The hallmark of osteopathic medical education is the inclusion of hands-on instruction in osteopathic manipulative medicine (OMM), which includes palpatory diagnosis and osteopathic manipulative treatment (OMT). This OMM training typically involves a primary instructor presenting theory and techniques with step-by-step demonstrations to a large group of first- and second-year osteopathic medical students. Additional instructors, referred to as table trainers, assist the primary instructor by supervising the students as they practice the presented techniques. To the authors’ knowledge, there is no currently accepted standard for a table trainer-to-student ratio in OMM skills laboratories within osteopathic medical schools in the United States. However, through a Google Web search and PubMed literature review, the authors identified published trainer-to-student ratios used in other health care skills training curricula. Psychomotor skills training courses in health care fields typically have a table trainer-to-student ratio of 1 trainer to 8 or fewer students. On the basis of these findings and psychomotor skills learning theory, the authors conclude that this ratio is likely sufficient for OMM skills training.


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Psychomotor skills training in health care fields varies from discipline-specific skills, such as dental hygiene, to cross-discipline and layperson skills, such as cardiopulmonary resuscitation (CPR). Most of these psychomotor skills involve complex perceptual discrimination and motor tasks performed in response to visual, auditory, or palpatory stimuli. Training in these skills is expected to result in cumulative learning, with student performance improving with repeated practice.

Unique to the osteopathic medical profession, osteopathic manipulative medicine (OMM) consists of psychomotor skills that are dependent on instruction, training, and ongoing practice to develop and maintain competency. Both in the initial phases of OMM instruction and in the later stages of practice, supervision is crucial for an acceptable educational environment from the perspectives of safety and quality. In terms of motor skill acquisition, research suggests that instructor feedback with information about the success or failure of meeting a specific motor goal is the most important variable for facilitating motor learning in students.

Because the curricular time allotted for the teaching of OMM at osteopathic medical schools is limited, optimal table trainer-to-student ratios are imperative for the proper instruction of palpatory diagnosis and osteopathic manipulative treatment (OMT) psychomotor skills that lead to clinical competency. In the present study, we conducted a Web search and literature review to identify published trainer-to-student ratios used in curricula for health care–related psychomotor skills training, with the objective of establishing a basis for making a recommendation for a minimum table trainer-to-student ratio for OMM skills training in the first- and second-year osteopathic medical school curriculum. The recommendation we present is intended to guide department chairs and faculty members in overseeing the delivery of OMM curricula and OMT instruction at colleges of osteopathic medicine.

Skills Training Overview

Health Care–Related Skills Training Courses

Many courses in health care–related skills that lead to certification of those skills have defined instructor-to-student ratios to maximize the competency of graduating students. These defined ratios are the result of any of 3 causes—(1)
they may be defined by the expertise of the course instructors, (2) they may be required by the curriculum accreditation organization, or (3) they may be state mandated.

For example, the US Department of Transportation’s National Highway Traffic Safety Administration, which provides accreditation in courses for first responders, emergency medical technicians, and paramedics, requires an instructor-to-student ratio of 1:6 for the psychomotor skills portions of these courses.\textsuperscript{3,5} The American Heart Association, which offers accreditation in many courses of first aid, CPR, and basic and advanced adult and pediatric cardiac life support, also requires an instructor-to-student ratio of 1:6 for all courses.\textsuperscript{6} This ratio applies regardless of the skill levels of course participants. Notably, CPR can be taught as early as the fifth grade in the United States, yet the same instructor-to-student ratio applies for grade-school children as it does for licensed physicians.\textsuperscript{6,7}

In manual medicine training, published instructor-to-student ratios include a 1:8 ratio in athletic training,\textsuperscript{8-13} a 1.5 ratio in medical texts, and 1:4 ratios in training to postural reeducation program training.\textsuperscript{14} and a 1:4 ratio in basic training courses for Osteopathy in the Cranial Field (OCF).\textsuperscript{15} These and other set instructor-to-student ratios are used throughout various medical disciplines, as shown in the Table. However, we found no set trainer-to-student ratios for physical therapy or chiropractic.

Health care research in psychomotor skills is largely skill specific. Dubrowski and MacRae\textsuperscript{2} conducted 1 of the few randomized, controlled studies investigating the effect of various instructor ratios on students’ acquisition of surgical skills. As part of an optional suture-training course, medical students were randomly assigned into 3 groups with different instructor-to-student ratios. Students in all groups received the same initial presentation, which consisted of a demonstration of suturing technique by a general surgeon followed by a suturing skills test to determine baseline skill levels. One week later, the students received 1 hour of small group instruction with fourth-year surgical residents serving as instructors, followed by the same suturing skills test to determine postinstruction skill levels. The same suturing test was then repeated a third time 1 week later to test for retention of skills.\textsuperscript{2}

The authors found that although there was no statistically significant difference in baseline skills between groups, the groups with instructor-to-student ratios of 1:2 and 1:4 learned suturing with a higher level of proficiency at the postinstruction skills test than did the group with a ratio of 1:12.\textsuperscript{2} Although there was some decline in skills among all groups 1 week later, the groups with the 1:2 and 1:4 ratios maintained a higher level of skills at the retention tests than did the group with the 1:12 ratio. No statistically significant differences were seen between the 1:2- and 1:4-ratio groups, and the authors concluded that a 1:4 ratio was likely optimal.\textsuperscript{2}

**Osteopathic Manipulative Medicine Training**

At most osteopathic medical schools, the first- and second-year OMM curriculum centers on didactic material that is presented in lecture and laboratory formats. The OMM didactic laboratory sessions typically involve a primary instructor using step-by-step demonstrations to present information on functional anatomy, differential diagnosis, palpatory assessment and diagnosis of somatic dysfunction, and OMT techniques. Additional instructors, commonly referred to as table trainers, assist the primary instructor by supervising the osteopathic medical students as they practice the presented techniques. In this respect, OMM laboratory sessions are similar to the suture training course described by Dubrowski and MacRae.\textsuperscript{2}

In most osteopathic medical schools, a variety of table trainers assist the primary instructor in OMM laboratory sessions. Table trainers may include second-year teaching assistants (who assist in the training of first-year osteopathic medical students); third- or fourth-year OMM predoctoral fellows; resident osteopathic physicians; and osteopathic clinical faculty or instructors (who may be specialists in family medicine, OMM, or other fields). In general, these table trainers have received specialized training in the material being presented and have been instructed on how to teach the procedures in a consistent manner.

Establishing guidelines for an instructor-to-student ratio in OMM skills laboratories has important implications for table-trainer staffing, particularly regarding supervision of osteopathic medical students as they learn and practice OMT techniques.

**Web and Literature Findings on Trainer-to-Student Ratios**

We performed a Web-based search using the Google search engine and the National Library of Medicine’s PubMed database to find relevant literature and other information regarding the requirements of various kinds of medical skills training. Both searches used the following keywords: instructor ratio, instructor-to-student ratio, psychomotor, student ratio, supervision, and table trainer. The Google search targeted medical skills training courses for the 2011-2012 academic year with instructor-to-student ratios that were accessible to the public online. After specific courses were identified, additional searches were performed to determine if the ratios were required by accrediting agencies. If no accrediting agency could be determined, examples of published ratios were noted. When multiple published ratios were found for a specific type of course, at least 2 examples of each ratio were noted.
<table>
<thead>
<tr>
<th>Type of Training</th>
<th>Ratio</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexander technique</td>
<td>1:5</td>
<td>Rickover. Alexander technique—taking the pressure off your body [4]</td>
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<tr>
<td>Athletic training, clinical skills</td>
<td>1:8</td>
<td>Commission on Accreditation of Athletic Training Education. Standards for the Accreditation of Entry-Level Athletic Training Education Programs [8]</td>
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<tr>
<td>Basic life support</td>
<td>1:6</td>
<td>New York State Department of Health. Emergency Medical Technician—Basic Curriculum [18]</td>
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<tr>
<td></td>
<td>1:6</td>
<td>Virginia Department of Health. BLS Curriculum Review Committee Presentation [17]</td>
</tr>
<tr>
<td></td>
<td>1:8</td>
<td>American Heart Association. Faculty Guide for BLS and Heartsaver Instructor Courses [18]</td>
</tr>
<tr>
<td>Cardiopulmonary resuscitation</td>
<td>1:5</td>
<td>Connolly et al. The ‘ABC for life’ programme—teaching basic life support in schools [19]</td>
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<tr>
<td></td>
<td>1:6</td>
<td>Dworkin. Teaching CPR in the schools [3]</td>
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<td></td>
<td>1:4</td>
<td>Montana University System. Purpose and Rationale [22]</td>
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<tr>
<td></td>
<td>1:4</td>
<td>DH M ethods of Education Inc. Course descriptions: dental and allied dental teaching methodology [23]</td>
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<td></td>
<td>1:5</td>
<td>Branson and Toevs. An assessment of issues related to clinical skill remediation in dental hygiene education [24]</td>
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<tr>
<td>Dentistry, clinical skills</td>
<td>1:4</td>
<td>Waterhouse et al. The development of a primary dental care outreach course [25]</td>
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<tr>
<td>Diagnostic medical sonography</td>
<td>1:1</td>
<td>Commission on Accreditation of Allied Health Education Programs. Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography [26]</td>
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<tr>
<td>Fetal monitoring</td>
<td>1:6</td>
<td>Association of Women’s Health, Obstetric and Neonatal Nurses. Fetal heart monitoring education can improve outcomes and reduce risk [27]</td>
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<td>Nurse anesthetist</td>
<td>1:1</td>
<td>Medical University of South Carolina. Anesthesia for Nurses Program, Student Handbook, Class of 2013 [28]</td>
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<tr>
<td></td>
<td>1:1</td>
<td>Mountain State University. MSN Nurse Anesthesia Student Handbook [29]</td>
</tr>
<tr>
<td></td>
<td>1:2</td>
<td>Michigan State University College of Nursing. Master of Science in Nursing: Nurse Anesthesia Supplemental Student Handbook [31]</td>
</tr>
<tr>
<td></td>
<td>1:2</td>
<td>Lincoln Memorial University. Master of science in nursing [32]</td>
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<tr>
<td>Nursing, clinical experiences</td>
<td>1:10</td>
<td>Bryant and Williams. The senior practicum [33]</td>
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<td></td>
<td>1:10</td>
<td>Commonwealth of Massachusetts, Department of Public Health. Guidelines for Clinical Education Experiences [34]</td>
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<td></td>
<td>1:10</td>
<td>West Chester University, Department of Nursing. BSN: bachelor of science in nursing [35]</td>
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<td>Nursing, pediatric provider</td>
<td>1:80 max</td>
<td>Emergency Nurses Association, Emergency Nursing Pediatric Course. Administrative procedures [36]</td>
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<tr>
<td>Nursing, trauma</td>
<td>1:4</td>
<td>Emergency Nurses Association. Trauma nursing core course [37]</td>
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<td>1:4</td>
<td>Alabama State Council Emergency Nurses Association. Trauma nursing core course [38]</td>
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<td></td>
<td>1:4</td>
<td>New York State Emergency Nurses Association. Trauma nursing core course [39]</td>
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<tr>
<td>Osteopathy in the cranial field, basic course</td>
<td>1:4</td>
<td>The Osteopathic Cranial Academy Inc. Introduction to osteopathy in the cranial field winter course [40]</td>
</tr>
<tr>
<td>Suturing</td>
<td>1:4</td>
<td>Dubrovski and MacRae. Randomised, controlled study investigating the optimal instructor: student ratios for teaching suturing skills [2]</td>
</tr>
</tbody>
</table>

* The Commission on Accreditation of Athletic Training Education has proposed changes in its standards to increase the required instructor-to-student ratio for clinical education from 1:8 to 1:5. [20]
Most published curricular requirements for psychomotor skills training involving direct physical supervision by an instructor include a minimum instructor-to-student ratio of 1:1 to 1:8, depending on the skill being taught (Table). For example, nurse anesthetist training has reported a ratio of 1:1 or 1:2, depending on the curriculum.\(^{20-32}\) However, after acquisition of basic skills, instructor-to-student ratios in nursing may be higher, such as those ratios required for clinical experiences, which may be 1:10.\(^{33-35}\) Furthermore, during these nursing clinical experiences, the instructor does not need to be physically present, although he or she must be immediately available.\(^{34}\)

The Centers for Medicare and Medicaid Services (CMS) has mandated supervision requirements for residents in various clinical settings. In the operating room, an attending surgeon may supervise as many as 2 resident physicians performing major surgery, provided that the attending surgeon is physically present in the operating room during the key or critical components of the surgical procedure.\(^{40}\) In the outpatient primary care training setting, an attending physician may supervise as many as 4 resident physicians without physically seeing any patients, provided that each patient’s plan of care is reviewed with the attending physician during or immediately after each visit. However, any minor office procedures performed on the patient must be physically supervised by the attending physician during the key or critical components of the procedure.\(^{40}\)

**Comment**

On the basis of published curricular requirements for psychomotor skills training in health care fields—with emphasis on published CMS requirements for physician training\(^{40}\) and requirements for other manual medicine skills (ie, athletic training, Alexander technique, OCF)\(^{48-15}\)—a table trainer-to-student ratio of 1:8 may be appropriate for the acquisition of OMM skills by osteopathic medical students in the laboratory environment. This ratio should allow table trainers to adequately supervise and assist students and to answer students’ questions.

The ratio of 1 table trainer to 8 students allows intermittent rather than constant feedback to the students regarding their performance. This type of teaching is supported by the “guidance hypothesis,” which proposes that varying the amount of instructor feedback affects the learning of psychomotor skills.\(^{42}\) According to the guidance hypothesis, instructor feedback may have a negative effect on the learning of motor skills if the feedback occurs too frequently during skill acquisition. Frequent instructor feedback typically results in better initial skill performance, but students receiving frequent feedback have been found to have inferior skill retention compared with students receiving only intermittent feedback.\(^{43,44}\)

The guidance hypothesis has demonstrated validity in the acquisition of manual medicine skills. Pringle\(^{45}\) taught 35 first-year chiropractic students a novel motion-testing technique with varying amounts of instructor feedback during multiple training sessions. Although constant instructor feedback resulted in the most accurate initial acquisition of the manual skill, intermittent feedback resulted in the best retention and learning.\(^{45}\) However, the group of students that received feedback only once during each training session had the lowest initial skills acquisition and the lowest skill retention.\(^{45}\)

There is some evidence that better retention and learning achieved during the first 2 years of osteopathic medical school may improve students’ confidence in their OMT skills during their third- and fourth-year clinical clerkships. In a study of fourth-year osteopathic medical students, nearly 20% of the students reported that lack of confidence in their OMT skills was the primary reason they did not use OMT during their clerkships.\(^{46}\) The variables that may contribute to osteopathic medical students’ confidence in their OMT skills, including table trainer ratios, are worthy of further study.

**When Osteopathic Manipulative Treatment Requires More Supervision**

Osteopathic manipulative medicine entails a variety of manual diagnostic and treatment skill sets. Osteopathic medical students are taught how to palpate each structure of the body—including bony landmarks, muscles, joints, skin, connective tissues, arteries, veins, nerves, and organs—to identify and differentiate between normal and abnormal contours, shapes, and motion characteristics. When vital structures are palpated and when manipulation is performed as part of the training session, 1-on-1 supervision is necessary during initial skill acquisition, especially when such highly vulnerable areas as the head and neck are involved.

Therefore, although a table trainer-to-student ratio of 1:8 may be appropriate for most OMM laboratory sessions, certain OMT techniques likely require a higher level of individual supervision. Examples of these OMT techniques are OCF; cervical high-velocity, low-amplitude; and trigger point injections. Basic courses in OCF approved by the Osteopathic Cranial Academy require a table trainer-to-student ratio of 1:4, or 1 table trainer to 2 pairs of students.\(^{15}\) Generally, 1 student of each pair is on the treatment table being palpated and treated, while the other student is performing the palpation and treatment. After the treating student completes the assigned tasks, the partners switch roles. Thus, the table trainer is actually supervising 2 students practicing cranial palpation and treatment at the same time, for a 1:2 trainer-to-student ratio. However, when providing instruction to an individual student...
Regarding hand placement, body position, or direction of forces, the trainer is working at a 1:1 ratio.

For teaching OMT techniques that require a high degree of individual student attention, the necessary table trainer-to-student ratio may be achieved by several different methods. One method is to increase the number of trainers present during the laboratory session. Another method is to decrease the number of techniques taught during the laboratory session, allowing the limited number of trainers to work with each student. Yet another method is to split the class into smaller groups to optimize the availability of the table trainers, thereby providing a higher table trainer–to-student ratio with the same number of instructors. By modulating the time needed to present the required course material, the course coordinator or OMM department chair can maximize the table trainer–to-student ratio.

The teaching of OMM skills at osteopathic medical schools is an important aspect of the curriculum, and assessing the table trainer-to-student ratio needed for osteopathic medical students to gain competency is important for determining the appropriate number of faculty needed to achieve the goal.

Osteopathic manipulative medicine consists of complex psychomotor skills that require adequate training and experience to be applied appropriately and competently. Table trainers play a fundamental role in conveying these skills to osteopathic medical students. The table trainer-to-student ratio may vary depending on the skill levels of the table trainers and the complexity of the material being taught. For most OMM skills laboratories, we propose a ratio of 1 table trainer to 8 students as appropriate. However, this proposed ratio should be further studied. Regardless of the faculty-to-student ratio, evaluation of students’ OMM skills through practical examination is necessary to determine whether the students have achieved the desired competencies prior to clinical clerkships.

Conclusion
Our recommendation of a ratio of 1:1 table trainer to 8 students for OMM skills laboratories is based on an assessment of related examples from national accrediting agencies and “real-world” practice at various institutions. Most of the examples presented in the Table are for courses that lead to standardized testing and certification. The sources for these examples did not all take into account the complex nature of psychomotor skill acquisition, which involves various methods of instruction and subsequent practice of the skills. Thus, the next phase of this inquiry requires prospective research studies to assess the accuracy of our recommendation and to identify the appropriate table trainer-to-student ratios for both initial OMM skill acquisition and skill retention.

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