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Australian medical student's perceptions of orthopaedic surgery: Factors influencing the pursuit of orthopaedic training

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Abstract
Introduction: Previous research has shown that myriad factors determine medical students' choice of career path. Exposure to surgical specialties is beneficial to medical students, no matter their eventual area of specialisation. Orthopaedic Surgery is the second largest surgical subspecialty and has an important role in the musculoskeletal health of Australians. Undergraduate musculoskeletal education is often delivered in combination with other clinical placements and has to compete with other specialties in the curriculum.
Methods: This study determined the understanding of Orthopaedics in a medical student cohort and explored factors influencing its choice as a specialty in an Australian context. Senior medical students from the University of Tasmania were examined on 20 different surgical scenarios and chose the appropriate subspecialty for the condition. Clinical scenarios included a host of Orthopaedic and non-Orthopaedic cases. The online platform used was Survey Monkey.
Results: As far as we are aware, this study was the first of its kind in Australia. It was determined that direct clinical exposure to Orthopaedics enhanced both understanding and desirability of the specialty. Over 80% of respondents reported favorable benefits that were statistically significant. Lack of clinical experience in Orthopaedics was associated with a poor understanding of the specialty in all cohorts.
Conclusion: Knowledge of medical students' perception of the educational opportunities provided in Orthopaedics has national significance at a workforce level and has relevance to the Australian Orthopaedic Association (AOA) and the Royal Australasian College of Surgeons (RACS). Indeed, medical students are more likely to consider an Orthopaedic career if their early experience of it was enjoyable, rewarding and educational.
Background and aims: The field of Orthopaedic Surgery, despite being the second largest surgical subspecialty in Australia, is a poorly understood field amongst medical students. Indeed, there is a level of misunderstanding about the nature and scope of Orthopaedic Surgery amongst both medical professionals and the general public. The reasons for this lack of understanding are not clear and have not been previously examined in the Australian context. Medical schools have an essential role in equipping junior doctors with the clinical skills and acumen that they need to function as medical professionals, however the time dedicated to formal Orthopaedic teaching is generally very limited and often ad hoc in nature.
Increasing medical students' understanding of the scope and importance of Orthopaedics is of vital importance to not only key stakeholders such as the Australian Orthopaedic Association (AOA) and the Royal Australasian College of Surgeons (RACS), but also to the Australian community at large. Fourth and Fifth Year Medical students at the University of Tasmania, in the clinical training part of their program, were invited to participate in an electronic survey to analyze their understanding of Orthopaedics and other surgical subspecialties in an Australian context. The students were asked to identify which surgical subspecialty would be most likely to treat the presented clinical case. The cases varied in their level of complexity, but were all deemed to be common enough issues to warrant focus in the medical school curriculum. The entire spectrum of Orthopaedics was included to delineate the depth and breadth of understanding of the medical student body.
The electronic survey utilized the Survey Monkey platform and involved 55 medical students in their final two clinical years; this cohort was chosen because they had the maximum Orthopaedic exposure in the medical program, usually in the form of four or five week rotations. There were approximately 200 students in total of Year 4 and 5 medical students and only 36 had completed an Orthopaedic rotation at the time of the survey. According to previous research, the likelihood of students selecting Orthopaedics as the managing craft group significantly improved if they had Orthopaedic Surgical experience (2) Overall, there was a gap in knowledge in students selecting the appropriate managing craft group in relation to Orthopaedic scenarios. Students were likely to associate Orthopaedic Surgeons with non-operative conditions such as gout, but a significant minority recognized the chief role of Rheumatology in this medical condition.
This study has highlighted the gap between medical students' perceptions and the reality of the scope of Orthopaedic Surgery. Moreover, it has emphasized the need for greater exposure and education in Orthopaedic Surgery if future medical practitioners are to successfully enter Orthopaedic Surgical Education and Training (SET). For those doctors who do not pursue Orthopaedics as a future vocation, exposure to the specialty in medical school enhances the appreciation of the field in terms of referral patterns and clinical scope, as well as facilitates improved understanding and communication between various craft groups, all of which benefit patients.

Keywords: orthopaedic surgery, Australian medical

Introduction

The field of Orthopaedic Surgery is the second largest surgical subspecialty in Australia, following General Surgery [9]. Despite this, Orthopaedics is a poorly understood surgical subspecialty amongst medical students and junior doctors [10]. Particular subspecialty areas such as hand surgery and spinal surgery are truly interdisciplinary in nature and are shared between Plastic Surgery/General Surgery and Neurosurgery,

respectively. Conditions such as carpal tunnel syndrome are, in many cases, managed by Plastic Surgeons, General Surgeons or Neurosurgeons with a particular interest in 'the hand' and/or peripheral nerve surgery, whereas Spine Surgeons often have an element of dual training in Orthopaedics and Neurosurgery, or have completed post-Fellowship training to be entitled to practice Spine Surgery. These areas of crossover create confusion amongst junior doctors, especially at the point of referral or when a patient does not fit discretely into a particular 'clinical category'. There is also a misunderstanding surrounding the scope of Orthopaedics amongst the general public and much work has been done by the AOA to address this issue by way of public education and a move towards organizational transparency [11].

A lack of understanding of the nature of Orthopaedics and its full depth and breadth is not unique to Australia; this misunderstanding has been demonstrated in overseas medical students in the US and UK [2, 5]. Education is key to not only revealing the full extent of Orthopaedics as a craft group to potential future trainees, but also to maximize good communication between medical teams, especially in relation to referral patterns and models of clinical leadership [9].

Medical student awareness of Orthopaedic Surgery has myriad implications for the future. Firstly, a lack of understanding or awareness has repercussions for both future Surgical and non-Surgical trainees alike. Indeed, the latter group is likely more significant, as it will form a significant section of the future Orthopaedic referral base. Moreover, by improving the understanding of Orthopaedics at an integrated referral network level, the referral process itself would likely be expedited and streamlined, thereby creating significant economic savings for both the public and private healthcare systems. In this era of increasing bureaucracy and "cost blowouts", any efforts to improve the efficiency of the Australian healthcare system have never been more important.

Although it is an intuitive idea, experience in an academic or professional area does not always translate into increased uptake or personal interest [12]. In medicine, however, it is well accepted, and evidence strongly suggests, that exposure to different medical specialties significantly increases students' knowledge and increases the likelihood that they will pursue future training in a particular area of interest. The importance of mentors and role models cannot be underestimated as having an essential role in providing vocational guidance and support [1] However, the number of medical schools with Orthopaedics as an independent part of the curriculum is declining [2]; this is not unique to Orthopaedics, but to Surgery in general, as many medical school programs become overwhelmed by the volume of knowledge that must be imparted to students over an increasingly shorter time period, both in terms of duration of the academic year and the length of medical school, which has been increasingly cut in recent years [4].

Medical schools provide a unique opportunity to educate and train future medical practitioners on the breadth and depth of surgical subspecialties. This study sought to determine the degree of understanding of Orthopaedics amongst an Australian medical school cohort; an additional focus was on the influence of an Orthopaedic rotation in clinical understanding and future career choice. It was hypothesized that medical students do not understand the full clinical scope of Orthopaedics, but that this improves with exposure in medical students' clinical years, where mentorship may have other additional benefits [13].

Methods

The 'Survey Monkey' platform was used to formulate the questions and was sent via email, following successful ethics approval, to all 4th and 5th Year Medical Students at the University of Tasmania, Australia; that is, those considered in their clinical years of medical school. The email invited the medical students to participate in an electronic survey to determine their understanding of Orthopaedics, other surgical subspecialties and also selected internal medicine specialties in relation to various clinical problems. The medical students were presented with 20 different surgical scenarios and asked to choose which specialty would be most likely to treat the surgical and/or medical condition. The other specialties incorporated in the survey were Neurosurgery, General Surgery, Ear Nose and Throat Surgery, Paediatric Surgery, Plastic and Reconstructive Surgery, Urology, Vascular Surgery, Maxillofacial Surgery, Ophthalmology and Rheumatology.

For those cases potentially requiring multidisciplinary care, students were asked to indicate the primary treating team. The cases were not exhaustive, but attempted to cover the full scope of Orthopaedics in an Australian context. Twenty of the presented scenarios outlined a condition routinely managed by another subspecialty (e.g., spinal cord compression) to assess students' understanding of the often-interdisciplinary nature of many conditions managed by or with Orthopaedic Surgeons. Statistical analyses were performed utilizing Excel; this facilitated the creation of descriptive statistics, confidence intervals and likert scores useful for the comparison of groups.

An example of a case scenario as shown

"A 69 year old female presents with chronic back pain lasting for two years and with inability to walk long distances. Her posture is continually deforming into a forward flexed position. Patient has bilateral weakness of the extensor muscles in her legs and diminished left ankle reflex. Diagnosis: Spondylolisthesis at L4-L5 causing spinal stenosis. Please choose from list of specialties for a referral. In the case where patients require multiple teams please choose the primary treating team"

Results

Overall, 55 medical students completed the online. There were no discernable differences in the baseline demographics. In total, all students were in their clinical. Thirty-six (65%) students had an interest in surgery as a future area of career specialisation, with 36.36% being particularly interested in Orthopaedic Surgery.

Table 1: Number of students selecting each specialty by clinical scenario.

	General surgery	Neurology	Orthopaedic	ENT	Pediatric surgery	Plastics/Recon	Urology	Vascular surgery	Max Fax	Ophthalmology	Rheum	Neurosurgery
Osteomyelitis	5	41						1			1	7
Septic Arthritis	2		43								10	
Rheumatoid arthritis	12					1					42	
Spondylolisthesis		5	25								5	20
Disc herniation		6	21						1			27
CTS	6	3	15			23	1				1	6
Compartment syndrome	8		38			3	1	4				1
Ulcer	17		16			8		13	1			
Rib fracture	6		48			1						
Subacromial bursitis	2		46		1	1				1	4	
Chronic leg and back pain		14	27								5	9
Wound necrosis	13		22			12		8				
Gout		1	23				1				30	
Unicameral Bone Cysts	3		46		5					1		
Adolescent idiopathic scoliosis	1		43		5		1				2	3
Dupuytren's contracture	1		24		6	22					2	
Undisplaced Weber B fracture			53			1				1		
Achilles tendon rupture	2		50			2					1	
osteoarthritis			52								3	
Stress fracture			54									1

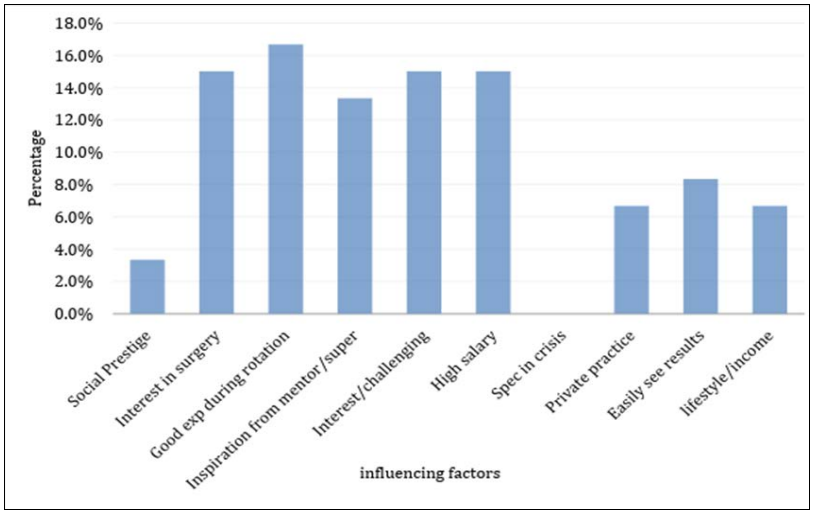

Fig 1: Influencing factors where Orthopaedics was chosen as a possible career path.

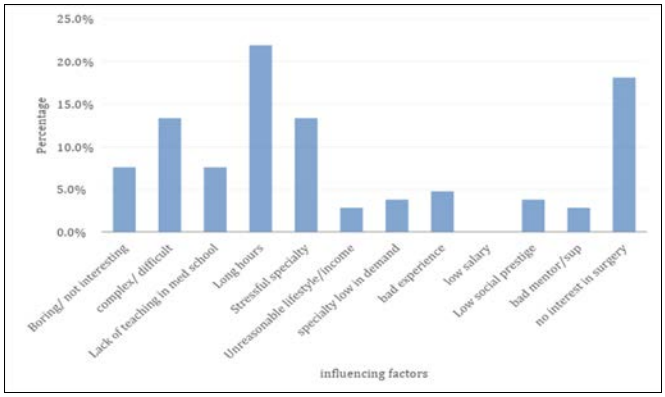

Fig 2: Influencing factors where Orthopaedics was not Considered as a possible career path.

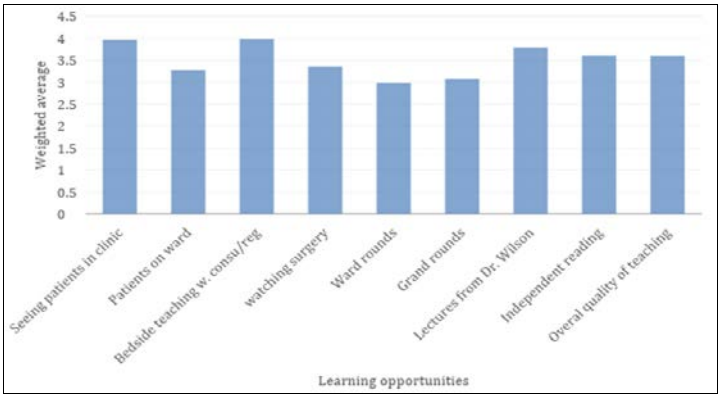

Fig 3: Educational value in Orthopaedics for each learning environment

Discussion

This study demonstrates that the field of Orthopaedics, although generally well understood by those who have completed a rotation in it, is poorly understood by those who haven't. It was discovered that this poor understanding extends to students in both Year 4 and 5 clinical years, but significantly improves with specialty exposure. Students were much more likely to associate the specialty of Orthopaedics with some medical conditions best managed by physicians (e.g. gout) and other craft groups (e.g. Cardiothoracic Surgery with rib/sternal fractures). This is likely influenced by the portrayal of the specialty as one involving 'the bones'.

The majority of medical students thought assessment of patients in the outpatient clinic and on the ward were the most beneficial learning environments with a 3.96-weighted average on the 1-5 likert scale.

Bedside teaching with the Registrar or Consultant was valued, with 3.98-weighted average. The Orthopaedic Clinical Lecture Series was also generally recognized as a worthwhile endeavour in terms of medical student education. The majority of medical students (54.5%) were satisfied or highly satisfied with the adequacy of the time given to Orthopaedic teaching at the University of Tasmania. The majority of medical students were identified as either 'frequently' or 'sometimes' having thoughts about their future career choices; clearly, by providing a good educational and role modeling experience, it is believed that the University of Tasmania can positively influence the career choices of its medical student cohort.

Despite Orthopaedics being a demanding specialty in regards to time commitment, length of training and career uncertainly in the early stages, in addition to the perception of it being a physically and intellectually challenging surgical subspecialty, Close to 40% of medical students would consider it as a future career path. It was identified that for those who would consider a future career in Orthopaedics, a combination of interest in surgery in general, experience during their Orthopaedic rotation, positive mentoring, clinical interest and favourable potential income were the main factors driving this ambition. For the majority of medical students who would not consider a future career in Orthopaedics at this stage, the four main reasons included "Long hours", "Complex and difficult", "Stressful" and "No interest in surgery". Only 11.43% of students thought that the specialty was in "low demand" and only 8.57% of students attributed their lack of interest in Orthopaedics as arising secondary to a "Bad experience with a mentor or supervisor".

Although there has been a focus on Orthopaedic education for the 4th and 5th Year medical students at the University of Tasmania, with initiatives such as formal Orthopaedic Clinical Lectures delivered on a monthly basis by one of the authors (MW in 2017) and by one of the Orthopaedic Consultants in previous years, 22.86% of students identified a lack of teaching opportunities as a reason not to pursue further training in Orthopaedics. The implication of this poor understanding or apprehension about Orthopaedics extends beyond the medical students. It has been previously revealed that perceptions held in medical schools mirror those in general practice [26]. Clearly this is of growing concern, as up to half of the Australian medical school graduates go on to a career in general practice. A lack of full knowledge about the specialty, even in those who have no desire to enter the Orthopaedic training program, is harmful to the specialty, with the potential loss of referrals and the attrition of potential candidates to other specialties. Indeed, exposure to Orthopaedics improves students' knowledge of the scope of practice and its future suitability as a career; efforts should be geared towards promoting this exposure, with the ongoing program of rotations in the clinical years, in addition to didactic lectures and skills workshops in the preclinical years of learning.

Despite the wealth of useful information gleaned from this study, the project was not without its weaknesses; voluntary online surveys have inherent selection biases that have been well described in the literature [25], with students interested in surgery more likely to participate. The results also represent a single institution (University of Tasmania) and are therefore influenced by clinical exposure and local teaching methods. The University of Tasmania Year 4 and 5 cohort has approximately 200 students. However, 55 students had participated in this survey, producing a 27.5% response rate, margin of error ±5%. It is not clear whether all individuals received the recruitment email. Some accounts may automatically redirect bulk mail to a "junk mail" folder or the like, and it is possible that the final year student participants did not have the time to complete the survey.

The majority of students recognized that spinal pathology could come under the remit of both Orthopaedics and Neurosurgery. In a case for spondylolisthesis, 45.45% would refer to Orthopaedics, while 36.35% would refer to Neurosurgery. An explanation for this may be the differing services available in different regions. There are three UTAS clinical schools, attached to different hospitals with varying levels of services available. For example, the rural clinical school located at the North West Regional Hospital does not offer Neurosurgery as a service. A majority of the participants (78.18%) would refer a patient with septic arthritis to Orthopaedics, while 18.18% would refer to Rheumatology. A majority of the participants (76.36%) would refer a patient with rheumatoid arthritis to a Rheumatology team, while 21.81% would refer to Orthopaedics. All students have completed a short placement in a Rheumatology rotation in Year 3, which explains their familiarity in the cases that are dealt by Rheumatologists.

Carpal tunnel release is a procedure that can be performed by multiple specialty surgeons, such as those in Orthopaedics, Plastic Surgery, Neurosurgery and General Surgery. (14) (15) This is reflected in the spread of the results, where 10.91%, 41.82% and 27.27% chose General Surgery, Plastic Surgery and Orthopaedics as the treating surgeons, respectively. The increasingly recognized condition of recurrent exertional compartment syndrome (RECS) was recognized as belonging to Orthopaedics; indeed, 69.09% chose Orthopaedics, while 14.55% and 7.27% chose General Surgery and Vascular Surgery, respectively. The management of the diabetic foot was also recognized as a condition managed by multiple teams from General Surgery and Orthopaedics, to Vascular Surgery and Plastic Surgery; indeed, it is a clinical entity that crosses domains. On the other hand, rib fractures were recognized, incorrectly, as belonging to Orthopaedics. A significant number of students (87.27%) selected Orthopaedics as the

primary treating team. Additionally, 10.91% selected General Surgery, which in some centres would be the correct admitting unit. Based in Hobart, The Tasmanian Cardiothoracic Surgical Unit's scope of practice involves chest wall procedures such as fractured ribs and the management of pectus excavatum. This case may have been incorrectly recognized as an Orthopaedic case because of a general association with fractures and Orthopaedics [16].

Shoulder conditions, including subacromial bursitis and rotator cuff tears, was correctly recognized as belonging to Orthopaedics, with a smaller proportion of students allocating Rheumatology as the primary treating team [23]. A large number of students (83.64%) correctly selected Orthopaedics for the management of subacromial bursitis. A small proportion of students (7.27%) selected Rheumatology as their primary treating team. This may be due to a misunderstanding of subacromial bursitis and/or Rheumatology in general. In contrast with other conditions where there is a principle specialty for a clinical condition, chronic back pain is an area of contention. The student responses reflect this, with responses spread across many specialties. Orthopaedics was the most selected (45.4%), followed by Neurosurgery (36.36%), then Neurology and Rheumatology (9.09% respectively). Chronic back pain is a perplexing entity, as often there is no identifiable cause for the pain and thus treatment is often prolonged, complex and usually non-operative management is exhausted first.

The case dealing with chronic wound management was varied in terms of student responses, which is a realistic representation of clinical practice. Orthopaedics was selected with 40% of responses, followed by General Surgery at 23.64%, Plastic Surgery at 21.82% and Vascular Surgery at 14.55%. Chronic wounds have myriad underlying etiologies, thus influencing the selection of primary treating team [24]. Access to certain specialties is also an important influencing factor in a Tasmanian context. The North West Regional Hospital in Burnie does not offer Plastic Surgery or Vascular Surgery, perhaps leading students to choose services available, such as Orthopaedics and General Surgery. Musculoskeletal lesions widely recognized as belonging to Orthopaedics. Unicameral bone cysts (UBC) are non-neoplastic bone lesions, which are usually asymptomatic and most commonly presents with pain when a pathological fracture occurs. The condition usually affects children between ages 5-15. The majority of the medical students correctly chose Orthopaedics (83.64%) as the primary treating team, while some students selected General Surgery (5.45%) and Paediatric Surgery (9.09%) [17].

Spinal deformity, such as adolescent idiopathic scoliosis (AIS), is strongly recognized as belonging to Orthopaedics (78.18%), with a minority going with Neurosurgery (5.45%); interestingly, the students seemed to attribute disc disease and adverse neurology equally with Orthopaedics and Neurosurgery, which is true in clinical practice. Spine deformity can be defined as abnormality in the shape, curvature and flexibility of the spine. The different types of spinal deformities include scoliosis, lordosis and kyphosis. Spinal Surgery has become a specialised area of surgery, and Fellowship training in Spinal Surgery involves input from both Orthopaedics and Neurosurgery. Along the same lines, Hand Surgery is a composite specialty. Dupuytren's disease, a fibroproliferative disorder, results in contracture deformity of the hand. [18] It was found that 43.64% students would refer to Orthopaedics, while 40% would refer to a Plastic and Reconstructive surgeon. Both options are reasonable; however, once again the choice of Orthopaedics rather than Plastic Surgery may be due to the absence of a Plastic Surgery Unit at the NWRH in Tasmania. Interestingly, a data analysis study performed in England from 2003-2007, 64,506 Dupuytren's disease cases were analysed and 79% of cases were overseen by Orthopaedic Surgeons, 19% by Plastic Surgeons [19].

A significant number of students, 90.91% and 96.36% had chosen an Orthopaedic referral for a case of Achilles tendon rupture and ankle fracture, respectively. It is well established that Orthopaedic Surgeons commonly deal with fractures in their day-to-day practice. Orthopaedic involvement should be sought for both non-operative and operative management, alike [20]. Knee osteoarthritis was recognized belonging in the Orthopaedic domain (94.55%), with 5.45% of medical students opting for Rheumatology as the primary referral team. It is proposed that there is good recognition of excellent arthroplasty outcomes [21]. Stress fractures are caused by overuse and repetitive activity, common in athletes, especially runners. The condition was recognized as being one managed by Orthopaedics (98.18%). Most stress fractures are uncomplicated and managed by a period of unloading. In this particular clinical case, of a femoral neck stress fracture, it is considered a high-risk stress fracture that may progress to a complete fracture, nonunion, or delayed union. Other sites for this subset of stress fractures are the patella, anterior cortex of the tibia, talus, tarsal navicular, great toe sesamoids and the fifth metatarsal. High-risk stress fractures should be treated aggressively and a consultation with an Orthopaedic Surgeon is considered best practice [22].

Conclusion

Previous research has shown that many factors determine medical students' choice of career path. Exposure to surgical specialties is beneficial to medical students, no matter their eventual area of specialisation. Orthopaedic Surgery is the second largest surgical subspecialty and has an important role in the musculoskeletal health of Australians. Undergraduate musculoskeletal education is often delivered in combination with other clinical placements and has to compete with other specialties in the curriculum.

This study determined the understanding of Orthopaedics and explored factors influencing its choice as a specialty in an Australian context. Senior medical students from the University of Tasmania were examined on different surgical scenarios. From this it was determined that direct clinical exposure to Orthopaedics enhanced both understanding and desirability of the specialty. Lack of clinical experience in Orthopaedics was associated with a poor understanding of the specialty in both year levels.

Knowledge of medical students' perception of the educational opportunities provided in Orthopaedics has national significance at a workforce level and has relevance to the Australian Orthopaedic Association in terms of specialty promotion. Indeed, medical students are more likely to

consider an Orthopaedic career if their early experience of it was enjoyable, rewarding and educational.

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