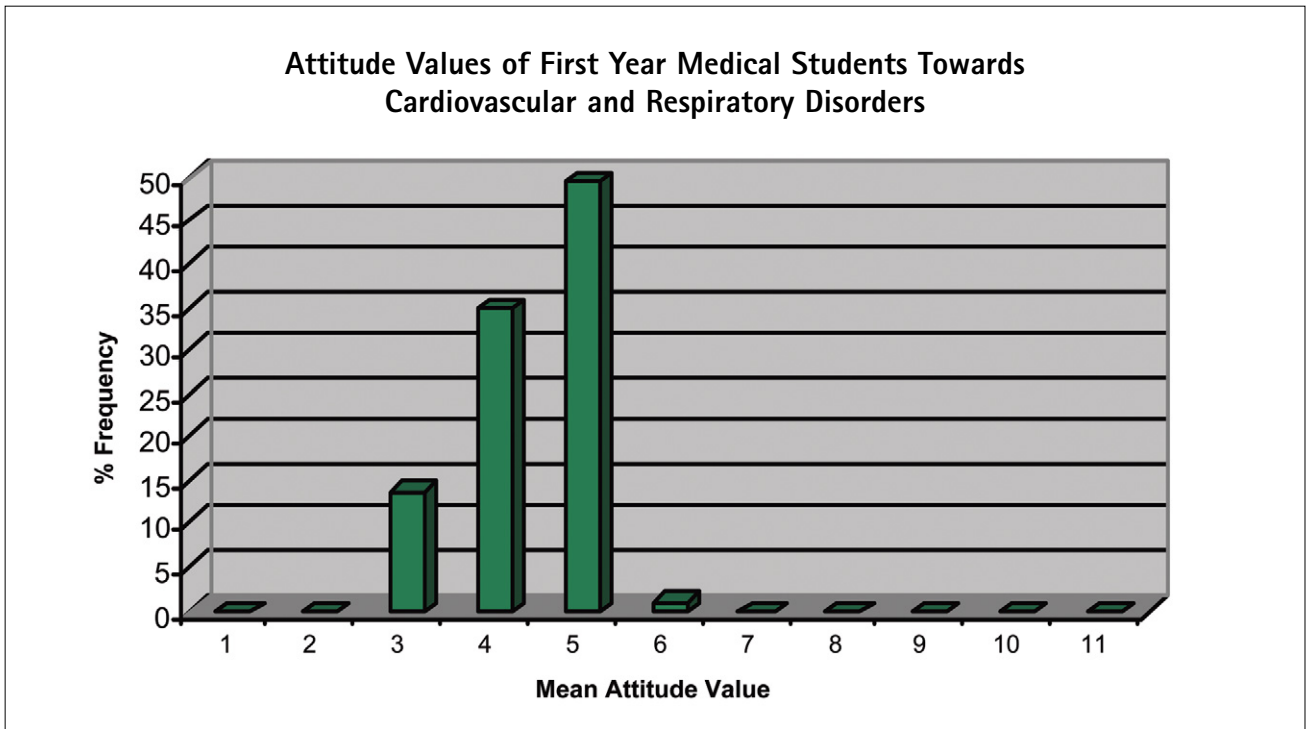


Figure 14. Histogram showing the attitudes of responding first year medical students towards the importance of having knowledge of musculoskeletal medical disorders in medicine. Using Likert scales, value 1 = not at all important value, 6 = very important.

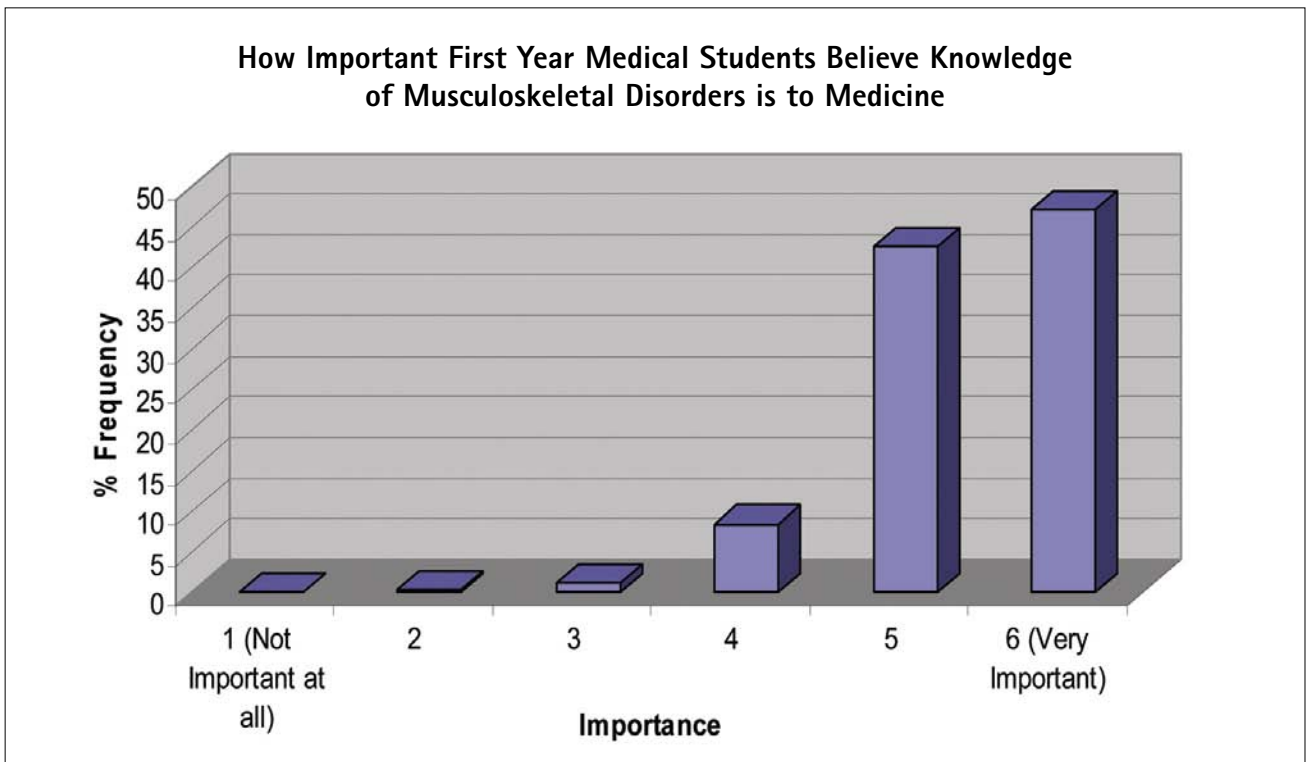


Figure 15. Histogram showing the attitudes of responding first year medical students towards the importance of having knowledge of cardiovascular and respiratory medical disorders in medicine. Using Likert scales, value 1 = not at all important, value 6 = very important.

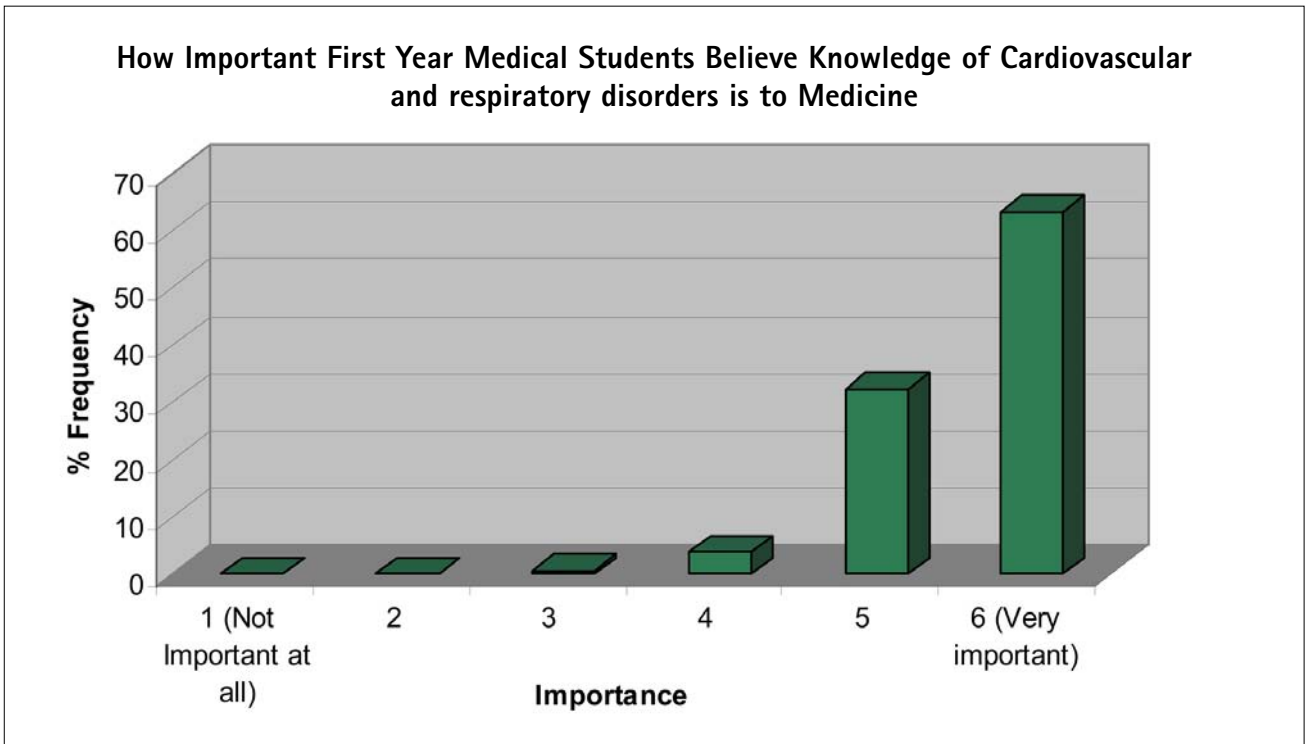


Figure 16. Histogram showing the interest of responding first year medical students towards learning about musculoskeletal medical disorders in medicine. Using Likert scales, value 1 = not interested, 6 = very interested.

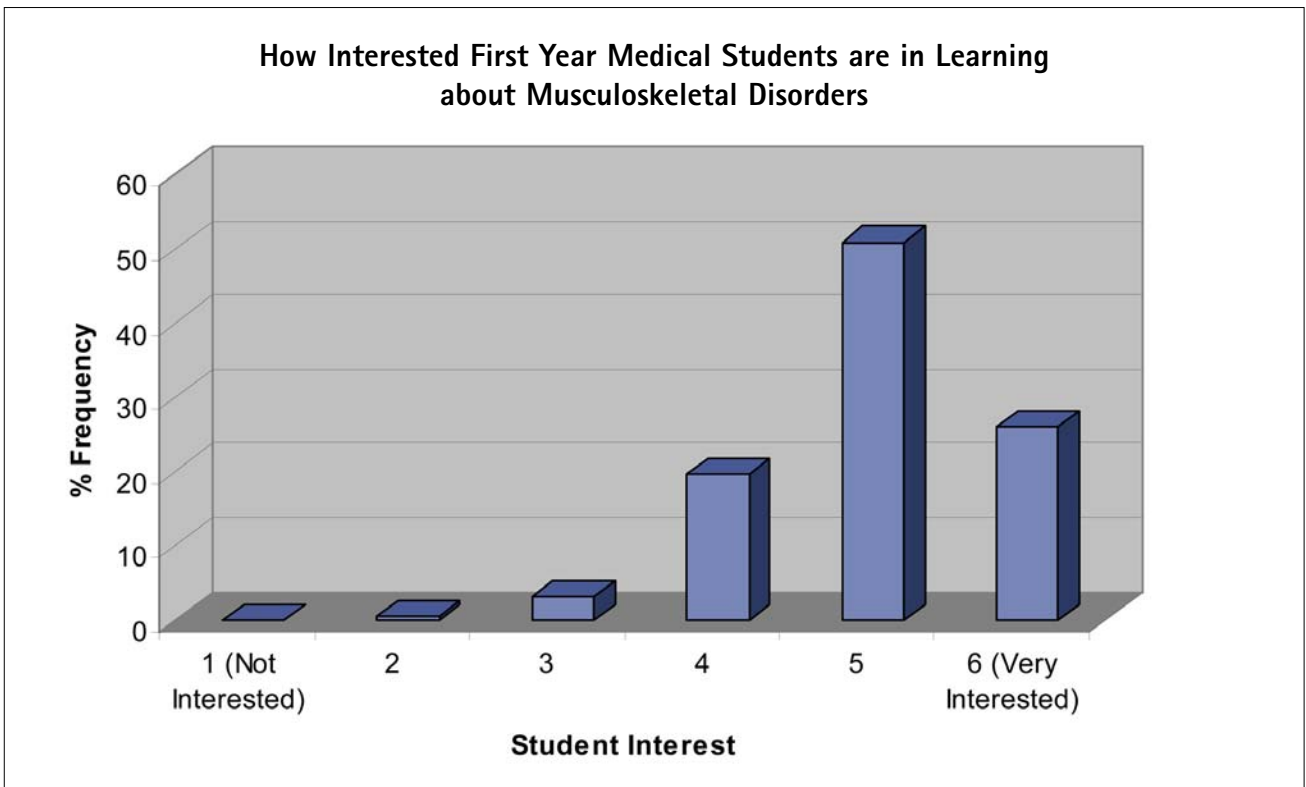


Figure 17. Histogram showing the interest of responding first year medical students towards learning about cardiovascular and respiratory medical disorders in medicine. Using Likert scales, value 1 = not interested, 6 = very interested.

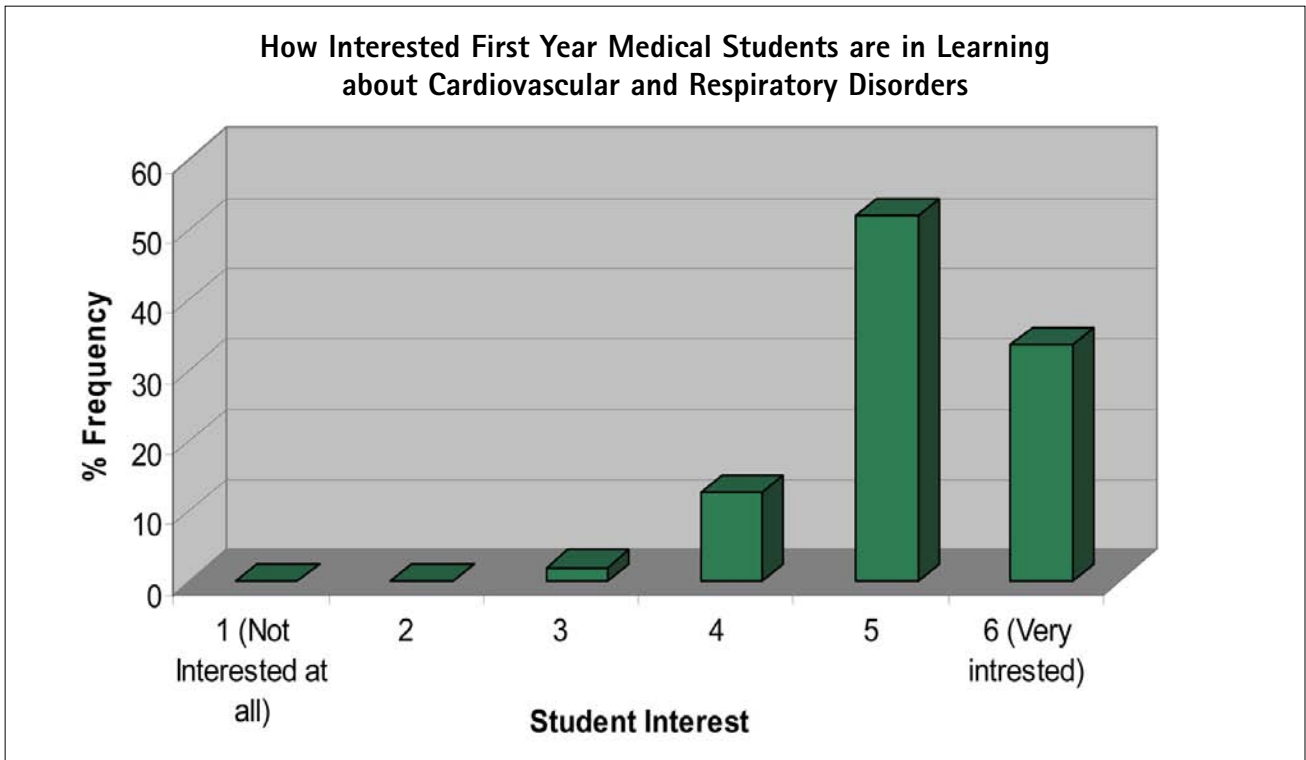


Figure 18. Histogram showing how first year medical students rate their knowledge of musculoskeletal medical disorders. Using Likert scales, value 1 = very poor, 6 = very good.

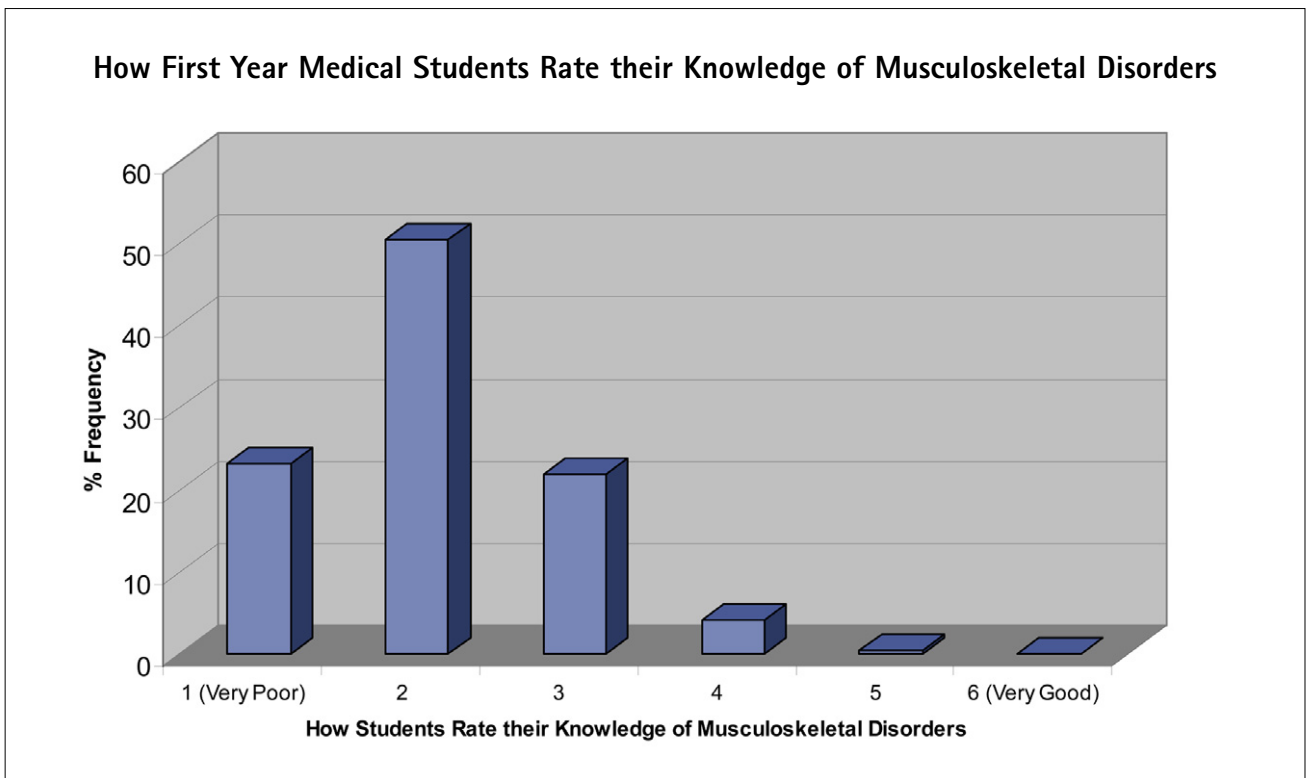


Figure 19. Histogram showing how first year medical students rate their knowledge of cardiovascular and respiratory medical disorders. Using Likert scales, value 1 = very poor, 6 = very good.

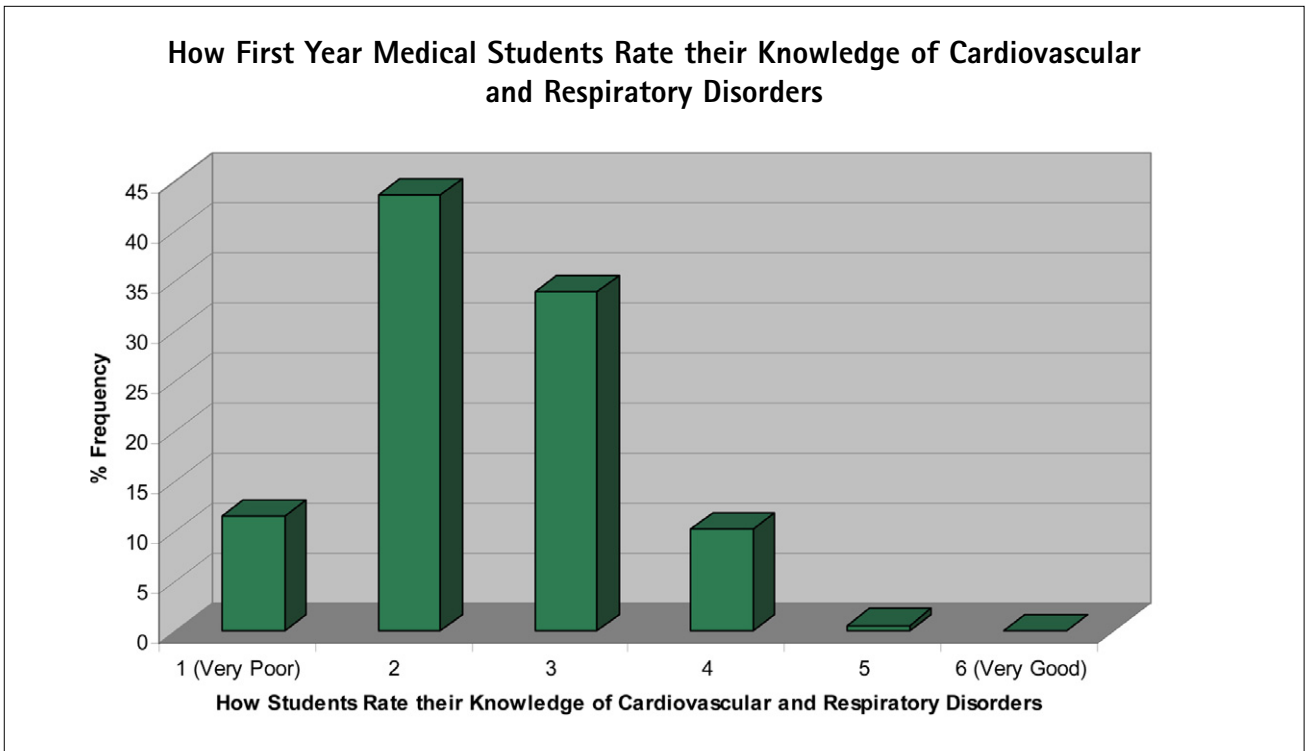


Figure 20. Histogram showing the proportion of musculoskeletal medical disorders first year medical students believed they were acquainted with. The data were acquired by presenting students with a list of musculoskeletal disorders and conditions.

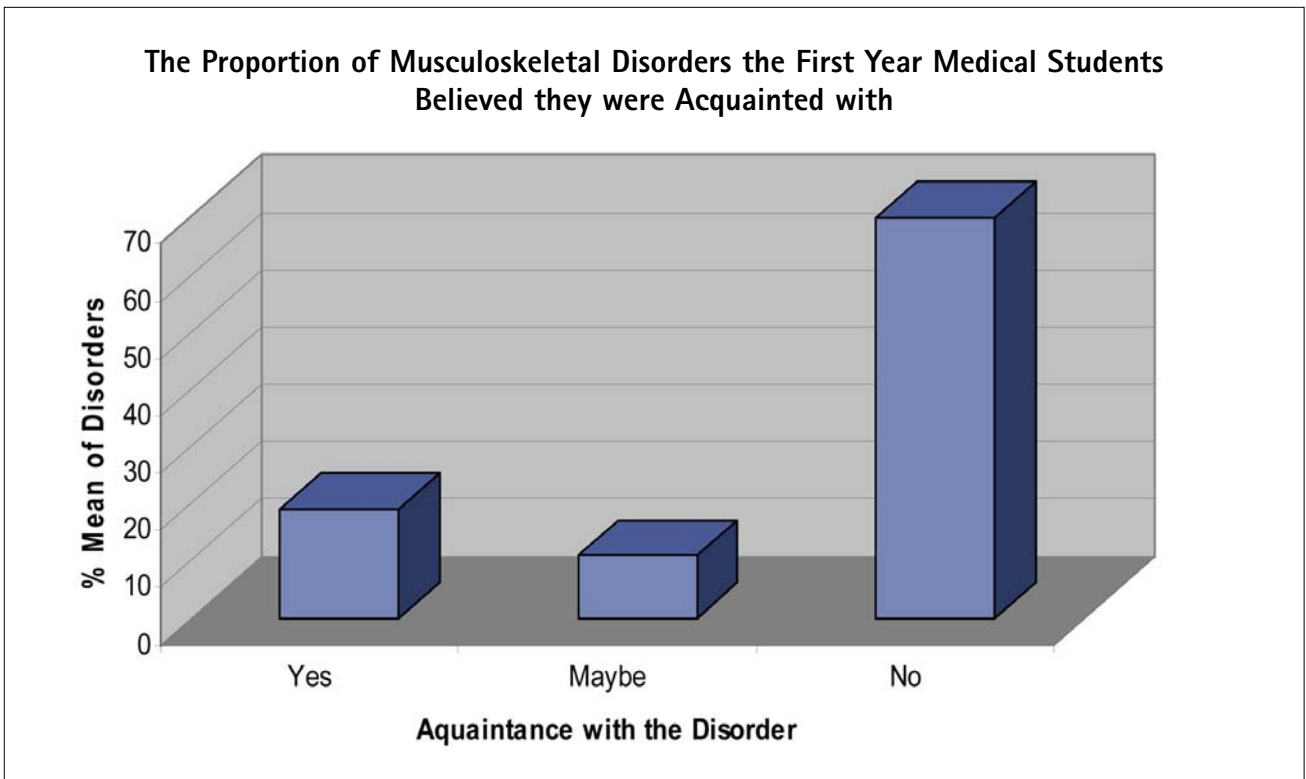


Figure 21. Histogram showing the proportion of cardiovascular and respiratory medical disorders first year medical students believed they were acquainted with. The data were acquired by presenting students with a list of cardiovascular and respiratory disorders and conditions.

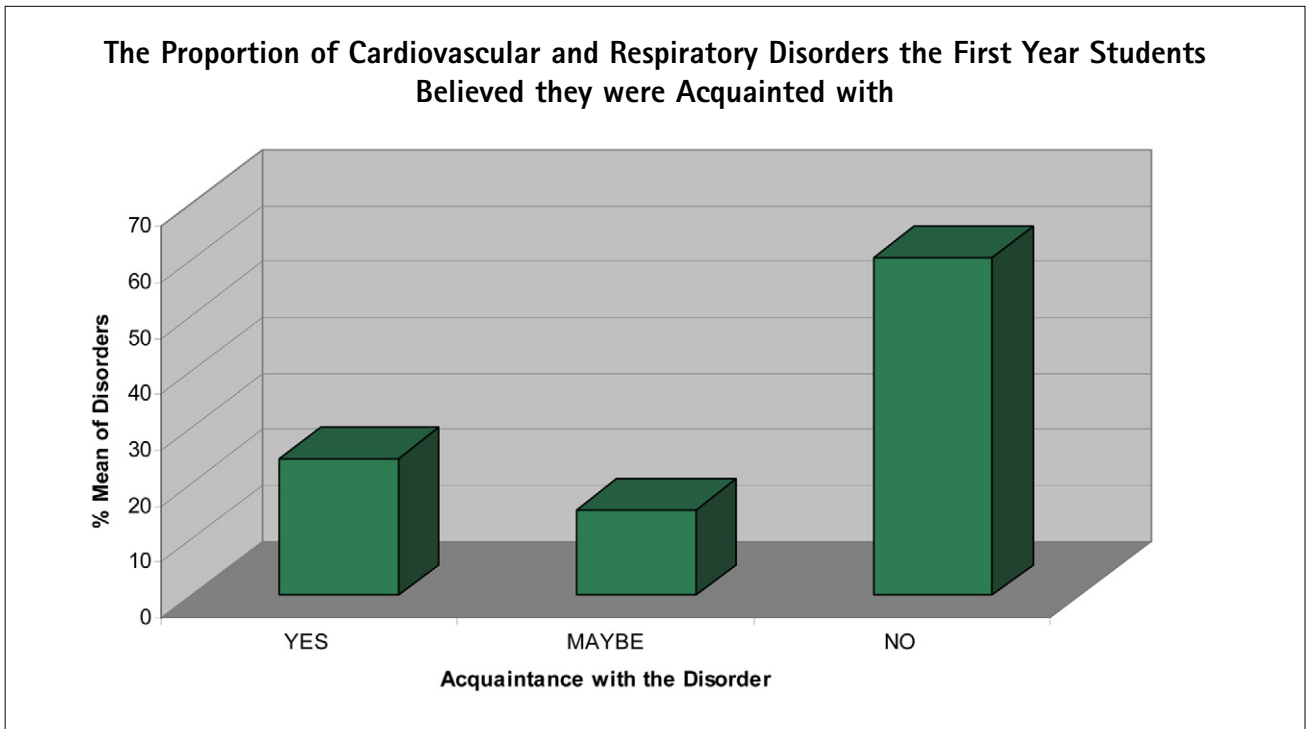


Figure 22. Histogram showing the scores (%) obtained by first year medical students from Extended Matching Questions (EMQs) on musculoskeletal medical disorders.

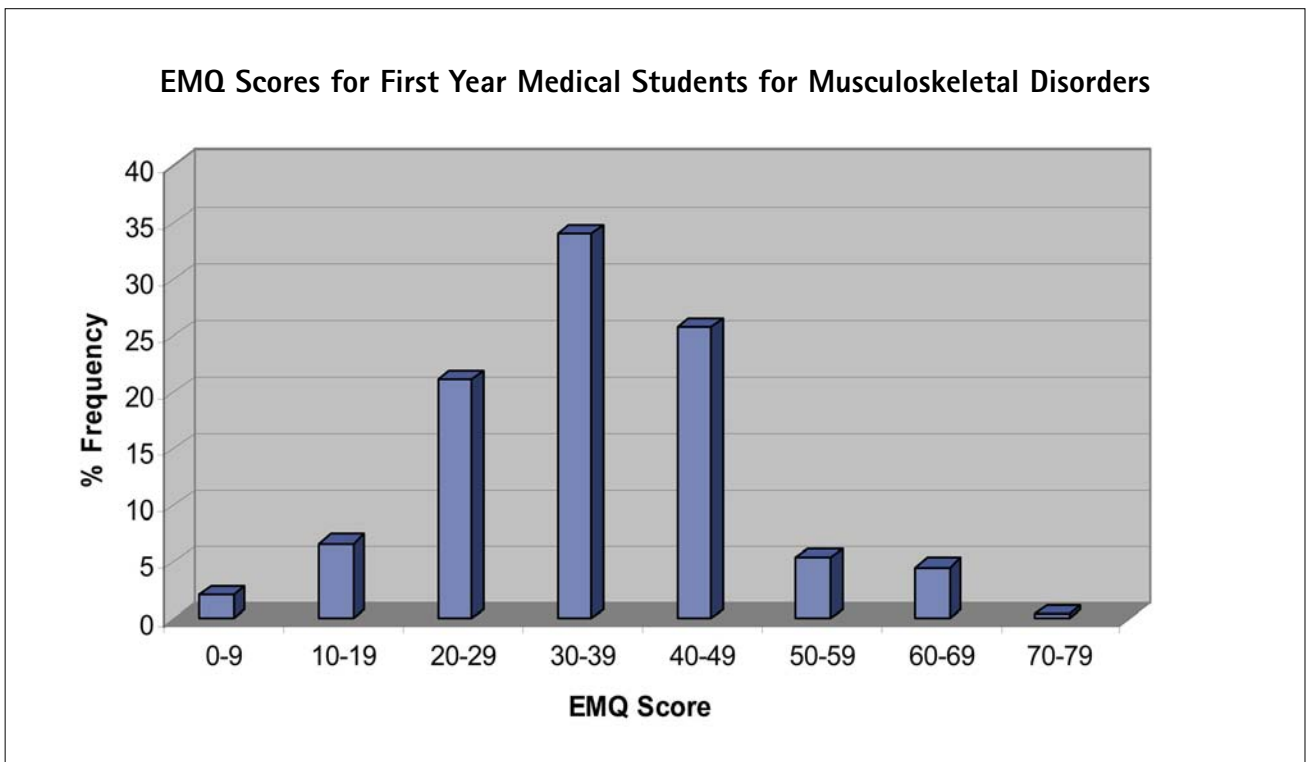


Figure 23. Histogram showing the relationship between EMQ scores and categories of musculoskeletal medical disorders.

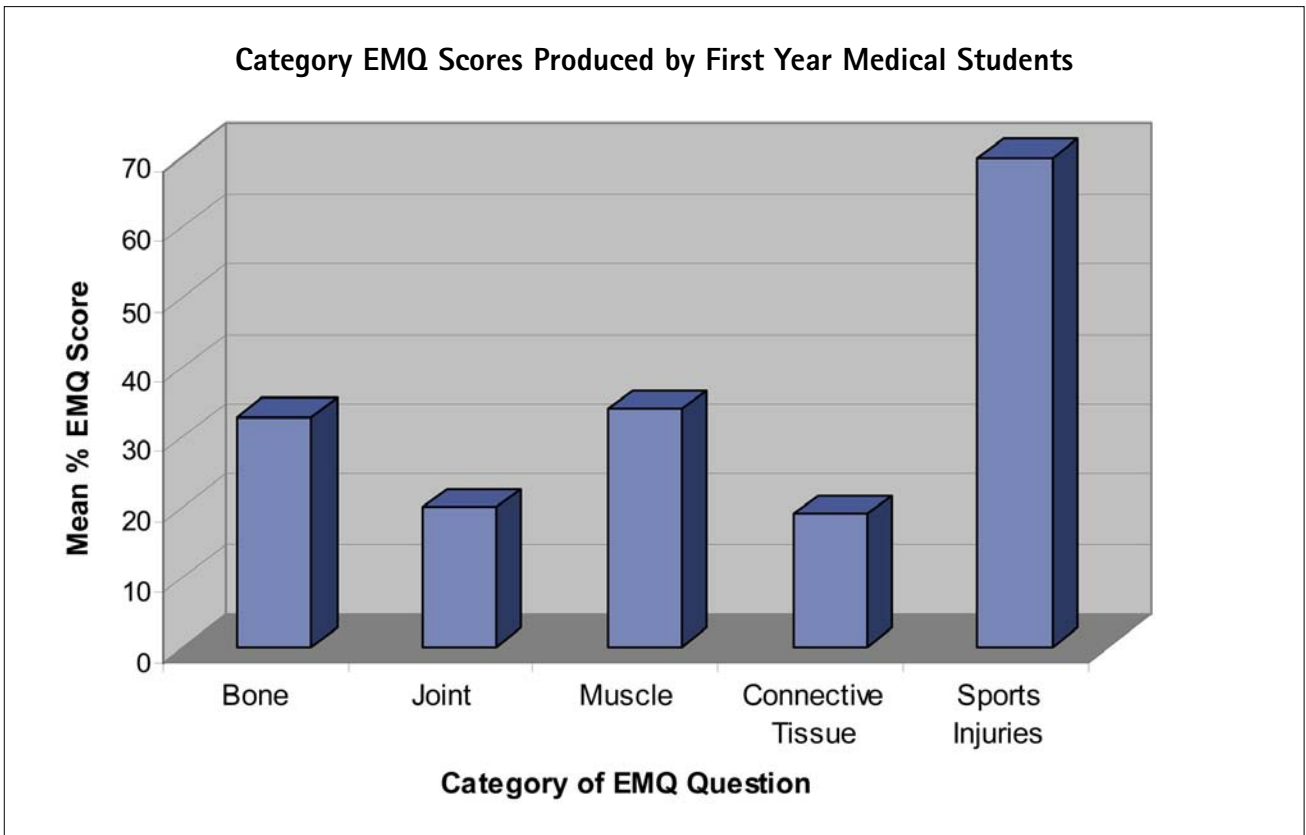


Figure 24. Histogram showing the scores (%) obtained by first year medical students from Extended Matching Questions (EMQs) on cardiovascular and respiratory medical disorders.

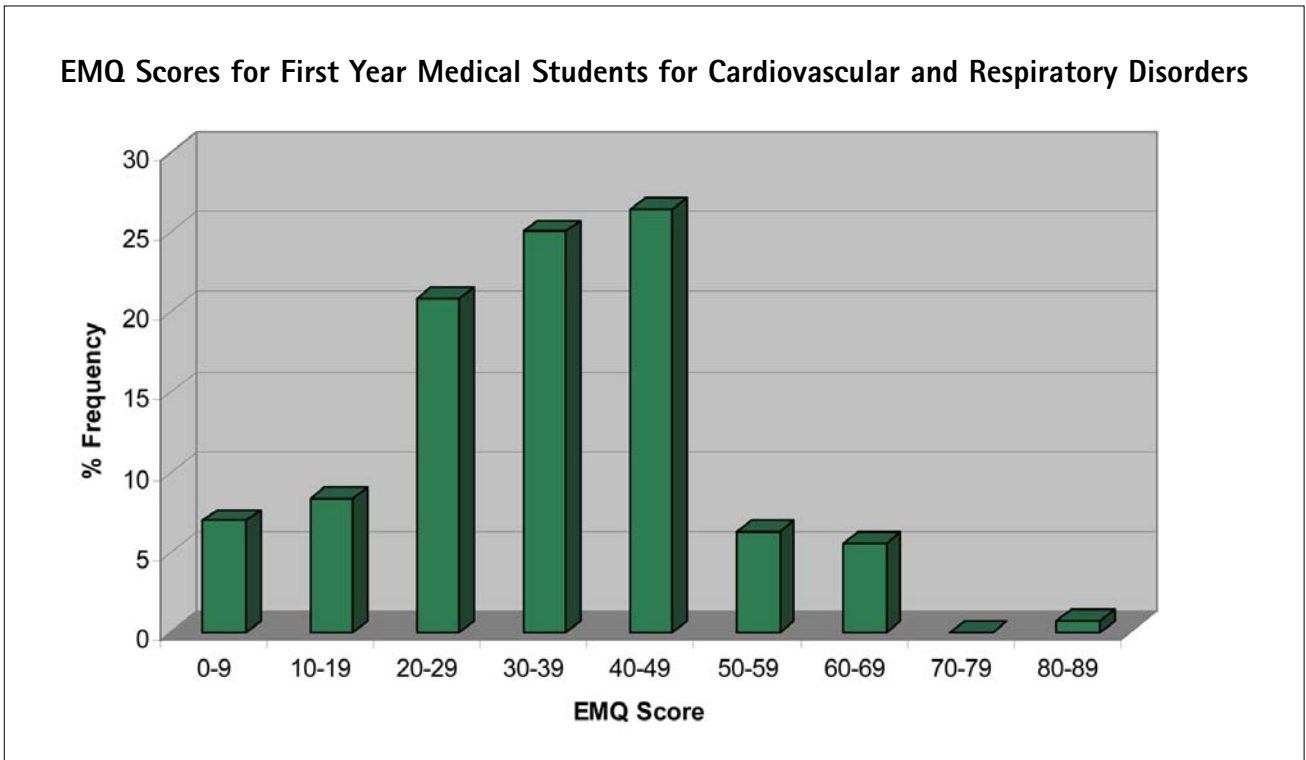
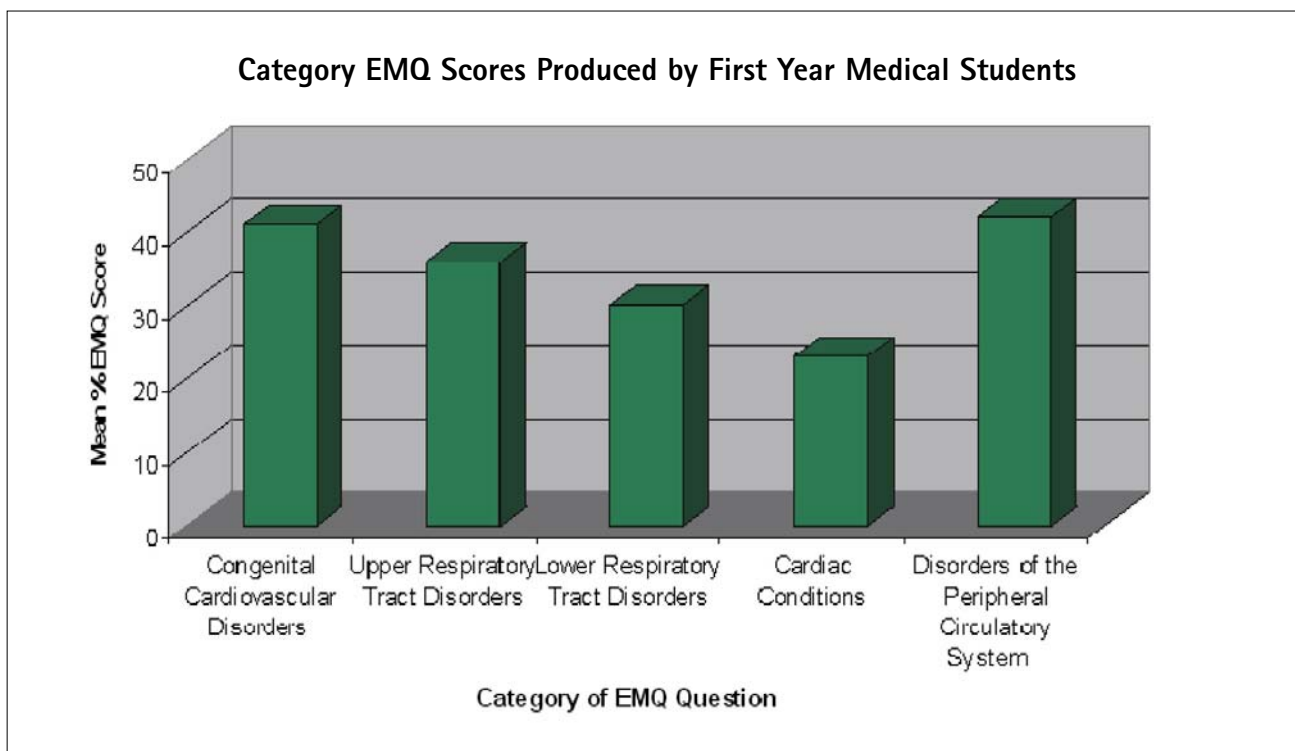


Figure 25. Histogram showing the relationship between EMQ scores and categories of cardiovascular and respiratory medical disorders.



DISCUSSION

Thurstone and Chave (1951) analyses of medical students' attitudes in the present study show that they consider anatomy to be of great importance to their clinical studies. The results confirm previous studies using the same methodologies for first year and final year students at Paris and Cardiff (Moxham and Plaisant, 2007) and for students at Imperial and Nottingham universities (Kerby et al., 2010). Thus, regardless of geopolitical and cultural backgrounds, and regardless of the nature of the anatomical courses undertaken, anatomy is regarded as having considerable value and purpose in an undergraduate medical course. The present study adds to these observations by reporting that, while medical students are positively inclined towards integration of anatomical material with clinical medicine and value the use of clinical examples/scenarios/case histories as motivational tools, the students fully appreciate that anatomy is a "foundation subject" and a scientific discipline that is more than just a device for studying clinical situations. Furthermore, there is ambivalence about the use of clinical scenarios for assessments and examinations at the early stages of the course.

These findings seem to support those of Regan de Bere and Mattick (2010) who suggest that "anatomy may require its own custom-built approach to teaching and learning". Indeed, in an earlier paper, Mattick and Knight (2007) reported that anatomical knowledge was considerably different to other closely related biomedical subjects. Overall, therefore, our findings support our initial hypothesis that medical students prefer anatomy to be made explicitly relevant to clinical needs. However, the results do not support the part of our hypothesis suggesting that students prefer this approach for assessment and examination. Furthermore, appreciation by the students of the clinical, scientific and cultural aspects of anatomy is aligned with the notion that anatomy should not be subsumed or totally integrated into clinical studies.

There is presently much debate about the positioning of anatomy in medical courses, with many anatomists and clinicians agreeing that anatomy teaching and learning should extend beyond the early years of the medical course. This commonsense suggestion, highlighting an important element in the future of clinical anatomy, needs some qualification based upon the student views expressed in our

survey. Seventy-seven percent of the students stated that anatomy forms the basic knowledge of the human body needed before it can be utilised in a clinical situation. 30% of the students were strongly of this view. Furthermore, on being asked where in the medical course anatomy should be taught, 61% answered at the beginning of the course and only 20% answered throughout the course. These findings do not obviate the need for anatomy to be reinforced throughout the course, nor do they argue against complex aspects of anatomy being introduced late in the course in relation to clinical situations. However, care must be taken to ensure that core anatomy is taught early on in the course and that the important professional skills that anatomy can deliver are not lost by dissembling courses and losing exposure to dissection and examination of cadavers.

Undoubtedly, there is much to be gained by using clinically-qualified staff in the teaching of anatomy and to emphasis clinical anatomy. Regan de Bere and Mattick (2010) reported that this was “key to keeping teaching grounded in relevant application”. There is concern in many parts of the world about the dearth of medically-qualified anatomists. This is perhaps inevitable given the emphasis on research-led teaching in many universities. Some attempts to train or approve anatomists without clinical qualifications have been undertaken. For example, the Anatomische Gesellschaft have a programme for the accreditation of anatomists in Germany (Fachanatom; <http://anatomische-gesellschaft.de>) and, for the Anatomical Society in the United Kingdom, a training programme for newly appointed anatomists has been established (Fraher and Evans, 2009). It is noteworthy in this respect that over 50% of the medical students in this survey did not believe that anatomy can only be taught by clinicians (11% were strongly of the opinion that it can only be taught by clinicians; 14% strongly held the contrary view). Looking at this aspect from a different perspective, students are often expected to take responsibility for their learning and not rely upon their teachers. It is instructive to note that, on a voluntary basis, only 34% of students were involved in medically-related reading beyond the recommended anatomical texts. This finding may reflect the lack of interest or time available to the student for self-integration of material, and/or is related to the perceived requirements of their examinations,

and/or is a measure of the lack of emphasis or direction provided by the teachers. Whatever the reason, it should be acknowledged that many students choose a superficial or strategic approach to their studies and not the deep approach that many teachers would wish (Smith and Mathias, 2010).

If, as is desired, the approach to teaching and learning anatomy should emphasis clinical relevance, we must be aware of the knowledge and experiences of medicine that newly-recruited students bring with them. Presently, teachers pay no regard to this aspect, assuming that medical students have little or no knowledge and that they are *tabulae rasae* upon which teachers and educators can direct/imprint their training. Our findings support our hypothesis that students have a significant knowledge of medicine before they commence their education and training at medical school. Using musculoskeletal, cardiovascular and respiratory medicine as signifiers of their medical knowledge, while many students claim little or no knowledge, the tests suggest that they do bring a significant amount of medicine with them to medical school. This being the case, teachers should not only focus upon the clinical relevance of anatomy but should appreciate that their students are not ignorant of medical conditions. Consequently, benefit can be obtained by encouraging students to impart their existing knowledge and by them recounting the “stories/narratives” whereby their knowledge of medicine was obtained. This approach would foster clinical relevance in their biomedical sciences studies and would improve staff-student interactions. Presently, there are trends in medical education to bring students into the clinic before they start their studies into biomedical sciences, the belief being that by exposure to clinical situations they can only then appreciate the need for learning anatomy and other biomedical sciences. By no means should one argue against the need for early clinical exposure. However, it is clear from the present study that: (1) students are already well aware of the importance of anatomy to clinical medicine and (2) they already bring with them a significant knowledge of medicine.

The future of clinical anatomy is assured but its context is important. Anatomy remains a central scientific and cultural element in the medical curriculum that requires its own pedagogic direction and principles.

Clinical anatomy requires that anatomists and clinicians fully understand what core clinical anatomy is. We remain some way from such an understanding and consequently it is not surprising that, for example, the Royal College of Surgeons in London have expressed concern about the future of anatomy in the undergraduate and postgraduate medical and surgical curriculum. Morley (2003) has argued against the “extensive” anatomy course, without regard for clinical context, on the basis that is merely imparting knowledge “just in case”. Putting aside aspects relating to the skills base from training in anatomy, and also the admonition from the General Medical Council in “Tomorrow’s Doctors” (2009) that a doctor must be a “scientist and a scholar”, without a generally accepted “core syllabus” in clinical anatomy we can hardly predict what is “just in case” let alone what is “just in time”!

While overall we would argue that anatomy must be delivered in a clinical context, we have concerns about just what is meant by “clinical context”. The French philosopher, Michel Foucault, whose father was a professor of anatomy, wrote in *The Birth of the Clinic; an Archaeology of Medical Perception* (London, 1973) about the culture of medicine and how it has changed with history. He concluded that the rise of anatomy had a profound effect upon the culture of medicine, shifting the emphasis from a concentration on disease towards an understanding of health. This is instructive since there is a great danger that our present emphasis on disease scenarios etc. for the teaching at an early stage in medical training may shift the culture of medicine away from health. And yet, we should not forget that medicine must remain focussed on *health* and *disease*. Consequently, doctors are expected to be advocates for health as well as diagnosticians of disease. An understanding of the science of anatomy is important in this respect and it is no wild conjecture to state that lay persons/patients are under the belief that anatomy is an essential aspect of medicine and that their doctors are well-versed in anatomical knowledge. Should anatomy continue to be down-played in the medical curriculum one fears not just for the culture of medicine but also for the standing and reputation of the medical profession as seen through the eyes of the lay person. In our view, the future of clinical anatomy relies upon an understanding of the descriptor “clinical” in terms of both health and disease.

REFERENCES

- COTTAM WW (1999) Adequacy of medical school gross anatomy education as perceived by certain postgraduate residency programs and anatomy course directors. *Clin Anat*, 12: 55-65.
- FOUCAULT M (1973) Birth of the clinic: an archaeology of medical perception (*Naissance de la clinique: une archéologie du regard médical*; 1963) translated by AM Sheridan. Tavistock Publications.
- FRAHER JP, EVANS DJR (2009) Training tomorrow’s anatomists today: a partnership approach. *Anat Sci Ed*, 2: 119-125.
- GENERAL MEDICAL COUNCIL (2009) Tomorrow’s Doctors. Recommendations on undergraduate medical education. London: General Medical Council Publications.1
- HOFER M, JANSEN M, SOBOLL (2007) Verbesserungspotenzial des Medizinstudiums aus retrospektiver Sicht von Faacharztprüflingen. *Dtsch Med Wochenschr*, 131: 373-378.
- KERBY J, SHUKUR ZN, SHALHOUB J (2010) The relationships between learning outcomes and methods of teaching anatomy as perceived by medical students. *Clin Anat*, in press.
- LEMON N (1973) Attitudes and their measurement. New York: Wiley.
- LOCKWOOD AM, ROBERTS AM (2007) The anatomy demonstrator of the future: an examination of the role of the medically-qualified anatomy demonstrator in the context of Tomorrow’s Doctors and modernizing medical careers. *Clin Anat*, 20: 455-459.
- MATTICK K, KNIGHT L (2007) High quality learning: Harder to achieve than we think? *Med Edu*, 41: 638-644.
- McHANWELL S, DAVIES DC, MORRIS J, PARKIN I, WHITEN S, ATKINSON M, DYBALL R, et al. (2007) A core syllabus in anatomy for medical students – adding common sense to need to know. *Eur J Anat*, 11 Supl 1: 3-18.
- MORLEY L (2003) Quality and power in higher education. Maidenhead, Berkshire: Open University Press and Society for Research into Higher Education.
- MOXHAM BJ, MOXHAM SA (2007) The relationships between attitudes, course aims and teaching methods for the teaching of gross anatomy in the medical curriculum. *Eur J Anat*, 11 Supl 1: 19-30.
- MOXHAM BJ, PLAISANT O (2007) Perception of medical students towards the clinical relevance of anatomy. *Clin Anat*, 20: 560-564.
- PABST R (2009) Anatomy curriculum for medical students: What can be learned for future curricula from evaluations and questionnaires completed by students, anatomists and clinicians in different countries? *Ann Anat*, 191: 541-546.
- PABST R, ROTHKÖTTER HJ (1997) Retrospective evaluation of undergraduate medical education by doctors at the end of their residency time in hospitals: consequences for the anatomical curriculum. *Anat Rec*, 249: 431-434.
- PATEL KM, MOXHAM BJ (2006) Attitudes of professional anatomists to curricular change. *Clin Anat*, 19: 132-141.
- PATEL KM, MOXHAM BJ (2008) The relationship between learning outcomes and methods of teaching anatomy as perceived by professional anatomists. *Clin Anat*, 21: 182-189.
- RAJECKI D (1990) Attitudes. Sunderland, Massachusetts: Freeman, WH.

REGAN DE BERE, MATTICK K (2010) From anatomical 'competence' to complex capability. The views and experiences of UK tutors on how we should teach anatomy to medical students. *Adv in Health Sci Educ*, 15: 573-585.

SMITH CF, MATHIAS HS (2010) Medical students' approaches to learning anatomy: students' experiences and relations to the learning environment. *Clin Anat*, 23: 106-114.

TERMINOLOGICA ANATOMICA (1998). Publication of the Federative International Committee for Anatomical Terminology (FICAT) for the International Federation of Associations of Anatomists. Stuttgart: Thieme.

THURSTONE LL, CHAVE EJ (1951) The measurement of attitude; a psychophysical method and some experiments with a scale for measuring attitude towards the church. Chicago, Ill. University of Chicago Press.