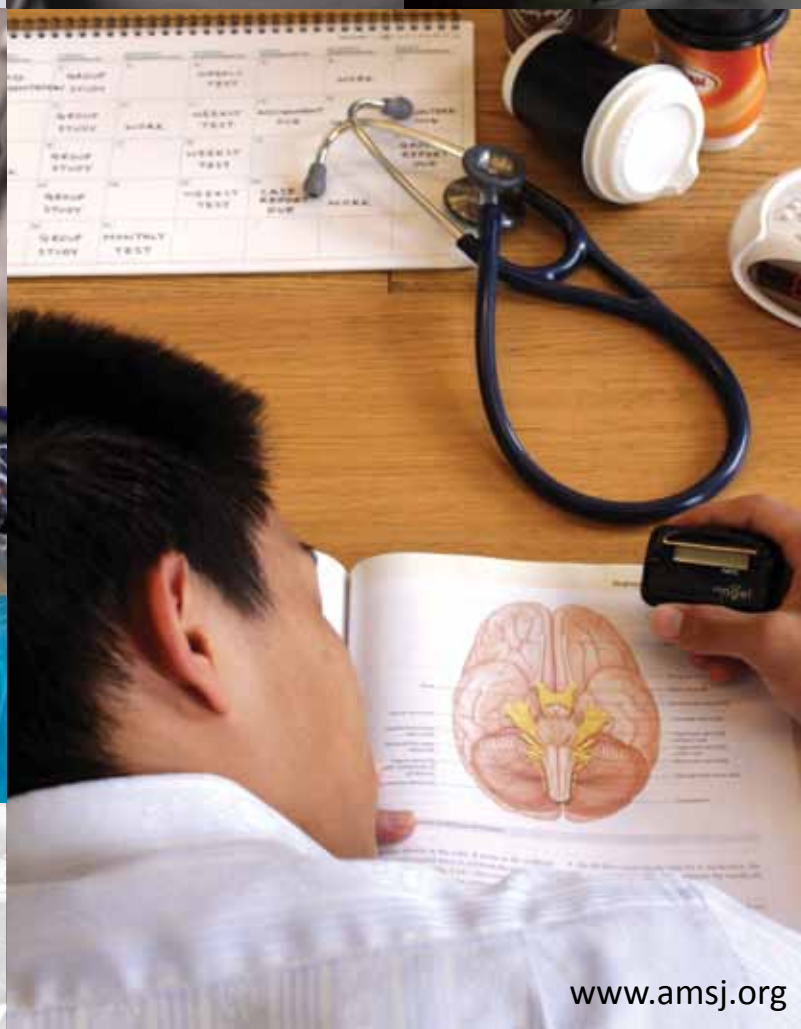
Volume 2, Issue 1 | 2011

Australian Medical Student Journal

A national medical examination?

Under the spotlight: mobile phones, stethoscopes, hand rubs



Guest contributors: Nobel Laureate, MJA editor, OHCM author

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Australian Medical Student Journal

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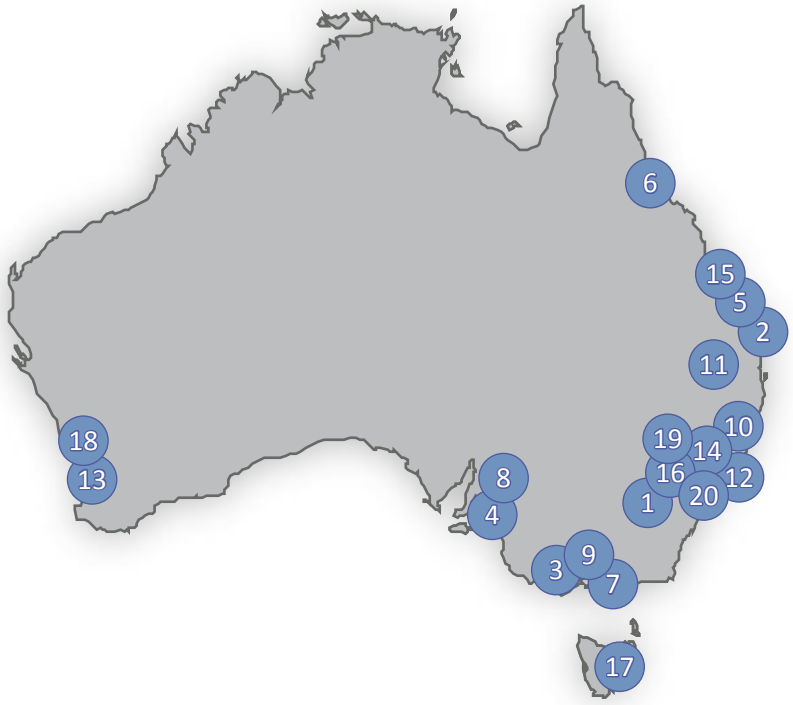

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Forging Ahead

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It is a pleasure to welcome you to this issue of the Australian Medical Student Journal (AMSJ).

After the very successful launch of the AMSJ's inaugural issue in 2010, it has been decided that the journal will now operate on a biannual basis from this year.

It has been almost a year since the AMSJ's launch function, which was held on the 29th of April 2010 at the new Lowy Cancer Research Centre in Sydney. A sizeable crowd of medical students, clinicians and academics from across Australia were present for the event, including many of the authors published in the inaugural issue. Among the guests was AMA President, Dr. Andrew Pesce, who cut the ribbon from the first box of copies. Also present were many of the generous sponsors of the inaugural issue.

The first copies being distributed at the launch.

Following the launch, 2,500 hard copies of the journal were distributed to students Australia-wide via the twenty university medical societies. In early July, through a partnership with the Australian Medical Students' Association (AMSA) Global Health Conference (GHC) in Hobart, copies were distributed to all 500 delegates. The new AMSJ website also proved to be a huge success, receiving around several thousand visits in the week after the launch, and over 15,000 visits in the months that followed.

The second half of 2010 saw the roll-out of the first major phase in expanding the AMSJ's staff structure. A national recruitment campaign has seen the AMSJ take on staff from all twenty Australian medical schools, giving the journal a tremendous presence in the student community within a short period of time. Check our staff list to find out who is the AMSJ Representative at your university.

Continuing in the footsteps of the inaugural issue, this issue contains a broad range of high-quality student research, reviews and opinion pieces. Women's and children's health are particularly well represented in this issue, with articles covering the acute abdomen in pregnancy, causes of neonatal death, ovarian conditions, vertical Hepatitis B transmission, and the confidentiality rights of minors. Medical hygiene also comes under the spotlight with articles on alcohol-based hand rubs, and stethoscopes as vectors of infection. We have also published articles from an interesting range of guest authors, this time with a little more of an educational slant. Among others, John Murtagh (author of Murtagh's General Practice) offers some advice on how to deal with baffling patient presentations, while Murray Longmore (author of the Oxford Handbook of Clinical Medicine) shares some tips on how to enjoy one's patients more! Nobel Laureate, Peter Doherty, and outgoing editor of the Medical Journal of Australia, Martin Van Der Weyden, offer some reflections on their interesting career paths.

We are also pleased to announce that we will be partnering with the AMSA Convention 2011 to present the 2011 NHMRC Student Research Competitions (see page 14). If you are in Sydney in July for the Convention, look out for us there.

Once again, I offer a huge thank you to everyone who has made this publication possible, including the authors, staff, sponsors, and most importantly, our readers.

I would encourage you to think of how you may like to contribute to the next issue of the AMSJ. Submissions are already open for the next issue, which is due to come out in September. Also, stay tuned for updates about our next round of national recruitment.

A group of AMSJ staff members at the launch.

Dr Andrew Pesce and Matt Schiller with the journal.

Ensuring pathways for junior doctors

Prof. James Angus
President, Medical Deans Australia and New Zealand (MDANZ)
Dean, Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne

It appears that all the students who graduated at the end of 2010 and are now doing their intern year did find a place.
But that is unlikely to be the case for all students finishing this year, and in the immediate future.

All medical students who qualify in Australia must be guaranteed access to an intern place, irrespective of how their study was funded or, indeed, which country they are from. This is a critical element to ensuring the ultimate goal for our medical workforce: that it be self-sustaining by 2025. [1]

Medical Deans, which represents all eighteen medical schools in Australia and the two New Zealand medical schools, has been actively seeking a commitment from governments over the past two to three years that there be sufficient and quality intern places available for all medical school graduates.

Unfortunately, while the significant increase in medical student places since 2005 has been well-publicised, it would seem State and Federal governments have only recently undertaken forward planning to accommodate the impact of these increased numbers as students graduate into the intern year, or indeed, move into later post-graduate training.

The increase in the graduating group began to be felt in 2009, but the real pressures on the health system will be in the next two to three years with 3,786 graduates projected for 2014, 1,400 more than in 2009. About 17% of these graduates are likely to be international fee paying students.

A year ago, Federal and State government Health Ministers met and guaranteed places only for Commonwealth-funded students, leaving about one-quarter of our medical students without certainty. By far the significant majority of these are international fee paying students.

International students must continue to be seen as an integral component of Australian medical schools. They are part of the longer-term goal of self-sustainability. The impact of not guaranteeing an internship on both the individual student as well as the Australian higher education sector has already been summarised in the first edition of this journal. [2] For Medical Deans, while that impact will be significant on each medical school, it will be felt far beyond: a significant downturn in the number of international students will compromise the wonderful diversity these students bring to our broader community, the value-add they can make to the Australian health care system by already knowing how the system works, and the ability of these students to take their place in the increasing global workforce.

Medical Deans acknowledges that it needs to work in partnership with government and the newly established Health Workforce Australia (HWA) to ensure that there is an agreed national training plan in place as soon as possible to underpin the self-sustainability goal for 2025. Without reliable data, no systematic planning can be undertaken. As Deans we recognise that a national plan will assist us to establish our enrolment targets, particularly with respect to international students, with a level of certainty able to be provided to each student surrounding their internship. We are encouraged that HWA will soon commence the development of that training plan and look forward to working with them.

This current bottleneck at the intern year will of course replicate itself through to vocational training over the next five to ten years. It is critically important therefore that every point across the medical education continuum is addressed through the training plan and sufficient resources for training allocated at each point. Setting targets at each point will enable each level of training to be prepared.

The Medical Schools Outcomes Database and Longitudinal Tracking Project (MSOD) will be most useful in informing the national training plan. This very successful project of Medical Deans will provide much-needed data on whether first year medical students act on their intentions with respect to type and location of future practice, and whether particular initiatives or programs undertaken during their studies have influenced the student's eventual choice. The data will greatly benefit the targeting of government resources and provide much-needed understanding of future areas of likely workforce gaps.

Prof. James Angus

The Australian Government's national health reform agenda, to be implemented through the National Health and Hospitals Network, provides a timely opportunity for a number of critical issues in medical education to be addressed. These include the recognition of the true cost of teaching and clinical supervision, the need for better planning and co-ordination of medical education across the whole spectrum of training, ensuring quality teaching continues to be delivered and the current high quality of our graduates is not diminished, and the importance of embedding translational educational research.

These are issues that Medical Deans will continue to address with vigour. In our view, they are critical to ensuring a self-sustaining workforce by 2025 and one which we can continue to proudly promote as outstanding.

Medical Deans
AUSTRALIA AND NEW ZEALAND

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Gifts between pharmaceutical companies and medical students: Benefits and/or bribes?

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Anthony has strong interests in Medicine and Surgery within a global perspective. He is particularly intrigued by the continued revolution of clinical medical practice and research framed by the context of its historical evolution.

It was with some interest that I read the Review Article 'What do medical students think about pharmaceutical promotion?' by Carmody and Mansfield, published in AMSJ Volume 1, Issue 1. [1]

As the article reports, there is a conspicuous lack of solid data investigating the relationship between pharmaceutical companies and medical students, particularly in Australia. Clearly there are both positive and negative aspects to this relationship, and I think the main concern many students hold is, at its roots, an ethical one. Can these companies exert an influence over our opinions about drugs, and subsequently affect our future prescribing practices? More importantly, does this have any relationship at all to accepting free gifts which might benefit our education?

The ethics regarding this issue is a veritable maze of should, should-sometimes and should-nots, and as with many issues, ethics often takes a second place to convenience, and sometimes even third place behind convenience and greed. Naturally, this is not to say that medical students are either indolent or opportunistic, but the importance of this issue is undeniable, with many Australian medical students uncertain about how to deal with pharmaceutical gifts and promotions.

From ethical principles, all moral individuals are bound by the Law of Reciprocity, which unequivocally states that we are disposed, as a matter of moral obligation, "to return good in proportion to the good we receive" – but how does this fit into the situation today? [2] Can a moral person, regardless of whether they are a medical student, accept a gift, be it a pen, mug, lanyard or free sandwich, and not feel a sense of ethical obligation towards the giver?

Carmody and Mansfield report that both doctors and students believe they possess a certain 'invulnerability' to any such nefarious ploys of inducing a reciprocal obligation, and as such feel free to accept small gifts without fear. Yet this is acting in direct opposition to the moral law of reciprocity, and consequently, does this mean we are acting unethically?

While medical students may think that getting something for free is an obvious win-win situation, in reality nothing could be further from the truth. If anything, it's one of those infuriating lose-lose situations. Accepting a gift means the beneficiary takes on a debt which may lead to a conflict of interest in the future, and in doing so acts unethically, something which is frowned upon quite seriously within the medical profession.

Some might argue that medical principlist ethics is not dictated by the moral law of reciprocity, but we all know that few things in this world come free, and in all seriousness, what are the odds that pharmaceutical companies are spending money on gifts for purely altruistic reasons? The Review Article mentions that each doctor in Australia is subjected to an estimated $21,000 worth of pharmaceutical company promotion each year. [1] Certainly, this is a pittance when compared to the US $11 billion that are spent on pharmaceutical marketing and promotions each year in the United States; yet the implications remain clear. [3]

With that said, there are positive sides to an early association between those studying medicine and the pharmaceutical industry. Disregarding the free pens, free food and other little (or not so little) gifts, pharmaceutical companies sponsor educational seminars, social outings and even travel costs to conferences. Surely this can only have a beneficial effect on our medical education. Or, should these too be considered 'gifts' of a different kind – gifts that will enrich us intellectually rather than materialistically? If nothing else, such an early relationship will help to prepare medical students for how to deal with the pharmaceutical industry after they graduate.

The path ahead is not clear, for the relationship between pharmaceutical companies and medical students has both positive and negative effects. Barack Obama is reputed to have said that "If you're walking down the right path and you're willing to keep walking, eventually you'll make progress"; yet how can we know where to place our feet if the 'right' path is hidden from us within a murky quagmire of ethical principles? Carmody and Mansfield suggest more research studies on this issue regarding Australian medical schools, and while I am not convinced this will make a pronounced change in clearing the fog obscuring the way forward, surely it cannot be a bad place to start.

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Amidst ovarian cancer screening challenges, there is hope

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I am writing in response to the review article by McMullen (AMSJ Volume 1, Issue 1). [1]

The major cause of gynaecologic-related cancer mortality in women in developed settings is ovarian cancer. [2] Recent research findings in this field provide hope in relation to both screening and early treatment – even though randomised controlled trial evidence in most screening techniques is still not available.

Serum CA125, which is the most commonly used tumour marker for ovarian cancer, is not suitable for population-based screening as it has been found to be elevated in only five to six out of ten women with stage I epithelial ovarian cancer. [3] Screening and diagnosis may therefore have to incorporate a variety of other tools. Primary prevention also needs to be considered.

Primary prevention is aimed at risk factors for ovarian cancer. A study of Australian women found an increased ovarian cancer risk related to high dietary intake of red and processed meat and fat. [4]

A meta-analysis found that smoking may increase the risk of developing mucinous ovarian cancer twofold. [5] Other studies have shown reduced serous ovarian cancer risk with hormonal contraceptive use, breastfeeding duration and increasing parity. [6] Health care workers could contribute to primary prevention by encouraging patients to quit smoking, change dietary habits and breastfeed their babies.

Screening is a type of secondary prevention. Screening will have a higher yield if it is targeted at people at increased risk. Multiple primary cancer links were found in an assessment of South Australian Cancer Registry data which suggested screening for ovarian cancers in patients with colon cancer or cancer of the uterus. [7]

Genetic counselling and testing is a good screening tool in persons at high risk of ovarian cancer and persons with familial ovarian cancer history. [8] Carriers of BRCA1 and BRCA2 mutations account for up to 15% of ovarian tumours. [9] Genetic advances have also identified GTF2A1 and GTF2A1 plus HAAO as principal markers in ovarian cancer diagnosis. [10]

As for the actual screening test to be used, urine angiostatin levels are elevated in patients with epithelial ovarian cancer and have been shown to be a superior marker in detection of epithelial ovarian cancer as compared to CA125. [11] Differentiation of cancer from healthy controls had a sensitivity of 88% and specificity of 92%; while differentiation of benign from neoplastic lesions had a sensitivity of 84% and specificity of 84%. When used in combination with CA125, 91% of ovarian cancers were identified.

Transvaginal ultrasonography has also been shown to be of use in diagnosis, especially

in augmentation of CA125 screening. [12] Multimodal screening, on the other hand, involving CA125 and ultrasonography in a pilot randomised trial has a positive predictive value of 21% with prolonged survival rates. [13]

In conclusion, serum CA125 is an inadequate solitary predictor in the diagnosis of ovarian cancer. Upcoming diagnostic methods provide an unprecedented opportunity to combine methods and thus improve diagnosis in Australia.

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Minors, confidentiality and healthcare: What crosses the line?

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Hugh has a strong interest in youth issues, both generally and with regards to healthcare provision. He presented last year at the "Children, Youth and Privacy" conference organised by Privacy Victoria. Currently, Hugh is undertaking research into Donation after Cardiac Death at The Alfred Hospital in Prahran, Victoria.

Healthcare provision and access to effective healthcare for young people (aged fifteen to 24 years) has long been a debated issue. [1,2]

The law is clear regarding the conditions under which a person under the age of eighteen (a 'minor') may consent to medical treatment. Yet there is a remarkable lack of clarity, and lack of legal precedent, over the right of minors to control the confidentiality of their medical information. This deficiency includes the extent to which disclosure should occur between medical professionals and the parents or guardians of the minor in question.

In Australia, adults have a right to complete confidentiality of all of their health information. The few exceptions to this occur when the doctor does not identify the person, when disclosure is in the public interest or in the case of forced disclosure. The right to confidentiality is a cornerstone of the nature of healthcare provision in Australia: if it did not exist, it is likely that the confidence of the public in seeking health care would be diminished. So why is it that minors are not afforded this right?

Ethically, the focus must be the minor's interests, not those of the parent, and it should be remembered that the treating doctor is the final judge of a minor's capacity to consent. In some cases, the doctor will maintain a minor's confidentiality in accordance with their wishes, but also encourage them to involve their parents in their treatment. This approach often leads to improved outcomes for the minor, as parent involvement is on the minor's agenda (and not that of the parent or doctor). It also establishes a more effective 'team' (the family-doctor unit) approach to their ongoing healthcare.

Of particular concern, parents and guardians are now able to access Medicare and pharmaceutical benefits scheme (PBS) claims for minors under the age of sixteen. [3] This allows parents to access information outlining when and from whom minors have received medical treatment, and what medications have been prescribed. If the minor is aged fourteen or fifteen, a form must be signed by the minor in order to release the information to the parent or guardian. Despite this, the ability of parents to potentially access the Medicare and PBS records of their child creates a potential deterrent for the minor to access future healthcare. Children under fourteen years, who may be deemed capable of consenting to a medical treatment, are not able to restrict parental access to their Medicare and PBS record at all. This situation also places the healthcare provider in a difficult situation.

There is little legal clarity as to the point at which a young person gains the right to confidentiality. Should a young person's ability to gain confidential healthcare be linked to their ability to consent to their own treatment (the Gillick competence)? There is a strong argument for this case. Research into minors with chronic ongoing illnesses such as diabetes has found that they may be Gillick competent from as young as the age as six. [4] Many of these minors self-manage complex conditions with little parental involvement, and perhaps should, in some cases, also have the right to confidentiality if deemed appropriate by the doctor, the minor and the parent. However, there are situations where confidentiality is not in the best interest of the minor. This may occur, for example, when a minor refuses treatment or is unable to comply with an agreed treatment without external assistance.

Perhaps the nature of health information should be an important consideration in this discussion of confidentiality? A minor may regard some types of health information as 'private,' while considering other issues to be suitable to discuss with their parents. For example, vaccination records would likely fit into the latter category, whilst a prescription for the oral contraceptive pill may be a more sensitive area over which the minor may wish to retain confidentiality. The difficulty with such a requirement, whereby the law is to classify the nature of the information and whether it should be confidential, is to effectively apply criterion to different 'types' of healthcare information. Furthermore, different minors are likely to have different opinions about what types of information could be freely 'shared.'

Alternatively, should privacy be linked

to a specific request not to disclose that information? This may be an effective way of balancing individual opinions and relationships between minors and their guardians. Should the expectation be, however, that for every piece of information shared the doctor asks the minor whether they wish it to remain confidential, or vice versa? What about information that the doctor may assume not to be private? Of course, in many ways this is the system currently in place, with doctors respecting minors' decisions to maintain privacy, with several notable exceptions as previously discussed.

This issue will continue to be a topic of debate and discussion within the community. Ultimately it is fundamental to put the best interest of the minor first, ensuring the best possible health outcomes. If the importance of privacy is not appreciated, we create the risk of discouraging young people from seeking healthcare – which is usually contrary to the intention of the parent or guardian in the first place. Current policy and medical practice should be evaluated to ensure that doctors have appropriate guidelines surrounding when privacy should be maintained with respect to minors. Finally, it is crucial to communicate to young people seeking care their right to privacy (and the limitations upon this right), in an upfront and honest way. This will ideally result in optimum healthcare provision for young Australians.

Acknowledgements

The author wishes to thank Sara Bird, Emily Jenkins and David Taylor for their general assistance.

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‘Bull-dogging’ for the RACP exams

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Katherine has worked with Australian Red Cross and the Inspire Foundation, and has undertaken a Cochrane review. She enjoys linking people of all ages with opportunities for personal and community development. She plans to undertake physician training.

The Royal Australasian College of Physicians’ (RACP) Clinical Examination takes a full day and for medical registrars is the barrier between basic and advanced training, including subspecialty training.

My experience was as an ‘examination assistant’ (or ‘bulldog’ in colloquial terms) for the candidates. I had been on my general medicine rotation and the consultant of my medical unit was looking for volunteers.

The clinical examination day comprises a morning and an afternoon session. Each session is comprised of two short cases and one long case. Short cases each take fifteen minutes. Candidates have three minutes before they enter the station to read one sentence which provides the name of the patient, presenting complaint and body system to examine. The candidate introduces themselves, examines the patient, presents their findings, is questioned by two examiners and walks out at the bell, remembering to wash their hands before they leave. In contrast to medical school OSCEs, candidates do not speak to the examiners while examining the patient. Instead they present afterwards, which is when they start scoring marks. My candidate asked me to signal him at six minutes (by tapping on my watch, coughing or clearing my throat) so he could spend the next nine minutes presenting and thus scoring marks. The examiners can also ask for investigations to be interpreted. For example, “What would you like to order for his murmur?” or, “You said ECG, tell us about this ECG and chest x-ray.” Fortunately, the short cases are assessed ‘blind’ by the examiners who have not examined the patients themselves. This is not so for the long cases.

For the long case, the candidate spends one hour alone with the patient. During this time, they take a thorough history, perform an examination, determine the patient’s medical and psychosocial issues and construct a management plan. After this, candidates have ten minutes before seeing the examiners. In these ten minutes, the candidate can think of potential questions and collect their thoughts. The long case assessment occurs over 25 minutes with two examiners. The candidate begins by presenting the case followed by non-stop questioning on anything from the history (“What were the circumstances of the fall you mentioned?”), physical examination (“What do you mean by nerve compression, what level?”), investigations (“How do you determine if the asthma is mild, moderate or severe?”), and management (“What if this person were to go to surgery?” or, “How might you educate this patient?”).

While the examination represents an artificial construct, particularly in respect to the short cases, the format does allow for assessment of a candidate’s ability to perform at a physician level, to analyse, interpret information and to deal with the inevitable dilemmas presented by real patients. “Under the pressure of the exam, candidates generally revert to their normal level of everyday practice,” says successful candidate Dr Luke Vos of Launceston General Hospital.

He advises budding physicians, “Preparation for clinical examinations really begins as soon as you enter physician training. The

essential elements of history taking, physical examination, construction of a differential diagnosis and the establishment of a plan for the investigation and management of each clinical problem are skills you can continue to refine from day one. While somewhat daunting, a willingness to expose yourself to constructive criticism from colleagues and mentors will help improve your approach and can prove invaluable. The skills you develop in preparation for the clinical exams will continue to serve you throughout your career.”

From a bulldog’s perspective, I could see how medical school trains us for these types of exams, but also prepares us for days when we just need to remain calm and focused on the next patient. And given that the clinical examination fee was $3,780 this year, there was definitely good motivation to pass!

More information can be found at the RACP PREP Basic Training Program website: http://www.racp.edu.au/page/basic-training/examinations/clinical-examination.

National standards in medical education

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Since 1999, the number of Australian medical schools has doubled. While this has brought about diversity, it has arguably also created a worrying lack of standardisation in the skills of graduates. National curricula are currently a hot topic, with the development of a standardised Australian curriculum for Kindergarten to Year 12 well underway. Is it time to rekindle a similar debate within Australia's medical education sector?

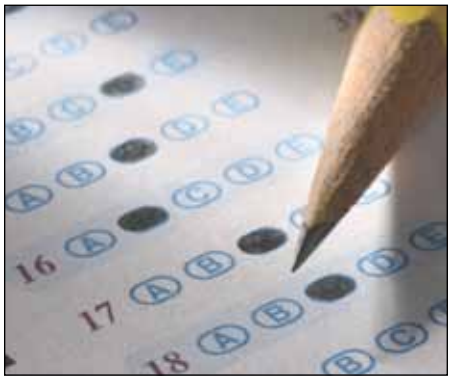
Presently, the only force acting to maintain a degree of standardisation between Australian medical curricula is the Australian Medical Council (AMC) and its accreditation processes. The AMC accreditation standards guide, while laudable, does not direct the specific structure or content of curricula, leaving the door open for the veritable potpourri of programs that we now have across the country. For example, the guideline for curriculum content of the basic biomedical sciences, which occupies one line of the document, does not even mention the names of the various biomedical disciplines: "[t]he course provides a comprehensive coverage of … basic biomedical sciences, sufficient to underpin clinical studies." [1] Either the AMC is not prepared to put more specific guidelines in the public domain, or little guidance exists to direct curriculum development. The open-ended regulatory framework has seemingly acted for more than a decade to feed a process of medical schools constantly reinventing the wheel with 'revolutionary' medical programs.

Of all the medical science disciplines, the teaching of anatomy has been the most criticised in recent times. Anatomy provides a case study in teaching disparities between universities. In a recent national survey, striking differences were demonstrated between medical schools in several areas, including the amount of hours dedicated to formalised anatomy teaching, the delivery of lessons, the use of cadavers, and the manner of assessment of anatomy knowledge. [2] For example, eleven of the nineteen medical schools surveyed have no specific requirement that student demonstrate sufficient anatomical knowledge at examination. Most medical schools pool anatomy questions with those of other disciplines, and calculate an overall passing grade. Thus, a student could be considered competent in basic clinical sciences without passing anatomy. These and other findings have prompted recent calls for a national curriculum for anatomy. [3] However, despite being extremely topical of late, anatomy is but one example of the heterogeneity in teaching across Australia. It would be difficult to make a strong case for having a standard curriculum for one subject and not others.

The suggestion of an Australian medical curriculum appears to be slowly gaining some currency. In 2010, the Dean of the University of Queensland School of Medicine, David Wilkinson, suggested the idea in light of worrying revelations about junior doctor competencies. [4] Others have gone further, suggesting that course content should be shared between medical schools, with increasing use of online methods of instruction. [5] However, the time and money already invested by individual schools in developing new programs has created an enormous amount of inertia and pride that will be difficult to overcome.

An alternative to a national curriculum is a national examination. In fact, such an examination would go a step further, by setting a benchmark for academic performance and ensuring that it is achieved by every graduate. It would essentially act as a de facto core curriculum, encouraging universities to prepare their students in the stated competencies of the examination. The Australian Medical Students' Association (AMSA) has a policy opposed to the implementation of such a barrier exam, arguing primarily that it would reduce diversity of curricula, and that of resulting student skills and knowledge [6]. The AMSA policy rests on two implicit assumptions: that diversity is good and homogeneity is bad, and that a national examination would lead to an excessive amount of homogeneity. Both of these are very much open to question. We need to find a better balance between diversity and homogeneity, as it would seem that the pendulum may have swung too far in favour of the former. There is no reason to think that such an examination would completely remove diversity of courses. Rather, it could select core areas of study or disciplines which lend themselves to standardisation, and examine those. More so than a strict national curriculum, it would leave universities with a lot of flexibility regarding their methods of teaching, additional content, and separate internal examinations.

Currently, the AMC assesses overseas-trained



doctors with a set of examinations that "are set at the level of attainment of medical knowledge, clinical skills and attitudes required of newly qualified graduates of Australian medical schools who are about to begin intern training." [7] It seems somewhat unusual that the newly qualified local graduates whose skills supposedly provide the benchmark of this examination are not themselves made to sit it. The AMC examinations comprise of a seven-hour multiple choice examination and a multi-station clinical examination. An expanded version of these could form the basis of a standardised national examination system for medical students. This would take the responsibility for assessment oversight away from individual universities, and in the process, provide an important quality control measure.

The United States Medical Licensing Examination (USMLE) is a model of a national examination system, well known for its rigour and difficulty. It is divided into three distinct steps, each taken as different stages in one's training. We should look to the USMLE as an example of how a standardised system can actually be effectively implemented. Furthermore, the nature of medical colleges in the United States (US) is a prime example of how a national examination does not have to spell the death of diversity. In the US, there is no equivalent accreditation body to the AMC, but the USMLE system ensures an excellent benchmark standard for graduates.

Such a standardised system could provide a means of comparing students from across the country. Currently, internship allocations are conducted on a state-by-state basis, with very different systems in different parts of the country. For example, in Victoria, the process is merit-based, while in New South Wales, it is a simple automated preferential system. Having a merit-based system is fraught by

the difficulty in comparing students from different universities, each with completely different examinations and marking systems. A national examination could provide a sound basis for comparing all graduates against each other nationally. From an administrative point of view, this would line up well with the advent of compulsory registration with the Medical Board of Australia, which began on the 1st of July 2010. However, whether a competitive allocation system is of itself desirable is another issue. Certainly, it would render the final year of medical school much more stressful for many, and may create stark disparities between hospitals, as the students with the poorest performances would inevitably end up at the least popular hospitals. On the other hand, nothing drives quality more than competition.

One must also keep in mind that a higher degree of standardisation does not necessarily equate with higher standards. There is no use in having a national curriculum or examination if the bar is set too low. The stakes involved in devising a system and ensuring its rigour would be enormous, with the danger that such a project may be hijacked by politics and vested interests. There would also need to be measures to ensure that a national system did not become overly cumbersome and resistant to change. Effective avenues for ongoing feedback and adaptation to changing healthcare needs would be critical.

Neither a national curriculum nor national examination should be rushed into. The intention of the authors is simply to stimulate a rigorous student discussion about this issue, and we hope to see the Australian Medical Student Journal facilitate this going into the future. Wheels are beginning to turn in this area, and it is important that we as students are not shut out of the debate, or potentially, the design.

Acknowledgement

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Telemedicine: The possibilities, practicalities and pitfalls

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The internet has woven itself into the fabric of society, by offering a plethora of services which have evolved from luxuries to necessities.

Telemedicine - the use of the internet to transmit information for diagnosis and management - has garnered recent attention because of the Federal Government's promise to provide AU$392million for its development, and the proposed national broadband network which may increase the efficiency of telemedical services. [1,2] Telemedicine, endorsed by the Australian Medical Association, [3] has a number of applications; however, the most highly publicised of these is the concept of online interactive consultations with a specialist practitioner in real-time, potentially using a Skype™-like platform.

In the coming years, telemedicine will likely play a significant role in our careers and as such, we must have an understanding of both its benefits and limitations. Despite the obvious potential of telemedicine, several questions remain in the minds of the public, doctors and also medical students. The first is: do we really require telemedicine? The costs are significant, but so is the need for the 12% of Australia's population inhabiting outer regional and remote locales - data travels significantly faster over hundreds of kilometres than patients and their families. For example, geriatric patients even in the relatively large Queensland town of Rockhampton may need to travel over 600 kilometres to their nearest geriatrician. [4] For frail elderly patients, this is hardly practical. To help address this, the University of Queensland's Centre for Online Health currently provides approximately 2,200 inpatient and outpatient consultations annually, primarily for geriatric and paediatric patients. A designated outpatient clinic exists at the Royal Children's Hospital, Brisbane, and the transmission of video, radiological images, laboratory data and medical records allow distant consultants to conduct 'video ward rounds' for their inpatients. [4,5]

Nonetheless, even if there is a need for telemedicine, is it effective? Can doctors really diagnose and treat patients they are not in the physical presence of? Although telemedicine has been studied in several ways, two particular studies investigated these questions. A Canadian randomised controlled trial found that telepsychiatry and face-to-face psychiatry produced equivalent clinical outcomes [n = 495]. Further, when comparing the travel and accommodation costs of patients versus the cost of videoconferencing technology, the authors found the costs of the latter to be 10% cheaper. [6] Similarly, a Scottish study which compared 44 outpatient diagnoses and management plans made by a neurologist in a face-to-face consultation and

one in a video consultation found there was complete agreement. [7] These data suggest telemedicine can be just as effective, and less costly, as conventional face-to-face medicine in specialist outpatient scenarios.

The main suggested purpose of telemedicine is to manage chronic conditions, which comprise the majority of the burden of disease in Australia. Telemedicine, however, is a far more versatile and powerful tool, and will likely play a role in our careers, no matter which medical or surgical fields we choose to enter. The reach of telemedicine even extends into the domain of the Emergency Department (ED). For example, the Victorian Stroke Telemedicine project allows neurologists in

Melbourne to be consulted by ED at Bendigo hospital, over 150 kilometres away. This is important because, when administered within three hours of the onset of ischaemic stroke, tissue plasminogen activator (tPA) is associated with higher rates of recovery. [8] Due to a lack of practitioners experienced in its use and the risk of intracerebral haemorrhage, tPA is not widely used, particularly in regional areas. Transferring stroke patients to an urban hospital for tPA will be futile if the three hour window closes whilst the patient is in transit. Videoconferencing allows for a discussion of the clinical features and the transmission of the requisite CT scan and laboratory results by ED staff in Bendigo to a neurologist in Melbourne, who will determine whether tPA is appropriate. A German study investigating this clinical situation showed a reduction in poor stroke outcomes as defined by low Barthel or Rankin scores, where a poor outcome was defined as a Barthel index <60 and/or a modified Rankin scale score >3 [44% versus 54% in control group, $p < 0.0001$]. [9]

There are several other applications of emergency telemedicine, which have not yet been trialled in Australia, but may become crucial in years to come. In severe trauma, patient outcomes significantly decline after 'the golden hour.' Critically injured trauma patients in rural hospitals may need air or ground transport to a distant referral hospital, during which time they may die. A retrospective analysis of trauma presentations in rural Arizona found that the use of telemedicine was deemed lifesaving in five out of 35 cases. [10] An American multi-centre study evaluated the utility of telemedicine in the assessment and treatment of burns. Among its findings were that burn centre physicians' ability to estimate burn severity was not impaired by video broadcast, and unnecessary air transport due to over-triage was reduced. [11] These findings were echoed by a study analysing 51 cases of trauma in Mississippi with total costs being reduced sevenfold, as only the most serious cases required subsequent transfer. In this study, however, mortality was not influenced by the implementation of telemedicine. [12]

The benefits of telemedicine include novel educational techniques. One particularly exciting application is in surgical mentoring. [13] A recent study describes the intra-operative instruction of eight general surgeons by experienced off-site specialist surgeons via videoconferencing. [14] The study concluded that surgical 'telementoring' improved both the outcomes for patients and the confidence and knowledge of less experienced surgeons, particularly when laparoscopic images can be transmitted directly to the off-site surgeon. Surgical telementoring may prove to be invaluable for those who choose to pursue a career in surgery, particularly in rural locations.

Telemedicine is needed in Australia, and it can be of benefit in both outpatient and critical care situations. Nevertheless, before launching hastily into a national system, there are barriers which need careful consideration. The most obvious limitation of telemedicine is that the distant specialist cannot physically examine the patient. In some circumstances such as dermatology, psychiatry and dementia syndromes, adequate examination can be performed via videoconference. In general, the onus is on the local General Practitioner (GP) to have elicited the relevant signs and to relay this information. In these situations, however, the issue of liability becomes clouded. If a GP misses or does not report an examination sign, and a specialist acts on this incomplete information, who is liable for potential mismanagement of the patient? Will medical insurance companies cover online consultations? When available, however, the transmission of high resolution medical images may often bypass the need for a detailed clinical examination.

The major barrier to telemedicine expansion for many years was the lack of financial incentives for practitioners. The Federal Government has addressed this barrier by proposing to remunerate GPs $100 for each consultation they establish and specialists $180 per consultation. [2] This is, on average, $34 more than what each would receive for standard face-to-face consultations. [15]

Is the internet fast enough for widespread telemedicine? While current internet speed is often sufficient, the national broadband network, when completed, is predicted to elevate speeds sufficiently to allow the transmission of complex data such as MRI scans. It remains to be seen whether connections can be sustained without frustrating drop outs or slow downs.

Since the protection of confidentiality in all aspects of medicine is paramount, concerns have been raised over the security of online videoconferencing. Currently, to protect eavesdropping, most telemedicine services use a 256-bit random digit key generated jointly by both conversing parties. It is infeasible that an outsider could crack a code with this many permutations, and hence the security of a videoconference far exceeds that of telephone calls and emails. [16] Security concerns, however, do not end there. Should consultations be recorded and stored? If so, what security measures must be taken to protect them from unauthorised use?

Widespread use of telemedicine may have a significant impact on healthcare in Australia's regional and rural areas. Evidence exists to support videoconferencing as a safe and effective alternative to traditional face-to-face consultations, as well as in emergency situations and in the training of rural surgeons. Telemedicine can be an important, effective and lucrative aspect of our own future medical practices, but concerns over security and liability must first be investigated and addressed before its implementation on a wider basis. Yes, it can work, and yes we do need it, because for rural Australians, specialist medical care must evolve from a luxury to a necessity.

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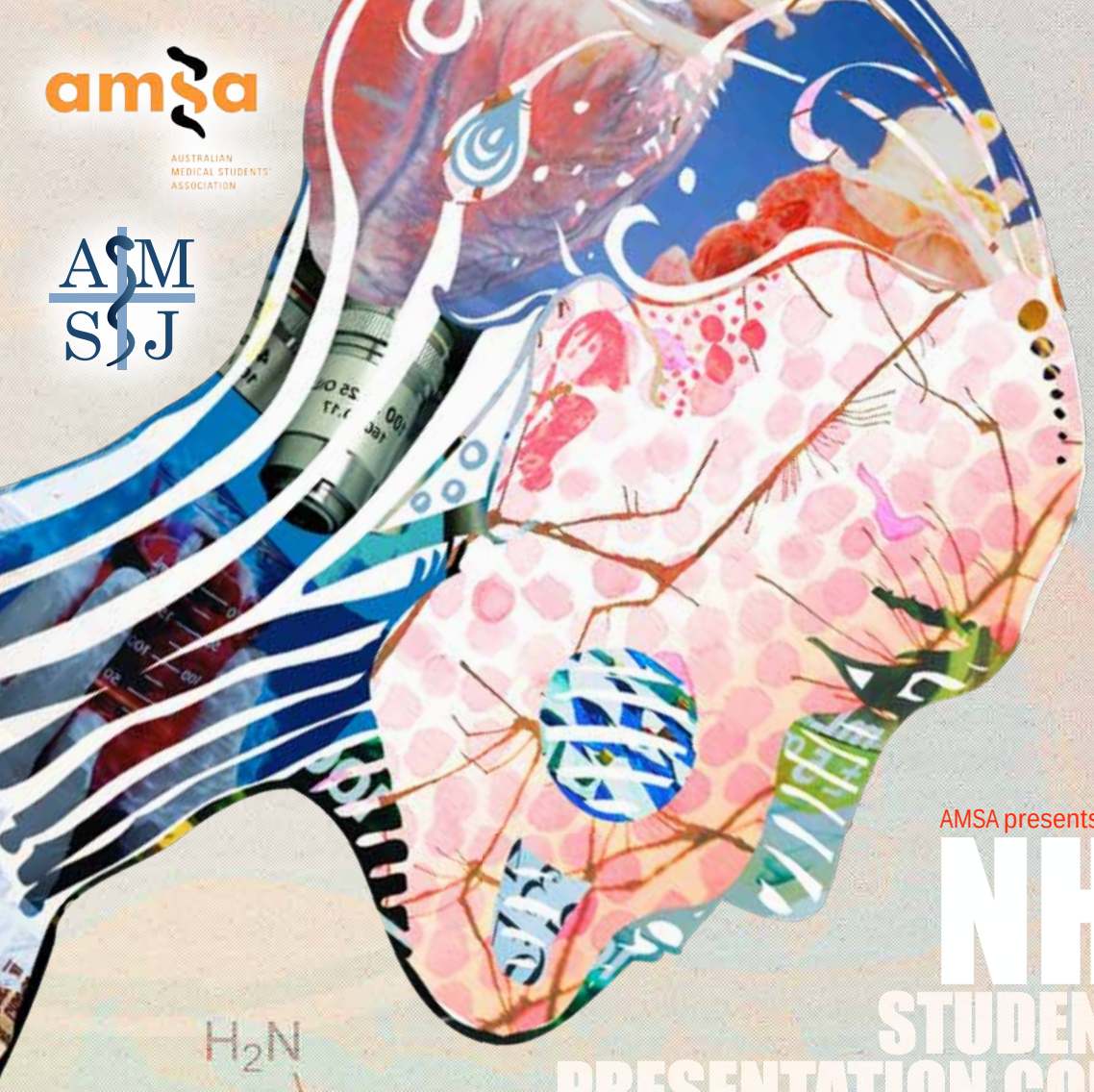

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The significance of aphasia in neurological cancers

Dr. Elizabeth D Paratz
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Elizabeth has just commenced internship at St Vincent's Hospital, where she hopes in the longer-term to study for Physician Training. This review is based on her successful entry in fifth-year medical school for the 2009 Karl David Yeomans Prize for Brain Cancer.

Aphasia associated with brain tumours has previously been regarded as essentially equivalent to the aphasia of stroke, and as a deficit unlikely to affect a patient's prognosis. Recent research challenges such hypotheses. Tumour-related aphasias are commonly anomic aphasias, and hence pathologically distinct from classic post-stroke aphasias. Accordingly, many rules from the world of stroke cannot be readily translated to the management of tumour-related aphasia. Furthermore, aphasia may be an important clinical prognostic parameter in neuro-oncology. Tumour-related aphasia is associated with an increased risk for developing depression, poorer coping and reduced survival time. It is important that health professionals are aware of the unique pathology and prognostic significance of neuro-oncological aphasia, and of strategies available for its relief.

Introduction

A diagnosis of a brain tumour (whether primary or secondary) is devastating, due not only to the life-limiting nature of the diagnosis, but also the impact of attendant symptoms. Brain tumours may cause distressing symptoms such as intractable vomiting, new-onset seizures, severe headaches, hemiplegia or aphasia. [1] In the maelstrom of scheduling surgery and radiotherapy or organising complex chemotherapy regimens, the significance of an aphasia may be overlooked.

In the presence of neurological disease, multiple patterns of aphasia may develop due to the complex neuroanatomy of language in the human brain. Tumour-related aphasia is a distinct pathologic entity. Its typically anomic nature reflects the generalised neural hypometabolism induced by a brain tumour, and differentiates it from the more site-specific aphasias of acute events such as stroke.

In terms of prognosis, aphasia worsens patients' quality of life and may shorten survival time. [2] Understanding and tackling tumour-related aphasia is therefore very important. Active treatment with speech pathology and medications, as well as minimising iatrogenic aphasia, best optimises language outcomes for patients diagnosed with a neurological malignancy.

1. What is language, and where is it in the brain?

The nature of language, and its neuroanatomical equivalents, has been defined in a number of ways. In one of the most accessible scientific definitions, Szofia Bullain [3] defines 'language' as "the formulation, transmission, and comprehension of thoughts by verbal and nonverbal symbols." More poetically, William Chomsky [4] delineated the power of language through his argument that, "We do not first have thoughts, ideas, feelings, and then put them into a verbal framework. We think in words, by means of words. Language and experience are inextricably interwoven, and the awareness of one awakens the other. [Language is]... as indispensable to our thoughts and experiences as are colours and tints to a painting." Elucidating the inner workings of this neurological work of art has long been a major research goal.

Decades of cortical localisation studies reveal that the 'language sites' of the brain are widespread. In the classic 'textbook' brain, key language centres are located in the left hemisphere, adjacent to the Sylvian fissure and supplied by the middle cerebral artery and its branches. These language centres can be divided into two major functional

groups – receptive and expressive. The receptive language centres (Brodmann's Areas 22, 39, 41 and 42 [the primary auditory centre]) are a central-command neuronal network containing information about sounds, words and the meanings of relationships. These areas, exemplified by Wernicke's Area, help understand and analyse spoken and written language. By contrast the expressive centres (Brodmann's Areas 6, 44, and 45), typified by Broca's Area, control the movements of the tongue, lips, and vocal cords to facilitate speech implementation. [5]

However, a simplistic 'Broca's and Wernicke's' view of the brain does not explain the full complexity of neural language processing. Almost every cortical region, as well as the cerebellum, plays a role. Regions in the temporal, parietal and occipital lobes all aid the sequencing of auditory records of oral language and visual representations of written language into neural word representations. [6] The supplementary motor cortex helps initiate and plan speech output, [7] while the right hemisphere contributes an understanding of prosody (the significance of variations in tone and pitch), and the cerebellum integrates the motor components of speech output. [8]

The neural geography of language is thus not nearly as reductionist as two localised zones in the left hemisphere. Rather, neurologist Aleksandr Luria [9] proposed that language is best understood as a functional system that, when mapped anatomically, forms an intricate 'cortical constellation' of dispersed loci.

Variation in the language constellation is fairly common, and may be either idiopathic or induced by neuropathology. In 1978, Ojemann [10] demonstrated that the topography of language cortex in any individual healthy person is often markedly different to the aforementioned 'textbook' maps. Pathology is also a powerful driver for variation in language localisation. Early seizure onset may displace language functions out of the temporal lobe and into the parietal lobe or right hemisphere. [11] Remarkably, in people with congenital focal lesions in the left hemisphere, the developing brain may even react by forming a mirror-image organisation of the entire cerebro-cerebellar linguistic network. In such people, language production is represented entirely homotopically to the normal left-hemisphere-dominant arrangement. [12]

Neurological malignancies are a highly pertinent example of a pathology that may induce relocation of language functions. One study of patients with gliomas and tumour-related aphasia identified that the major determinant of whether the right hemisphere successfully integrated into the language network was the rate of tumour growth

– only patients with slowly-progressing gliomas were able to re-locate their language function. [13,14] In a study evaluating contralateral language in brain tumour patients, 60% of the patients exhibited activation of the right inferior frontal gyrus, while in 18% a new right hemisphere dominance was observed. [15]

2. What are aphasias and what type occurs in neurological malignancies?

As illustrated above, language is a complex entity, and lesions in different areas of the brain produce a variety of speech and language disorders. Four of the best-characterised aphasias are Broca's aphasia, Wernicke's aphasia, anomic aphasia and global aphasia. The hallmark of a Broca's aphasia (due to damage at the site of Broca's Area), is impaired speech; it is non-fluent, agrammatical and effortful, despite intact understanding. Often, the patient is aware of their errors and consequently extremely frustrated; this may be expressed through crying, screaming or yelling. In Wernicke's aphasia (due to damage at the site of Wernicke's Area), the patient exhibits fluent and well-articulated, but ultimately meaningless, speech. The creation of neologisms is one of the characteristic features of this class of aphasia. The patient is usually unaware of their deficit, and so might appear inappropriately ecstatic and joyful.

Anomic aphasia (due to damage to the left temporal lobe, but also caused by multiple other lesions) is often mistaken for a Wernicke's aphasia, since again the patient has intact repetition and fluent speech. However, the key problem here is a difficulty in finding words and naming objects. In global aphasia (due to damage involving both Broca's and Wernicke's Areas and most of the region between them), the deficit affects all aspects of language. The patient usually understands only a few words or phrases, and may be able to say a few words or imitate a few sounds. Usually, they are absolutely unable to read or write. Emotionally, the patient is frequently depressed.

If the pathways connecting the major language centres are destroyed, a 'disconnection syndrome' is seen. The two best-described 'disconnection syndrome aphasias' are conduction aphasia and transcortical aphasia. In conduction aphasia (due to the disconnection of the receptive and expressive areas), the patient has relatively fluent speech, word-finding difficulties, variable reading and writing abilities and poor repetition. In transcortical aphasia (due to the disconnection of the peri-Sylvian language areas from the cerebral cortex), the patient has intact repetition but experiences problems in producing spontaneous speech or understanding spoken language. [3]

Most of the scientific literature on aphasia is based on studies performed on stroke survivors. Classically, these patients were believed to develop a stereotyped 'vascular aphasia' (Broca's or Wernicke's aphasia) secondary to infarct of the vascular territories of the superior or inferior division of the left middle cerebral artery respectively. [16] However, new technologies – such as positron emission tomography (PET) scanning, functional magnetic resonance imaging (fMRI) and magnetoencephalography – have revealed that the classical lesion symptom correlations are in fact significantly less predictive than expected [17], with localised aphasias potentially associating with widespread damage and vice versa. With sophisticated modern imaging, post-stroke aphasias may now be meticulously delineated, and the geographical complexity of aphasia appreciated.

There is a lesser volume of research into tumour-related aphasia, but current findings suggest that tumour-related aphasia differs fundamentally from those of stroke. Many of the new lessons learnt from post-stroke aphasia cannot be generalised to the management of neoplastic aphasia, and there is a real need to expand the volume of aphasia research focusing specifically on brain tumour patients.

Aphasia is common in the world of brain tumours. Dominant hemispheric primary brain tumours cause aphasia in 53% of patients. [18] Tumour-related aphasia is typically mild, with anomic aphasia the most common subtype – and this prevalence of an anomic aphasia occurs regardless of the tumour's exact location or grade. [19] The reasons for the dominance of anomic aphasia, and independence of tumour location and aphasia type, are thought to be tied to the histopathological nature of brain tumours.

The pathology of tumour-related aphasia is markedly different to post-stroke aphasia. One of the major causes of this difference is the temporal profile of a brain tumour (chronic) compared to a stroke (acute). It is hypothesised that the gradual progression of brain tumours allows for linguistic reorganisation during tumour growth, but this reorganisation cannot occur in the setting of an acute neurologic insult, such as a stroke. [20] This mechanism fits well with the discovery that the rate of tumour growth is the key variable influencing language relocation. In the clinical setting, an excellent example of this hypothesis is seen with lesions of the fronto-parietal operculum. Typically, a stroke in this area produces a Broca's aphasia whereas a tumour at the same site will not, presumably since the brain has had enough time to relocate the necessary language functions. [21]

The second reason why there is such dissimilarity between vascular versus neoplastic aphasia is that, in each situation, the mechanism of neuronal injury is completely different. Characteristically, a stroke is a devastating injury that drives the brain tissue to infarct. By contrast, brain cancers grow by infiltration and displacement, only damaging neurons in the later stages. Recent research using PET scanning to investigate the nature of neuronal injury at this stage has elucidated that brain cancers appear to induce a generalised hypometabolic state in both the peri-tumoural area as well as regions that are distant from the cancer. [22] This explains both the relative mildness of tumour-related aphasia and the unimportance of exact tumour location; rather than creating a discrete zone of infarcted tissue, brain tumours induce a generalised depression of neuronal function.

3. Does aphasia really affect a patient (who is already dealing) with brain cancer?

As Ludwig Wittgenstein insightfully declared, [23] "The limits of my language stand for the limits of my world." The ability for expression with spoken words and writing makes humans unique. Language and speech not only facilitate our interpersonal interactions but also, as Chomsky stressed, are an integral part of cognition. When these critical brain functions are disrupted or lost, the result is devastating. There could hardly be a worse time in life to lose the capacity for language than when one is battling a brain tumour. Dealing with cancer requires language facilities of a highly sophisticated level, as patients navigate a complicated healthcare system, provide informed consent to complex procedures, identify problems with treatment and learn new self-care measures.

For those patients who survive their brain tumour, it is well-documented that deficits in language impair the ability to return to work, or even perform routine daily activities. For those patients whose tumour is incurable, a language deficit is a source of great frustration when trying to communicate meaningfully with much-loved family and friends in final weeks. [24] To return to the poignant words of Wittgenstein, to experience one's language vanishing is to be forcefully reminded of how the limits of one's world are inexorably shrinking.

Aphasia per se is an extremely distressing problem, and a real trigger for depression. People with aphasia experience a lower health-related quality of life, with reduced activity levels, level of independence, social relationships and access to aspects of their environment. [25-7] One study found that 50% of patients with aphasia showed significant depression, as measured by four different depression scales. The prevalence of depression correlated well with degree of insight remaining. [28]

It is perhaps unfortunate, therefore, that patients with tumour-related aphasia usually do retain their insight and intellectual ability. Haas' study [29] into the intellectual abilities of patients with neoplastic aphasia found that "the intellectual performance in aphasic patients

with brain tumours was impressive... We found no differences in the intellectual performances between aphasics, non-aphasics with left-sided tumours and patients with right-sided tumours." While in the larger picture it is usually beneficial to retain intellectual capacity, sadly in the context of aphasia it means these high-performing patients with tumour-related aphasia are especially vulnerable to severe depression. Neoplastic aphasia may thus lead to adverse psychological outcomes over and above those that would already be anticipated in a person diagnosed with a brain tumour.

However, the true malignant potential of tumour-related aphasia is not confined to creating poor quality of life and a high risk for depression – aphasia may even worsen the prognosis of patients with neurological malignancies. One study of 116 patients with high-grade glioma [2] analysed speech deficit as a subdivision of global functional status in terms of incidence, category and prognosis for survival. Patients with speech deficit had significantly poorer median survival (six months) compared to those with intact speech (10.5 months). These findings are supported by Meyers, [30] who showed that a multifaceted set of 'quality-of-life' parameters, including language deficits, effectively predicted for survival. Meyers suggests that these newer prognostic variables should now be included alongside more standard clinical indices, such as tumour grade.

4. What can doctors and medical students do?

The nature of tumour-related aphasia is unique and important, and traditional models of understanding borrowed from stroke medicine need to be replaced with brain-tumour-specific paradigms. However, the role of the clinician or medical student can successfully extend far beyond merely appreciating the unusual nature of tumour-related aphasia. Doctors can improve their management of neoplastic aphasia in two major ways: by actively promoting return of language function, and by anticipating and avoiding iatrogenic damage.

a) Therapies for aphasia

Oncology teams can now target aphasias with intensive speech pathology and even medication. With 30-50% of brain tumour patients suffering aphasia, the speech pathologist is an essential member of the neuro-oncology unit. At diagnosis, the patient's degree of deficit should be assessed and scored, coping strategies devised and communication therapy instituted for best outcome. [2] Recent studies have found that intense treatment over a short period is more efficacious than low-intensity therapy over a longer time-course. [16]

Another new possibility in aphasia therapy lies in emerging medical treatments. Studies show that taking bifemelane (a cholinergic agent) 300mg daily can improve fluent aphasias (such as Wernicke's and anomic aphasia), while bromocriptine (a dopamine agonist) creates significant improvement in non-fluent aphasias (such as Broca's aphasia). [3] Transcranial magnetic stimulation has also been proposed to offer benefits, with encouraging findings from several recent small case series. [31,32]

b) Avoiding iatrogenic damage

Iatrogenic worsening of aphasia may occur as a complication of treating brain tumours with surgery, chemotherapy or radiotherapy. Of these modalities, surgery is most frequently associated with a worsening of aphasia, or even the creation of a new and different aphasia. The most extreme example is cerebellar mutism, where surgery results in transient mutism and severe physical disabilities. [33] Obviously, neurosurgeons with poor technique are most likely to create additional neurological damage. However, even the most skilled surgeons may cause 'iatrogenic aphasias' due to the anatomical variation in individual brains – particularly those with pathology – described earlier. Further difficulty is introduced when the tumour is extremely infiltrative, as these cancers are much more difficult to resect with clear margins and minimal damage. The current gold standard for protecting against these post-surgical aphasias is to perform pre-operative fMRI, as well as intra-operative brain mapping of linguistic areas. [19]

Medical cancer therapies such as chemotherapy and radiotherapy are also implicated in worsening aphasia. [34] In children treated with cisplatin or carboplatin for brain tumours, an increased incidence of hearing loss is linked to poor language development. Sodium thiosulfate, known to reduce the incidence of platinum ototoxicity in adults, is currently being investigated for its applicability to a paediatric population. [35,36] Radiotherapy can also impair language ability, again particularly when the patient is young. [37] One study showed that when radiation dose was doubled from 18 Gray to 36 Gray, the patient's intelligence quotient (IQ) decreased by a mean value of twelve points. Consequently, many oncology teams now refuse radiotherapy to children under three years old, and limit radiation to the minimum effective dose for others. [38]

Conclusion

Aphasia is common in the world of neuro-oncology, occurring in 53% of patients with dominant-hemisphere tumours, and it is critical that health professionals are confident in their approach to it. Recent findings have identified tumour-related aphasia as a unique pathologic phenomenon, and also a major quality-of-life issue with real prognostic significance. It is essential that aphasia not be considered an incidental neurological deficit only of esoteric interest. Many interventions are available, and oncology teams should be aware of their powers in helping to relieve and minimise aphasia in brain tumours.

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Conflicts of Interest

None declared.

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Approach to the acute abdomen during pregnancy

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Tao submitted this article to the AMSJ as a final year medical student in 2010. She was the recipient of the University Medal for Medicine. The review was stimulated by a few memorable patient encounters during her Obstetrics and Gynaecology term at the Royal Hospital for Women, Randwick.

Many physiological changes in pregnancy may affect the presentation of abdominal pain in the pregnant patient. Rapid diagnosis and management is required to prevent dire complications for both mother and fetus. Most radiological investigations are not harmful to the developing fetus and can avoid unnecessary and potentially detrimental explorative surgery. The role of laparoscopy in the pregnant patient is increasingly being established, particularly in centres with this surgical expertise.

Introduction

Acute abdomen in a pregnant patient is a diagnostic and therapeutic challenge for the surgeon. The incidence of acute abdomen during pregnancy is one in 500-635. [1] The most common causes are: acute appendicitis (one in 500-2,000 pregnancies), acute cholecystitis (one in 1,600-10,000) and intestinal obstruction (one in 1,500-16,000). [2] Despite technological advances, preoperative diagnosis of acute abdominal conditions is often inaccurate. This appears to be due to both anatomical and physiological changes of pregnancy, and a general reluctance towards using radiographic imaging. [2-4] Evaluation of therapeutic choices for the gravid patient requires consideration of both maternal and fetal safety under the effects of anaesthesia and surgical manipulation. In recent years, laparoscopic treatment of the acute abdomen has become the standard procedure for selected groups of patients in some centres. [5] Nevertheless, whether laparoscopy improves upon laparotomy in achieving good obstetric and operative outcomes is still unclear. This review summarises the current literature on the diagnosis and surgical treatment of pregnant patients presenting with an acute abdomen.

General considerations

The presentation of a pregnant woman for non-obstetric surgery can be a stressful event for all involved. Approach to the surgical problem may be influenced by concerns for the effect of surgery and anaesthesia on the developing fetus and the potential to induce premature labour. [6]

A recent systematic review by Cohen-Karem *et al.* [7] reported the findings of 54 studies on selected maternal and fetal outcomes following a variety of non-obstetric surgical interventions. Of the 12,542 pregnancies included, one maternal death was reported, 5.8% resulted in a spontaneous miscarriage, 8.2% in premature delivery and 2% in a major birth defect. The authors concluded that surgery and general anaesthesia are not significant risk factors for spontaneous abortion and do not increase the risk for major birth defects, even if the operation was performed in the first trimester. However, when assessing the studies included in the systematic review individually, the highest rate of spontaneous abortion and premature delivery recorded was 17% [8] and 30% [9] respectively.

Our current knowledge about the influence of surgery on pregnancy is primarily based upon observational data and retrospective analyses. As with all studies without a control group, it is difficult to ascertain whether the outcomes measured are secondary to the intervention or the underlying disease process. Clearly, a prospective trial would be best to answer these questions, but this is unlikely given the circumstances of surgery in pregnancy. Furthermore, with the low incidence of surgery during pregnancy, it would indeed be logistically difficult to implement clinical trials large enough to satisfy the required statistical power. To that end, the evidence base is primarily composed of case reports and experimental animal studies, and controversies regarding best practice remain.

Acute abdomen: The clinical picture

An acute abdomen may be the result of gastrointestinal, gynaecological or urological pathology, as well as frank trauma, both blunt and penetrating. Surgical intervention is usually warranted – delays in diagnosis and treatment with resultant viscus rupture and widespread peritonitis can have dire fetal and maternal consequences. [10,11]

Nevertheless, the diagnosis of acute abdomen during pregnancy is challenging for a number of reasons:

1. Symptoms of nausea, vomiting, anorexia, dyspepsia, 'stomach' pain and constipation often accompany normal pregnancy. [2,3]
2. Classical signs of peritonism can be obscured by the expanding uterus which displaces other intra-abdominal organs and stretches the anterior abdominal wall. [12]
3. Haematological and biochemical results may be misleading due to a physiologic leukocytosis and dilutional anaemia of pregnancy. [4]

Radiological assessment

Radiological procedures on the gravid patient are taken reluctantly due to potential teratogenic risks and the associated medico-legal consequences of iatrogenic birth defects. [13,14]

Information on the dose-dependent effects of radiation on fetal health comes from animal studies, human observational studies and studies of atomic bomb survivors. [14] Ionising radiation can lead to cell death, carcinogenesis and mutations in germ cells. [16] During the first three weeks of pregnancy, radiation injury results in implantation failure or undetectable death of the embryo. [15,17] Effects of subsequent radiation injury depend on the timing of exposure and the sensitive period of various organs to teratogenesis. [17] The greatest risk to the developing central nervous system is between the fifth and eighteenth week of gestation, whereby radiation doses greater than 10 rad may cause a decrease in the Intelligence Quotient and doses greater than 100 rad may result in severe mental retardation. [18] As the pregnancy progresses, the concern shifts from teratogenesis to increasing the risk of childhood haematological cancer. The current figure suggests that radiation may increase the background incidence of cancers before the age of 20 (0.3-0.4%) by 0.06% per rad delivered to the fetus. [18,19]

Despite the known teratogenicity of ionising radiation, there is no evidence to indicate that current radiation dosage from common diagnostic studies is associated with an increase in birth defects. According to the American College of Radiology, 'No single diagnostic procedure results in a radiation dose that threatens the well-being of the developing pre-embryo, embryo or fetus.' [20] According to the National Council on Radiation Protection, 'Fetal risk is considered to be negligible at 5 rad or less when compared with the other risks of pregnancy, and the risk of malformation is significantly increased above control levels only at doses above 15 rad.' [21] Table 1 lists the radiation dosage of common diagnostic studies. Importantly, as there is a dosage range associated with many procedures, parameters may be altered by the radiologist to achieve the lowest effective radiation dose.

Table 1: *Estimated Fetal Exposure from some common radiologic procedures. [16]*

Procedure	Fetal Exposure
Chest X-ray (2 views)	0.02-0.7 mrad
Abdominal film (single view)	100 mrad
Intravenous pyelography	≥1 rad*
Hip film (single view)	200 mrad
Mammography	7-20 mrad
Barium enema or small bowel series	2-4 rad
CT scan of head or chest	<1 rad
CT scan of abdomen and lumbar spine	3.5 rad
CT pelvimetry	250 mrad

N.B. Conversions for absorbed doses:
1 rad = 1000 mrad; 100 rad = 1 Gy (Gray)
**Exposure depends on the number of films*

Ultrasound and magnetic resonance imaging (MRI) do not deliver ionising radiation and have not been shown to have any harmful effects on pregnancy. [15] Ultrasound is the investigation of choice for most gynaecological causes of acute abdomen such as adnexal mass and torsion. [15] Use of intravenous gadolinium as contrast material for MRI is controversial as it is capable of crossing the placenta with undetermined consequences. [22]

Value of diagnostic surgery

The value of exploratory surgery during pregnancy, largely for suspected appendicitis, has been the focus of a number of studies in the literature. The primary benefits of operative exploration are rapidity and diagnostic accuracy, in addition to the potential for immediate therapeutic intervention at the time of diagnosis. [15]

The pre-operative diagnostic accuracy of acute appendicitis during pregnancy ranges from 50-77%. [12,23-26] The proportion of those found to have negative appendicitis intraoperatively with unexpected pathology findings (for example, mesenteric adenitis or ovarian torsion) is approximately 10-20%, [12,23,24] with the remainder having no abnormality. In particular, the rate of negative appendicitis is considerably greater in pregnant women than in non-pregnant women (23% versus 18%). [23] The converse to a negative surgical diagnosis, however, is a delay in diagnosis resulting in potentially drastic complications. Perhaps, the combination of challenges in clinical diagnosis, and fear of maternal and fetal mortality with a complicated appendicitis has been used as justification for a more aggressive surgical approach towards pregnant women with suspected appendicitis.

The incidence of perforation is thought to be greater in pregnant than in non-pregnant women. [27] A 66% perforation incidence has been documented when surgery is delayed by more than 24 hours compared to 0% incidence when surgery is conducted prior to 24 hours after the initial presentation. [9] The decision is thus balanced on the associated risk of misdiagnosis with that of perforation.

McGory *et al.* [23] recently examined fetal outcomes in over 3,000 pregnant patients who had appendicectomy. Importantly, the study showed that the risk of fetal loss and early delivery was almost as high with negative appendicectomy as with complicated or ruptured appendicitis. The authors concluded that explorative surgery poses significant risks to the fetus and efforts to improve diagnostic imaging prior to surgery may decrease adverse fetal outcomes. However, the study was limited in that the dataset precluded analyses of those patients in whom no surgical procedure was attempted following a negative intraoperative diagnosis of appendicitis. In Saunders and Milton's [12] small series of 26 pregnant women with negative laparotomy findings for suspected appendicitis, those in whom no further surgery was performed were considerably more likely to continue their pregnancy undisturbed, compared to those who proceeded with appendicectomy as planned (89% versus 57%, respectively). Thus, there may be some value in minimally invasive, brief and/or simple diagnostic surgery for the acute abdomen during pregnancy.

Anaesthetic considerations

There are a number of anaesthetic risks unique to the pregnant patient. They can be divided into those that pose potential teratogenic effects on the fetus and those that arise from maternal physiologic changes, which in turn can affect uteroplacental blood flow. [6,14,28]

Available literature on the safety of anaesthetic agents is encouraging, without sufficient evidence to suggest a clear relationship between adverse fetal outcome and anaesthetic type. No anaesthetic, opioid, sedative-hypnotic or muscle relaxant appears to be more teratogenic or safer than another agent. [28] Mazze and Källén's [29] study on 5,405 pregnant women from three Swedish health registries found no increase in congenital anomalies with different types of anaesthesia used in surgery during pregnancy. Many authors are more inclined to believe that any morbidity to the fetus is primarily from the underlying disease, not the anaesthetic agent. [14,28] Nevertheless, virtually all anaesthetic agents have teratogenic potential at clinical concentrations. [6] For example, nitrous oxide has been shown to inactivate methionine synthetase through oxidation of vitamin B12, which in turn inhibits DNA synthesis, cell division and biochemical pathways in methylation reactions. [30,31]

While no clinical data currently link these cellular actions with teratogenic outcomes, their theoretical risk should not be completely disregarded. Several authors agree that surgery during the first trimester, the period of organogenesis, should be avoided if not emergent. [4,6,28]

Multiple cardiovascular and pulmonary physiologic changes occur in pregnancy which implicates anaesthetic management. To the anaesthetist, greater concern for the fetus arises from intra-operative maternal hypotension or hypoxia than from exposure to anaesthetic agents. Because of the increased risk of hypoxaemia, difficulties with intubation, acid aspiration and risks to the fetus, regional anaesthesia should be selected over general anaesthesia where possible. [6]

Laparoscopy versus laparotomy

Once considered an absolute contraindication during pregnancy [33], laparoscopy is now performed in certain centres for acute abdominal conditions on pregnant patients with apparently favourable results.

In comparison to laparotomy, there are several benefits for the pregnant patient, including: less fetal depression due to reduced postoperative opioid requirements, decreased maternal postoperative hypovolaemia, shorter hospital stay, early mobilisation which may minimise the increased thromboembolic risk associated with pregnancy, early return of gastrointestinal activity due to less bowel manipulation resulting in fewer postoperative adhesions and earlier return to full diet causing less nutritional stress to the fetus. [3,15,34,35]

The main concerns towards laparoscopy during pregnancy relate to the effects on uteroplacental perfusion from pneumoperitoneum, uterine injury from laparoscopic trocar insertion and the potential for

fetal hypercarbic acidosis. [15,34]

Physiologic responses to pneumoperitoneum

The cardiopulmonary stresses and subsequent physiologic adaptations during pneumoperitoneum are hypothesised to cause systemic hypertension and decreased cardiac output, ultimately leading to reduced uterine perfusion and increased risk of fetal hypoxia. [3,10,35] Whether this decrease in uterine blood flow is of danger to the fetus is somewhat contentious. Frequent intra-abdominal pressure fluctuations occur during maternal valsalva, coughing and straining, with no observable ill effects on fetal outcomes; [10] although these activities are not sustained for the length of time taken during an operation. It has been suggested that manual uterine retraction during open appendicectomy or cholecystectomy may have greater impact on uterine perfusion than that which occurs during pneumoperitoneum. [39]

Fetal uptake of carbon dioxide (CO_2) is another potential danger of laparoscopy. Studies on pregnant ewes and baboons have reported prolonged fetal hypercarbia, acidosis and increased lactate levels with maternal CO_2 insufflation. [3,40-43] Hunter *et al.* [41] described fetal hypertension and tachycardia, attributing them to fetal hypercarbia. Until more complete data is available, careful anaesthetic attention to maternal ventilation is vital.

Studies in the human

To date, over 500 cases of laparoscopy on pregnant women have been described. [44] Most have a focus on gastrointestinal causes of acute abdomen. All studies have been retrospective, and most reports come from centres and surgeons with special interest, experience and skills in laparoscopy, whose results may not reflect complication rates more generally.

There is some literature to suggest that the incidence of significant fetal and maternal adverse effects after laparoscopy is minimal and does not endanger a pregnancy any more than a laparotomy. [5,15,29,43,45-52] However, the majority of the evidence is based on single case reports and small series studies, which often do not include a comparative laparotomy group from which to draw meaningful conclusions. This is considered in conjunction with the observation that there is often a tendency to under-report unsuccessful cases. Nevertheless, several reports from Swedish health registries have provided safety comparisons between laparoscopy and laparotomy procedures in large samples of pregnant women.

Reedy *et al.* [43] compared 2,181 laparoscopies and 1,522 laparotomies performed on pregnant women of four to 20 weeks gestation during the period 1973-1993. Between the two procedures, they found no difference in birth weight, gestational duration, rates of intrauterine growth restriction, congenital malformations, stillbirths and neonatal deaths. An increased risk for infants to be born with low birth weight, prematurity and growth restriction was found in women who underwent surgery overall compared to the general population, although it could not be determined whether this increased risk was related to the anaesthesia, surgical procedure or the acute condition itself.

An earlier study of the same Swedish health registries reported similar findings on the increased risk of prematurity and low birth weight infants associated with surgery during pregnancy, but more importantly, showed that laparoscopy can be safely performed during any trimester of pregnancy. [29] Of a total of 868 laparoscopic cases performed during pregnancy, 768 occurred in the first trimester, 29 in the second and 71 in the third. Mazze *et al.* [29] reported no increased incidence of adverse outcomes when compared with laparotomy. A number of subsequent smaller studies have also suggested the safety of laparoscopy during all three trimesters. [52,53] This is in contrast to historic recommendations which limit 26-28 weeks as the upper limit of gestational age safe for laparoscopy. [4]

Despite these encouraging results, the Swedish registry studies are limited in that the database was designed only to study live births, disenabling the comparison of the rate of spontaneous abortion between laparoscopy and laparotomy. The association of spontaneous abortion with laparoscopy has been illuminated by a recent systematic review of 28 articles documenting 637 cases, [54] which found that fetal loss was significantly higher in women who had laparoscopic appendicectomy than women who underwent open appendicectomy (5.6% versus 3.1%), despite a higher rate of non-appendicitis among the laparoscopy recipients. The authors concluded that open appendicectomy is the safer option for pregnant women for whom surgical intervention is needed. This is in opposition to most previous reports.

Occasional reports, such as those above, raise caution regarding the use of laparoscopy during pregnancy. The absolute safety of laparoscopic surgery on the gravid human patient has yet to be confirmed. [34] Amos *et al.* [8] in 1996 reported laparoscopy on seven pregnant patients – three appendectomies and four cholecystectomies. Alarmingly, there were four fetal deaths, three within the first week of operation. The authors speculated that the adverse outcomes may have been related to the physiologic consequences of pneumoperitoneum. While the study has received criticism from other investigators regarding its methodology, it has aroused considerable caution in the surgical community regarding the safety of laparoscopy during pregnancy.

Finally, long term effects on the child after delivery have not been well investigated. One study following eleven children for a period of one to eight years did not find an increased incidence of developmental and physical abnormalities. [55]

Conclusion

The presentation of an acute abdomen during pregnancy requires a rapid approach to assessment and management. If truly emergent, the indication and timing for surgery should not differ from that of the non-pregnant population. Most radiological investigations are not harmful to fetal development and can be used safely to diagnose abdominal pathology. Appropriate use of diagnostic imaging may prevent unnecessary surgical exploration which has been associated with an increased rate of fetal loss. Some evidence suggests that laparoscopy can be safe and advantageous for both the mother and her fetus when performed by an experienced team. However, the evidence base lacks prospective trials and long-term studies. Altered maternal physiology, particularly under the influence of laparoscopic pneumoperitoneum, requires careful intra-operative anaesthetic monitoring. The advance in imaging technology, anaesthetic care and surgical techniques has influenced diagnostic and therapeutic algorithms, and management needs to account for the skills mix in individual hospitals.

Conflicts of Interest

None declared.

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Prostate cancer: Past, present and future Australian initiatives for improving men's health

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Background: Prostate cancer is the most common internal cancer in Australian men. Whilst recent trends demonstrate stabilising incidence and decreasing mortality rates, it remains a major health burden for Australian men and requires continued action. This report outlines the status of prostate cancer in Australia's health care system, both past and present, and analyses the effectiveness of healthcare campaigns used to generate awareness. The aim is to assess awareness, perception and public behaviour toward this disease, as well as to impart Australia's strategies on improving public knowledge in this area. **Methods:** A comprehensive search of English language literature was conducted. Articles were limited to those relating to prostate cancer in Australia. Additionally, websites of various prostate cancer awareness campaigns or organisations were evaluated, based on a comprehensive list provided by the National Men's Health Policy Submissions Document. [1] **Results:** One hundred and ninety-five relevant journal articles were found, which were subsequently evaluated independently by three authors. Of these, 56 fit the inclusion criteria. **Conclusion:** Development in knowledge, awareness and attitudes toward prostate cancer has been significant over the past few years. However, despite prostate cancer being a major health burden for Australian men, there are still misconceptions and a lack of awareness amongst the general population. The combination of prostate cancer specific organisations such as the Prostate Cancer Foundation of Australia, campaigns and events such as 'Movember' and 'Be a Man,' health promotion in schools, universities and workplaces, as well as the development of a national men's health policy can only further serve to advance prostate cancer awareness.

Table 1. *Prostate cancer statistics in Australia. [2-4]*

Prostate Cancer in Australia: Facts at a Glance
• 1 man every 3 hours dies from this disease
• 1 in 9 men in Australia develops prostate cancer in their lifetime
• 3,300 men die of prostate cancer each year
• 20,000 new cases are diagnosed every year
• 32 men learn that they have prostate cancer each day
• Prostate cancer is the second most common cancer in Australian men and is second most common cause of cancer deaths in men
• Men in rural areas are at greater risk of prostate cancer

Men's Health & Prostate Cancer: Synopsis

'...to achieve the highest standard of health, health policies have to recognise that women and men, owing to their biological differences and their gender roles, have different needs, obstacles and opportunities...'

-World Health Organisation (WHO) Madrid Statement, 2002

One in nine Australian men will develop prostate cancer in their lifetime. It is the second most commonly diagnosed cancer in Australian men and is also the second-leading cause of cancer death in Australian men, with a mortality rate of 20.4 per 100,000 per year. [2,3] Given that Australia has an ageing population, the identification of increasing age as a risk factor for prostate cancer has proved significant, with 85% of new cases and 96% of prostate cancer-related deaths occurring in men aged over 60 years (Table 1). [4]

It is also estimated that there are over 61,000 Australian men currently living with a diagnosis of prostate cancer. [5] While recent trends of stabilising incidence and decreasing mortality rates are encouraging, prostate cancer remains a major burden for Australian men. [6] As such, it has been included as part of the National Health Priority Areas (NHPAs) – to which the Australian Government is devoting significant resources, time and effort. [4]

Despite the high incidence and significant health burden, there remains a great imbalance in many areas when comparing prostate cancer to its most prevalent female counterpart, breast cancer. This includes a lack of media coverage and publicity, resulting in a lack of awareness of prostate cancer. On top of this, breast cancer attracts unparalleled research funding from individuals and governments, while prostate cancer struggles to gain a fraction of such support. [7]

On a positive note, government support for prostate cancer initiatives has steadily grown over the past few years. In 2008, the Federal Department of Health and Ageing announced the development of

a National Men's Health Policy, with prostate cancer a cornerstone component. [1] Following an extensive review and consultation process, the resulting policy was released in May 2010. Furthermore, in 2008 the Australian Government also committed $15 million over five years to establish two dedicated prostate cancer research centres, [8] which aim to continue research into improved diagnostic and screening tools that are superior to the Prostate Specific Antigen (PSA) test, as well as new treatments for prostate cancer. Additionally, the Australian Government, through the National Health and Medical Research Council (NHMRC), has invested $45.2 million for research involving prostate cancer since 2004, with 45 active grants in 2009 valued at $10.8million. [8]

Awareness campaigns are also seen to be vital in providing accurate and up to date information. [9] In the past fifteen years, organisations such as the Prostate Cancer Foundation of Australia (PCFA), Andrology Australia and the Movember Foundation have been formed to address the lack of knowledge of prostate cancer amongst Australian men. Public health campaigns such as the establishment of September as 'Prostate Cancer Awareness Month' and 'Grow a Mo for Movember' have also refocused the male population's attention to the importance of their own health.

Only recently has men's health been in the spotlight for medical students in Australia. Although the Australian Medical Students' Association (AMSA) currently has no official working policy on men's health, they have a representative to Andrology Australia, the peak body on male reproductive health in Australia. [10] Furthermore, AMSA strongly supports the participation of Australian medical students in the 'Grow a Mo for Movember' event – often coupled with other grassroots events from various medical student societies promoting awareness.

In this report, the authors have outlined the status of prostate cancer in Australia's healthcare system and analysed the effectiveness of healthcare campaigns used to generate awareness. Through a community study, literature review and analysis of current practice, the aim is to impart Australia's strategies on improving public knowledge in prostate cancer and to promote future strategies and initiatives which can be employed to boost the confidence of men to proactively take charge of their own health.

Methods

The authors searched English language literature indexed in three databases: MEDLINE (1994 to present), EMBASE and the Cochrane Central Register of Controlled Trials. A limited manual search of journals was also performed. Articles were limited to those relating to prostate cancer in Australia.

Studies eligible included Randomised Controlled Trials (RCTs), journal reviews and cross-sectional studies. Economic evaluation studies were also permitted to assess effectiveness of prostate cancer screening. Authors selected those and extracted information from articles on prostate cancer policy, awareness, promotion, strategies and past trends.

Additionally, websites of various prostate cancer awareness campaigns or organisations were searched and evaluated, based on a comprehensive list provided by the National Men's Health Policy Submissions Document [1].

Results

One hundred and ninety-five relevant journal articles were found, which were subsequently evaluated and analysed independently by three authors. Of these, 56 were deemed to fit the inclusion criteria. The others were rejected primarily because they examined the pathophysiology or various treatment options for prostate cancer, rather than the stated objectives of this review. Those looking at statistics outside Australia were also excluded.

Discussion

Defining the Past – From Indifference to Curiosity

The overwhelming attitudes to men's health in the past were troubling. Pro-masculine concepts such as "men don't show their weakness" and "real men don't go to the doctor" were prevalent, and are unfortunately still somewhat present today. Prostate cancer and other 'male cancers' were not regarded as being as "fashionable-a-focus" compared to female cancers such as breast and cervical cancer. In 1994, the then Federal Minister for Health pointed out that while breast cancer research received AU$1.5million dollars annually, prostate cancer research only received a comparatively paltry AU$300,000, despite a similar mortality rate for both cancers (2,300 versus 2,600 deaths per year). [11] Social attitudes to prostate screening, particularly towards digital rectal examination (DRE), which until the late-1980's was the mainstay of prostate cancer screening, were inhibitory to community-wide screening in Australia. A drawback to the use of DRE as a screening method was a poor positive predictive value of 31%, indicating that a high proportion of those screened and thought to be at high risk of having prostate cancer were 'needlessly' or even 'wastefully' investigated. [12]

The introduction of PSA testing in 1988, a minimally invasive blood test, was a much more socially accepted way of screening. By 2008, it seemed that the widespread introduction of PSA and trans-rectal ultrasound (TRUS) in the early 1990's had contributed towards three trends: an almost 50% decrease in the rates of men with advanced stages of prostate cancer at diagnosis; a 2% per year decrease in deaths caused by prostate cancer; and a substantial increase in prostate cancer incidence. [13] These results raised the possibility that the PSA screening test resulted in a decreased advanced stage diagnosis and decrease in deaths.

It was around the time of the mid-nineties that attitudes and awareness of prostate cancer gradually began to change. Prostate cancer began to receive minimal but critical media and public attention, mainly due to independent initiatives. The PCFA was founded in 1996 to provide support and clarify treatment information for cancer sufferers. In January of that same year, a draft of the Australian Government-supported National Men's Health Policy was released. It identified several action areas, including the need for more research into men's health related behaviours and needs, public education strategies and the development of health benchmarks and policies for assessing men's health initiatives. Although the policy never eventuated, this was a watershed moment in the history of men's health in Australia.

Forging At Present: Screening, Promotion, Awareness, Policy

Screening

Currently, one of the key issues regarding prostate cancer in Australia is the debate over mass population screening. The PSA test and DRE are the most popular and widely used screening options in medical practice. However, The Cancer Council of Australia (TCCA) and the Urological Society of Australia and New Zealand (USANZ) currently do not recommend the use of either PSA or DRE for population-based screening. Published studies thus far have been conflicting on the issue of population screening. Key issues from these studies that need to be addressed include the cost effectiveness of screening, over-detection and over-treatment. Research is still ongoing in this area.

In light of this information, a patient-centred approach for individual decisions about testing is currently recommended. [14] This involves an informed, shared, decision-making process between the doctor and patient, discussing the benefits, risks and uncertainties of PSA testing before it is commenced. Additionally, research has shown that since the introduction of the PSA test, the rates of men seeking PSA tests have more than doubled in the period 1996-2006, by an average of 6.2% per annum. [15]

Promotion

Paralleling the shifting view toward prostate cancer and the introduction of screening and treatments, media coverage of prostate cancer has grown over the last decade.

Studies have demonstrated the effect of celebrity cancer diagnosis on prostate cancer screening. [16] When well-known celebrities such as Sam Newman (sports personality) and Alan Jones (radio personality) were diagnosed with prostate cancer in 2008, there was a significant jump in the number of PSA tests after the wider community heard endorsement for screening campaigns (an estimated increase of 39,000 tests after seasonal adjustment). [17] Interestingly, this figure has since returned to a seasonally adjusted normal figure, perhaps indicating that such events encourage short-term screening rather than promoting long-term care.

Awareness

Personal Perceptions

There is generally a poor public awareness of prostate cancer and related issues in the Australian society, particularly amongst men. [18] According to a recently published survey, a disturbingly high number of men within the general population of Australia are unaware of prostate cancer issues (Table 2). [5] It has been suggested that this deficit in knowledge amongst men in the at-risk age group could delay diagnosis and treatment. [3]

Organisations & Campaigns

As information regarding prostate cancer became more readily available, there has been a recent push to increase awareness of the issues surrounding the condition in the wider community. Organisations such as the PCFA, Andrology Australia, Australian Prostate Cancer Collaboration (APCC) and the Movember Foundation were established with the aim of encouraging research and raising awareness in this area. The effects of these efforts have been significant. A total of $10million has been raised for prostate cancer research from the Movember campaigns alone. Furthermore, 82% of participants in the campaign discussed men's health with friends, family or work colleagues, 13% sought medical advice and 38% encouraged someone else to seek medical advice for this condition. [19]

Table 2. *Perceptions of prostate cancer amongst the Australian population. [5]*

Worries
80% did not know the function of the prostate
35% had no knowledge of treatments for prostate cancer
53% had no knowledge of treatment side effects
Highlights
94% identified that prostate cancer was likely to cause difficulty with urination
70% would discuss with GP and specialist before making a decision on treatment.

However, community surveys have shown that current promotion strategies increase awareness but fail to encourage men not to rely on clinical symptoms as the primary motivator for accessing health services. [20] Thus, there needs to be greater integration of promotional campaigns with education to ensure best outcomes. This may be achieved through campaigns targeting women to act as surrogate providers of information, or by promoting quality information about prostate cancer through non-threatening means such as the internet.

Policy

The Australian Federal Government moved to reintroduce the National Health Policy on Men's Health in 2008 after a previous failed attempt in 1996. This was coupled with a Senate select committee to independently examine the state of men's health, as well as funding and support available from the government. The policy document was completed and released in May 2010.

As part of the consultation process, Men's Health Ambassadors were appointed to promote the policy process and to feedback suggestions and ideas to government. Discussion forums, papers and community group consultations helped form the basis of the policy construction. The policy aimed to also take into account men's existing knowledge of health and health seeking behaviours, and to address not only behaviour change, but also to consider the social determinants of men's health.

The Senate Committee released three recommendations on prostate cancer for government consideration: [21]

1. Funding for the Australian Prostate BioResource – an initiative collecting prostate tissue from patients for bioresearch;

2. Funding for the Prostate Cancer Information pack – an information package for patients with newly diagnosed prostate cancer outlining treatment options, support groups and so on; and

3. Funding for specialist prostate cancer nurses, particularly in rural and regional areas (areas of higher prostate cancer mortality).

Refining the Future

Despite the gradual improvement and the above awareness initiatives, there still remains a lack of knowledge about prostate cancer in the general population. This shows that although prostate cancer has come full circle in the community, there are definitely still areas that need to be refined. These include:

1. Overcoming past stereotypes

In the past, gender stereotypes have greatly inhibited the success of prostate cancer treatment. It has been well documented that men have a significantly lower level of awareness of risks to their health and are less likely to seek help for medical problems compared to women. [22,23] Traditionally, men are the providers of the family and are stoic – expected to put on a strong, brave front and are generally derided if they are seen to be weak. Hence, to conform to this social norm, they are more likely to ignore their symptoms, until it is too late. With this being the case, prostate cancer in these men would have more time to spread and present at an advanced stage. [24] A continued effort is needed to ensure the stereotypes of the past are broken.

2. Health policy and services

The current government policy initiative addresses prostate cancer, amongst other men's health issues, which is a positive step. It is important that the social determinants of health in regards to prostate cancer are not be ignored. For example, in Australia there is a higher rate of prostate cancer mortality in rural compared to metropolitan areas. [25] In addition, the effects of socio-economic status, living standards, social gradient, stress, employment and social support on prostate cancer outcomes and mortality are all factors that need to be considered to ensure a broader focus in developing men's health policy. [26]

Given this, we suggest that AMSA develops a men's health policy document in conjunction with the release of the federal policy. This can aid in focusing medical students' attention to this important topic.

3. Role of medical professionals

It is imperative that as clinicians we are knowledgeable in the benefits and risks of screening, as there is still much debate surrounding its effectiveness. An informed decision-making process between the doctor and patient, discussing all areas of the PSA test should be conducted before any screening is attempted.

It is also important that medical professionals coordinate and provide adequate psychological support for those diagnosed with prostate cancer and their families. Research has shown that not only the diagnosis, but also the treatment method adversely affects the patients, their family and friends. In an analysis of patients and their

partners six months post-diagnosis, the rate of major depression and anxiety disorders was doubled compared to the general community. [27] In light of this, referral to prostate cancer support groups, which are organised by the PCFA, should be considered. Finally, it is also important that adequate teaching and clinical experience is provided to medical students during their training. Familiarisation with associated issues, including screening and treatment options, is paramount to prepare our future generation of medical professionals.

4. Community awareness

The community at large can also continue contributing towards raising awareness. The continued growth of events such as Movember, in terms of participants and popularity, needs to be ensured.

Medical students are not exempt! Along with continual representation at male health organisations, such as the current arrangement with Andrology Australia, the participation and support of Australian medical students in events such as the AMSA Movember Mo-Mentor competition, as well as locally organised Men's Health fundraisers should be considered and continued to increase awareness further.

5. Development of mass screening test

With the controversy surrounding the PSA test, the 'holy grail' in the fight against cancer is the development of an accurate mass population screening tool. Whilst this may be many years away, we are one step closer with the aforementioned announcement by the Australian Government to commit $15 million over five years to establish two dedicated prostate cancer research centres in Melbourne and Brisbane.

Conclusion

Development in knowledge, awareness and attitudes toward prostate cancer has been significant over the past years in Australia. However, despite prostate cancer being a major health burden for Australian men, there are still misconceptions and a lack of awareness amongst the general population.

The combination of prostate cancer specific organisations, campaigns and events, health promotion and the development of a national men's health policy can only further serve to advance prostate cancer awareness. Together with research and funding, there is undoubtedly hope for the future.

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Conflicts of Interest

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On the nature of the alcohol-based hand rub and its use for hand hygiene in medicine and healthcare

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Having personally witnessed cases of inadequate hand hygiene practices amongst health professionals, Adrian was inspired to write this article as a means of raising awareness of the issue amongst future health professionals. The idea to focus on alcohol-based hand rubs came from observing an increase in their presence over the last decade. His other general interests include clinical immunology.

Hand hygiene (HH) is today recognised as being the most important factor in preventing the spread of infections; however, adequate compliance with this remains unacceptably low amongst healthcare workers (HCWs). One of the leading products in the push for successful HH is the alcohol-based hand rub (ABHR), which currently exists as a ubiquitous item in healthcare facilities. This review amalgamates the current understanding of ABHRs, presenting an overview of important issues including its correct usage and insights into HH. Aimed at Australian HCWs and students, a small yet significant amount of attention is devoted to Hand Hygiene Australia – one of the leading authorities in this subject area. It may be concluded that the ABHR is an effective hand disinfectant that also improves HH compliance, and is thus highly recommended for use in healthcare settings.

Hand hygiene beginnings

Since the late nineteenth century, hand hygiene (HH) in medicine and healthcare has emerged as a significant concept in the prevention of infection. The basic notion has been present for a considerable time; yet it was chiefly the observations of the Hungarian obstetrician, Ignaz Semmelweis (1818-65), that highlighted the implications of HH upon patient health. Whilst at the General Hospital of Vienna in 1846, Semmelweis noted that parturient women who were attended to by physicians and medical students had a significantly higher mortality rate of puerperal fever - an endemic of which was present at the time - than those who were attended to solely by midwives. [1]

Through his series of meticulous observations, he noticed that the basis of this was the fact that physicians and students attended autopsies and midwives did not; hence, he hypothesised, the causative agent was transmitted from the autopsy rooms to the obstetric wards, mostly likely via the hands. Despite soap and water handwashing already being required for physicians and students, Semmelweis ordered that they sanitise their hands with 4% chlorinated lime solution before and in between seeing patients. This notion was initially not well-received by his peers; yet its practice was marked with the considerable decrease in mortality from puerperal fever amongst the antepartum patients. [1,2] His discovery thus marked the beginnings of modern HH practice, and along with the work of the English surgeon Joseph Lister (1827-1912), who highlighted the need for antisepsis in medicine, [1,3] a thorough understanding of its importance was born.

Hand flora

Thorough HH is recognised today as being the most important factor in preventing nosocomial infections, [4] with an estimated 4.9×10^4 Colony Forming Units (CFU)/cm^2 bacteria on the hands of HCWs [5] compared to 10^2-10^3 CFU/cm^2 on normal skin. [6] Micro-organisms, particularly when referred to in terms of the hands, have categorically been broken down into two groups: transient flora and resident flora. Transient flora reside in outer layers of the skin and are acquired through direct patient contact or through contaminated surfaces. They are not "consistently present in the majority of persons" [7] and may easily be removed by careful handwashing. Continued removal on a long-term basis, however, is not desirable since it alters normal flora and, hence, may give rise to proliferation of potentially pathogenic flora. Resident flora, in comparison, reside in the deeper layers of the

skin and are considered to be relatively permanent and not usually removed by routine handwashing. Of most concern are the transient flora which are associated with nosocomial infections, [2,6,8] although resident flora may be implicated in some infections that involve the alteration of host immunity with, for example, catheterisation. [6]

Handwashing versus hand hygiene

'Handwashing' is defined by The Centers for Disease Control and Prevention (CDC) as the "vigorous, brief rubbing together of surfaces of lathered hands, followed by rinsing under a stream of water." [4] Whilst the precise definition of 'handwashing' varies across the globe, [6] the process fundamentally involves two methods of cleaning: mechanical and chemical. The physical removal of pathogens through frictional scrubbing is termed 'mechanical cleaning.' Plain (non-antimicrobial) soaps and detergents are generally also utilised. These are chemically composed of hydrophobic and hydrophilic components, consisting of a long, non-polar hydrocarbon tail, and a polar and typically ionic head. As a result, micro-organisms - mostly transient flora - and other particles are suspended in solution to be washed away by excess water. Chemical methods of handwashing employ specialised antimicrobial soaps that kill and/or inhibit the growth of micro-organisms through various means, depending on the active chemical(s) present. [4] A routine handwash, according to various leading authorities, involves use of plain or anti-microbial soaps and vigorous scrubbing for some time before hand-drying on paper towels. [2,4,7]

Whilst sometimes used synonymously with handwashing, HH generally encompasses a broader scope of coverage than handwashing with plain or medicated soap and water; including also "antiseptic hand rub, antiseptic hand wash or surgical hand antisepsis." [2] According to Hand Hygiene Australia (HHA), these procedures have different products and durations compared to handwashing. [9] HHA also associates HH with general hand care (such as the use of moisturisers to prevent skin cracking). [9] Indeed, the precise distinction and definition of HH, much like the definition of handwashing, varies amongst the literature.

Alcohol-based hand rubs

Although strong evidence exists to support HH in the reduction of nosocomial infections, full compliance with HH in the healthcare setting remains surprisingly low, with some studies reporting no more than 40% compliance amongst staff. [6,8,10] Thus, one of the leading products in the push for adequate HH is the alcohol-based hand

rub (ABHR) which emerged prominently in recent times. [11] ABHR dispensers are fast becoming a ubiquitous item in the healthcare setting owing to the convenience of ABHRs. Compared to handwashing with soap and water, they are antimicrobially more effective in vitro and in vivo [6,12] and the application time is significantly less. Consequently, compliance with proper HH methodology has been reported to be significantly higher when ABHRs are introduced, far more effective than education intervention programmes. [13]

Mode-of-action

ABHRs contain ethanol, n-propanol, isopropyl alcohol or mixtures of these. [14-16] The alcohols exhibit both bacteriostatic and bactericidal activity, and whilst their mechanisms are not well-understood, it is widely accepted that the primary mode-of-action is the denaturation and precipitation of proteins. [7,14-17]

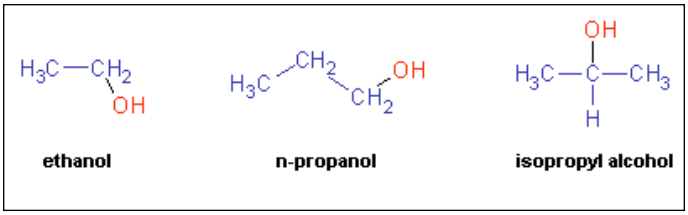

Figure 1. *The three alcohols that can be found in ABHRs. Polar, hydroxyl ends are marked in red; non-polar, aliphatic ends are in blue.*

Due to the hydrophilic and hydrophobic properties at the hydroxyl group (–OH) and aliphatic ends respectively (Figure 1), these alcohols facilitate the denaturation of proteins by first disrupting the lipid bilayer membrane of various micro-organisms, [15] permitting exposure of cellular proteins. Protein unravelling and destruction occur by the disruption of intermolecular bonding or forces. For the tertiary structure of proteins, the disruption of such bonding between the 'tucked-in' hydrophobic amino acid side chains and the surface hydrophilic side chains leads to significant unfolding of the polypeptide backbone and hence, denaturation of the protein (Figure 2). [18]

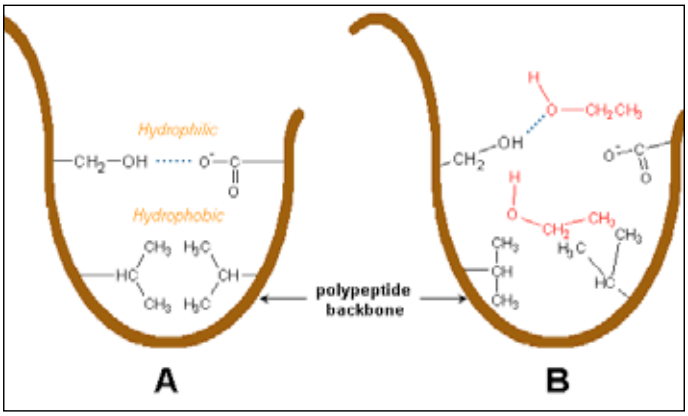

Figure 2. *Examples of tertiary interactions of hydrophilic and hydrophobic side chains (A) and the disruption caused by adding an alcohol (ethanol, for this diagram) (B). Note how the hydrophobic side chains are 'tucked in', away from the external, aqueous environment in Figure A.*

Proteins susceptible to denaturation are reportedly found at the cell wall and cell membrane, thereby compromising the micro-organisms' membrane and cytoplasmic integrity from the resultant disruptions. [17] However, in order for these effects to occur, it is necessary for the alcohols to be present at certain concentrations in aqueous solutions. Many ABHRs contain 60-80% v/v alcohol which represent the concentrations that deliver the most effective antimicrobial activity. Each alcohol, however, has its own unique, optimal concentration – ethanol, for instance, appears to be most effective at 80% v/v. [19,20] The dilution of alcohol is thought to be necessary as high concentrations coagulate proteins on the exterior of the cell wall, therefore preventing entry of the alcohol. [18] However, some antimicrobial activity may still be observed at these levels. [21] In similar concentrations, n-propanol appears to be the most effective alcohol, followed by isopropyl alcohol. [20]

Activity

ABHRs have been shown to possess antiseptic action across a range of micro-organisms. Against most gram-positive and gram-negative vegetative bacteria, the alcohols are highly effective, killing within several seconds. [7,10] In addition, ABHRs have shown promise against drug-resistant pathogens, such as methicillin-resistant *Staphylococcus aureus* (MRSA), [22] and other resilient bacteria such as *Mycobacterium tuberculosis*. [7]

There are, however, examples of bacteria where ABHRs are ineffective; one of the more prominent examples being *Clostridium difficile*. [23,24] This is an issue as *C. difficile* diseases are increasing in the healthcare setting and therefore, other methods must be used to combat it. Recent research indicates that handwashing with warm water and soap is an effective alternative in removing C. difficile spores. [25] Having said this, ABHR activity against bacterial spores has often been reported as poor; [10] yet, there are exceptions. Research by Morton in 1983, cited by Ali *et al.* [17] found that Bacillus anthracis spores could be killed by isopropyl alcohol in a few minutes. From a practical view-point, however, ABHRs should not be used against spores until they are at least supplemented with 1% hydrogen peroxide which may confer better sporicidal activity. [10]

Against parasites and protozoan oocytes, ABHRs are poor. [2,26] Conversely, the alcohols have been found to have excellent activity against a range of fungi and enveloped viruses, (such as human immunodeficiency, herpex simplex, influenza and hepatitis B viruses), [15,17] and some non-enveloped viruses (for instance, rhinovirus and rotavirus). [2,27] Apart from enveloped viruses, ethanol is generally more potent against viruses than isopropyl alcohol. [2,28]

Issues

ABHRs are highly effective and versatile antimicrobial agents which have emerged as a chief tool against nosocomial infections. They are widely available, safe, do not require a sink or additional water, and have a quick application time thus not compromising the quality of patient care. [29] These important benefits have helped to promote ABHRs and proper HH amongst HCWs. Furthermore, ABHRs are generally less irritating to the skin than many other antiseptic products and soap and water, making it an attractive alternative. [8,30] Despite this, alcohol does have an inherent drying effect on the skin which may cause some irritation; thus many ABHRs contain emollients, such as glycerol, and humectants which can prevent such irritation and dermatitis. [31]

An increasingly prominent issue for HCWs is antibiotic resistance amongst bacteria, and therefore, extra vigilance is exercised with the utilisation of antibiotic and antiseptic agents. [32,33] As previously mentioned, ABHRs have proven to be effective against such resistant bacteria, and, currently, no evidence yet exists to suggest that topical antimicrobial agents, such as ABHRs, contribute to antibiotic resistance. [10,34] From a scientific point-of-view, this conclusion is certainly sound as ABHRs, in contrast to antibiotics, cause widespread physical damage to micro-organisms by the non-specific denaturation of many proteins. Mutation, and therefore resistance, is extremely unlikely, if not impossible. Moreover, it has been suggested that insufficient exposure time to the alcohol due to rapid evaporation reduces the risk of resistance developing. [10]

ABHRs, of course, are not free from their limitations and disadvantages. Whilst they display excellent antimicrobial activity, residual activity is not present and flora grows back hours after use. Consequently, some ABHRs have added antiseptics, such as chlorhexidine gluconate, for synergistic bactericidal effects and possible prolonged activity. [10,15] In addition, ABHRs are highly flammable and therefore pose a fire hazard; however, fires as a result of these products are thought to

be rare. [6,35] One measure of their flammability is the 'flash point,' defined as the lowest temperature needed for a volatile liquid to produce an ignitable vapour. For the 'diluted' alcohol in ABHRs, flash points range from approximately 21°C to 24°C. [6] Thus, care should be taken with naked flames and sparks around ABHR dispensers, which should be well-designed to minimise unwarranted evaporation or exposure of the product.

Further concerns identified include the fragrances of certain volatile ABHRs which may upset people with respiratory sensitivity or allergies. [16,36] Additional costs to install ABHR dispensers and provide education has been highlighted as a minor issue which prevented the more widespread usage of ABHRs. [28] However, the cost to the hospital system resulting from nosocomial infections is far greater than the costs to supply ABHRs, [37] thus making these products financially worthwhile. Table 1 summarises the main advantages and disadvantages of ABHRs.

Table 1. *Main advantages and disadvantages of ABHRs.*

Advantages
Highly effective against a range of micro-organisms
Relatively non-toxic
Fast application with no water, sinks or paper towels needed
Improves hand hygiene compliance
Disadvantages
May cause skin and respiratory irritation
Flammable (fire hazard)
Poor residual activity

Correct procedure

ABHRs are not designed to physically clean one's hands. Hands that are visibly or obviously contaminated with debris, proteinaceous and/or organic material should be washed with soap and water and dried. [2,32] Before use of the ABHR, HHA states that jewellery should be removed and artificial nails should not be worn. [9] This is consistent with research that these objects significantly harbour pathogens. [38-40] Following this, any lesions or abrasions on the hands must be covered appropriately with water-proof material to minimise the chances of pathogen cross-transmission. [32] A sufficient amount of undiluted hand rub should then be squirted into the open palm. Depending on the manufacturer's instructions, this amount will vary, [2] though between 2mL and 3mL is the volume often used. [8,20]

The ABHR should be rubbed in completely with both hands until dry, [32] covering all surfaces of the hands, and following the authoritative procedure outlined by the World Health Organisation's (WHO) 'How to Handrub?' poster. [41] To benefit from the full antimicrobial effect of the alcohol, the process should last for at least 30 seconds; [19,31,42] however, HHA only suggests ten to fifteen seconds. [9] Importantly, they recommend ABHRs have the approval of the Therapeutic Goods Administration and meet the European Committee for Standardisation (EN1500) standard for bactericidal activity. [9]

The use of ABHRs and general HH is indicated in a variety of healthcare situations – many of these are listed in the HHA manual. [9] However, most notably, the WHO lists five critical occasions when HH is essential as the so-called 'Five Moments for Hand Hygiene' (FMHH): (1) before touching a patient; (2) before aseptic procedures; (3) after contact with bodily fluids; (4) after patient contact; and (5) after touching a patient's environment. [16] Indeed, these indications were "created to bridge the gap between the results of scientific studies and evidence-based guidelines and the necessity to provide user-centred, practical tools." [43]

One of the many reasons why HH compliance is low is due to the belief that wearing disposable gloves negates the need for proper HH. [44,45] This assumption is false, and studies have shown that gloves contain microscopic pores, exacerbated by normal clinical use, that may permit entry of viruses. [46-48] Widmer [6] mentions a 1988 study by Doebbeling *et al.* where certain micro-organisms handled by gloves were able to be isolated on the hands themselves. Therefore, adequate HH must be followed with glove use, and it is currently recommended people follow HH practices before donning and after removing gloves. [9,10] Despite this, the WHO reports that HH upon de-gloving is still an unresolved issue. [16]

Discussion

It is clear that ABHRs have proven to be highly effective and convenient, and are becoming increasingly accepted amongst HCWs. There are, undeniably, disadvantages with their use; but by far the biggest barrier to more prevalent and proper usage is not any intrinsic limitation, rather it lies with the users of the hand rub themselves. The lack of time, misconceptions, inaccessible handwashing supplies, forgetfulness, few role-models, lack of institutional HH protocols and skin irritation are some of the issues that stand in the way of better compliance amongst HCWs. [8,31,45] Therefore, these barriers must be recognised and addressed appropriately in order to improve compliance.

A relatively unexplored barrier includes religious beliefs. Most notably, the religion of Islam forbids the consumption of alcohol and hence, contact with it through ABHRs by Muslim HCWs is a cause of concern. [49] However, the amount of alcohol systemically absorbed is negligible and any absorbed amount quickly declines after several minutes. [50,51] In addition, the use of alcohol as a medicinal agent to improve health is, in actual fact, permitted under Islam. This was reinforced by the World Muslim League in 2002. [49] Thus, an increased appreciation and awareness of the concerns of HCWs with religious beliefs that ban contact with alcohol is fundamental to improving HH compliance. [49] Further research is suggested to holistically address this matter. [52]

The main challenge with ABHR use lies in maintaining HCWs' adherence to the product and protocols. [53] The introduction of systematic, hospital- and discipline-wide programmes with HH education, promotion and feedback have proven successful and instrumental in combating this issue and many of the aforementioned barriers. [54-56] At the heart of these programmes, multimodal and multidisciplinary strategies should be employed to maximise success in ensuring optimal compliance. [2,8,45,53]

Kampf [57] identified 'six golden rules' of improving compliance which, in the first two rules, advocated the use of accessible and acceptable ABHRs. His other recommendations included the implementation of education and promotion, creating budgets to cover associated costs, creating role models and having a balanced staff-patient ratio. A suggested approach by Apisarnthanarak *et al.* [58] also adds performing audits, providing feedback and identifying and addressing individual obstacles; for example, combating 'forgetfulness' with promotional posters. In fact, HHA asserts that "ensuring ABHR is readily available at the point-of-care…can reduce many of the potential barriers to good HH." [9] The National Health and Medical Research Council (NHMRC) goes on to suggest automated ABHR dispensers and computerised voice prompts to increase compliance. [32] Hence, whilst different approaches are taken, multimodal programmes demonstrate fitting responses to some existing barriers.

Without doubt, the FMHH is a key constituent of various multimodal strategies, employing the use of simple visuals for the successful delivery of these critical moments. [43] These visuals can be placed in multiple locations, thereby encouraging and reminding HCWs of safe HH practices. The protocol also allows for suitable monitoring with its clearly defined indications, which is a necessary and vital step in ensuring the continued success of the programme, and certainly a step that is advocated by WHO. [32,59] Hence, owing to its value, the FMHH is an integral component in the HHA's National Hand Hygiene Initiative (NHHI) for Australian HCWs. [60]

Table 2. *A list of selected prominent guidelines and protocols for HH and the use of ABHRs. *URLs are correct as of January 2011.*

Guideline	Source*
NHMRC: Australian Guidelines for the Prevention and Control of Infections in Healthcare (2010)	http://www.nhmrc.gov.au/_files_nhmrc/file/publications/synopses/ CD33_ InfectionControlGuidelines2010.pdf
Hand Hygiene Australia Manual (2009)	http://www.hha.org.au/UserFiles/file/Manual/ManualJuly2009v2(Nov09).pdf
WHO Guidelines on Hand Hygiene in Health Care (2009) & 'Five Moments for Hand Hygiene' (2009)	http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf
CDC (MMWR): Guideline for Hand Hygiene in Health-Care Settings (2002)	Boyce JM, Pittet D. Guideline for hand hygiene in health-care settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/ IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America. MMWR Recomm Rep. 2002;51(RR-16):1-45, quiz CE1-4.
APIC Guideline for Handwashing and Hand Antisepsis in Health Care Settings (1995)	Larson E. APIC guideline for handwashing and hand antisepsis in health care settings. Am J Infect Control 1995;23(4):251-69.

The guidelines listed in Table 2, along with all other HH protocols, should form the basis of HH practices today. Amongst HCWs, it is simply unacceptable to disregard such protocols, particularly knowing the potential consequences of non-compliance. Certainly, it is not suggested that HH practices ought to be replaced entirely by ABHRs - and in fact, the efficacy of solely using ABHRs has been doubted. [19,61] Rather, ABHRs should be used in conjunction with HH procedures as products to improve the standard of HH. With this in mind, and current HCWs and students alike being instrumental in pushing for better HH practices, the future certainly looks more promising for modern healthcare.

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Conflicts of Interest

None declared.

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Stethoscopes as vectors of infections

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Nathania has clinical and research interests in tropical infectious diseases and medical education. She has undertaken volunteer work on Palm Island, and was the Convener of the Northern Territory Intervention Panel Discussion in 2009. Her shortlist of medical careers includes emergency medicine and rural general practice.

Aim: To conduct a review of the literature to evaluate whether stethoscopes constitute a clinically significant vector of healthcare-associated infection, and to explore the behaviour, attitudes and beliefs about stethoscope hygiene amongst medical students. **Methods:** Section one: PubMed was searched for empirical studies written in English, published before 1 May 2010, dealing with colonisation rates of stethoscopes and self-reported frequency of stethoscope cleaning by healthcare staff. Thirty-one articles were systematically reviewed. Section two: Qualitative and quantitative cross-sectional study of medical students. A convenience sample of seventeen undergraduate medical students in years two, three and four were asked a series of thirteen questions exploring their knowledge, practice of and attitudes towards stethoscope hygiene. **Results:** The diaphragm and bell of stethoscopes are colonised with micro-organisms on average 87.3% of the time. On average, 14% of stethoscopes carry MRSA, and 16.5% carry gram-negative species. On average, 58.8% of doctors clean their stethoscope annually or never. Fifty-nine percent of students surveyed had never cleaned their stethoscope. Only 29% of students had ever been advised about stethoscope hygiene. Eighty-two percent of students felt senior colleagues had influenced their attitude (positive or negative) toward stethoscope hygiene. **Conclusions:** Stethoscopes potentially represent a moderate-to-high risk of infection transmission, particularly in vulnerable settings, yet stethoscope hygiene is rarely considered or practiced by doctors and medical students. Improving stethoscope hygiene in practice requires addressing the lack of formal education on the subject and the shortage of positive role models.

Introduction

Infection control education is an area receiving an increasing amount of attention both from government agencies and in the literature. It has now been well demonstrated that good infection control practices in the clinical workplace depend upon comprehensive education from the student level up, and from the senior leadership level down. [1,2]

As a fourth-year medical student, a question arose while on clinical rotation: is the humble and universal stethoscope perhaps more of an infection risk than anyone consciously realises? I observed stethoscopes placed on unclean skin, on the abdomen of patients with gastroenteritis, near colostomy openings, sternotomy wounds and onto the chest of newborns without ever witnessing a stethoscope being cleaned by any member of staff. Furthermore, reflecting on my medical education thus far, stethoscope hygiene had not once been formally raised as an issue of which to be mindful.

This review therefore sets out to investigate the issue of stethoscope hygiene. The aims are two-fold: firstly, to examine and systematically review the literature to evaluate whether stethoscopes constitute a clinically significant vector of healthcare-associated infection; and secondly, to explore medical students' behaviour, attitudes and beliefs about stethoscope hygiene.

Methods

A systematic search of the PubMed database was conducted, using the keywords "stethoscope," "infection control," "nosocomial," "vector" and "disinfection," which yielded a total 31 articles in English. These

were reviewed systematically to answer four questions:

1. What is the rate of colonisation of stethoscopes?
2. What evidence is there that stethoscope colonisation results in nosocomial infection?
3. Are patient-dedicated stethoscopes used appropriately and effectively?
4. How often do healthcare staff reportedly clean their stethoscopes?

Subsequently, a very small qualitative and quantitative cross-sectional study was performed on a convenience sample of seventeen medical students, across the pre-clinical second (n=1) and third (n=4) years, and the clinical fourth-year (n=12). Participants were asked a series of thirteen questions (Table 1) exploring their knowledge of, practice of and attitudes towards stethoscope hygiene. The results of both of these investigations are discussed as follows.

Table 1. *Peer survey questionnaire.*

Peer Survey Questionnaire
What year of medicine are you studying?
In the course of your medical education, have you ever been advised about hand-washing? • If yes, has this been formal or informal teaching?
Have you ever been advised about safe intravenous (IV) cannulation? • If yes, has this been formal or informal teaching?
Compared to most methods of nosocomial infection transmission, what role do you think stethoscopes play?
Have you ever been advised about stethoscope cleaning? • If yes, has this been formal or informal teaching?
Have you cleaned your stethoscope before? • If yes, why and how did you clean it? • If no, is there any reason why you have chosen not to, or why it has not occurred to you?
Do you think the attitude or example of senior colleagues has influenced your perception regarding stethoscopes as a vector of infection? • If yes, how?
To your knowledge, does the regional teaching hospital have a protocol regarding stethoscope cleaning?

Results and Discussion

Section 1: Systematic literature review

The literature review revealed firstly that the diaphragm and bell of stethoscopes are frequently colonised with micro-organisms (on average 87.3% of the time) (Table 2). [3-25] It is less clear whether the population of micro-organisms is typically pathogenic. The most abundant organisms tend to be coagulase-negative *Staphylococcus spp*, which are relatively benign. [6,9,12-15,17,18,20,22-24]

Table 2. *Review of cross-sectional studies on colonisation rates and pathogenic profiles of stethoscopes (before cleaning).*

Study	Number of stethoscopes (*n*)	Overall colonisation rate (%)	Mean CFU count per stethoscope
[3]	62	61	-
[4]	155	-	Personal: 50.3 Ward: 29.3
[6]	100	90	
[5]	22 personal; 24 ICU	67 personal; 95 ICU	-
[7]	50	98	47.7
[8]	49	-	-
[9]	99	100	-
[10]	200	80	-
[11]	50	-	-
[12]	12	100	8 to 221
[13]	300	87	-
[14]	24	71	-
[15]	150	-	37
[16]	41	100	-
[17]	43	-	-
[18]	55	100	-
[19]	29	89	69
[20]	50	74	-
[21]	43	85	-
[22]	122	-	132
[23]	92	100	-
[24]	105	-	-
[25]	106	-	-
		Mean: 87.3%	Mean: 67.7

CFU = colony-forming unit; - = data nor available; ICU = intensive care unit

On the other hand, an average of 14% of stethoscopes (one in seven) are colonised with MRSA, [7,10-12,16-18,20,21,24,25] and an average of 16.5% carry gram-negative species (Table 3). [7,13,14,16,17,21,23] The microbiological profile of stethoscopes varies significantly from study to study and hospital to hospital, thus making it difficult to make accurate generalisations. Nevertheless, some hospitals reported rates as high as 69% for MRSA [17] and 60% for gram-negative bacteria. [7] With this in mind, it is preferable to consider every stethoscope as a potential carrier of pathogenic organisms.

Crucially, there is some debate in the literature as to whether stethoscope contamination (or environmental contamination more broadly) can lead to infection in the patient. Eleven of seventeen articles supported the notion that a causal relationship does exist, particularly via indirect transmission from stethoscopes to clinicians' hands and then to patients. [13,26-32] This argument was reinforced by the fact that gram-positive bacteria survive for up to eighteen hours on stethoscope membranes, [33] and respiratory syncytial virus (RSV) can be recovered from inanimate surfaces for up to six hours, [34,35] with these organisms remaining infectious when transferred from surfaces to hands. On the other hand, three studies highlighted that gram-negative bacteria only remain viable for several hours on stethoscope diaphragms, [33] and that environmental contamination by *Staphylococcus aureus* appears to play only a minimal role in infection transmission. [36,37]

Table 3. *Mean profile of colonisation rate per species.*

Species	Mean colonisation rate (% of stethoscopes)	Number of studies providing data
Staphylococcus spp	75.0	6
• *Staphylococcus aureus*	23.0	7
• Coagulase-negative spp	60.5	8
• MRSA	14.0	11
Gram-positive bacilli	69.5	2
Gram-negative spp	16.5	6
• *Acinetobacter spp*	1.4	3

The question of whether stethoscope contamination actually results in infection in the patient is pivotal to determining whether there is a true need for systematic stethoscope decontamination. At the time of writing, the literature seems not entirely cohesive on the issue, and further research is likely required before stethoscope hygiene will be aggressively implemented. However, until such evidence exists, it is wise for individual clinicians to err on the side of prudence and to consider that contaminated stethoscopes are indeed likely to result in clinical infection.

The main infection control measure currently in place regarding stethoscopes – that is, dedicated stethoscopes for patients infected with resistant organisms – is often not adhered to properly, primarily because staff find hospital-provided stethoscopes to have poor sound quality and to be uncomfortable. [8,38] In addition, one observational study found that stethoscopes designated for single-patient use were often used around other areas of the hospital. [12] This highlights the importance of considering other ways of minimising the risk posed by stethoscopes, such as frequent cleaning of the bell and diaphragm. In this way, systematic decontamination of stethoscopes between all patients would allow doctors and nurses to use their own stethoscopes safely, even on vulnerable or resistant strain-carrying patients.

Section 2: Medical student survey

Twelve studies were identified in which a cross-sectional survey of the frequency of stethoscope cleaning by healthcare staff was performed. [3,5-7,10,11,14,15,17,19,22,33] Most showed very poor stethoscope hygiene. Contrary to current guidelines, [39] not a single study reported any percentage of staff cleaning their stethoscope before and after each patient. Rather, three quarters of the twelve studies reported high rates of doctors cleaning their stethoscope only annually or never (mean = 58.8% of doctors). [3,7,11,14,15,17,19,22,33] This is very similar to the findings in this peer survey, where more than half the students had never cleaned their stethoscope (59%), and 28% of those who had ever cleaned it had only done so once to six times in the last year (Table 4).

In contrast, three out of five studies showed that bacterial contamination rises significantly after one day of use without cleaning and after the stethoscope is used to examine more than five patients without cleaning, which suggests that even daily cleaning is not sufficient. [3,15,24] It is particularly interesting to note that doctors and students alike seem to believe stethoscope cleaning is appropriate in some circumstances.

Table 4. *Frequency of stethoscope cleaning by students.*

Frequency	Number (%)
Never cleaned their stethoscope	10/17 (59%)
Ever cleaned their stethoscope	7/17 (41%)
• Cleaned 1-6 times in last 12 months	2/7 (28%)
• Cleaned >6 times in last 12 months	0 (0%)
• At the end of each week	0 (0%)
• At the end of each day	2/7 (28%)
• After every patient encounter	3/7 (43%)

One study showed that 10% of doctors cleaned their stethoscopes only when it was soiled by blood or human secretions. [6] Similarly, three students wrote in the survey:

"I cleaned [my stethoscope] after using it on a patient who appeared visibly unclean. I don't clean it before and after patients."

"I cleaned it when I was in ICU because of high-risk patients in this ward."

"I have cleaned the diaphragm once after using it on a patient with a *Pseudomonas* infection."

Anecdotally, this type of attitude to when and why it is necessary to clean stethoscopes is quite common. In fact, if a student or clinician gives any thought to stethoscope hygiene, it is usually only in the context of a gastroenteritis epidemic with patients known to carry resistant organisms, or simply with visible and obvious soiling of the stethoscope.

The analysis of both the literature and the peer survey revealed three apparent principal reasons for the observed poor practice of and poor attitudes towards stethoscope hygiene. Firstly, the lack of formal education received by students on the subject plays an important role. While 100% of students had received formal teaching surrounding hand hygiene and 94% had been advised about safe intravenous cannulation (mainly through formal teaching), only 29% had ever been advised about stethoscope cleaning, and this had mostly (80%) been through informal teaching on placements (Table 5).

Table 5. *Comparative frequency of education regarding different modes of infection transmission, and structure of teaching.*

Student status of 17 students surveyed	**Number (%)**	**Formal teaching** Number (%)	**Informal teaching** Number (%)
Advised about hand-washing	17 (100%)	17/17 (100%)	8/17 (47%)
Advised about safe IV cannulating	16 (94%)	14/16 (87%)	8/16 (50%)
Advised about stethoscope cleaning	5 (29%)	1/5 (25%)	4/5 (80%)

The fact that stethoscope hygiene does not figure in the medical curriculum seems to have a large impact on students' attitudes:

"It has slipped my mind considering we've never had any formal education regarding stethoscope hygiene."

Not only does an absence of formal education on the subject predispose future clinicians to consider stethoscope hygiene unimportant, it also means that those who might have considered cleaning their stethoscope will not have developed an effective cleaning technique. [16] For these reasons, formal education must be considered in the effort to improve stethoscope hygiene practices.

The second most important factor contributing to poor stethoscope hygiene practices seems to be an ignorance or absence of hospital protocol on the subject. Of two studies examining how many doctors had ever been advised about stethoscope hygiene, both found that 100% of surveyed doctors had never been advised. [17,19] Similarly, 100% of the students in the peer study had no knowledge of the presence or absence of stethoscope hygiene protocols at the regional teaching hospital, despite being initiated to the hospital protocol on hand hygiene, intravenous cannulation and sharps safety. These findings highlight that hospitals play a part in encouraging good clinical practice by instituting and enforcing relevant protocol.

Furthermore, governmental and non-governmental agencies play a part by producing guidelines and recommendations that shape hospital protocol in the first place. Thus, the roles of hospitals and guideline-producing agencies should be considered in the effort towards improving clinical stethoscope hygiene practice.

The third and possibly most important influence in engendering the current poor attitudes and behaviours in relation to stethoscope cleaning is the shortage of positive role models – and indeed, the presence of negative role models. When surveyed, 82% of students responded that doctors had indeed influenced their attitude towards stethoscope hygiene. Of these, 14% claimed their senior doctors had acted as positive role models, while the remaining 86% emphasised that not seeing doctors clean their stethoscopes had caused them not to value stethoscope hygiene. Either way, it appears the example of senior doctors makes lasting impressions on students:

"Since my placement in a rural town, where my head doctor taught me about stethoscope cleaning, I try to clean mine after every patient."

"I haven't met a doctor who cleans their stethoscopes between each patient, so I haven't really felt the need to do so either."

The importance of positive leadership has been recognised as an extremely powerful influence on the behaviour of subordinate colleagues in other areas of infection control for many years. [1,2,40] What is more, senior doctors seem to comply with infection control practices more if they perceive themselves as role models for other colleagues. [41] The literature review and peer survey findings suggest that the same principles apply to stethoscope hygiene.

Conclusion

Stethoscopes represent a moderate-to-high risk of infection transmission, particularly in vulnerable settings. Nevertheless, stethoscope hygiene is rarely considered or practiced by doctors and medical students. This problem appears to stem from a lack of formal education on the matter, an absence or ignorance of hospital protocol and lastly – and most importantly – from a shortage of positive role models. Further research needs to be conducted to conclusively demonstrate whether stethoscope contamination results in clinically significant infections, as this is likely to help in the promotion of formal education on the matter. Governmental health bodies should continue to clarify their stance on the issue of stethoscope hygiene, and to put forward protocol recommendations to hospitals, which should in turn advise all staff and clinical students accordingly. Ideally such measures will ultimately ensure that enough senior clinicians will improve their own behaviours, so that they may subsequently act as positive role models to the ensuing generation of doctors. All of these efforts should be directed at eliminating every last significant source of healthcare-associated infection, and promoting a safer environment for staff and patients.

Conflicts of Interest

None declared.

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Preventing vertical hepatitis B transmission across all borders: A review of current concepts

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Gemma, currently studying at JCU, has a passion for women's health and paediatric medicine. She is interested in practising in developing communities and research pertaining to this.

Aim: The aim of this review is to emphasise the global significance of Hepatitis B (HBV) and its vertical transmission, and to summarise the current status of preventative strategies. **Methods:** A literature review was carried out. PubMed, The Cochrane Collaboration and Medline were searched for both primary studies and reviews pertaining to vertical HBV transmission, its prevention and barriers to prevention. Key words used included "HBV," "Hepatitis B," "vertical transmission," "mother to child transmission," "prevention" and "epidemiology." **Results:** HBV is a major cause of death from liver cancer and liver failure. HBV is the ninth leading cause of death internationally and accounts for up to 80% of the world's primary liver cancers. In highly endemic areas, 75% of chronic HBV is acquired by vertical transmission (mother to child transmission at birth), or by horizontal transmission in early childhood. The earlier in life the disease is acquired, the greater the adverse consequences. Available therapies for preventing mother to child transmission are very effective and include multiple doses of HBV vaccine and usually, HBV immunoglobulin. However, up to 10% of infants acquire HBV despite this standard prophylaxis. Whether anti-viral agents should be given to mothers with a high viral load to prevent transmission remains controversial. **Conclusion:** HBV is an extremely important global public health issue. Prevention of vertical transmission is the most important preventative strategy and current prophylactic therapies are highly effective. Emerging approaches for mothers with a high viral load require further investigation to determine whether they are effective and safe. Developing countries face the issues of cost, access and education to apply prevention strategies, while developed countries need processes to ensure adherence to established recommendations.

Introduction

Infection with Hepatitis B virus (HBV) is a global health issue. Liver damage is the major complication of HBV infection. Such damage may be acute or chronic and results from an immune response to the virus. The acute hepatitis syndrome varies from a mild asymptomatic presentation to a severe, even fatal illness. Chronic infection with HBV is a more significant international public health issue than the acute illness. Chronic hepatitis is more common and has the potential to cause significant morbidity and mortality due to a resultant cirrhosis and/or hepatocellular carcinoma. [1-4] One third of the world's population is estimated to have once been infected with HBV, with an estimated 360 to 400 million chronic carriers internationally. Importantly, each year, approximately one million deaths are caused by HBV, making it the ninth leading cause of global mortality. [3,5-7] This is a critical health issue to address.

Mother to child transmission (MTCT) is of great importance for two main reasons. Firstly, it is a numerically important mode of transmission; and secondly, the earlier an individual is infected, the more likely it is that chronic infection will result. [8-11] If the individual is an infant at the time of infection, a 90% chance exists that they will develop a chronic infection. In contrast, if an individual is an adult at the time of infection, they have a 6% to 10% chance of the infection becoming chronic; a much lower probability. [3,12,13] Therefore, understanding this mode of transmission is very important in reducing the morbidity and mortality inflicted by HBV.

Although vertical transmission may be perceived as a major problem,

it also presents a major opportunity for effective intervention. For the purpose of this investigation, vertical transmission includes antenatal transmission via the placenta, transmission during delivery and postnatal transmission from mother to child during infancy. [14]

International epidemiology

Prevalence of HBV (defined as the proportion of individuals with HBV surface antigen positive status) varies significantly between countries. Certain areas of the world are classified as having high prevalence (>8%) including China, South-East Asia and sub-Saharan Africa; intermediate prevalence (2-7%), in southern and eastern Europe; and low prevalence (<2%) in Western Europe, North America and Australia. [15-18] However, even within low prevalence regions there are ethnic groups with high carrier rates that require special consideration. The highest rates of HBV carriers are found in developing countries, attributable to a multitude of factors including insufficiency of medical facilities and lack of education. [19]

Unfortunately, there is a lack of information regarding the global burden of HBV. In response to this deficit a mathematical model was constructed in 2005 which estimated the annual mortality rate for HBV-related disease to be 620,000. From these findings it was then proposed that 94% of these HBV-related deaths occurred as a result of chronic infection-related cirrhosis and hepatocellular carcinoma, while only 6% of these deaths could be attributed to acute hepatitis B. [20] In contrast, the World Health Organisation (WHO) has estimated a total annual mortality relating to HBV and the development of chronic clinical forms to be one million. [5]

Of the 360 to 400 million chronic HBV carriers worldwide, it is hypothesised that one quarter will die of liver disease as a result of their carrier state. [5,21] Despite the differences in the absolute values reported in the literature, it is clear that chronic HBV infection is a major health issue. Of particular relevance to this review, in the highly endemic aforementioned areas, up to 75% of chronic carriers acquire HBV by vertical transmission. [19,20,22] HBV also causes 60% to 80% of the world's primary liver cancers. [19,23] It is therefore evident that preventing vertical transmission is a critically important measure in disease prevention.

Mechanisms of vertical transmission

Vertical transmission of HBV incorporates a number of routes of infection. In particular, this term refers to transmission during pregnancy (antenatal), at the time of birth (at parturition) and after delivery (postpartum). However, it is important to note that most

transmissions from mother to child occur during parturition.

Antenatal transmission
Intrauterine infection is the mechanism by which the fetus is infected during the antenatal period. [15] It is estimated that this mode of transmission accounts for 10% to 44.4% of infection in at-risk infants. [15,24,25] This is thought to happen through the placenta, either by "cellular transfer" or by transplacental leakage of maternal blood. [14,15,26,27] The major risk factors for intrauterine transmission include premature labour, HBV DNA of cord blood and mothers of HBeAg-positive status. [24,28,29] Viral structure, HBV mutations, placental barrier and the immune status of the mother and of the fetus have also been implicated. [29] It has also been proposed that antenatal HBV transmission can occur through infected oocytes but this is yet to been confirmed. [15]

The issue of whether invasive procedures undertaken during pregnancy increase the risk of HBV transmission is debated. A relatively small amount of research considers if amniocentesis or chorionic villous sampling increases the risk of HBV transmission to the fetus in HBV infected mothers. The general consensus is that this risk seems to be low when the procedure is performed accurately. [21,30-34] This is an area of research that needs to be investigated further to reach a conclusion.

Transmission during parturition
This route of transmission arguably poses the greatest threat to the infant. HBV-DNA has been detected in amniotic fluid samples and vaginal secretions. [5,15] It is controversial as to whether delivery via caesarean section is beneficial in these individuals. [10]

Postnatal transmission
Postnatal transmission is believed to occur through body fluid interacting with mucosal surfaces. [3,35] Transmission occurs if the infant is in close contact with infected individuals. Whether breastfeeding increases the risk of transmission remains controversial. [10]

Current preventative strategies and their efficacy

Current preventative strategies include active (Hepatitis B vaccine) and/or passive prophylaxis (Hepatitis B immunoglobulin).

Hepatitis B virus vaccine
There are two licensed forms of the hepatitis B vaccine (HBVac), plasma-derived and recombinant. Both are effective, with no significant difference in hepatitis B occurrence between either product following administration. [16,36] These vaccines are composed of the HBV surface antigen, commonly referred to as HBsAg, exposing the most immunogenic epitope on the surface of the vaccine particles. [19] Completion of the vaccination program in healthy individuals induces protection in about 95% of cases. [19,37] Without HBVac, the mortality associated with both the acute and chronic infections is predicted to rise dramatically. [20]

HBVac has proven to be efficacious. The vaccination alone is 90% effective in preventing vertical transmission when administered to newborns. In addition, vaccination of newborns provides pre-exposure prophylaxis to infants born to women without hepatitis B, reducing the risk of becoming a chronic carrier in infancy and early childhood (prevention of early horizontal transmission). [38-40] This is particularly important in highly endemic areas.

Hepatitis B immunoglobulin
Hepatitis B immunoglobulin (HBIG) is a purified solution derived from human plasma containing large amounts of antibodies to HBsAg (anti-HBs or HBsAb). This substance is derived from donations given by immune individuals. [5,8,41] HBIG significantly reduces hepatitis B occurrence when compared with placebo or no intervention. HBIG is effective immediately following administration providing a high level of infant protection for a number of months. [16]

Combination of HBV vaccine and HBIG
Studies have proposed that the combination of neonatal HBVac and HBIG administration is more effective than either strategy alone. [16,42,43] This combination of HBIG at the time of birth and the completion of a HBVac program over the first six months of life is effective in preventing perinatal transmission and is routine in most countries. [44]

The contemporary challenge is that despite combined (active and passive) neonatal immunoprophylaxis, around 10% of neonates born to HBV carriers will become chronically infected. [16,42]

Current recommended prophylaxis protocol

Screening is critical in identifying which of the mothers are positive for HBV. It has been recommended that all pregnant women undergo prenatal screening for HBsAg to identify which neonates will require prophylaxis. [38,45]

Considering that HBV is such a burden on international public health, there is a need for a uniform prevention protocol. Currently, the WHO, World Gastroenterology Organisation (WGO) and the United States (US) Centers for Disease Control and Prevention (CDC) all recommend joint HBV immune prophylaxis. This includes HBVac and hepatitis B immunoglobulin within 24 hours after birth. [8,38]

These recommendations are supported by a number of trials in which HBVac and HBIG administered to the neonate were beneficial in the prevention of vertical transmission. [8,38,46]

Emerging and controversial prophylactic therapies

Due to the inability of routine prophylaxis administered postpartum to prevent all cases of MTCT, there is cause to investigate other possible interventions. Those currently being investigated and trialled include the administration of HBIG during the third trimester and antiviral therapy in the third trimester.

HBIG during the third trimester
Despite remaining a controversial topic, many studies have found a decrease in the percentage of chronic HBV infections in infants, even when used in combination with routine prophylaxis of HBVac and HBIG post-partum. [8,10] Interestingly, it is also being proposed that HBIG enhances the immune response to HBVac. [8,42]

In a recent (2010) cohort study, the rate of vertical chronic HBV transmission was only 4% when mothers received HBIG in combination routine prophylaxis. [8,10]

In addition to reducing the percentage of chronic HBV infections, HBIG has also been implicated in a subsequent increase in neonatal HBsAb seropositivity and a lower rate of intrauterine infection following administration; [8,21,47] however, this has not been a consistent result.[8,42,48]

While still unclear, the proposed mechanisms behind the interruption of HBV transmission are as follows. HBsAg is bound by HBsAb (from the HBIG) which stimulates the complement system. This enhances humoral immunity resulting in a reduced maternal HBV load, protection of uninfected cells and inhibition of viral replication. It is possible that HBIG facilitates a passive foetal immunity. [49,50] In contrast, another study has suggested that HBIG neutralises HBV in the maternal blood thereby reducing the risk of intrauterine infection. [8,42,51] This area of research is still under investigation. It will be particularly important to consider this prophylactic measure in mothers whose infants are in the high risk groups.

Antiviral therapy during the third trimester
Antiviral therapy during the third trimester is the emerging prophylactic approach of the greatest contemporary interest (Figure 1). The main antiviral agents being considered in this context include lamivudine, tenofovir and telbivudine. Lamivudine works by blocking HBV DNA polymerase. In doing so, it inhibits the synthesis of DNA and reduces the replication of intermediates targeting the infection. [49]

As the mother's viral load increases, so does the risk of HBV perinatal transmission, which has been recorded as being as high as 28%. [44,52] This promotes the theory that the risk of perinatal transmission is reduced if the mother's viral load is also reduced at parturition, highlighting the potential of using antivirals. [44]

A number of studies have proposed that lamivudine can cause a rapid reduction of HBV DNA levels which is of particular importance in mothers with a high viral load. [21,53-56] This is supported by a number of studies which have shown significantly lower intrauterine HBV infection rates in women receiving this therapy. [21,47]

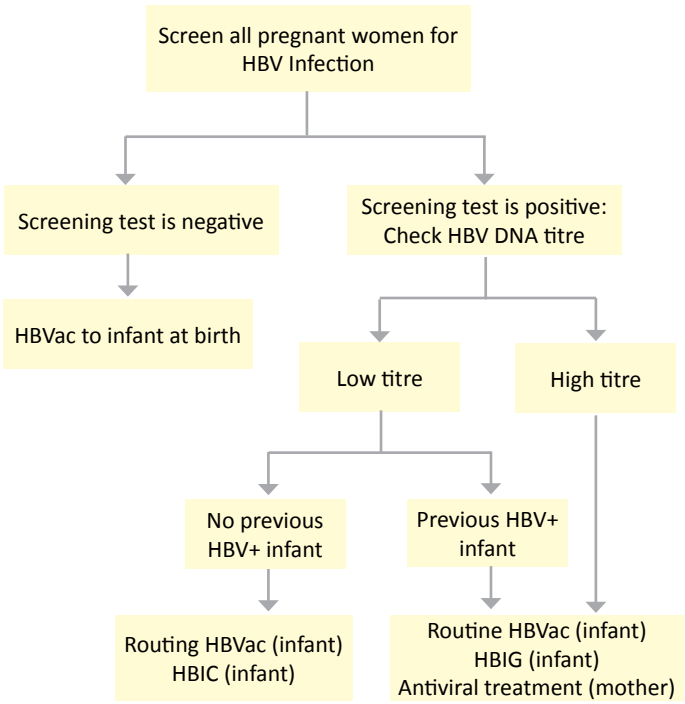

Figure 1. *Management of HBV infection during pregnancy*

As with all treatment regimes, both the risks and benefits must be considered before commencing therapy, despite the safety and efficacy of anti-viral agents such as lamivudine. Currently there is insufficient conclusive evidence relating to antiviral therapy to prevent HBV MTCT and thus, this treatment cannot be recommended at this time. [44] It is also to be noted that the mothers' liver disease status should be considered before commencing or continuing antiviral treatment. [21] The risks include the development of drug resistance in the mother and flares of hepatitis in the mother when the anti-viral drug is stopped in the postpartum period. The optimal timing of commencement and duration of use of these agents must also be determined.

Additional preventative measures

Topics under debate include associations between MTCT of HBV and bottle feeding or delivery methods such as caesarean section, in an attempt to inhibit the morbidity and mortality inflicted by this disease.

Breastfeeding

The literature is not clear as to whether breastfeeding should be avoided when the mother is hepatitis type B positive. This is a rather controversial topic as it is not known if HBV can be transmitted from mother to infant through breastmilk. [10]

Interestingly, studies have found that in HBV positive women who have breastfed, the rate of MTCT was lower than those who bottle-fed. [21,57,58] Conversely, other reports have found no difference in transmission rates among the two groups. [21,59]

It must be noted that HBV-infected mothers are advised against donating breastmilk and that breastfeeding is not recommended if the mother is taking antiviral medication. [21] This research has severe consequences for both the infant and community should bottle-feeding be recommended in these mothers.

Caesarean sections

As of yet, there is no hard evidence to argue whether delivery of the at-risk child should be via Caesarean section. [10]

Barriers to the delivery of preventative strategies

While the current preventative strategies are effective in inhibiting MTCT of HBV in the majority of cases, both developing and Western countries struggle to apply these methods in clinical practice. [38]

Developed countries

Developed countries have the economic stability and resources to successfully prevent the majority of cases of vertical HBV transmission. However, studies have shown that even in these countries, the recommended preventative strategies are not being carried out in every HBV infected mother. [38,44,60,61]

The US CDC states that 97% of American women undergo prenatal screening for HBsAg and that 92% of at-risk infants complete the full HBVac course by age three. [44] To the contrary, a 2010 study from the US found that although the proportion of mothers being screened for HBsAg was high, these rates were lower in certain ethnic and socioeconomic groups. Moreover, the study found that of the infants born to HBsAg-positive mothers, a mere 62.1% received the recommended prophylaxis within twelve hours of birth, with 13.7% receiving no HBVac whatsoever. It was concluded that having written hospital policy was the strongest predictor of HBVac administration. [38]

This is of significant concern. We now have the measures to prevent the majority of MTCT of HBV, yet health care facilities are failing to deliver this care. Not only are there gaps in policy making, but there are also gaps in policy implementation. Uniform protocols which are strictly adhered to are important for optimising prophylaxis rates. [38]

Developing countries

The main barriers against prevention in developing countries include cost, education and access. The cost of screening pregnant women is an extra expense, as is the cost of educating the community and local health workers. Access is also an obstacle in developing countries, with a high proportion of women receiving no antenatal care at all, let alone any specific to HBV. [62] These barriers are seemingly related to the economic and social issues these countries face.

The future of this research

There is a real deficit of information regarding disease prevention in infants not protected by the current prophylactic measures. The emerging prophylactic therapies, whilst seemingly promising, need to undergo larger rigorous clinical trials and safety audits.

Whilst vertical HBV transmission is a universal problem, the major burden is placed on developing countries. China is the exception. It seems that much of the cutting edge research relating to this topic from the last decade has come from China. This is positive for the future of HBV-infected mothers and their infants; as China becomes an increasingly larger economic player, solutions to these problems may be achieved. However, we also need to look at research in health care delivery. How do we improve compliance with protocol in this important area of disease prevention?

Conclusion

Vertical transmission of hepatitis B is a significant public health issue. It has been estimated that HBV infection is responsible for half of all cases of hepatocellular carcinoma and one third of liver cirrhosis. [3]

Currently the recommendations are to administer routine prophylaxis to the infants at risk, consisting of a completed course of HBVac and HBIG. This combination is highly effective in preventing perinatal transmission. [44] Despite the advances in prophylactic therapy, we are still faced with the harsh reality that up to 10% of infants are not effectively protected by this standard protocol and will still become

chronically infected. [16,42]

It should also be remembered that despite these advances in research and the current prophylactic recommendations, healthcare facilities are continuing to struggle with implementation. [38] The global community needs to work together to eradicate this disease. Inclusion of HBVac into national immunisation programs is estimated to prevent more than 80% of deaths relating to HBV alone. [20] Both governments and healthcare facilities need to contribute to gaps in policy making and implementation. [38]

Although countries such as the US and China are investing in research to uncover new and more effective means of prevention, there is still a considerable shortfall in the available literature. Uniform recommendations need to be set out as a standard for health care facilities to follow. In addition, there is a need for large scale studies to be performed so that the inconclusive information regarding the emerging preventative strategies can be resolved and vertical transmission can be effectively prevented, even amongst the highest risk groups.

Conflicts of Interest

None declared.

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Causes of death in neonatal intensive care units

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Introduction

Of the approximately 130 million babies born each year, an estimated four million babies die in the neonatal period. Globally, the main causes of death are estimated to be preterm birth (28%), severe infections (26%) and asphyxia (23%). [1] New South Wales (NSW) is the most populous state in Australia with approximately 86,000 births per year. In 2006, 6,044 babies in NSW were registered to neonatal intensive care units (NICUs), representing 2.3% of total live births in that year. [2] Gestational age is highly correlated with birth outcomes including mortality. Each extra week of time spent in utero increases an infant's chances of survival significantly, and by 27 weeks of pregnancy, over 90% of infants will survive.

There are significant differences between common causes of death in the pre-term population (less than 37 weeks gestation) and the term population (37+ weeks gestation). The most notable difference is an approximate five-fold increase in deaths caused by congenital neurological malformations in the term population compared with the pre-term population [3]. Premature infants have a considerably higher chance of dying than full-term infants. However, improved neonatal care, particularly the widespread use of surfactant replacement and antenatal steroids, has almost halved neonatal mortality in many parts of the world. [1] Between 1985 and 1991 in the United States, the overall neonatal mortality rate declined from 5.4 to 4.0 per 1,000 live births. An understanding of causes of neonatal death and changes in mortality rates is critical for prenatal counselling, decision making, quality control and further improvement in management.

In NSW, newborn infants are admitted to NICUs under the following criteria: gestational age less than 32 weeks, birth weight less than 1,500 grams, need for mechanical ventilation for four hours or more, continuous positive airways pressure for four hours or more and/or major surgery, defined as opening of the body cavity.

Newborns admitted to NICUs are cared for by a highly specialised team of medical, nursing and allied health staff. Despite the level of sickness and intensity of morbidities of NICU patients, mortality rates are relatively low. Neonatal mortality rate is defined as the number of neonatal deaths per 1,000 live births and includes all deaths of infants within 28 days after birth.

Each neonate who dies in the NICU represents not only a financial cost to the community but more importantly, a significant emotional stress and grief for the involved parents and staff. Systematic audits are the first step in the descriptive epidemiology of neonatal mortality and a necessary means for identifying the cause(s) of death. [3] Accurate documentation of causes of neonatal death enables analysis of change in neonatal death rates and causes over time, and allows for assessment of their preventability through improved management. As such, it has been found that there have been substantial changes in the causes leading to death in the NICU. These changes may reflect the combined effects of prenatal diagnosis and changing community and medical attitudes. [4] Therefore, a NSW and Australian Capital Territory (ACT) state-wide audit is indicated to determine the common causes of death in NICUs, which will form the basis for continuing quality improvement and outcome evaluation.

Epidemiology and common causes of death in the neonatal population

The proportion of deaths that occur in the neonatal period is increasing, reaching 38% in 2,000. [1] Three-quarters of neonatal deaths occur in the first week of life. The highest risk of death is on day one, with 25-45% of neonatal deaths occurring within the first 24 hours of life. An Irish study found that 89% of term infants in their 2004 cohort died within the first week of life, and the rest died between the seventh and 28th day of life. [5] In a cross sectional survey covering a population of 1,316,681, information was collected retrospectively for a one-year reference period on 30,473 births and 1,521 neonatal deaths from five rural sites in India. Of all neonatal deaths, 39.3% occurred on first day of life, and 56.8 % during the first three days, which highlights the importance of the first three days as the most hazardous phase of life. [6]

Globally, the main causes of death are estimated to be preterm birth (28%), severe infections (26%) and asphyxia (23%). [1] Of the remaining deaths, congenital anomalies account for 7%. The leading cause of infant death in the United States in 2004 was congenital malformations, deformations and chromosomal abnormalities (congenital malformations), accounting for 20% of all infant deaths. Disorders relating to short gestation and low birth-weight, not elsewhere classified, were second, accounting for 17% of all infant deaths. This was followed by Sudden Infant Death Syndrome (SIDS), accounting for 8% of infant deaths. The fourth and fifth leading causes - newborns affected by maternal complications of pregnancy (maternal complications) and accidents (unintentional injuries) - accounted for 6% and 4% respectively of all infant deaths in 2004. Together the five leading causes accounted for 55% of all infant deaths in the United States of America (USA) in 2004, [7] as illustrated in Figure 1. On the other hand, an Irish neonatal mortality survey found prematurity to be the leading cause of death in 2004, accounting for 45% of total deaths. In 2002, 1999 and 1987 prematurity accounted for 36%, 37% and 40% respectively. In all previous years congenital malformations were the leading cause of death. Congenital malformations accounted for 32% of the total cause of death in 2004. Seventy-eight percent of these died within the first week of life. [5]

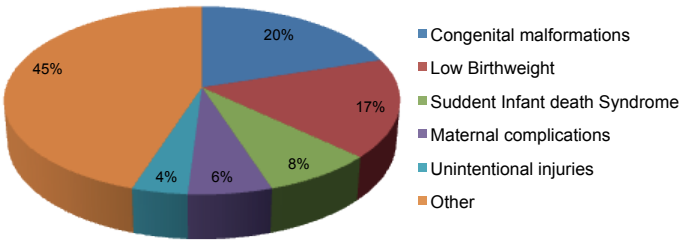

Figure 1. *Profile of leading causes of death in USA in 2004. [7]*

Comparison of preterm and term population-mortality rates and causes of death

Gestational age is highly correlated with birth outcomes including mortality. Each extra week of time spent in utero increases an infant's chances of survival significantly and by 27 weeks of pregnancy, over 90% of infants will survive. Figure 2 details the percent survival at each gestational age. There are significant differences between common causes of death in the pre-term population and term population. The most notable difference is an approximate five-fold increase in deaths caused by congenital neurological anomalies in the term population compared with the pre-term population. [3] Other differences include an increased proportion of congenital malformation deaths and deaths in the 'other' category amongst term infants, compared with an increased proportion of cardio-respiratory deaths and deaths due to infection or gastrointestinal problems in the pre-term population. [8]

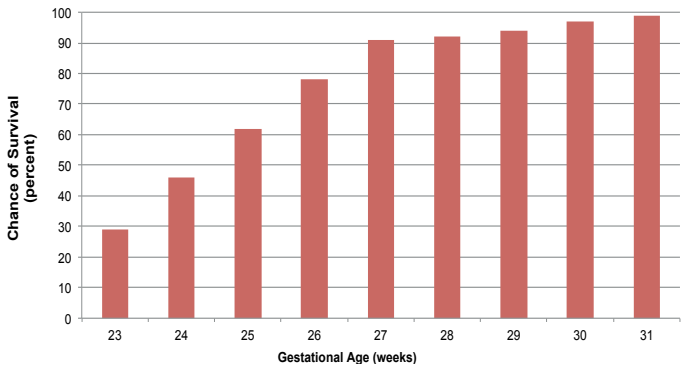

Figure 2. *Percent survival at each gestational age. [9]*

An Irish study which examined a cohort of term infants in 2004 found that congenital malformations were the leading cause of death and accounted for 48% of total deaths. Chromosomal abnormalities and cardiac malformations were found to be the two leading groups of specific congenital malformations. Asphyxia was the second most common cause of death, occurring in 9% of the total deaths, which compares to 7.5% of deaths in 2002 and 8% of deaths in 1987. Other causes of death in term infants included infection, SIDS and splenic rupture (<1%). [5]

On the other hand, a Wellington study showed that just under half the total of deaths due to infection occurred in infants of less than 37 weeks gestation, even though such groups only make up 25% of all neonatal deaths. Four of six deaths due to bacterial infection were congenital. [10] A large proportion of cardio-respiratory deaths in the pre-term population may be indicative of the level of approach in different NICUs. The more aggressive the approach to resuscitation, the more likely deaths are caused by cardio-respiratory factors; in NICUs with a less aggressive approach, those same infants may die due to extreme prematurity without any viable chance of further survival. [4] Finally, extreme prematurity makes up the majority of deaths in the pre-term population while congenital malformation makes up the majority of deaths in the term infant population. [11]

Premature infants have a considerably higher chance of dying than full-term infants and at an earlier postnatal age. Tomashek *et al.*'s study [12] found that 38% of all neonatal deaths among late-preterm infants occurred during the early neonatal period (within seven days after birth), compared with 22% for term infants. Furthermore, late-preterm infants were nearly six times more likely than term infants to die during their first week of life (2.8 versus 0.5 deaths per 1,000 live births). Khashu *et al.*'s [13] population study compared the mortality of late preterm infants to those born at term. An analysis was performed of all singleton births between 33 and 40 weeks gestation (divided into two groups: late preterm (33-36 weeks) and term (37-40 weeks)) from April 1999 to March 2002 in the province of British Columbia, Canada. It was found that neonatal mortality rates were significantly higher in the late preterm group. In the Netherlands in 2006, [14] 1.3 million deaths were analysed and it was found that perinatal mortality was 9.8 per 1,000 total births (fetal mortality 6.8 per 1,000 births and early neonatal mortality 3.1 per 1,000 live births). The very preterm births (22.0-25+6 weeks of gestation) accounted for 29% of all perinatal mortality with a mortality risk of 935 per 1,000 births. Full-term births (≥ 37.0 weeks) accounted for 26% of all perinatal mortality with a mortality risk of 2.8 per 1,000 births. More than half (55%) of all infant deaths in the United States in 2004 occurred in infants born at less than 32 weeks gestation, when they only account for 2% of all live births. In addition, mortality rates for the late preterm population (34-36 weeks) were three times more than those of the term population. [15]

Mortality rates for varying gestational age groups in the very preterm population

The pattern of survival differs for varying gestational groups, with survival rates increasing with gestational age. Serenius *et al.* [16] stated that survival rates are 43%, 63%, and 77% at 23, 24, and 25 weeks gestation respectively amongst infants delivered in two Swedish tertiary centres in 1992-1998. Table 1 summarises the findings of a prospective observational study of all infants with a gestational age of 22 to 27 weeks who were born in Norway in 1999 and 2000 which revealed similar results. [17] The survival rates were found to be increasing with gestational age from 0% for <23 weeks in both cohorts to 82% and 93% for 27 weeks in the 1999 and 2000 cohorts respectively.

Table 1. *Survival rates for varying gestational groups in two cohorts, 1999 versus 2000. [17]*

Gestation (weeks)	1999 cohort	2000 cohort
<23	0%	0%
23	16%	39%
24	44%	60%
25	66%	80%
26	72%	84%
27	82%	93%

Inversely, the mortality rate decreases with increasing gestational age as indicated in Synne *et al.*'s study [18] where the mortality rate was 84% at 23 weeks, 57% at 24 weeks, 45% at 25 weeks, 37% at 26 weeks, 23% at 27 weeks, and 13% at 28 weeks gestational age, amongst infants <30 weeks at British Columbia's tertiary centre from 1983 to 1989. Furthermore, for each gestational age, mortality rate versus birth weight plots showed a decreasing mortality rate with increasing birth weight, except for infants who were large for gestational age. [18] A prospective cohort study of preterm infants born at Royal Women's Hospital, Melbourne from January 1994 to December 1996 describes the mortality rate for preterm infants (23-36 weeks gestation). The total mortality rate was found to be 4.8%, which diminished rapidly between 23 and 28 weeks gestational age (from 64.5% at 23 weeks to 4.0% at 28 weeks), then more slowly, to reach 0.4% at 36 weeks. [19]

Changes in mortality rates overtime and the relationship between causes of death and postnatal age of death

Between 1985 and 1988 in the USA, the overall neonatal mortality rate declined by approximately 12%, from 5.4 to 4.7 per 1000 live births. Between 1988 and 1991, the overall neonatal mortality rate further declined by approximately 15% from 4.7 to 4.0 per 1,000 live births. The greater decline in the neonatal mortality rate in the later period resulted primarily from the reduction in the rate of mortality caused by respiratory diseases. [20]

Premature infants have a considerably higher chance of dying than full-term infants. However, improved neonatal care, particularly the widespread use of surfactant replacement and antenatal steroids has almost halved neonatal mortality in many parts of the world. [1] Stoelhorst *et al.* [21] found that the neonatal mortality rate in the USA declined from 4.63 per 1,000 live births in 2003 to 4.52 in 2004, while Gonzales *et al.* [22] found that the neonatal mortality rate in Chile between 1990 and 2000 decreased from 8.3 to 5.7 per 1,000 live births during that period. Furthermore, an Irish study found that the mortality rate decreased from 5.3 per 1,000 live births in 1987, to 3.1 per 1,000 live births in 2002, to 2.9 per 1,000 live births in 2004. [5] Kramer *et al.* [23] presented infant mortality rates for all live births in Canada and the United States for 1985 and 1995, and 1985-1987 and 1992-1994. Mortality rates were lower in Canada for both time periods. Table 2 illustrates the decreases in infant mortality over the two time periods.

Table 2. *Infant mortality per 1,000 births amongst all live births, United States 1985 and 1995, and Canada 1985-1987 and 1992-1994. [23]*

Age Group	United States		Canada	
	1985	1995	1985-1987	1992-1994
Early Neonatal (age 0-6d)	5.7	4.0	4.1	3.3
Late Neonatal (age 7-27d)	1.1	1.0	0.9	0.7
Postneonatal (age 28-364d)	3.6	2.6	2.9	2.2
Total	10.4	7.5	7.8	6.2

The reduction in mortality is primarily due to increased survival of infants born below 1,500g birth-weight and 32 weeks' gestational age in the periods before and after institution of surfactant therapy. [23] This is further explored in Wong *et al.*'s study [10] which suggests that mortality rates for term and preterm infants <37 weeks gestation were stable with a significant decrease in the mortality rate for infants <24 weeks gestation observed. For all infants, there was also a decrease in death due to congenital anomaly and prematurity but an increase in death due to infection and neurological causes.

Luke and Brown [24] conducted a study which also demonstrated the significant reduction in infant mortality achieved during the 1990s by comparing two cohorts, 1989-1991 and 1999-2001. The reductions were greater for early preterm (<33 weeks) compared with moderate preterm (33-36 weeks) and term (37-43 weeks) birth, [24] which is in line with the results of Kramer *et al.*'s study. [23,24] In the 25 to 28 week gestational age group, the percentage of neonatal deaths decreased from 13.1% to 12.1%, in the 29 to 32 week gestational age group it decreased from 7.0% to 6.3%, in the 33 to 36 week gestational age group it decreased from 12.3% to 12.2%, in the 37 to 40 week gestational group it decreased from 33.0% to 31.8%, and in the 41-43 week gestational age group, it decreased from 10.8% to 6.7%. [24]

As aforementioned, the widespread use of surfactant replacement and antenatal steroids in the early 1990s greatly contributed to reductions in neonatal mortality rates. Stoelhorst *et al.*'s [21] comparison of two cohorts from 1983 and 1996-1997 of very preterm infants highlights significant changes which occurred over that period of time and the consequent reductions in mortality. The overall mortality rate decreased from 30% in the 1983 cohort to 11% in the 1996-1997 cohort, and the rate of mortality was lower across all gestational age categories for the 1996-1997 cohort, as illustrated in Figure 3.

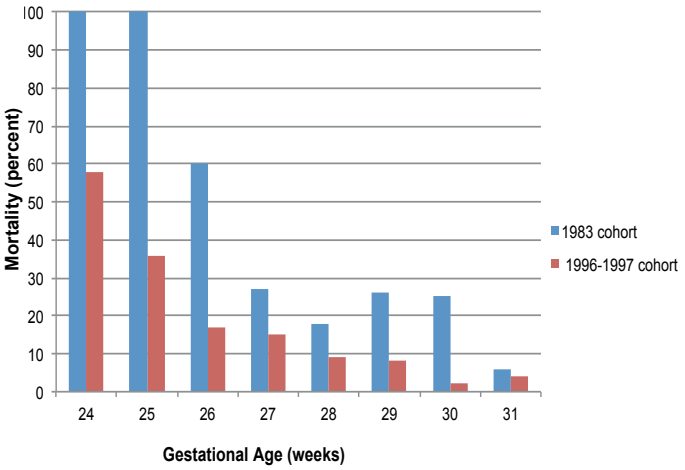

Figure 3. *Mortality according to gestational age in two separate cohorts. [21]*

In addition to the reduction in neonatal mortality rates, the comparison of the two cohorts also highlighted an increase in postnatal age of death overtime, and a lesser percentage of early neonatal death. In the 1996/1997 cohort, the non-surviving infants died after an average of 12.7 days, compared with 5.9 days for the 1983 cohort. Early neonatal death was 55% in the 1996/1997 cohort, with 34% of deaths occurring within the first 24 hours of life. This compares with 93% of early neonatal deaths in the 1983 cohort, and 71% within the first 24 hours of life. Late neonatal death (between seven and 28 days after birth) was 38% in the 1996/1997 group and 0% in the 1983 group. The most important cause of death in both groups was respiratory distress syndrome.

There is a distinct relationship between postnatal age of death and causes of death. Tomashek *et al.*'s study [12] from 1995 to 2002 found that between those years, rates of overall early neonatal mortality declined significantly in both late-preterm infants (by 22.2%) and term infants (by 28.6%). During the early neonatal period, congenital malformations, and intrauterine hypoxia and birth asphyxia were the two leading causes of death for both late-preterm and term infants. [25] Late-preterm neonates were nearly 19 times more likely than term infants to die of atelectasis, ten times more likely to die of maternal pregnancy complications and six times more likely to die of congenital malformations in the early neonatal period. Hydrops fetalis, disorders related to short gestation and low birth weight, and respiratory distress of the newborn were other important causes of early neonatal death. The overall late neonatal mortality rate did not change significantly between 1995 and 2002; however such rates were three times higher in late-preterm infants than in term infants throughout the study period. Congenital malformations and SIDS were the two leading causes of death in the late neonatal period. Other important causes of late neonatal death include necrotising enterocolitis and bacterial sepsis of the newborn. [12]

Conclusion

Neonatal mortality continues to cause emotional grief and place a financial burden on the health system and the community. An understanding of causes of neonatal death and changes in mortality rates is critical for prenatal counselling, decision making, quality control and further improvement in management. Literature surrounding mortality rates and causes of death in the neonatal population does exist and suggests a decrease in mortality rates over the last decade, and highlights differences in causes of death for varying gestational age groups. Despite this, gaps in research have been identified and as such, it is indicated that a NSW state-wide audit be conducted to classify detailed, accurate and specific causes of death amongst the neonatal population. This will allow for the identification of trends, and to elicit

targets for intervention and aid in the improvement of neonatal care and resource allocation, specifically in NSW.

Conflicts of Interest

None declared.

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Diagnostic modelling in General Practice

Prof. John Murtagh
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Prof. John Murtagh is the author of several internationally adopted textbooks including General Practice, Practice Tips, Patient Education *and* Cautionary Tales. *Murtagh's* General Practice *has been translated into eleven languages and has been adopted by the Russian and Chinese Ministries of Health. In 1995, he was awarded the Member of the Order of Australia for services to medical education, research and publishing. He practices part-time in General Practice and currently has teaching responsibilities at three universities in addition to conducting national workshops for registrars in the General Practice Training Program.*

Introduction

All facets of the great profession of medicine are fascinating and that is basically the reason why I pursued a career in General Practice. It provides the opportunity to diagnose and manage diseases from A-Z (acne to zoonoses). Practising in a rural community, with the luxury of managing the local hospital, was the ideal environment for my interests and consequently I entered rural practice in partnership with my wife, Dr Jill Rosenblatt in 1969. As the only practitioners in the community of Neerim South we enjoyed considerable responsibility especially with the management of emergencies. The discipline of General Practice, however, is one of the most difficult and challenging of all the healing arts. General Practitioners are at the front line of patient care and have to manage presenting problems as they appear at any time and place.

The patient with multiple vague symptoms

One ever presenting challenging characteristic is the patient presenting with a 'potpourri' of presenting problems that does not fit the classic textbook presentation of a specific disease or disorder. Our patients may present with a 'shopping list' of seemingly unconnected complaints or vague symptoms that we may well term 'the undifferentiated illness syndrome.' The challenge is to have a system or protocol that helps to arrive at the diagnosis, be it organic, psychosocial or both. The following case history illustrates this condition.

The patient

Mrs PT, aged 43, housewife and mother of two children.

Presenting problem

Four months of tiredness and fatigue.

Other problems list

- Generalised aches and pains
- Headache (vague tension pattern)
- Anxiety
- Irritable mood
- Anorexia
- Heartburn
- Constipation
- Sleep disorder
- Weight loss (minor)

Physical examination

The general appearance and systems examination were normal. Pulse, blood pressure, temperature, respiration and urine dipstick were all normal.

Discussion

The case of Mrs PT is a very common scenario in General Practice. Such a history can make our heads spin as we reflect on the diagnosis and management. The question is: "Are we dealing with a genuine, perhaps very serious, organic problem or somatisation or similar functional disorder?" Of course we should have reviewed the past history, the family history, the psychiatric history, and the drug history – all of which would be background knowledge to the family doctor. For the situation where the provisional diagnosis is not obvious after this process the writer has developed a diagnostic strategy model to act as an aide memoir to move forward.

Prof. John Murtagh

The 'Murtagh' diagnostic model

The strategy of the model is to ask five self-posed questions about this particular presenting problem:

- What is the probable diagnosis?
- What serious disorder/s must not be missed?
- What conditions can be missed in this situation?
- Could the patient have one of the 'masquerades' commonly encountered?
- Is the patient trying to tell me something? (Look for 'yellow flags.')

Not to be missed conditions?

The life threatening disorders can be classified simply as VIM: vascular, infection (severe) and malignancy. Another classification is: infection, infarction, malignancy and metabolic. This leads us to consider 'red flags' or 'alarm symptoms' which make us think of a possible serious condition. Examples are age >50, history of cancer, weight loss, fever, travel to tropical areas, vomiting, pallor, collapse at toilet, neurological deficit and altered consciousness or cognition.

A good history should include at least six key general questions to pin-point 'red flags.'

- Tell me about your general health? Tiredness, fatigue or weakness?
- Do you have a fever or night sweats?
- Have you lost any (unplanned) weight?
- Have you noticed any unusual lumps?
- Do you have persistent pain anywhere?
- Have you noticed any unusual bleeding?

The masquerades

After many years of practice and feedback from these patients the writer has identified that there are some disorders that can present as a masquerade (disguise or pretender) for these undifferentiated illnesses. They have been divided into two groups of seven first-line (or more common) and second-line masquerades. I have a checklist of these on the wall behind the patient!

The seven first-line masquerades are:

- Depression
- Diabetes
- Drugs – iatrogenic, over-the-counter, or self-abuse
- Anaemia
- Thyroid and other endocrine disorders – especially Addison's disease
- Spinal dysfunction – pain syndromes
- Urinary tract infection

The seven second-line masquerades are:

- Baffling bacterial infections (e.g. tuberculosis, endocarditis and zoonoses)
- Baffling viral and protozoal infections (e.g. Epstein-Barr virus, dengue, malaria and influenza)
- HIV/AIDS
- Malignant disease (e.g. ovary, colon, lung, lymphoma, leukaemia or myeloma)
- Chronic renal failure
- Connective tissue disorders (e.g. rheumatoid arthritis, systemic lupus erythematosus or giant cell arteritis)
- Neurological disorders

The case of Mrs PT

This patient did in fact have a depressive illness without a specific known precipitating cause. It is extremely common in medical practice and demands early recognition as the ramifications of untreated depression are profound. Depression has been estimated to be prevalent in 5% of the Australian community in any one year. The lifetime risk of being treated for depression is approximately 12% for men and 25% for women.

A useful working rule is to consider depression as an illness that seriously dampens the five basic activities of humans, namely:

- Energy for activity
- Appetite
- Sex drive
- Sleep
- Ability to cope with life

Mrs PT did exhibit some of the 'yellow flags,' namely deterioration in work performance, inability to cope with family commitments and marital disharmony. She was treated with support and psychotherapy and did respond to this basic conservative therapy. If she had failed to respond adequately she would have been prescribed medication – one of the selective serotonin reuptake inhibitors (SSRIs).

How to enjoy your patients

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Dr. Longmore is the co-author of the Oxford Handbook of Clinical Medicine *and the* Oxford Handbook of Clinical Specialities.

We all want to be remembered for something – a major contribution to science, or a political triumph bringing peace to a beleaguered world, or perhaps you would like to be honoured with an eponymous syndrome? Or, more modestly, as one committed housewife said, "I would like simply to be remembered for making good gravy." She held on to this humble desire until it was pointed out to her by some wit, that such a wish was really taking cannibalism too far. So what do we boil down to? If not exactly gravy, then perhaps a juicy bundle of conflicting desires encased in a will for pleasure. No philosopher, artist or scientist has been able to come up with a better reason for doing something than pleasure (giving it, and receiving it).

A world without pleasure is pointless. We may sense this pointlessness on a bad day as we go out to work, fighting stolidly to save impossible lives. But if we accord taking pleasure in our patients as a primary aim, all may not be lost. Of course we know that patients' welfare and the relief of suffering should be our first concern. But this wears thin after a decade or two (or a week or two) at unpromising bedsides. Pleasure is the only motivator that lasts a professional lifetime. Like it or not, there is no alternative to pleasure. Just as the sex therapist must "give permission" to inhibited clients to enable them to partake of the full range of sexual pleasures, so medical authors have to give permission to fellow doctors to sample clinical pleasures. We are so conditioned by our objective scientific training that we tend to put pleasure last in the list of tasks we must accomplish - if it ever gets onto the list at all.

So what are the pleasures we are talking about? I was once told by a connoisseur, who happens to be a judge, that all pleasures are sensory (as he refilled my glass with a sumptuous wine). So "enjoying our patients" does sound rather cannibalistic in this context. While we do not exactly endorse this approach, it reminds us that swallowing is the vital precursor of many pleasures. And in the clinical context, this means swallowing the whole patient – hook, line and sinker. For those who do not fish, it may be necessary to point out that the sinker is what is relied on to get to the bottom of anything deep, dark, and likely to be prowled by predators. We doctors are such predators. So on this view, patients lower their symptoms into the depths of our minds and if they catch our attention, we swallow them, and regurgitate a diagnosis or two. So straightaway we have learned something important: the judge was wrong. Not all pleasures are sensory; making a diagnosis is an intellectual pleasure – albeit a delicious one, we grant. If you accept this logic, you may be tempted to assume that because it takes brains to make a diagnosis, the brainier we are, the better. Nothing could be further from the truth, because with brains comes the facility for self-doubt. And this is the enemy of pure pleasure.

Are there any sensory pleasures our patients can offer us? Yes, I can report from a consultation held when I was eighteen. I was on the receiving end at a clinic of a revered ophthalmologist. I had been over-using a microscope, looking at how wheat-shoots grow in different wavelengths of light. I used a prism filled with sodium metabisulfite to create a fabulously beautiful spectrum, and I watched down the microscope how wheat-shoots grew towards different parts of the gloriously-gleaming spectrum. I did this for days on end, not out of loyalty to the hypothesis I was testing, I was riveted by the beauty[i] - we have to enjoy our science as well as our patients.

As a result, a minor problem might have been developing in my eyes. I don't now remember what the problem was or whether it had a diagnosis (let's call it "monochromatic monomania"); all I remember is the ophthalmologist peering into my eyes with his ophthalmoscope at the end of his busy cataract clinic. "Beautiful," he said. "Simply beautiful…" "Beautiful?" I queried. "Yes, I hardly ever see healthy young retinas, and I never tire of their beauty." Pleasure…lasting a lifetime. There really is no alternative. And as we trace the tortuous paths of our clinical lives, with some AV nipping here, some copper wiring there and a fundus of knowledge that can beat an encyclopaedia, we realise

[i] *Humans have always revered the beauty inherent in spectra. For example, Dorothea in Middlemarch being hypnotised by these "little fountains of pure light" or Isaac Newton dividing the spectrum into seven fragments of heaven. Seven to match the beauty of musical scales (filling the seven intervals between the eight notes of the scale). Even for Newton, beauty could trump scientific rigour. If it's beautiful, must it be true? So thought Albert Einstein and John Keats, and what is good enough for this pair will serve for the purposes of this essay.*

that we can revisit the pleasures of our lost youth only in memory. So the judge was wrong yet again. Memory is a pleasure, and memory is not purely sensory. And eliciting memories in your patients is a sure-fire way of augmenting pleasures for both the patient and her doctor.

Vicarious pleasure is another non-sensory modality of pleasure that we suspect our erring judge did in fact know all about. He got as much pleasure seeing me enjoy the wine as he got from his own glass. The synchronicity of pleasures is something to marvel at. Pleasures come not as single spies, but as battalions, defeating all that is humdrum in our lives. So when we see a beautiful retina, and exclaim as much to our patient, the chances are that the patient who had no idea that he or she contained something perfect, will volunteer some amusing or interesting aside, which further adds to the pleasures of the consultation.

Kindling is a good term to use here. This term is sometimes used in seizures: according to this model, one seizure kindles the next by lowering the threshold for subsequent seizures. This may be why you should not let seizures go untreated. Kindling also explains why grumpy doctors stay grumpy; they have never given pleasure a chance. Just a small commitment to pleasure may be all that is necessary to transform such a doctor. Once started, kindling will see to the rest. Have you been grumpy lately? Maybe there is something to learn here. Of course nothing is guaranteed to make a grumpy doctor grumpier still than hearing laughter emanating from a consultation going on next door. This is the surest sign of pleasure being imparted, and overhearing it is sure to set the grumpy doctor's teeth on edge, or in my case it incites me to think up some pretext ("Where is my ophthalmoscope?") for bursting in on the consultation to find out exactly how this marvellous trick is done.

In conclusion, there are five ways to enjoy our patients more:

1. Don't try to minimise or ignore patients' foibles. Bask in their absurdities and variations.
2. Give patients the benefit of the doubt. Don't be over-ambitious. Simply patching up our patients so they can go on doing what made them ill in the first place may be enough. Anything else risks all-out war!
3. Let patients like you. Be equally prepared to receive and initiate acts of gallantry. Remember: this consultation may be your last or your patient's last, so make it vivid.
4. Trim your ego; slash your ulterior motives; and sever forever any tendency to self-pity. Whatever the provocation, refuse to be grumpy! Laugh more, especially at yourself.
5. Encourage your patients to take their doctor's pronouncements with a soupçon of salt, especially if the doctor is an Oxford author whose logic is circular and whose angle of approach borders on the obtuse.

The Exercise Paradox

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Dr. Kuchar has an interest in cardiac arrhythmia management, catheter ablation and implantable devices. He trained in Cardiology at St Vincent's Hospital with a postgraduate fellowship at Harvard Medical School and Massachusetts General Hospital. Dr. Kuchar was one of the pioneers of signal averaged ECG, laying the way for its use in predicting sudden cardiac death.

In 2009, a woman pleaded guilty to reckless homicide and faces up to five years in prison for exercising her husband to death in a swimming pool. He suffered a 'heart attack.' [1] We cannot know, however, whether this was an ischaemic event or an arrhythmia. Exercise is promoted and encouraged in society; it is considered a healthy pursuit with benefits to the heart and mind. We know that certain heart diseases make exercising dangerous, but what risk is exercise to a healthy person without known heart disease?

Ancient history records the death of the Greek messenger Phidippides who ran 26 miles from Marathon to Athens to deliver the news of the victory over Persian invaders, only to collapse and die soon after his arrival.

In the past few years we have heard of professional athletes collapsing during soccer and basketball games and on the athletics track. These are graphically represented and frequently viewed on YouTube. In September last year, Evander Sno, a midfielder for Dutch soccer giants, Ajax, suffered a cardiac arrest during a match. He was successfully resuscitated after four shocks from an external defibrillator – an outcome unfortunately not shared by several athletes in recent years.

Dr. Dennis L Kuchar

Can these deaths be prevented?

Not so long ago, there was evidence to suggest that marathon runners were immune to coronary artery disease, [2] and this idea has pervaded public perception. If someone can compete in countless marathons and triathlons, how could they possibly be at risk of dying from a heart attack? This has been debunked however, with the finding that coronary disease is the major cause of exercise related deaths in the over 35 age group; a phenomenon also seen in younger individuals. [3] To confuse matters more, there is evidence that strenuous activity kills patients with known heart disease but the risk is reduced if they exercise on a regular basis compared with those who are sedentary. [4] To top it off, recent Australian research shows evidence of damage to the right ventricle detected by MRI following a triathlon in normal hearts. [5]

One of the problems in identifying athletes at risk is the similar appearances of the athletic heart to abnormal pathological hearts. Physiologic changes can occur which mimic the appearance of these conditions (so-called 'athlete's heart'). They can manifest as morphologic changes (such as wall thickening mimicking hypertrophic cardiomyopathy), ECG changes (usually voltage changes, non-specific ST segment and T wave changes) and an increase in ventricular arrhythmias. Ventricular arrhythmias can be a harbinger of serious heart disease and portend a bad prognosis, but they can also be benign and occur in individuals with no structural heart disease and normal life expectancy. Deconditioning has been suggested as a means of differentiating normal from pathological, [6] with regression of hypertrophy, resolution of ECG changes and reduction in ventricular arrhythmia frequency when the athlete stops exercise for a few months. However, reversal of these conditions does not guarantee absence of disease manifestation at a later stage, with a significant proportion of those with resolution of arrhythmia diagnosed with a cardiomyopathy in later years.

In a recent meta-analysis of sudden death in sport, [7] cardiac abnormalities were found in more than 90% of cases with the commonest causes being coronary artery disease (either due to atherosclerosis or congenital anomalies) and hypertrophic cardiomyopathy (HCM). Dilated cardiomyopathy, arrhythmogenic right ventricular dysplasia (ARVD) and mitral valve prolapse made up a significant proportion. These are conditions that are apparent at autopsy, but a group of arrhythmic causes of sudden death, including long QT syndrome, Wolff Parkinson White syndrome (WPW) and conduction disease can only be identified during life or after successful resuscitation from a cardiac arrest. Drug doping, often implied as a feature in high profile athletes by the media, is thought to be an unlikely cause of exercise related death on the basis of histopathologic studies. [7]

How do we identify those at risk?

Pre-participation screening for heart disease would seem logical in an athletic population. A rigorous program has been implemented in Italy for the past 30 years. It includes history taking, a physical examination and ECG; an abnormality then prompts an echocardiogram and further assessment. A history of syncope during exercise and a family history of premature sudden death are examples of red flags, which should prompt cardiac referral. Exclusion from participation in competitive sport in Italy, amongst individuals with anomalies identified during screening, has been credited with an 89% reduction in the incidence of sudden cardiac death. [8] This type of screening program has not been universally adopted because of the perceived financial cost, the large number of people needing screening, the low yield in identifying at-risk athletes and the recognition that it is impossible to eliminate this risk entirely. ECG abnormalities may be present in up to 40% of athletes, leading to unnecessary further testing; but specific syndromes such as HCM, long QT syndrome and WPW may be identified in this way.

What should we do when we identify an at risk athlete?

The diagnosis of a cardiac condition in a prospective athlete can be devastating. Their dreams and aspirations, years of hard work and high achievement can suddenly dissolve in an instant with forced exclusion from sport participation. There are strong financial disincentives to making an adverse diagnosis. This was illustrated in the case of Reggie Lewis, a professional basketball player for the Boston Celtics in the 1990's on a multimillion dollar contract. He was diagnosed with HCM after an episode of syncope whilst playing, and was advised to quit the

game. He sought several expert opinions in the Boston area, all but one of which concurred with the diagnosis. He followed the advice of the physician who 'passed him fit' with a diagnosis of vasovagal syncope on the basis of a positive tilt test. He continued to play after rejecting the other opinions offered and died suddenly during a practice game. In the Italian experience, athletes excluded from competitive sport participation in Italy because of heart disease had rare cardiac events, whereas a number who defied the ban and went on to play competitively in another country had a significant incidence of sudden death.

Is it feasible to allow these people to compete with protection?

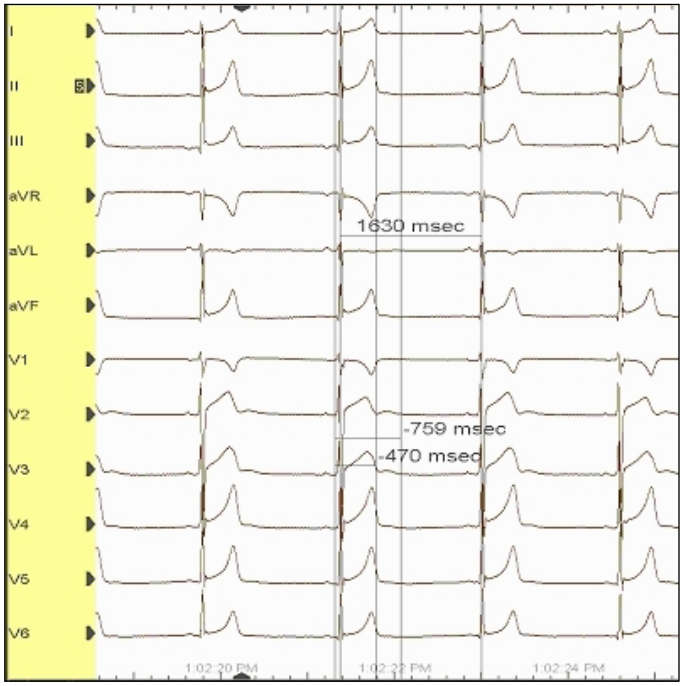
One option that has been debated among cardiologists is to allow athletes with potentially life threatening arrhythmias to continue to play, but with an implanted defibrillator. [8] Evander Sno underwent defibrillator implantation and returned to training two weeks later. This, however, is not a failsafe solution. It is an issue that has not been resolved by medical and sporting bodies and there are medical concerns with this practice. These include damage to the implanted apparatus from direct trauma, the possibility of inappropriate shock delivery because of sinus tachycardia and the possible failure of the device to revert a ventricular arrhythmia under the 'adrenaline-charged' conditions during vigorous activity. Beta-blockers, which have a protective role, are banned in competitive sports.

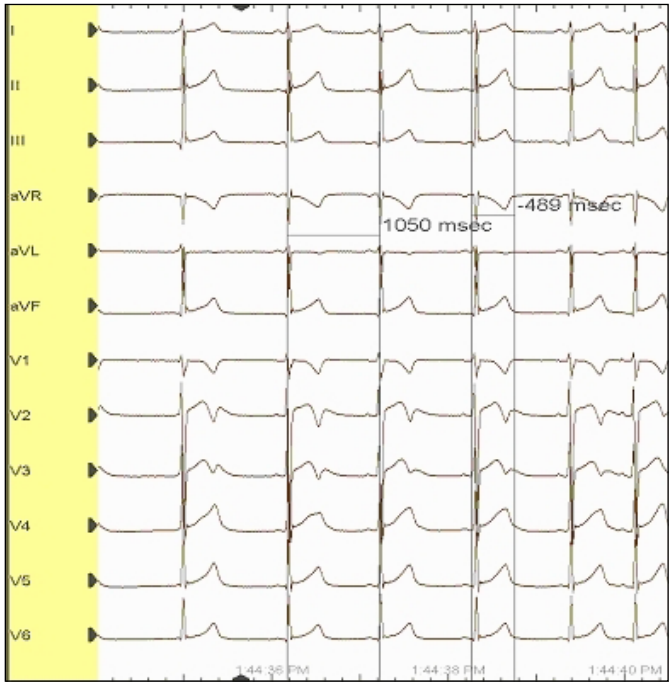
I recently saw an eighteen year old European-based soccer player who had a syncopal episode during a half-marathon. He underwent rigorous testing including exercise testing, an echocardiogram, Holter monitoring, a cardiac MRI and cardiac electrophysiologic testing. A provisional diagnosis of long QT syndrome was made on the basis of his post syncope ECG in the Emergency Department and the response to an adrenaline infusion during electrophysiologic testing. Abnormal prolongation of the QT interval together with characteristic bizarre T wave changes were noted during the infusion (Figure 1). This provocative test is felt by many to enhance the diagnostic accuracy for this condition. [10]

The diagnosis of long QT syndrome would mean exclusion from competitive sport participation. How confidently can the diagnosis be made? Unfortunately, not all cardiologists agree with the implications of this test, arguing that it produces non-specific responses that may mimic long QT in some cases. Many argue that it is better to over-diagnose than under-diagnose this potentially lethal condition, [10] as the stakes are high if the diagnosis is missed and the individual continues to exercise at a high level. Genetic testing may offer an element of added confidence to the diagnosis, but it can take six months to obtain a result and around 20% of patients with the condition will not have a known genetic mutation identified.

So where does that leave the athlete? Does he go on and continue to play at a high level? Does he really care that he may have a condition that might cause him to faint or even die, when he aspires to hero status in a game with millions of zealous followers? Do we monitor him closely with an implantable heart rhythm recording device? Do we follow him around with an external defibrillator? Do we pass him fit to compete in an unrestricted manner? Evander Sno's life was saved by the fortunate availability and judicious use of an external defibrillator. These devices should be seriously considered in public sporting facilities, particularly if at-risk athletes are known to be playing at these venues.

Time will tell if the right decision has been made.





Figures 1 and 2: *Pre (left) and post adrenaline infusion ECG traces: In the right hand trace, after infusion of adrenaline, with a heart rate of ~60/min (RR interval 1050ms), the QT interval is >480ms in duration (normal <440). Note also the marked notching in the T waves in V2 and V3.*

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The effect of Duchenne Muscular Dystrophy on Purkinje cell number in the mdx mouse

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Benjamin undertook this research project in the third year of his study at the University of New South Wales. He is currently based at Sutherland hospital (Caringbah) during the final year of his training as a medical student.

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Prof. Rae is a biochemist with a background in magnetic resonance and interdisciplinary brain research. She has a great interest in combining different research approaches to study the brain.

Background: Duchenne muscular dystrophy (DMD) is an X-linked recessive disease which causes skeletal muscle wasting in males, resulting in premature death during their early to mid 20s. Males with DMD carry defects in the gene encoding for dystrophin, a protein important in ensuring sarcolemmal stability. Dystrophin has also been implicated in disruption to Purkinje cells in the cerebellum. This disruption to cerebellar Purkinje cells has been proposed to be involved in reducing the IQ of affected boys. **Aim**: To compare Purkinje cell number and distribution in mutant mdx and normal mice. **Methods**: Cerebellar slices from both mutant (n=4) and normal (n=4) mice were prepared and stained. The number of Purkinje cells in each slice was estimated by three different cell counting techniques. Counting methods were as follows: firstly, the actual number of Purkinje cells per lobe; secondly, a randomised estimate where five random sections of the Purkinje cells layer were selected, counted and averaged; thirdly, an estimated maximum possible count, where three segments from the Purkinje cell layer with the highest density of cells were used to estimate Purkinje cell population. **Results**: No statistical significance in Purkinje cell numbers between the two groups was found. However, there was a trend towards a decrease in the median number of Purkinje cells in the mutant group, particularly in lobules 3, 4/5, 6 and 10. **Conclusion**: The study findings suggest a decrease in Purkinje cell number in mdx mice. The small sample size of this study precludes definitive statistical analysis of Purkinje cell numbers in either group. These findings demonstrate a need for larger mouse-model studies to accurately assess differences in cell numbers between the two groups. Given that the greatest difference in cell numbers was demonstrated in lobules 3 and 4/5, the authors suggest that DMD may affect the cerebellum during the maturation of these lobules. Importantly, a reduced Purkinje cell population may be implicated in the intellectual morbidity in boys with DMD.

Introduction

Duchenne muscular dystrophy (DMD) is an X-linked recessive disease with an incidence of 1 in 3,500 male live births, making it the most common form of muscular dystrophy worldwide. [1,2] Dystrophin, a protein which has a role in sarcolemmal stability in skeletal muscles, is absent in patients with DMD. The resulting progressive muscular weakness eventually leads to death. Deficiency in dystrophin has also been shown in neurons in the cerebral cortex, cerebellum and hippocampal CA1–CA3 regions. [3]

The cerebellum is covered externally by grey matter which is divided into: (1) a molecular layer; (2) a Purkinje cell (PC) layer; and (3) a granular cell layer. [4] PCs integrate and relay their synaptic information to the deep cerebellar nuclei (DCN) and vestibular nuclei. The DCN then project to the cerebral cortex via the thalamus, mediating fine motor control and balance. [5] Our research focuses on the effects of the lack of dystrophin on the cerebellum, in particular, the PC population.

Methods

Animals and tissue preparation

This opportunistic study was performed with discarded cerebellar slices from the UNSW Stewart Head Laboratory. All experiments were conducted blind to the phenotype of the mice and the mice were either ten or eleven weeks old. Prior to receiving the tissues, the mdx and control mice were anaesthetised with halothane then decapitated with the individual cerebellums of the respective mice rapidly removed and transferred to ice-cold cutting buffer. The cerebellum was fixed to the pedestal of a Vibroslicer™ (Campden Instruments Ltd., Loughborough, England) with cyanoacrylate. Finally, the slices were fixed in 4% paraformaldehyde. The slices provided were 100µm thick sagittal sections through the vermis, along with other sections within the cerebellar hemispheres. In total, there were eight samples - four were mdx mice and the other four were control mice.

Immunohistochemistry

The cerebellar slices were stained with Calbindin due to its superiority to Nissl Staining and facilitation of cerebellar PC counting. [6,7] All vermal slices selected were stained with Calbindin and immunohistochemistry was performed under the laboratory standard protocol for immunohistochemistry. [8]

Cell counts

PCs from every section were counted with the Stereo Investigator® (MicroBrightField, Inc., Williston, USA) in the Prince of Wales Medical Research Institute, Sydney, Australia (POWMRI). The counting technique potentially overestimated PC numbers. However, given that the same method was applied to every section analysed, it was decided not to use any correction factor.

The PC number was collected from the three separate sections of the vermal slice: from lobe 10; lobes 3 and 4/5 from the anterior cerebellum and lobes 6 and 8 from the posterior cerebellum.

Although the ideal thickness of slices for the purpose of counting PC numbers is 50 µm, the slices in this study were 100 µm thick. Therefore, three cell counting techniques were used to estimate PC numbers.

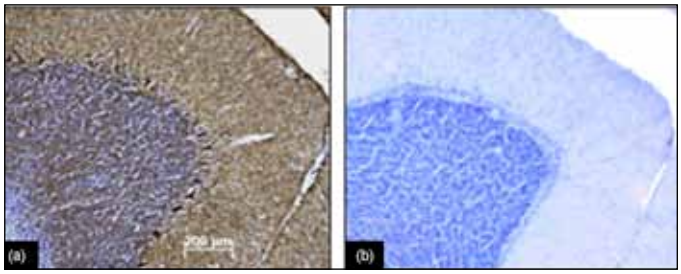

Figure 1. *Comparison of Nissl stained and Calbindin-D28k immunostained sections. (a) Calbindin immunopositive PCs clearly visible along the PC layer. (b) PCs not visible in Nissl stained section. [7]*

- Method 1: Actual number of PCs per lobe (actual PC count without mathematical adjustment).
- Method 2: The randomised estimated counts. Using the Stereo Investigator®, five sections were randomly selected along the PC layer of variable distances and the number of PCs within those sections counted. Results were averaged. The total possible PC count was estimated by multiplying that average with the total length of the PC layer in that lobe.
- Method 3: The estimated maximum possible count. Three segments of variable length along the PC layer with the densest population of PCs were selected. The number of PCs per unit length was averaged and multiplied by the total length of the PC layer of that lobe.

Statistical Methods

The unpaired t-test was applied to test the equivalence of PC counts between mutant and normal mice at different lobules statistically. Where the number of PCs was normally distributed the Mann-Whitney U test was used. Box-and-whisker plots were drawn to illustrate a comparison of the PC numbers in the mutant and normal mice. All tests were performed using STATA™ 9.0 (Stata Corporation, College Station, TX, USA). All statistical evaluations were made assuming a two-sided test with significance level of 0.05.

Results

Qualitative assessment

On examination of the slides without microscopy, there were no obvious differences between the mdx from the normal mice. The calbindin staining appeared homogenously distributed. It must be noted however that these missing rows may be a natural occurrence in the groups of mice tested.

Statistical assessment

The unpaired Student t-test (Table 1) and the Mann-Whitney U test (Table 2) did not reveal any significant difference in the number of PC counts between mutants and controls at different lobules, regardless of the method of cell counting. It is likely, however, that our small sample size precludes statistical assessment using these tests.

Actual PC count and box-and-whisker plots

Box-and-whisker plots demonstrate a difference in the median PC count at lobules 3, 4/5 and 6 between mutant and normal mice. The findings of our PC counts are presented below, organised by the method of cell counting used.

Table 1. *P-values of the comparison of the number of PC counts between mutant mice and controls using unpaired t-test.*

Site	Method 1	Method 2	Method 3
Lobule 10	0.2608	0.6899	0.7885
Lobule 8	0.7976	0.5258	0.6430
Lobule 6	0.0980	0.2294	0.9254
Lobule 4/5	0.0924	0.1671	0.3774
Lobule 3	0.1455	0.3410	0.2890

Table 2. *P-values of the comparison of the number of PC counts between mutant mice and controls using Mann-Whitney U test.*

Site	Method 1	Method 2	Method 3
Lobule 10	0.2482	0.7728	1.0000
Lobule 8	0.8845	0.2454	0.7728
Lobule 6	0.1489	0.1489	0.7728
Lobule 4/5	0.0833	0.1489	0.2482
Lobule 3	0.2482	0.4678	0.2482

Method 1

Our data showed significant differences in the median PC count between the mutant and control groups (Figure 2). Differences were most apparent in lobules 3, 4&5, 6 and 10. The largest difference was found in lobules 4&5 and 6.

Figure 3 demonstrates the mean PC number in each group. This figure illustrates a decrease in the mean PC number in lobules 3, 4/5 and 6. The percent decrease in the mdx group was 33.5%, 39% and 33% in lobules 3, 4/5 and 6 respectively.

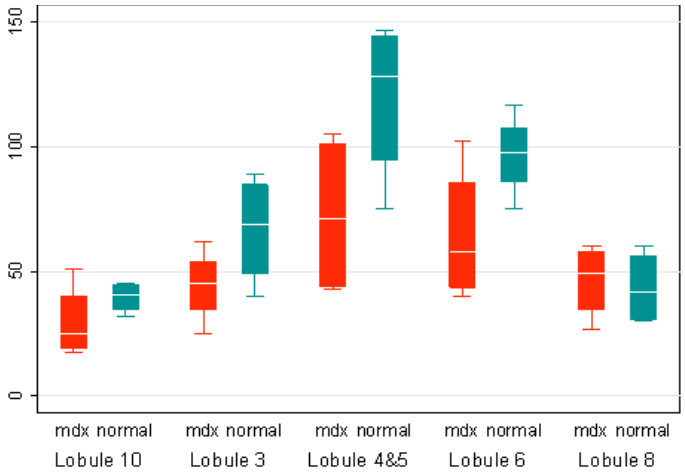

Figure 2. *Box-and-whisker plot of PC counts in mutants and controls at different lobules using method 1.*

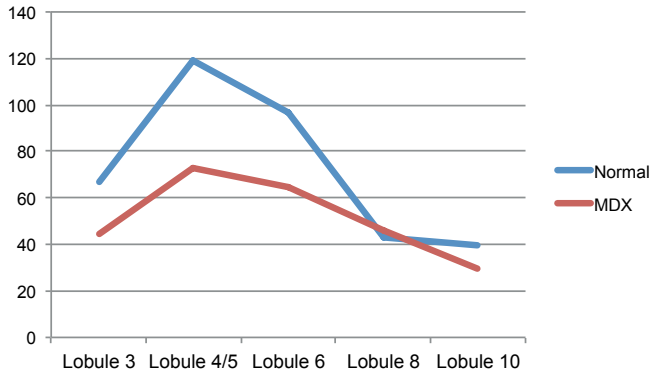

Figure 3. *Method 1 – Actual PC count. x-axis: lobule number; y-axis: the mean results of the PC number in the mdx and normal mice.*

Table 3. *Method 1 - table of results of the actual PC count.*

	Mouse	Lobule 10	Lobule 8	Lobule 6	Lobule 4/5	Lobule 3
MDX	1	51	60	102.5	105	62
	2	29	56	69	97.5	44.5
	3	17.5	42.5	47	45	25
	4	20.5	26.5	40	43	45.5
Control	1	44	52.5	97	146.5	89
	2	32	30	75	114	80.5
	3	37.5	31	117	75	40
	4	45	60	98.5	142	57.5

Method 2

Figures 4 and 5 demonstrate large differences in the number of PCs in lobules 3, 4/5 and 6. The most significant difference was found in lobule 4/5. The mean PC count in the mutant group was decreased by 16%, 30% and 24.5% in lobules 3, 4/5 and 6 respectively.

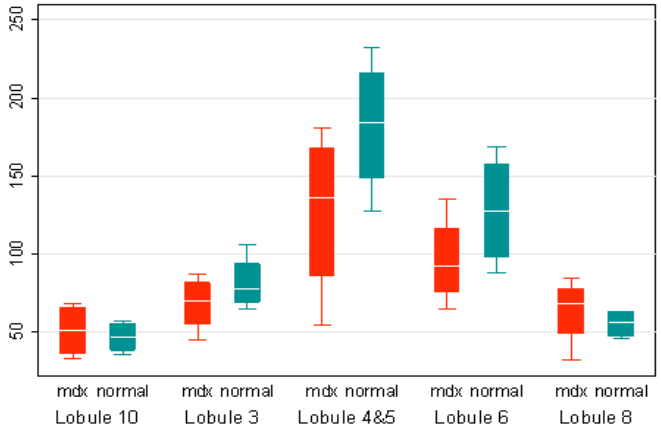

Figure 4. *Box-and-whisker plot of PC counts in mutants and controls at different lobules using method 2.*

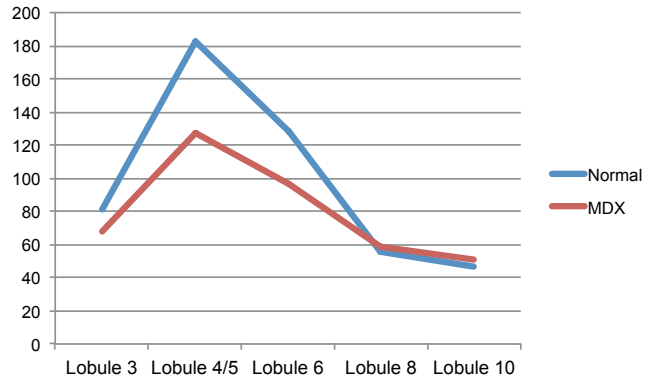

Figure 5. *Method 2 - The estimated randomised PC counts. x-axis: lobule number; y-axis: the mean results of the PC number in the mdx and normal mice.*

Table 4. *Method 2 - table of results of the estimated randomised PC counts.*

	Mouse	Lobule 10	Lobule 8	Lobule 6	Lobule 4/5	Lobule 3
MDX	1	68	65	135.6	180.9	87.6
	2	63.7	71	97.8	154.7	75.8
	3	38.9	65.8	86.7	116.8	65
	4	33.1	32.4	65	55	44.8
Control	1	57	63.5	107.4	199.2	106.4
	2	35.6	45.8	88	170	81
	3	41	48.8	169	127.5	65
	4	53.2	63.5	147	232	73.5

Method 3

Figures 6 and 7 demonstrate differences in the PC number, particularly in lobules 3 and 4/5. The most significant difference was found in lobule 4/5. However, this difference was less significant than those observed in method 1 and 2. Figure 7 illustrates a decrease in PC number in the mutant group by 16% and 16% in lobules 3 and 4&5 respectively.

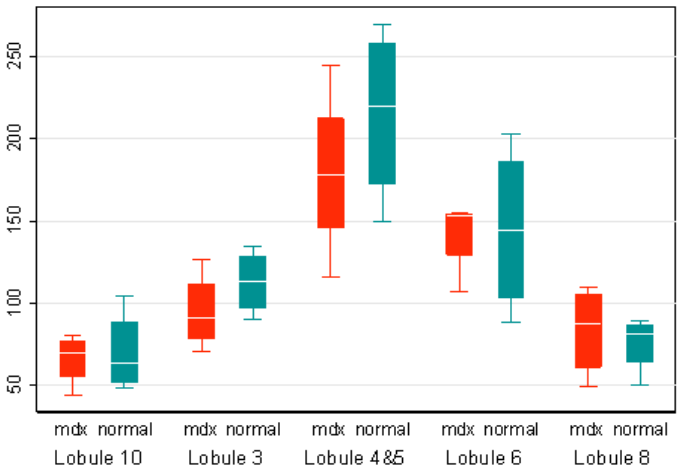

Figure 6. *Box-and-whisker plot of PC counts in mutants and controls at different lobules using method 3.*

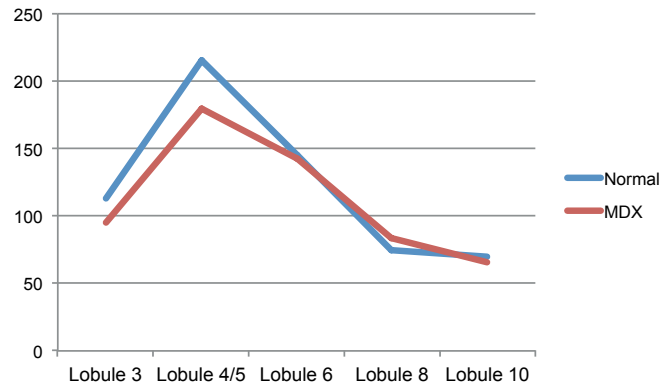

Figure 7. *Method 3 – The estimated maximum possible PC count. x-axis: lobule number; y-axis: the mean results of the PC number in the mdx and normal mice.*

Table 5. *Method 3 - tabulated results of the estimated maximum possible PC count.*

	Mouse	Lobule 10	Lobule 8	Lobule 6	Lobule 4/5	Lobule 3
MDX	1	80	101	151.7	244.9	96.7
	2	73	73	155.4	175.9	126.5
	3	65.7	110	106.8	180.6	71
	4	44.2	48.8	153.69	115.6	85.4
Control	1	72.5	78	118.5	246	123
	2	47.9	49.7	88	194.5	103.6
	3	55	89	203	150	90
	4	104	84	169.1	270	134.7

Sample size estimation

Table 6 summarises the mean and standard deviation (S.D.) of the number of PC counts among each group of mice at different lobules. Sample size estimation was based on these results. Considering multiple tests by adjustment using the Bonferroni method, two-sided unpaired t-test using equal variance shows that the sample sizes

Table 6. *Summary of the number of PC counts between mutant mice and controls at different lobules.*

	Method 1 (mean ± S.D)		Method 2 (mean ± S.D)		Method 3 (mean ± S.D)	
Site	Control	Mutant	Control	Mutant	Control	Mutant
Lobule 10	39.6±6.1	29.5±15.1	46.7±10.1	50.9±17.5	69.9±25.0	65.7±15.5
Lobule 8	43.4±15.2	46.3±15.2	55.4±9.4	63.6±22.3	75.2±17.6	83.2±27.8
Lobule 6	96.9±17.2	64.6±28.1	127.9±36.8	96.3±29.5	144.7±51.3	141.9±23.4
Lobule 4/5	119.4±32.9	72.6±33.2	182.2±44.4	126.9±54.7	215.1±53.6	179.3±52.8
Lobule 3	66.8±22.3	44.3±15.1	81.5±17.9	68.3±18.2	112.8±19.9	94.9±23.5

required to compare the PC counts between mutant mice and controls at significance level of 0.05 and power of 0.8 using method 1, 2 and 3 would be 66 (33 control and 33 mutant), 546 (273 control and 272 mutant), and 9,490 (4,745 mutant and 4,745 control), respectively. The number of mice needed for this study would be 11,610 (5,805 control and 5,805 mutant) to test the PC counts between mutant mice and controls at different lobules using different counting methods at a significance level of 0.05 (the significance level should be 0.05/15 after adjustment if three methods are used in the same study) and power of 0.8.

Discussion

This study found limited evidence suggestive of a reduction in PC number in the mdx mouse, particularly in lobules 4/5 and 6. Several previous studies have also analysed PC numbers and attempted to correlate PC number with other mutations, such as the Staggerer, Lurcher chimera, Stumbler, Reeler and Weaver mice. [9-13]

This analysis has yielded statistically insignificant results for all counting methods and for every lobule. However, it is likely that the small sample size precludes statistical analysis. Thus, data is presented via box-and-whisker plots and the tabulation of raw data. Differences between the mutant and control group are demonstrated, particularly in lobules 4/5 and 6 across all three methods.

The number of PCs is influenced by intrinsic mechanisms (such as the organism's genetic makeup) and extrinsic mechanisms (for example, hormonal factors which determine stem cell survival and recruitment).

PCs in lobules 1 and 10 are the earliest to mature, whereas those in lobules 6, 7 and 8, that is, lobules in the posterior cerebellum, are the latest. [14] The results in method 1 demonstrate a marked decrease in the PC population in lobules 3, 4/5, a marginal decrease in lobules 6 and 10 and a negligible decrease in lobule 8. Therefore, it is suggested that since the lobules which are affected tend to be those which mature earlier, the stage at which DMD affects the cerebellum and notably the PCs may be between the neurogenesis of PCs and the full maturation of all the lobules.

Furthermore, other neurological structures have been shown to be affected by a lack of dystrophin. For example, in the peripheral nervous system, utrophin and the short dystrophin soform (Dp116) are co-localised at the outermost layer of the myelin sheath of nerve fibers. Dystrophin is also present in the outer plexiform layer in the retina and cochlear hair cells, and is mostly absent from subcortical neurons. [15,16] Thus, a lack of dystrophin has shown to cause sensorineural hearing loss in mdx mice. Given that neurological structures are affected by a lack of dystrophin, we postulate that the lack of dystrophin may have an effect on cerebellar PCs.

Moreover, dystrophin has also been shown to regulate Ca^{2+} flux and its absence leads to increased intracellular calcium. [17,18] Raynor and Mulroy [15] have suggested that dystrophin may play a role in protecting the cell membrane of cochlear hair cells against mechanically induced damage, by regulation of calcium influx or stabilisation of membrane structure as previously described. Given that PCs begin to express calcium-binding protein or calbindin as they mature, [5] we speculate that perhaps this dysregulation of Ca^{2+} flux due to a lack of dystrophin may be responsible for potential problems with maturation at this stage.

Conclusion

It was Duchenne himself who first noted cognitive deficits in patients with DMD. [19] In addition to other morbidities, DMD has since been shown to cause a reduction in the IQ score of boys with the disease. IQ scores in this group are 1 standard deviation lower than the average population. [2] Clinically, our study examines the effect of DMD on the cerebellar PC population and the cells associated with it. Our study findings suggest a trend towards a decrease in the number of PCs in mdx mice. Although we are unable to pin-point the exact pathophysiology underlying the intellectual deficits in those with DMD, we propose several points in the neurogenesis of PCs where DMD may disrupt PC development. Our study findings suggest the need for a large trial to determine the statistical significance of differences in PC numbers in mdx and normal mice.

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Conflicts of Interest

None declared.

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Enforcing medical treatment under the Involuntary Treatment Order: An ethical dilemma?

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Seth has a particular interest in mental health and is currently investigating the role of neuroinflammation in cognitive decline.

Introduction: This case report aims to address the ethical issues and obligations of enforcing medical care onto psychiatric patients under the Queensland Mental Health Act 2000 Involuntary Treatment Order (ITO), and will also present Queensland's legal standpoint and limitations on providing this care under the Act. **Case Presentation:** PF, a 47 year old male with a history of depression and recent diagnosis of Gleason 7 prostate cancer was admitted to the acute mental health unit following an intentional overdose of alprazolam. His risk to himself prompted the application of an ITO. Although PF was due for investigation of his recently diagnosed prostate cancer, he refused following his suicide attempt. **Conclusion**: Although an ITO allows for enforcement of psychiatric treatment, no legal allowances exist for enforcement of medical care. In situations where medical conditions may be indirectly detrimental to a person's mental health, ethically-appropriate techniques should be employed.

Case Presentation

PF is a 47 year old male patient with a 28-year history of depression, who was admitted to the Acute Mental Health Unit (AMHU) at a Queensland hospital following a suicide attempt involving an overdose of alprazolam (14 x 0.5mg tablets). PF had experienced a number of life stressors in the several weeks preceding, having dealt with a divorce from his wife of 20 years due to adultery on her part, and a recent diagnosis of prostate cancer (Gleason Score 7). PF was living with his daughter at the time of presentation. This was PF's first known episode of attempted suicide and self-harm.

Admission to the AMHU coincided with another appointment at the hospital for a bone scan to exclude prostate cancer metastases. It was PF's belief that he had definitely developed metastatic cancer, and as such, he did not feel the need to have this diagnosis confirmed despite extensive counselling and discussion with his psychiatric management team.

During the initial assessment, PF seemed agitated yet withdrawn, refusing to provide a detailed history regarding his divorce. He had given a recent history of poor sleep, appetite and concentration. PF's mood was clearly depressed and this was reflected in his affect. Although his thought form was largely intact, his view regarding his prostate cancer appeared to be a fixed, false belief manifesting as a delusion. Thought content was focused around his helplessness surrounding current events. He was particularly negative about the severity of his prostate cancer and was angry about the relationship breakdown with his wife. PF's refusal to partake in prostate cancer staging and rather rely on his own beliefs about possible metastases demonstrated impaired judgement. Although PF was well aware of his depression and its effects, his refusal of psychiatric treatment was sufficient evidence that his insight was impaired.

Although PF was deemed to be very low risk for aggression or self-neglect, he was placed on an Involuntary Treatment Order (ITO) primarily due to his high risk of self-harm and suicide. His high risk of absconding further contributed to the need for involuntary treatment.

Legal and ethical obligations of the ITO

Part 3, principle 8a of the Queensland Mental Health Act 2000 states that "treatment provided under this Act must be administered to a person who has a mental illness only if it is appropriate to promote and maintain the person's mental health and wellbeing." [1] There is no clear jurisdiction for enforcement of medical care under an ITO in Queensland, unless the medical condition is directly associated with the development of the mental illness. As a result, in cases where there is no direct association between the medical condition and mental illness, a complex legal and ethical dilemma presents itself.

Principlism, a widely used bioethical theory, refers to the use of a set of principles – autonomy, beneficence, non-maleficence and justice – in place of other moral theories. These provide a set of guidelines to combat moral problems that may occur in any medical practice, including psychiatry. [2] A key underlying tenet of this moral theory is that one should, to the greatest extent, retain the patient's right to autonomy with regards to psychiatric and medical care. [3] Autonomy, in its most simple terms, refers to the right of an individual to self-determination; in this context, with regards to treatment of PF's prostate cancer. Personal autonomy is regarded as a basic human right both in moral theory and legally under the Australian Human Rights Commission Act 1986. [4] In terms of autonomy, enforcement of medical treatment on a patient against their wishes is a direct breach of this principle; from this perspective, it would clearly not be acceptable to impose a bone scan on PF.

Beneficence refers to the provision of services that are of benefit to the patient. [3] In this case, provision of medical imaging for staging of prostate cancer was being proposed with the patient's wellbeing in mind, in a situation where the patient may not have been able to reasonably make appropriate treatment decisions. A common criticism of the principle of beneficence is that it encompasses an outdated, paternalistic attitude towards patient care, with health professionals deciding what is in a patient's best interests. Paternalism derives from the desire to avoid adverse consequences; the use of an ITO for patients who are thought to be clinically unable to make their own decisions is an example of this principle being enforced in an extreme fashion. Although PF should ethically retain his right to autonomy, his depressive state may impair his judgement about the consequences of not seeking treatment for his cancer. This raises the question as to whether this decision should be put into the hands of a person more able to provide an objective assessment on his behalf (in this case, the consultant psychiatrist).

A key influence upon the provision of medical care is non-maleficence;

that is, abstaining from any course of action that will cause harm to a patient. [3] Unfortunately, no procedure in medicine is without some degree of risk, and often a difficult choice must be made between benefits of a treatment and the risk of severe complications. Current literature suggests that the benefit of staging prostate cancer outweighs both the low risk of complications of a bone scan and the consequences of not performing the test. [5] Therefore enforcing this medical management to PF's case, although not completely free of risks or complications, would be considered 'non-maleficent' in that this risk is relatively low compared to not performing the scan.

Discussion

The current legal guidelines state that PF's prostate cancer cannot be treated involuntarily through the Mental Health Act; that is, PF should not be forced to participate in diagnostic testing and management plans regarding this illness. Although the prostate cancer may not have any physiological link to PF's mental illness, the diagnosis of this cancer was identified as a major contributor to PF's depression and suicidal behaviour. Given PF's current mental state, he did not appear to be able to make appropriate decisions regarding his psychiatric care. Such an assertion may also be applied to his judgement of general medical care. Using a principles-based ethical approach, although enforcement of prostate cancer management in a psychiatric patient breaches both patient autonomy and patient justice, this practice could be considered valid in that there is significant benefit with regards to the patient's health, with minimal side effects or patient discomfort.

A study by Schwartz, Vingiano and Perez [6] examined the attitudes of 24 psychiatric patients with regards to their involuntary treatment after discharge. The authors found that upon discharge, the majority of patients (seventeen out of the 24) were aware that their initial refusal of medication was a manifestation of their mental illness, and were happy with the decision made by the psychiatric health team to override their autonomy and place them on an involuntary treatment order. Patients who did not agree with the involuntary treatment decision often suffered severe mental illness with high levels of grandiosity and their response to treatment was less-than-adequate. This study may suggest that a paternalistic approach can be both beneficial and acceptable to patients in certain circumstances, namely, following an acute psychiatric episode. However, despite these findings, it remains difficult to overcome the ethical concerns regarding the overriding principle of autonomy. In most cases, other approaches to dealing with PF's situation would be available, such as involvement of family and friends in assisting with an explanation of the medical treatment needed to the patient, as well as providing support and assurance to the patient should they become distressed with the management plan. Intervening factors such as this would normally help to diffuse some of the ethical tensions which may arise in similar situations.

In the case of PF, management of the prostate cancer issues by the AMHU was ethically and legally appropriate given the circumstances of his admission; PF was given adequate advice from his psychiatric team and still refused to have the bone scan. In such a situation, methods may be required to ensure that the patient is aware of their medical conditions and are able to make appropriate decisions about their health care. For example, the incorporation of the patient's social supports may play a key role in providing emotional and social guidance, while assisting the patient to make a sound clinical judgement. In cases where support persons are unavailable, the pathway is wholly dependent on the urgency of the medical problem. If the physical health problem is deemed 'non-urgent' it may be necessary to first manage the patient's primary psychiatric complaint, until judgement is no longer impaired. Alternatively, if the physical health problem is 'urgent' then the importance of acute medical treatment becomes much higher, and a case-by-case decision needs to be made about the path of action that will lead to the best outcome for the patient. While PF's case raises an important ethical dilemma in its own right, above all else it highlights the more difficult dilemma that would have been faced if his need for investigation or treatment was more urgent.

Conclusion

The ethical issues associated with the use of the ITO are complex. Although from one aspect, enforcement of medical treatment is given with the 'best intentions' for the patient, patient autonomy must be upheld wherever possible.

In the mental health setting, patient autonomy is breached in situations where the said patient is not able to make decisions regarding management of their illness. This practice has been legalised through the Queensland Mental Health Act 2000, and other similar pieces of legislation throughout Australia and the world. However, the Mental Health Act does not reserve the same limitations for general medical conditions, unless they share a direct physiological relationship with the mental illness. Although this causes issues in the holistic treatment of psychiatric patients, it may prompt health professionals to either use other methods to ensure patients receive needed medical treatment through techniques such as involving patients' nominated next-of-kin, or delaying medical intervention until the patient's mental state has improved.

Consent

Informed consent was obtained from the patient for this case report.

Conflicts of Interest

None declared.

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Ovarian hyperstimulation syndrome

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Sneha's medical interests lie with general adult and paediatric medicine. In her spare time, Sneha enjoys sight-seeing and travelling.

This case report describes a lady who presented with abdominal pain, hypotension and multiple ovarian follicles following egg collection and embryo transfer. She was provisionally diagnosed with Ovarian Hyperstimulation Syndrome (OHSS) and managed accordingly. This case study describes her clinical presentation, investigations, progress, management and outcome. No current laboratory diagnostic/prognostic markers are available for OHSS; the condition is currently diagnosed clinically. The subsequent discussion elaborates on the epidemiology, pathophysiology, clinical features, assessment, management and risk factors of OHSS, and aims to increase awareness of this important complication of infertility treatment to assist diagnosis, prevention and early institution of treatment.

Case Introduction

Mrs. SR is a 39 year-old G7P1M5E1 female who underwent egg collection and embryo transfer. Ten days following egg collection and six days following embryo transfer, she developed fever, abdominal pain, nausea and vomiting. She was initially managed in a private hospital with fluids and analgesia but remained febrile. Abdominal imaging demonstrated ascites and multiple enlarged ovarian follicles. Mrs. SR was transferred to a public hospital for further management under a provisional diagnosis of OHSS.

On initial assessment, she was noted to be tachycardic, hypotensive and febrile. Her oxygen saturation was 100% on supplemental oxygen. She was oliguric, cold and clammy. Her respiratory examination revealed bibasal crepitations and there was rebound tenderness of the abdomen. The remainder of the examination revealed no further abnormalities.

Background and medical history

Mrs. SR was investigated for infertility in 2006 with no cause identified. Her background history included four previous in vitro fertilisation (IVF) attempts, resulting in early trimester miscarriages and an ectopic pregnancy. Dilatation and curettage following twin pregnancy miscarriage in 2005 had revealed normal fetal tissue. In 2007, she successfully underwent IVF with an uneventful pregnancy and normal vaginal birth.

Mrs. SR's menarche was at age thirteen and her menses were since irregular. There was no history of polycystic ovarian syndrome (PCOS), sexually transmitted infections, vaginal discharge or pelvic inflammatory disease. She had a history of depression, obesity and asthma but was on no regular medications for these conditions. Her IVF medications included a GNRH-agonist, recombinant-FSH, hCG, and progesterone. She was allergic to penicillin and trimethoprim.

There was no significant family history reported by Mrs. SR. She consumed minimal alcohol and was a non-smoker.

Physical examination

On admission, Mrs. SR appeared unwell. She was dyspnoeic and unable to talk in full sentences. Her vital signs on admission are shown below in Table 1.

Mrs. SR was oliguric, cold and clammy, with no other signs of dehydration. She had abdominal rebound tenderness and voluntary guarding. There were no palpable abdominal masses or hernias.

Table 1. *Mrs. SR's vital signs on admission.*

Vitals on admission	
Heart rate	128
Blood pressure	90/60
Temperature	37.8 degrees Celsius
Oxygen saturation	100% on 5L/min oxygen
BMI	38.6

Her inspiratory effort was poor and there were bibasal crepitations. Cardiovascular examination was unremarkable.

Resuscitation/Initial Treatment

- Six litres normal saline
- IV ceftriaxone and metronidazole
- Supplemental oxygen (5L/min)

Diagnosis

A provisional diagnosis of OHSS was made. Differential diagnoses included ectopic pregnancy, bowel damage during egg-collection/implantation, unrelated bowel pathology (such as appendicitis/diverticulitis), ovarian torsion, ruptured ovarian cyst and drug fever.

Results of initial investigations are provided in Table 2.

Table 2. *Results of Mrs. SR's initial investigations.*

Investigations	
b-HCG	<5
Bedside echocardiography	No pericardial fluid
Blood culure	Gram positive cocci
Urine culture	Candida
CXR	Bibasal atelectasis No obvious signs of pulmonary embolus or pleural effusion

Outcome

Gynaecological and surgical teams reviewed Mrs. SR and agreed with the provisional diagnosis of OHSS. Due to her poor clinical status (respiratory symptoms and third space losses), Mrs. SR was intubated and managed supportively in ICU for nine days. Her symptoms gradually resolved and her blood results normalised during this time. She was transferred to the rehabilitation ward to facilitate her ongoing recovery and returned home five and a half weeks after her initial presentation.

This case demonstrates one of the more significant complications following egg harvest. A detailed discussion of OHSS, its pathophysiology, epidemiology, clinical symptoms and management follows.

Ovarian Hyperstimulation Syndrome

Incidence

The incidence of OHSS reported in different studies varies depending on the classification system used. A classification of severity and associated clinical features is given below in Table 3.

Globally, OHSS affects 100-200 women per 100,000 cycles annually (prevalence is 0.5-5% for severe forms). In Australia, 30% of the women undergoing IVF develop OHSS and 0.5-2% require hospitalisation. [1,2]

As demonstrated from Table 4, although the incidence of severe-OHSS from IVF is 0.1-2%, it is progressively increasing. [1,3]

Table 3. *OHSS severity and associated clinical features. [2]*

OHSS severity	Clinical features
Mild	Patients develop abdominal distension and pain. Ovarian size remains below 8 cm.
Moderate	Patients develop moderate abdominal pain associated with nausea and/or vomiting. Ultrasound shows ascites and ovarian size approaches 8-12 cm.
Severe	Patients develop clinically evident ascites with some progressing to develop hydrothorax. Patients also develop oliguria and ovarian size approaches greater than 12 cm. Pathological findings may include haemoconcentration and hypoproteinaemia.
Critical	Patients may have tense ascites and/or hydrothorax. Haematocrit is usually lower than 55% and white cell count decreases to less than 25,000/mL. Patients may develop thromboembolism, oliguria/anuria and/or acute respiratory distress.

Table 4. *Incidence of mild/moderate/severe forms of OHSS with gonadotrophin, clomiphine citrate and IVF. [1]*

Ovulation induction method	Incidence
Gonadotrophins	8.4-23% (mild forms)
	0.005-7% (moderate forms)
	0.008-10% (severe forms)
Clomiphine citrate	13.5% (mild forms)
	sporadic (moderate and severe forms)
IVF	3-6% (moderate form)
	0.1-2% (severe form)
	20-30% (mild form)

**Based on clinical presentation and laboratory findings, OHSS is defined as mild, moderate or severe. [1,3]*

Pharmacological ovarian stimulation in IVF

OHSS may arise from various forms of infertility treatments (gonadotrophins, clomiphine citrate or IVF). [4-7]

Clomiphine citrate is an oral tablet which induces ovulation. It is taken for three days, commencing on the second day following menstrual bleeding. Ovulation can be further aided by administration of metformin and subcutaneous abdominal injections of gonadotrophins (given for ≥10 days). These medications directly stimulate the ovaries to produce follicles. In some cases, progesterone and hCG are administered for a few days following ovulation until outcome is established. Following production of follicles, ovulation may be stimulated by monthly subcutaneous abdominal recombinant-hCG injections. [4,7]

Pathophysiology

OHSS is an iatrogenic complication of pharmacological ovarian stimulation. Its pathophysiology is not completely understood. It usually occurs a several days after follicular rupture following hCG administration, which promotes the release of vasoactive substances (histamine, serotonin, prolactin, interleukins, TNF-alpha, VEGF and so on) that affect the endothelial adherens junctions and result in trans-endothelial permeability. Consequently, there is third space loss (leading to shock, oliguria/anuria and/or electrolyte imbalances), haemoconcentration and an increased risk of clot formation. The overactive adhesion molecules and ovarian inflammatory response further promote OHSS by affecting folliculogenesis, ovulation, corpus luteum formation and luteolysis. These collectively result in the clinical features observed in OHSS. Strong links have been observed between hCG and the development of OHSS. In fact, more than one dose of hCG and progression to pregnancy following induction are risk factors for OHSS in patients receiving IVF treatment. [3,4,6-8]

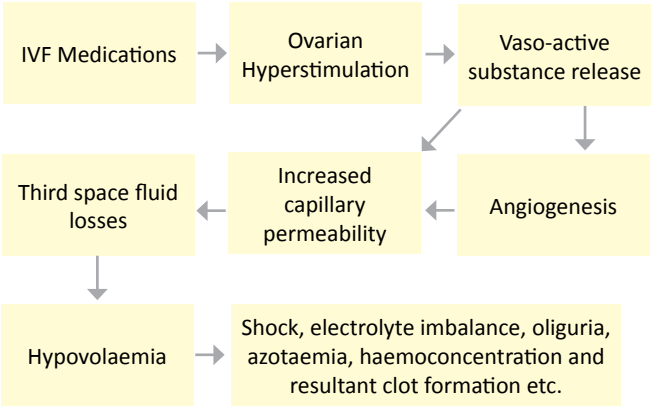

Figure 1. *Pathophysiology of OHSS. [3,4,6-8]*

Risk factors

Risk factors include oligomenorrohea, young age, low body mass index (BMI), PCOS, high dose exogenous, gonadotropins, high oestradiol (E2) levels, previous history of OHSS and more than twenty oocytes on oocyte retrieval. [3,4,7,8]

Clinical features

Patients generally develop symptoms four to five days after egg harvest. Initial symptoms of mild disease may include nausea and abdominal distension or discomfort. Disease progression is generally marked by the persistence of symptoms and the development of vomiting, weight gain, ascites, pleural effusion, hypoalbuminaemia and other symptoms described under the pathophysiology section. Complications of OHSS may manifest as thromboembolism, acute renal failure, respiratory compromise, hyperkalaemia and infection. These are further detailed in Table 3. [3-6]

Clinical assessment of patients with probable OHSS should include a complete history and examination. Work up should include basic haematological testing (including full blood count, urea/electrolytes/creatinine, liver function tests, beta-HCG and coagulation studies),

abdominal ultrasound, and chest x-ray. Further investigations should be performed based on individual circumstances. [3-6]

Treatment

Treatment for OHSS is primarily supportive. Current best practice guidelines advise management on an outpatient (for mild-OHSS) or inpatient (for severe-OHSS) basis. However, research is being conducted to better understand the pathophysiology and hence, diagnostic and prognostic markers and treatment options for OHSS. [2-6]

Outpatient basis

Currently, outpatients are symptomatically managed. It is recommended that they be regularly monitored and reviewed for weight changes, pain intensity, nausea, vomiting and bloating. If the condition worsens, patients are advised to report to their clinician. [2-6]

Inpatient basis

In contrast to outpatients, inpatients are more closely managed with strict fluid-balance assessment and electrolyte monitoring. Any electrolyte abnormalities should be promptly corrected. Treatment is symptomatic and includes anti-emetic medications, paracentesis (if required), analgesia and DVT prophylaxis. Diuretics may be used once the patient is haemodynamically stable and has a haematocrit >38%. Allied health staff (physiotherapist, dietician and psychologist) play a significant role decreasing morbidity. [2-5,7,8]

There is some controversy regarding fluid administration in OHSS. Currently, crystalloids and colloids are thought to be similarly effective in increasing intravascular volume. While paracentesis is used for symptomatic relief, and has been found to relieve respiratory symptoms in the acute setting, there is no data on its long term efficacy in symptom control. [4,5,7,8]

Conclusion

OHSS is a rare but potentially fatal complication of infertility treatment. Hence, it is extremely important to ensure continuing awareness of its causes, clinical manifestations, treatment, prevention and epidemiology. This will ensure early recognition and management of the condition and reduce morbidity and mortality.

Consent

Informed consent was obtained from the patient for publication of this case report and accompanying figures.

Conflicts of Interest

None declared.

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Peter Doherty: An unlikely career

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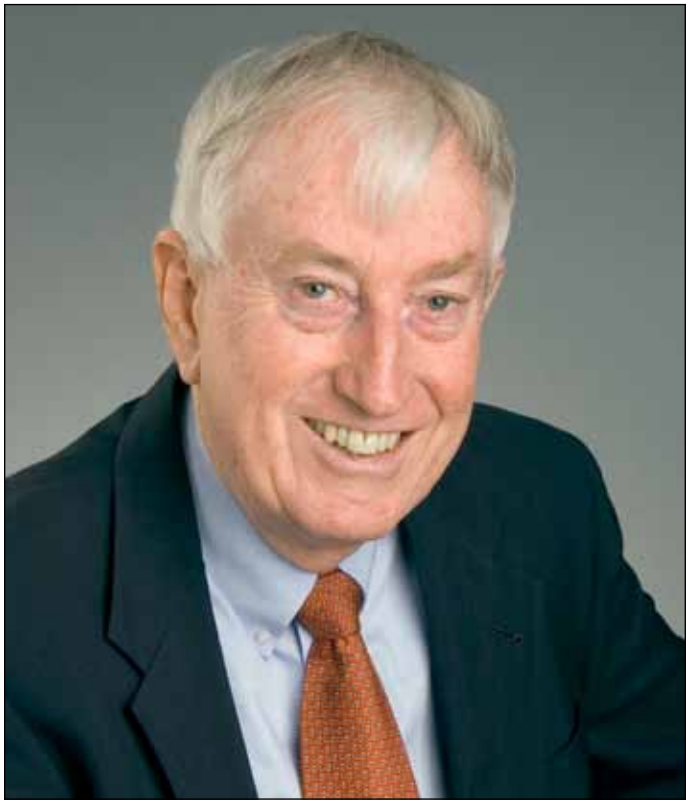
Prof. Peter Doherty won the Nobel Prize in Medicine in 1996 with his colleague Rolf Zinkernagel for the discovery of the interaction between T cells and the major histocompatibility complex (MHC). He was named Australian of the Year in 1997. He continues to make major contributions to immunology research, specifically in the area of influenza. The editors of the AMSJ asked Prof. Doherty to share some of the details of his journey leading up to his renowned immunological discoveries.

Growing up in a 1950s Brisbane outer suburb had its moments but, as a sixteen year old, there did seem to be at least the possibility of more challenging alternatives! I read constantly: Hemingway, Sartre, Steinbeck, Dostoyevsky, Zola, Camus, Huxley - Aldous the novelist - not his elder brother Julian, the scientist and later UNESCO head. Books are transforming. Reading *After Many a Summer Dies the Swan*, *Eyeless in Gaza* and *Brave New World* put me in touch with ideas that Aldous presumably drew from his experience as a member of England's great scientific/humanist family including his grandfather Thomas Henry Huxley, defender of 'The Origin of the Species' and pioneer marine biologist.

Books, and the classical music my mother played constantly as part of her escape into technique and beauty, should have taught me that there is a more sophisticated culture that is accessible to anyone who cares to make the effort but, at sixteen, I didn't fully understand how to reach for that. My parents left school at age fifteen, and about the only people I knew who had any higher education were my secondary school teachers, the local doctors and dentist. I reckoned I needed a decent job and, though I knew I could write reasonably well, that seemed too risky. Also, my interest in biological research had been piqued, first by Aldous Huxley, then by my much older cousin, Ralph Doherty, the co-discoverer of the Ross River virus, who had a distinguished research career in viral epidemiology, becoming Director of the Queensland Institute of Medical Research and ending his career as medical Dean, then Pro-Vice Chancellor at the University of Queensland.

Being totally naïve and with the minimal empathy that afflicts many adolescent males, I reckoned that I did not want to be a medical doctor. The thought of spending my life around sick people had no appeal! Of course, I now realise that is also true for many medical professionals: I could have been a pathologist or an orthopedic surgeon! So, wanting to work on infectious disease, I chose veterinary science, though with the idea of doing research on food-producing animals rather than being on the "caring" side of dog and cat medicine. Greater sympathy comes with age and, looking back, I have the sense that life as a medical cardiologist or neurologist could well have been fulfilling. Would I have ever done anything substantial in science? Who knows, we can only explore one possibility at a time!

I spent nine years working as a veterinary researcher, first in Brisbane and later at the Moredun Institute in Edinburgh. There I completed a research PhD, the scientific "ticket," working on a viral meningo-encephalitis of sheep, and also became a competent neuropathologist. My scientific "home" was the British Neuropathology Society, and the first international scientific meeting I attended was on neuropathology, in Paris. A clear recollection is of the conference dinner in La Conciergerie, the forbidding stone palace that housed many "guests" of the revolution (including Marie Antoinette) before their terminal



Prof. Peter C Doherty

"date' with Madame La Guillotine. By the time of that evening in 1970, though, I'd escaped from the narrowness and parochialism of 1950's Australia. Returning from the USA to Melbourne in 2002, I sometimes had the sense that John Howard was intent on taking us right back there!

The price of liberty is eternal vigilance, and that's as true in contemporary Australia as it has ever been anywhere! Some doctors have always taken on the role of guardians of the public good. The Australian Greens' leader Bob Brown was, for example, a medical practitioner. For $10 you can be a student member of Doctors for the Environment, Australia. You may have missed it if you read only the Murdoch press, but the first eight months of 2010 rank with 1998 as the hottest globally on record.

In the late 1960's, my Edinburgh research colleague, Hugh Reid and I made some novel observations on plasmablast localisation and antibody production in the brains of the infected sheep we were studying. That boosted an interest in immunity I had contracted from one of my university teachers, the eminent parasitologist J.F.A. Sprent, and from reading books by Macfarlane Burnet, the iconic Melbourne medical scientist who shared the 1960 Nobel Prize with Peter Medawar for defining the concept of immunological tolerance.

Due to return to Australia to take a senior position working on virus pathogenesis in the CSIRO Division of Animal Health Laboratories in Parkville, Melbourne, I went to a meeting of the Metchnikoff Club, an Edinburgh immunology discussion group, and heard the London cancer researcher, Mel Greaves, talk about his interest in T cell mediated immunity. Fascinated, though knowing little about it, I wrote to my

future boss at the CSIRO, Eric French, and suggested that I should maybe take another year or two to learn about cellular immunity. I had been talking earlier to Cedric Mims, then the doyen of those interested in viral pathogenesis, and he'd told me a little about the T cell work that was in progress in the John Curtin School of Medical Research at the Australian National University. Eric agreed that I should go to the ANU for a while, and the JCSMR Microbiology Department Head, Gordon Ada, organised a two-year postdoctoral fellowship for me to work with Cedric. By the time I got there, Mims had accepted the Chair of Microbiology at London's Guy's Hospital Medical School and I essentially inherited his laboratory.

In Canberra, I stopped being a veterinary researcher and became an MD, a mouse doctor. That's where I teamed up with Rolf Zinkernagel, a Basel medical graduate, and we made the discovery that was to earn us the Nobel Prize some 23 years later. I'm the first person with a veterinary training to have enjoyed that distinction. Journalists sometimes ask, "Did you start out with the idea of winning a Nobel Prize?" The obvious reply has to be, "I would need to have been pretty stupid to train as a vet if that's where I thought I was heading!" In fact, those who set out to win a Nobel often end up being more than a little mad! Since 1901, fewer than 200 people have been awarded the Nobel Prize for Physiology or Medicine. Even for great scientists, the odds are pretty low and many miss out, including several prominent Australians.

Back in 1974, Zinkernagel and I became well known overnight in the field of immunology and, apart from being an advocate for public education and evidence based reality and publishing a couple of "lay" books on science, that's been my professional path for the past 35 years. Rolf recently retired after a distinguished career and I'm still working, on influenza, and writing another book. If you're interested, you can read about how it all played out in my autobiography [1] and 1996 Nobel Lecture on the Nobel e-Museum Website, [2] in *The Beginner's Guide to Winning the Nobel Prize* [3] and in *Challenged by Complexity: My 20th century in immunology*. [4]

The most important point I'd make to you as medical students is: keep your mind open to new ideas and novel possibilities. Have the courage to follow the main chance! We make career decisions very early, but we can only hope that we will continue to mature and change. Maybe it will suit you to follow a well-trodden path, and there are many fine paths in the medical tradition. Maybe you will find another passion. Life is an adventure though, as that great Australian Malcolm Fraser once remarked: "Life isn't meant to be easy." Those who deny that reality are likely to end up being relaxed, comfortable, dull and indifferent to the suffering of others. But then you're medical students and, even if you don't know it yet, you've already rejected that kind of minimal, self-obsessed existence.

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Martin Van Der Weyden: A Career Sustained by Scholarships

Dr. Martin Van Der Weyden
Editor, Medical Journal of Australia

Martin Van Der Weyden has been the editor of the Medical Journal of Australia (MJA) for the past fifteen years. Over this time, he has earned a reputation as a passionate, quirky, and often controversial figure. His influence has most definitely been a transformational one, taking the MJA from near irrelevance (once irreverently nicknamed the 'Blue Comic') to being one of the top 20 general medical journals in the world and a key driver of change here in Australia.

As we go to print, Dr Van Der Weyden is preparing to retire from his position as Editor, which will mark the end of an era in Australian medical publishing. The editors of the AMSJ invited him to share some of his life story and reflections at this fitting juncture. What follows is a short account of the making of one of Australia's most interesting medical personalities.

My family emigrated to Australia from Holland after World War II, ostensibly to provide a better future for my five siblings and myself. We settled in Corrimal, one of the northern suburbs of Wollongong, primarily because of its proximity to the steel works in neighbouring Port Kembla, which was the employment Mecca for migrant workers.

My primary school education was by the Sisters of Joseph - the order founded by St. Mary McKillop. The Sisters encouraged excellence in scholarship and conducted special sessions on Saturday mornings to prepare selected students for bursary examinations. I was one of those selected and won a bursary to attend Holy Cross College in Ryde, Sydney as a boarder.

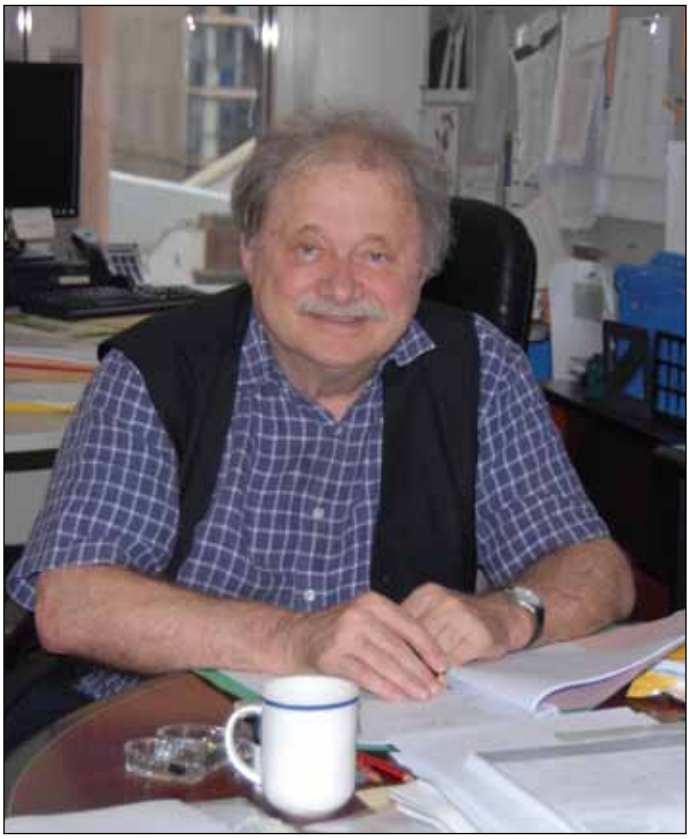
On attaining the Leaving Certificate in 1959 I was awarded a Commonwealth Scholarship - the brainchild and legacy of Prime Minister Robert Menzies. I studied Medicine at Sydney University and graduated MBBS in 1966.

My formative years were spent at Sydney Hospital, the first and oldest hospital in Australia known as the Rum Hospital, notorious for being funded by the proceeds of the early colony's illegal trade in spirits. My tenure as a medical registrar at Sydney Hospital was supported by a scholarship endowed by the Penfold family of Penfold wine fame, a fitting endowment for the Rum Hospital! I became a Member of the Royal Australasian College of Physicians by examination in 1969 and decided on advice from my mentor Dr. Allan McGuinness, Senior Physician at Sydney Hospital, to pursue a career in Haematology under the guidance of Professor Barry Firkin at the Clinical Research Unit at Royal Prince Alfred Hospital.

In the interim, Firkin moved to the Alfred Hospital in Melbourne as the Professor of Medicine at Monash Medical School. So newly married I moved to Melbourne to take up a position of Research Fellow in Clinical Haematology, a position made possible by a scholarship from the Alfred Hospital Research Fund.

Whilst at the Alfred I met Dr. J B Wyngaarden, Chair of Medicine at Duke University in Durham, North Carolina, who came to the Alfred as Visiting Professor. He strongly advised me to take time out from the treadmill of vocational training and spend time in a research laboratory acquiring new skills. He recommended that I work with William (Bill) N Kelley who was at Duke and widely known for describing with others the inborn error of metabolism of the Lesch-Nyhan Syndrome, namely a deficiency of an enzyme of the purine salvage pathway - HGPRT.

Once again, I was fortunate to be awarded the Merck Sharp and



Dr. Martin Van Der Weyden

Dohme International Fellowship in Clinical Pharmacology, the second Australian to be the recipient of this prestigious scholarship. So with my wife Merle and newly born son Damien we moved to Durham, NC, to join Bill Kelley in the Department of Rheumatic and Genetic Diseases. It was like joining the United Nations with research fellows from all over the United States along with fellows from Canada, Mexico and Germany, all busily researching the basic biochemistry (enzyme purification and characterisation) of purine and pyrimidine metabolism.

It was to be a most engaging, enjoyable and productive period in my career and encapsulated Wyngaarden's advice to: "Do something outside clinical medicine and enjoy a time that will not come your way as you ascend the ladder of clinical or academic medicine." This period of my career culminated in describing along with others the deficiency of the purine enzyme adenosine deaminase in patients with Severe Combined Immunodeficiency, delineated the heterogeneity of this enzyme in human tissue and why its deficiency results in such a profound disorder of immune function. This work was made possible by a scholarship from the National Science Foundation (US).

During this exciting time I was offered positions at the National Institute of Health (Bethesda, Maryland) and at the University of Michigan, Ann Arbor, but I came back to Australia on another scholarship as a National Health and Medical Research Fellow at Monash University Department of Medicine at the Alfred Hospital. From that base I became the Director of Investigative Medicine at the Alfred, a Professor of Haematology at Monash and a senior attending Physician at the Alfred.

My research during this period was recognised by award of the Susman Prize of the Royal Australasian College of Physicians.

But as time went on, research offered no new challenges and the conservatism and dreariness of academia became progressively stifling and overbearing. Then in 1995, along came the opportunity to become the Editor of The Medical Journal of Australia… And as they say: the rest is history.

Duke University (reproduced with permission)

But what do I make of all this? Be prepared to spend time away from clinical medicine, pursue both science and clinical studies as each informs the other. Be prepared to accept the modest penury that is one's stipend and, above all, value clinical networks and the advice of mentors.

And where possible heed Wyngaarden's advice: "Do something different!"

For some further reflections on Dr Van Der Weyden's time at the MJA, the editors would direct readers to an article by Melissa Sweet published online in early 2010.

Sweet M. Reflections from the retiring editor of the Medical Journal of Australia. Croakey: The Crikey Health Blog. [updated 2010; accessed 26 Oct 2010]. Available from:URL: http://blogs.crikey.com.au/croakey/2010/02/02/reflections-from-the-retiring-editor-of-the-medical-journal-of-australia/

Why medical school is depressing and what we should be doing about it

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Minh has been involved with the Flinders Medical Students Society for the last two years as the Publications Officer and initiator of several student well-being activities, and currently is a member of the Expert Reference Group for beyondblue's Doctors' Mental Health Program, which provides expert stakeholder advice to beyondblue and its Advisory Committee regarding the development, implementation and evaluation of the Program.

Introduction

In recent years, there has been quite some attention given to supporting the health and well-being of doctors but less to that of medical students, particularly their mental health and well-being. [1-3] Up to 90% of medical students will need medical care whilst in medical school, and while many of these health needs may be routine, medical students are more susceptible than age-matched peers for serious mental illnesses such as depression, anxiety, substance misuse and burnout. [4,5] Preliminary data from a study last year showed that Australian medical students reported higher rates of depression, while another study estimated that one quarter of students suffered from symptoms of mental illness. [6] There is also some evidence that difficulties during medical school may manifest later in one's medical career. [7] With up to a third of hospital physicians at one point experiencing psychiatric morbidity, identifying and supporting these individuals is essential as these doctors are more likely to deliver sub-optimal patient care, misuse substances and leave the profession early. [8] This article will discuss how medical school can and does have a profound effect on our mental well-being, putting us at risk of depression, burnout and other mental illnesses.

Why are we more prone to depression and other mental illnesses?

1. Medical school is time-poor

Medical students, like doctors, tend to be notoriously bad at looking after themselves. In fact, as a broad generalisation we also have trouble managing finances, personal relationships, and other aspects of life outside medicine. This undoubtedly stems from the fact that we are extremely time-poor, medical training is demanding and the learning is infinite. There is significant pressure to succeed (from ourselves and externally) and we often enter medicine with, or subsequently develop, driven personalities to cope. Medicine often becomes our first priority as we attempt to juggle substantial study commitments, part-time work, family and social lives. When our personal lives become overshadowed by the preoccupation of studying medicine, this can and often does lead to reduced self-care and a decline in mental well-being over a gradual period of time. [9]

2. Medical school is competitive

Admission to medicine is competitive and attracts outstanding individuals. Many students are academically gifted and highly motivated. Although medical faculties encourage co-operation and collaboration amongst students, medical school remains a competitive environment, explicit or otherwise. We all know the feeling of being the only individual in a tutorial not to understand a concept, whilst our classmates do so with ease. Difficult topics that we struggle for hours to master come naturally to others, and this may be a bitter pill to swallow for many students who have been highly successful in previous academic and working lives - and as a result, a source of maladjustment. With the decreasing availability of intern and specialty training positions, competition is a very real facet of medical school, and thus an additional source of pressure on each of us to not just pass, but to excel in medicine. [10]

3. Medical culture is not supportive

The challenges of medical school extend beyond the fact that we are

time-poor and in a highly competitive environment. Medical culture itself has long supported inappropriate health-seeking behaviour, such as denial and self treatment. We are encouraged in medical school to ensure our own adequate health, but in reality, those who fail to cope with the demands are often viewed critically by fellow students for missing tutorials or clinical sessions, whether privately or openly. Additionally, there is very little scope for taking time off in an already hectic academic year, and it is common for medical students to function through illness and fatigue, particularly during examination time.

Many students accept this as the minimum; exceeding healthy physical boundaries is perceived as 'dedication to one's studies,' almost a badge of honour. As practicing physicians this culture is perpetrated. Doctors have an enormous sense of obligation to medicine, and taking time off is often seen as 'letting the team and the patients down.' Many doctors approach their work with a sense of 'collective martyrdom,' whereby it is considered normal to sacrifice oneself for ones' patients and profession. While sacrificing some things to pursue your passion is one thing, it is a different matter to lead an unbalanced, unhealthy life in the name of medicine. [9]

4. Mental illness in medicine is stigmatised

Negative attitudes associated with mental illness are a very real phenomenon in medical school. A study last year showed that a significant proportion of Australian medical students were influenced by the stigma associated with mental illness. Seventy-two percent of medical students surveyed indicated that they would feel ashamed if they had depression and 20% saw it as a 'sign of personal weakness.' [6] The fear of not being allowed to study or practice medicine is an overarching attitude that is enough to prevent many students from admitting a problem, even to themselves. This stigma is intensified by the competitive nature of medical school entry; no one wants to lose their place after working so hard for it. It thus becomes increasingly difficult for students to feel they can ask for help, with up to 50% of medical students not seeking treatment during times of need. [4,6,12]

'Self-stigma' occurs when a person internalises the negative attitudes of others and applies these to themself (such as feeling that depression is a sign of weakness because you think this is what other people believe). 'Perceived' stigma is the feeling that others hold stigmatising attitudes (for example, the irrational belief that medical school boards will persecute you if you are depressed). Both of these are widespread and reduce the likelihood of a student seeking professional help when

needed. [11] As a result, these students often receive late or sub-optimal treatment which can result in a poor prognosis or relapse. [9,11,12]

5. Medical students have poor 'mental health literacy'

'Mental health literacy' is a term used to describe 'knowledge and attitudes about mental disorders which aid in their recognition, management and prevention.' [11] Medical students generally have low mental health literacy, and experience difficulty identifying depression or other mental illnesses in themselves or other students. Even with psychiatric training, students may struggle to recognise their own symptoms because medicine is taught in the context of an external patient, rather than ourself as the patient. We travel through medical school with the erroneous belief that we are not susceptible to the illnesses about which we learn, and are unable to apply our medical knowledge objectively towards ourselves. Similarly, we may not pick up the signs of mental illness in fellow medical students, whom we see only in a social or emotional role.

In addition to this, depressive illness in medical school is often mistaken as normal behaviour associated with the 'workload.' One of the most common manifestations of depression, concentration difficulties, may cause students to fall further and further behind in coursework. These individuals, unable to recognise the warning signs, feel the need to study harder rather than taking a break, leading to the intensification of pressure and reducing the likelihood of seeking professional help. This vicious cycle, combined with very few opportunities to take time off during the academic year, can lead to rapid impairment of student well-being. [9]

The problem with medical school

Many people may not be prepared for the challenges of a life in medicine at the commencement of medical school. Medical admission committees attempt to select students who will not only make good clinicians, but will also cope well with the demands of medicine. We all remember our admission interview for medical school and being asked about 'stress' and 'coping skills.' This is a flawed process in several ways.

Firstly, most of us do not match all of the ideals of a perfect, well-balanced doctor. We may be great communicators with patients, but still be developing our personal self-care and stress management techniques. Thus, we may pass a structured interview and be admitted to medicine based on other personality strengths rather than those associated with an ability to cope with medicine.

Secondly, admission committees will admit that there is no evidence to show that interview performance correlates with actual personal qualities, including a candidate's ability to cope with stress. In reality, semi-structured interview 'performance' only allows a candidate to demonstrate some knowledge of medicine (be it actual or prepared) in a simulated interview setting. Even if the interview process did accurately select people with good general 'coping skills,' it is still almost impossible to correlate this with how well a person would cope in medicine. This is arguably something that can only be determined by time spent in the medical profession itself, due to its unique stressors. [13]

Once students enter medicine, there appears to be a gaping hole in the promotion of medical student health and well-being throughout medical school. Cursory endorsement of the local on-campus health service suffices for many medical schools, and largely leaves students to fend for themselves. As we progress, medical school teaches us to be doctors, with almost a sole focus on the acquisition of clinical knowledge and examination skills, but a seeming deficit in personal skills associated with self-care in relation to medicine. [3] Some consider this outside the scope of a medical curriculum. Others say personal development is just that – something the individual must learn themselves.

What can we do about this?

"Undertaking appropriate self-care and obtaining appropriate medical assistance when needed is considered an individual responsibility" - John Hill, South Australian State Minister for Health (personal e-mail communication, May 4, 2010). But should it be?

There is growing evidence that mental health promotion activities aimed towards 'at-risk' groups, such as medical students, are effective in increasing the awareness of mental illnesses, reducing stigma and improving student well-being (Table 1). This may help to prevent a first-episode of mental illness by improved identification and health-seeking behaviour in those that do develop mental illness such as depression. [12,14] Aiming these interventions at students during medical school can raise awareness of how common mental illness is within medicine, the stressors and risk factors unique to medicine, positive self-care measures, mental health first aid, and the support avenues that are available. Additionally, these forums are important for breaking down negative attitudes. Knowledge of these issues during the formative years of our medical careers can only benefit us as individuals and as a profession down the track.

It is encouraging that many Australian medical schools are beginning to realise the importance of this issue. Monash University has been a leader in this area, with the incorporation of a 'Health Enhancement Program' into its core medical curriculum to teach students about the relevance of mental and physical health in medicine. [15] However, in addition to activities that raise awareness, medical faculties also need to improve the delivery of support services for medical students, who have a very unique set of stressors when compared to other university students. This may include counsellors who have an understanding of the medical curriculum, teaching methods such as Case or Problem Based Learning, and the difficulties faced during clinical years. These services need to be well promoted, highly accessible and strictly confidential to protect the identity of students and to improve help-seeking behaviour. Support in the form of peer-mentoring should also be encouraged.

Student-run medical societies are also crucial. The Australian Medical

Mental Health in Medicine Seminar 2010, run by the Flinders Medical Students' Society.

Table 1. *Summary of interventions to improve medical student wellbeing and health seeking behavior*

Intervention/Setting	Aims	Intervention	Evaluation	Results
Health Enhancement Program (Monash University School of Medicine) Australia Evidence level: III-1* [15]	Foster behaviours, skills, attitudes and knowledge of self-care strategies for managing stress and maintaining healthy lifestyle, and understanding of the mind-body relationship.	Eight lectures on mental and physical health, mind-body medicine, behaviour change strategies, mindfulness therapies, and the ESSENCE lifestyle program, supported by six two-hour tutorials.	Depression, anxiety and hostility scales of the Symptom Checklist-90-R incorporating the Global Severity Index (GSI) and WHO Quality of Life (WHOQOL) questionnaire to measure effects on wellbeing.	Improved student well-being was noted for depression and hostility subscales but not the anxiety subscale.
Mental Health in Medicine Seminar (Flinders University Medical Students Society) Australia Evidence level: III-3*	Raise awareness of depression in medicine: stressors and risks factors unique to medicine, prevalence, positive self-care, mental health first aid, and support avenues.	Half-day didactic semin-ar discussing epidemio-logy, *stigmatising* attitudes, causes, risk factors, signs and symptoms of depression, stress management, and support avenues as a student and physician.	Pre/post intervention survey to assess changes in mental health literacy (knowledge/attitudes towards depression and help-seeking behaviour). Based on International Depression Literacy Survey.	Results pending at time of publication.
Student Well-Being Program (SWBP) (West Virginia Uni. School of Medicine) United States Evidence level: III-3* [16]	Prevention and treatment of medical student impairment.	Voluntary lunch hour lectures (six lectures over six month period) for first and second year students addressing various aspects of wellbeing.	Post-intervention questionairre distributed to 94 students assessing perceptions of depression, academic difficulties, substance abuse, health-seeking behaviour.	Participants who had one or more symptoms of impairment were more likely to feel a need for counselling and to seek help.
Physician Life-style Management Elective (Wright State Uni. School of Medicine) United States Evidence level: III-3* [17]	Enhance the quality of medical student life-planning as a future physician and prevent physician disability.	Voluntary two week elective (lectures) for first year students focusing on physician health, practice management, relationships, and physician disability.	Ratings of each didactic session were collected from seventeen first year medical students.	Students rated sessions on the residency experience highest followed by assertiveness training, then by emotional health management.
Wellness Elective (Case Western Reserve University School of Medicine) United States Evidence level: III-3* [19]	Provide students with information on wellness, stress reduction, and coping strategies.	Series of six, weekly lectures from medical and allied health professionals on wellness, coping strategies and stress reduction.	Evaluated via essay review and a questionnaire administered after the elective concluded.	Participants reported that the elective helped them realise the importance of personal wellbeing, self-care, and provided a variety of coping strategies.
Self-care intervention (Indiana University School of Medicine) United States Evidence level: III-3* [18]	Promote positive health habits and emotional adjustment during students' first semester via self-awareness and self-care interventions.	Lecture, written information, and group discussions on emotional adjustments, sleep hygiene, substance use and recognition/ management of depression and anxiety.	Survey assessing patterns of sleep, alcohol consumption, depression, exercise, caffeine use, satisfaction with teaching, social life, physical health, emotional health, finances, time management.	Promising effects on patterns of alcohol consumption, exercise and socialisation. Influenced some sleep and exercise behaviours, but not overall emotional or academic adjustment.

**National Health and Medical Research Council levels of evidence. I: Systematic review of randomised controlled trials. II: One properly designed randomised controlled trial. III-1: One well designed pseudo-randomised controlled trial. III-2: Non-randomised trials, case–control and cohort studies. III-3: Studies with historical controls, single-arm studies, or interrupted time series. IV: Case-series evidence.*

Students' Association has *focused* heavily on medical student health and well-being in recent years and has developed a policy through which medical student societies around the country are encouraged to promote student well-being. Individual medical societies are increasingly providing well-being events targeting medical student mental health. The medical society at the Flinders School of Medicine last year ran a high-profile seminar day for the medical student body *focusing* on medical student depression. Student-run well-being events were also held at several other medical schools. There is evidence that these health promotion events improve medical student awareness and health seeking behaviour, regardless of the format (didactic session, tutorial or short elective course) and thus it is now essential that all medical schools play some role in promoting student well-being. [3,16-18]

Conclusion

Many medical students appear to be happy and highly motivated. Whilst this may be true for the majority of us, there is a significant proportion who may struggle to adjust to medicine. Students are also subject to many unique stressors throughout the course of their medical education, ranging from adjusting to a high-pressure learning environment with an infinite knowledge base, to the emotional challenges of death and dying. Combined with the driven personalities that many of us bring into medicine, or subsequently develop, we tend to be an 'at-risk' group for mental illnesses such as depression, burnout and substance misuse. Medical culture must also be held at least partly responsible, having for a long time encouraged poor self-care and help-seeking behaviour. Students who struggle are seen to be weak and 'not cut out for medicine'. This culture needs to change and it is incumbent on each and every one of us to play a role in this. Whether it is by participating in a well-being event at your medical school, or by being supportive when a colleague appears to be struggling, we can all do more to ensure that our medical student body is a healthy and vibrant one.

Conflicts of Interest

None declared.

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A trauma elective in Sydney: How does it compare to London?

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"Will you see shark bites?" was a question I was asked a few times by other medical students when I told them I was doing an elective in trauma at Liverpool Hospital, Sydney. While I promptly replied this was unlikely (especially as Liverpool is a lot further from the coast than I initially realised), I was secretly hoping I would see something exciting. Although there were no shark bites or kangaroo assaults, I did see some very interesting cases while over on your side of the world, such as a patient who managed to sever his radial artery with an angle grinder and a traumatic amputation of a patient's arm by an industrial machine.

Trauma as a speciality

One of the first things I noticed was that the set-up of the trauma department was different from in the United Kingdom (UK). At home, trauma as a speciality is generally combined with orthopaedics, and there are few surgeons specialising in trauma as a whole. This helped to explain the initial email I received back from my elective supervisor, who said that this was an elective in trauma, not emergency medicine, which made me worry I would be doing orthopaedics for six weeks! The orthopaedic and trauma surgeons in the UK manage the musculoskeletal aspect of the poly-trauma patient's care, and other surgeons are called upon as necessary, for example vascular surgeons. Here there are specific 'trauma' surgeons who specialise after completing general surgical training, and are responsible for the overall surgical management of the trauma patient. This includes following them up on the wards, in the intensive care unit (ICU) and clinic as necessary. This was something I had not come across before. Indeed, trauma surgery as a single speciality does not currently exist in the UK, nor is there a training program. There are, however, some centres that provide more specialist trauma care, such as the Royal London Hospital.

Mechanism of injury

In many ways, the type of trauma I saw in Sydney was very similar to that of London. The majority of the trauma I have seen in both cities is as a result of motor vehicle collisions, which was not surprising. [1] Another common mechanism was falls, with increasingly elderly populations with many co-morbidities contributing to this problem in developed countries. [2] This is now being complicated when the fall results in a head injury, with many of these patients also being on anticoagulants. [2] In both countries, the majority of cases I have seen are therefore a blunt type of trauma rather than penetrating, although stabbings are on the increase in London, [3] and possibly Sydney too. [4]

Accessing trauma patients

At my medical school (Barts and the Royal London School of Medicine and Dentistry) we are proud that the Royal London Hospital (a major trauma centre) is one of the few hospitals in the country with a helipad on the roof. However, they are a lot more common in Australia! I realised that although the mechanism of injury is similar in both countries, the way the trauma service has to be delivered is not – due to the massive difference in geography. As the UK has a much smaller land mass in comparison, patients are rarely more than a few hours drive from a hospital. Clearly, in Australia this is very different, particularly if a patient needs to get to a major trauma centre rather than a small rural hospital. As a consequence, transport is used differently. In London,

the Helicopter Emergency Medical Service (HEMS) is used primarily to treat and bring severely injured patients to an appropriate hospital. This is also the case in Australia; however, the air ambulance is also used for transfers between hospitals. It seems therefore that Australia has potentially more difficulty accessing trauma patients and bringing them to an appropriate hospital than we do in the UK, which may affect patient outcomes. [5]

Major trauma centres

The experience of being in the 'resus room' at Liverpool Hospital was very similar to my experience at the Royal London Hospital. At Liverpool I was very impressed by the slick, coordinated and well-organised trauma calls, with everyone aware of their roles and clearly following the same trauma protocol with every patient. Perhaps slightly strangely, it made me think that if I were to be unfortunate enough to be stabbed or run over on my elective, this was where I would want to go. This meticulous approach to detail in management of the trauma patient and the expert care they receive has evidence to support it. I did not, however, realise what an impact it had – a study in the United States has shown that high-volume trauma centres reduce death from major injury by up to 50%. [6] Major trauma patients who are managed initially in local hospitals are also up to five times more likely to die than those who are taken directly to a major trauma centre. [7] Quite astounding statistics, which added to my increasing realisation of how important these centres are, in collaboration with a well-organised trauma service.

Next stage in care

Experiencing the next stage of the patient's journey was an enriching learning process, something I had not done before. This meant going to the ICU on daily rounds, and seeing the consequences of the traumatic event that brought them into the resus room. It allowed me to see trauma as a disease process rather than a one-off event, and to appreciate the importance of the 'chain of survival.' I was amazed by the many effects that trauma could produce, aside from the obvious broken bones or lacerations. I remember one case where a lady who had been in a motor vehicle collision had seat-belt marks across her chest and abdomen. She presented to the emergency department a few days after the event, complaining firstly of abdominal pain, which was later shown to be traumatic pancreatitis. She later suffered a transient ischaemic attack thought to be as a result of a haematoma that developed within her neck, due to the seat-belt trauma.

Conclusion

My experiences at both the Royal London Hospital in the UK and Liverpool Hospital in Australia were fantastic and provided a good understanding of how a trauma patient is managed. Whilst I may not have had as much hands-on experience as if I had gone to a developing country, being in two leading major trauma centres has taught me a huge amount and has been extremely inspiring.

Conflicts of Interest

None declared.

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The good, the bad and the ugly of mobile phone use in clinical practice

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After a great elective experience in London in 2009 Chris has been inspired to pursue a career in Neurosurgery. He is also an avid sportsman and particularly enjoys playing soccer and squash.

Act 1

Scene: at the bedside

Enter stage: registrar, intern, medical student, Mrs. Thompson

Registrar: "Hi Mrs. Thompson, how are you travelling?"

Mrs. Thompson: "Not too well dear, I've had a pounding headache since last night."

Registrar: "Really? Well you are recovering from a stroke, but I wonder if we have overlooked something. Maybe we should scan your head again?"

Medical student (to the rescue!): "We changed Mrs. Thompson's aspirin to Asasantin yesterday and it says here on my mobile phone application that Asasantin can cause headache. Should we try stopping it to see if her headache resolves before we zap her brain again?"

Act 2

Scene: outpatient clinics

Enter stage: consultant, medical student, Mr. McLeod

Consultant: "We seem to have your COPD under control with your current medications. It has been a while now since you've been hospitalised with an exacerbation."

Mr. McLeod: "Yeah I feel…"

Ring, ring (interruption by consultant's mobile phone)

Consultant: "Yes, it's me speaking. Go ahead…"

Conversation between consultant and his registrar regarding Mrs. Vince, a current inpatient; during conversation it is revealed to all present in the room that Mrs. Vince's bowel habits have been erratic and now she has PR bleeding; consultant recommends a gastro consult

Consultant: "Now, what were we saying?"

Act 3

Scene: at the bedside

Enter stage: consultant, registrar, intern, medical student

Mr. Walker's biopsy report has confirmed squamous cell carcinoma of the lung; it is now time to break the news to him

Consultant: "Hi Mr. Walker, how did you sleep?"

Mr. Walker: "Didn't get much sleep last night. I'm very anxious about the result."

Consultant: "Well, the result has come back and I'm afraid the news is not as good as we would have hoped for. Is your wife here with you today?"

Mr. Walker: "No she's just stepped out to run some errands. That's ok though, just give it to me straight. I want to know exactly what's going on."

Consultant: "Ok Mr. Walker. Well the biopsy reveals that you do have cancer. It is a type of lung cancer called squamous…"

Ring, ring (interruption by consultant's mobile phone)

Consultant: "Hold on Mr. Walker, I need to take this call. I will be back in a moment."

Registrar, intern and medical student standing around the patient's bed looking at each other and feeling rather awkward about the situation; meanwhile Mr. Walker has broken down and is now sobbing away after receiving the worst news of his life

~

The three scenarios described above have all been actual events that I have encountered during my clinical years of medical school. Although mobile phones have many benefits, such as allowing fast communication and access to important information at the point-of-care, there is also the potential for problems such as interference with vital medical equipment, breach of patient privacy and confidentiality, and frequent interruptions during consults, even whilst breaking bad news. In this article the pros and cons of mobile phone use in clinical practice will be discussed and we will hopefully gain some insight into how best to approach this dilemma as future clinicians.

Mobile phones are having an increasingly important role in day-to-day clinical practice and are now almost a necessity. However, not all that long ago there was an unwritten policy of no phones on ward rounds, in theatre or in lectures, as their use was considered rude. Yet these days we are almost blasé about their use. Personally, I must admit to using my own mobile phone on the wards and in the clinic setting. Although I tend to ignore phone calls and messages, replying when I feel it more appropriate, I do often reach for my pocket to use the multitude of applications on my iPhone© (created by Apple Inc., Cupertino, CA, USA). If despite all these "apps" I cannot find the answer to my clinical question, it is just as easy to gain access to the internet and Google™ it!

Then there is the flipside of patients using their mobile phones in hospital. If it is ok for clinicians to use their phones, why shouldn't it be the same for patients? An interesting article by Pearce explores this very issue. [1] In terms of patients using their phones in hospital, the author believes that there are three main sources of potential danger or inconvenience. Firstly, charging of mobile phones. There is a risk that patients may unplug medical devices in order to charge their phones, necessitating additional vigilance by nursing staff to ensure this does not happen. Secondly, ring tones and phone conversations. Noisy ring tones and loud talking can be irritating to both patients and staff. The final issue discussed is that of patient privacy and the

particular problem of taking photographs and videos using a mobile. On the other hand there are obvious benefits of allowing patients to use their phones. Mobile phones allow direct communication between the patient and their families or friends, not only reducing isolation, but also limiting calls to the ward enquiring about patients' well-being.

The use of mobile phones in hospital is very common, even in areas where it is "prohibited" such as in the intensive care unit (ICU). In one study, 66% of surgeons admitted to using their phones on a regular basis, including in operating theatres. [2] The capabilities of modern mobile phones are immense and the technology is relentlessly advancing. There is obvious potential for benefit. However, this needs to be weighed up against the problems associated with mobile phone use in the hospital. The good, the bad and the ugly of mobile phone use in clinical practice will now be explored.

The good

Improved communication

Trying to contact a doctor through the paging system employed by the majority of hospitals can sometimes be quite frustrating and inefficient. Using mobile phones allows direct contact, which is especially critical in cases of emergencies. In a study conducted at Queen Elizabeth Hospital in Barbados, telephone operators were asked to monitor time elapsed as they attempted to contact medical staff by various methods. [3] Overall, medical staff could be contacted within two minutes most easily by mobile phones and it was considered a more efficient means of communication. It will be interesting to see if the paging system will be superseded by mobile phone technology in the near future.

Photo-messaging is another tool which has led to improvements in communication. Registrars can take photos of, for example, a traumatic injury or a peculiar rash, and forward it to their consultant for an opinion. Lam *et al.* utilised mobile phone photo-messaging in 27 cases of hand trauma for communication between the registrar and consultant, and based on their findings recommended the technology in clinical practice. [4]

Another potentially useful application of mobile phones is in medical image transmission. Because the medical imaging systems are built and used in hospitals, doctors out of the hospital have problems accessing them immediately on emergent cases. Lee *et al.* [5] developed a system that could transmit the images acquired by medical imaging systems in hospital to the remote doctors' handheld device using a cellular phone network.

Communication can also be improved between the hospital and patients. A study at the Royal Children's Hospital in Melbourne revealed that using SMS text messaging improves outpatient attendance. [6] Furthermore the cost of sending the SMS reminders was small compared with the increase in patient revenue and associated benefits generated as a result of improved attendance. Phone applications which send alert messages have also been developed to help increase patient compliance with taking medication.

Improved clinical practice

One of the greatest benefits of mobile phones in clinical practice is having immediate access to medical information at the point-of-care. This has the potential to reduce costs, improve accuracy in diagnosis and treatment, reduce errors and optimise workflow. [7] Personally, I refer to a handful of applications on a daily basis when I am unsure of a particular diagnosis or just need a quick refresher. One of the most useful applications that I have is Epocrates© (created by Epocrates Inc., San Mateo, CA, USA), which provides access to several resources including a drug guide. Within seconds I am able to search a particular medication, find the appropriate dose for the patient and be warned of any specific safety and monitoring issues. As an intern, this will be an invaluable tool.

Leon *et al.* [8] implemented and evaluated point-of-care, wireless internet access using smart phones for information retrieval during daily clinical rounds and academic activities of internal medicine residents in a community hospital. Overall, the doctors found these devices easy to use and the information retrieved was perceived to be useful for patient care and academic activities. Mobile phones are also useful for personal scheduling and checking emails on the go.

Miscellaneous

Some very interesting uses for mobile phones have been explored. One example is the application of mobile phone technology for managing chemotherapy-associated side-effects. [9] The symptoms of a patient are communicated to healthcare professionals via a server and they are then provided advice on management of toxicity. Overall the patients felt secure in the knowledge that their symptoms were being closely monitored and that they were participating effectively in their own care.

Another novel use of mobiles is for the assessment of burns as described by Shokrollahi *et al.* [10] Camera phones appear to be reliable for the assessment of total body surface area and burn depth in minor burns and potentially also in major burns.

Engineers at Washington University have recently created a device that incorporates ultrasound technology into a mobile phone. [11] Such technology can be particularly useful in diagnosing patients who have access difficulties and it can further improve medicine in developing countries.

The bad

Interference with medical equipment

When the use of mobile phones first became widespread, there was major concern regarding interference with vital equipment within the hospital. To this day, there are signs sporadically scattered throughout hospitals warning against the use of mobile phones particularly in areas such as the ICU and in theatre. The question arises however, are these concerns warranted? What impact does signage in the hospital have anyway? I can recall an instance where my registrar was holding open the door to the ICU whilst talking on her phone, and directly behind her was a "No Mobile Phones" sign. There have been some anecdotal reports of phones causing interference; however in general this is usually harmless to the patient such as alarms being triggered and electrocardiograms showing reversible aberrations. Overall, the evidence suggests that there is no significant risk from using mobile phones in hospitals as long as they are more than one metre away from sensitive equipment. [12] Furthermore, with advances in technology, newer medical equipment is becoming less sensitive to interference, as manufacturers are adopting increasingly stringent standards for screening. [13]

Interruptions

Witnessing constant interruptions by mobile phones during patient consultations on the wards and in the outpatient clinics is what really prompted me to reflect on this issue. Oftentimes patients are stopped mid-sentence and the doctor draws his or her focus elsewhere momentarily. This results in a distracted doctor who may then go on to forget vital pieces of information and subsequently fail to manage their patient optimally. Unfortunately, the rude interruptions are not always followed by an apology. It reaches breaking point when the clinician performs a truly insensitive and inappropriate act by answering their phone shortly after informing a patient of a serious diagnosis. Another important point to make is that it is difficult for a clinician to offer good advice regarding another patient over the phone, particularly when they already have a patient in front of them. This is because of both confidentiality issues and the fact that the clinician may be distracted by thoughts regarding their current patient.

These days, as medical students, we have come to expect at least one interruption per lecture by the clinician taking a phone call. Although it is understandable that they are busy people and are awaiting important calls, it can be quite frustrating once the lecturer has ended the call and

tries to re-engage a distracted group, often having forgotten their train of thought. On the other hand, clinicians have expressed their disdain regarding medical students sneakily sending an SMS under the desk or preferring to play a game on their iPhone rather than pay attention to the lecture content.

Thankfully, interruptions by mobile phones have become a recognised issue and groups have tried to implement strategies to reduce them. Solvoll and Scholl [14] proposed a system which would intercept the signals from the existing communication system before they are sent out to the mobile devices. The signals would then be routed through a context-aware system, paired with context information and available rules defined by the doctor, which will then decide what to do.

Privacy and confidentiality issues

Mobile phones nowadays have the capabilities to take high resolution still photos and even high definition videos. This has raised concern regarding breach of patient privacy and confidentiality. Unless explicit patient consent is given, it is not appropriate to take a photo of a patient's ailment and share it with others. At a bare minimum, there must be an effort to de-personalise a photo, by not including their face and covering any names that may appear in the image. In the United Kingdom, the confusion surrounding use of mobile phones in hospitals has led to the Medicines and Healthcare Products Regulatory Agency advising more selective restrictions on their use. [15] They have reasonably suggested that a total ban on mobile phones is not needed and is impossible to enforce effectively, but they do acknowledge that the use of camera phones may compromise patient confidentiality.

Another concern is with regards to the discussion of a patient over a mobile phone conversation. You only need to walk the corridors of a hospital or take a ride in the lift to hear a doctor or other healthcare professional discussing their patient with little concern about confidentiality. An effort should be made to delay such conversations until in a private setting.

The ugly

There has been evidence to suggest that nosocomial pathogens can be transferred throughout a hospital on objects such as ties and lanyards, to the point where some hospitals have now developed recommendations regarding "dangling bits." However, do we realise that our mobile phones are just as good an incubator for pathogens? In a study conducted by Ulger *et al.* [16], the contamination rate of healthcare workers' mobile phones and hands in the operating room and ICU was determined. In total, 94.5% of mobile phones demonstrated evidence of bacterial contamination with various bacteria (gram negative strains in 31.3% and *Staphylococcus Aureus* in 52%, including methicillin-resistant strains). Overall, distributions of the isolated microorganisms from mobile phones were similar to strains isolated from hands, and some phones were contaminated with nosocomially-important pathogens. The authors go on to suggest that we may need to develop active preventative strategies such as routine decontamination of mobile phones with alcohol-containing disinfectant to reduce the risk of cross-infection.

Conclusion

Having now reflected on the issue of mobile phone use in clinical practice, it is pertinent to adopt certain practises that will allow us as future clinicians to attain the benefits of mobile phones, without compromising patient care and respect.

Firstly, and most importantly, one should not answer their phone or respond to a message during consultation with a patient. If, for some unforeseen reason, there is no alternative but to answer the phone, a sincere apology should be promptly provided. Whether or not, as discussed above, certain strategies to reduce interruptions will be implemented remains to be seen. For now, it is easy enough to simply put one's phone on silent mode and respond when more appropriate. Furthermore, when discussing another patient over the phone, one should ensure that it is done in a suitable setting in order to uphold all patients' right to privacy and confidentiality. If it is useful to take a photo of a patient's ailment and share it with a colleague for educational purposes or for advice, firstly the patient's permission should be obtained. Then we should do our utmost to ensure their face does not appear in the image, and that all names are disguised.

Regarding the risk of interference with medical equipment by mobile phones, the evidence suggests that it is safe to use a mobile phone so long as there is at least a one metre distance from sensitive equipment.

Finally, now having the knowledge that mobile phones are potential sources of spread of infection, it would be sensible to sanitise our hands after their use and periodically give our phones a thorough clean with an alcoholic-based antiseptic solution.

By implementing the above strategies, we can exploit the benefits, whilst minimising the potential bad or ugly aspects, of mobile phone use in clinical practice.

Conflicts of Interest

None declared.

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Up the creek without a paddle: An Australian take on disaster medicine

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Disaster medicine is a subject category that invokes thoughts of emergency medicine on a much grander scale; one that involves all levels of healthcare governance. But in reality, it is an area of medicine that is often neglected in Australia, despite its pertinence in this land of extremes. This has been shown to be currently so with the education of Australian medical students, where it is perceived as being too "young a branch on the old tree of medicine." [1] But what exactly is disaster medicine, and why is there a lack of discussion of this field in a country so often threatened by disasters, natural and man-made? This was recently investigated by a delegation of medical students across Australia during a summer course in disaster medicine and management. They were amongst the 41 students, across five continents, that converged upon Gadjah Mada University in Yogyakarta, Indonesia under the auspices of the World Health Organisation and the Indonesian Ministry of Health. The following article explores the nature of disaster medicine. It then outlines the experiences of students undertaking the summer course run in Indonesia in this area. Finally, it provides an insight into the potential value of incorporating disaster medicine training into the Australian medical education curriculum.

Introduction

Imagine you are on placement in a rural location in the middle of summer enjoying your free time when wildfires rapidly surround and engulf the town you are based in. Local gas explosions rock the area, as you see dozens of patients with severe burns or in critical conditions lying on the ground. Some are conscious, screaming or clutching their abdomens, while others are unconscious and there is word of hundreds more streaming into the local hospital to escape the fires. All desperately need your help. Hysteria erupts and communication lines are down due to the catastrophe that has suddenly occurred. With nothing in hand, what do you do with no one else on the scene? Who do you save and how do you deal with streams of panicking individuals?

The term 'disaster medicine' is difficult to define, and over the years numerous definitions have been proposed as the discipline began to flourish. The World Health Organisation (WHO) defines 'disaster' as an occurrence where normal conditions of existence are disrupted and the level of suffering exceeds the capacity of the hazard-affected community to respond to it. [2] The distinct difference between disaster and emergency being that external assistance would be required for a disaster but not an emergency. However, as seen with the various other definitions in existence, no real standard exists; and the prevailing view of those in the field is that the aim is to not only provide aid at the time of a disaster, but also before and afterwards. [1,3-4] This is in order to adequately prepare for the potential risks and address the full impact of a given disaster's consequences on the community as a whole. It requires a collaborative effort from numerous established medical disciplines, from emergency medicine to communicable diseases, paediatrics and non-medical organisations. The areas of logistics, potable water provision, food, sanitation and shelter also need to be equally addressed in the response process. [1,3-4]

Figure 1. *Participants are assessed in water rescue from a previous module during a water rafting exercise. Here, participants begin to resuscitate an unconscious patient during a disaster simulation.*

The current view has shifted from simply providing emergency relief (as understood in the WHO's definition) to a more holistic approach incorporating risk reduction and management as preventative measures to decrease the overall impact of a potential disaster. [1,3-4] This is a key change in the mentality of the discipline, as it aims to address causal factors through the basic tenants of disaster medicine: prevention, preparedness, mitigation, response and recovery. [5] These demand a multi-levelled approach encompassing local, regional, national and international organisations.

The field of disaster medicine is both broad and unpredictable, and health workers need to be aware of the realities a disaster presents. Survivors are often forced to live in cramped overcrowded conditions with little access to safe drinking water and adequate sanitation, creating further health risks. [6] These conditions can consequently involve communicable and vector-borne diseases which serve to exacerbate the situation.

The fallout from a disaster situation cannot be neglected. It should be noted that the consequences are not only to infrastructure; nor are all injuries and diseases immediately treatable. The population is burdened with the long term health effects from physical and psychological trauma, as well as the reality of having to adjust to an altered way of life and the loss of loved ones. This can understandably leave an emotional and functional void. [7-8] Human dignity and proper protocols must be maintained despite the chaos that can ensue. [7] Triage is a necessity in times of crisis, as is the identification of bodies and correct management of the deceased - this is integral to the disaster response to not only gauge the extent of the human cost, but because it is just. [7] The terrible reality is that these are daily

occurrences worldwide. It is estimated that at least one natural disaster occurs per day somewhere in the world, with the potential for mass casualty being ever-present. [4] This estimation does sound alarming, but it does not even take into account the 'man-made' disasters which occur with similar frequency. It was thus with these diverse fields in mind that medical students from sixteen countries took part in disaster medicine training in Yogyakarta, Indonesia.

An Indonesian learning experience

Given its location on the edges of tectonic plates, Indonesia is at the epicentre of frequent earthquakes and volcanic eruptions. This is notwithstanding its long history of many other natural disasters including floods, landslides and tropical cyclones. As a consequence, the nation – especially through its network of health sectors – is particularly equipped with indisputable expertise when it comes to crisis management. In order to cope with these catastrophes, the Ministry of Health has established nine regional crisis centres around the country to formulate guidelines and respond to health crisis brought on by these disasters. [9] These centres are also responsible for strengthening the partnership between government, non-governmental organisations (NGO) and local communities, in addition to the capacity building of human resources. Coordination among all sectors is essential in disaster response, for better outcomes and to prevent the duplication of efforts.

A range of speakers addressed issues that arise during emergencies and disasters. One concerned disaster victim identification and dead body management. In another session, Albert Maramis, WHO representative in Indonesia, spoke about the importance of tackling mental and psychosocial issues after a traumatic event. Psychiatrist, Dr Carla Marchira, also explored the use of therapeutic communication in managing these mental health problems. Nur Azid Mahardinata from the medical faculty of Gadjah Mada University discussed ethical issues in disasters and the principles in approaching these dilemmas. Dr Paul Byleveld from the Australian Red Cross brought forward issues regarding communicable disease control and introduced the participants to the Sphere Project, which is a set of minimum standards in providing humanitarian assistance.

As part of the course, the participants visited Yogyakarta's Sardjito Hospital and were briefed by the Chief of Emergency about the structure of the department. According to the Chief of Emergency, the department was very busy, with only a doctor and a nurse on call. During the participants' time there, two patients lay in the ward; one suffering from an acute myocardial infarction from a few hours prior and the other with dengue haemorrhagic fever and meningitis. Immediately, six patients were brought into the department – all of whom appeared to have been involved in a car accident - with head and chest wounds, and open leg fractures.

The students were immediately handed stethoscopes, asked to assess the vital signs and stabilise the patients. Needless to say, it isn't hard to imagine that participants' hearts were racing and adrenaline pumping. Fifteen minutes in, the atmosphere in the department changed abruptly and applause was audible. Victims previously in pain were seen sitting up on the beds with broad smiles, apparently without any real injuries. It was in fact a simulation designed to assess student's responsiveness to the wounded, especially under stressful conditions such as that in an emergency department. It definitely comprised one of the most memorable experiences during the summer course.

Figure 2. *Dr. Vijay Nath Kyaw Win guiding a disaster medicine summer course participant through stabilising and assessing a patient during a simulation.*

Four sessions had particularly been devised in preparing students for practical scenarios. Students first learnt to save drowning victims in a swimming pool with and without equipment during water rescue training. This was followed by providing aid to the victims while water rafting. Furthermore, a clinical skills day on triage, basic life support, intubation, suturing and victim transport was conducted. The most intriguing session was one where participants were taught to fully utilise limited resources; including banana leaves as bandages, ice cream sticks as splints, jackets as stretchers and flip-flops as cervical collars. Lastly, participants took part in role-playing another simulation on the final day of the course to reinforce previously acquired knowledge on triage, treatment and transport of victims.

The participants also managed to visit YAKKUM Rehabilitation Centre, a foundation which empowers people with disabilities to achieve maximum independence in their daily lives. The organisation provides medical, psychosocial support, occupational therapy, vocational training and physical mobility aids to children and young adults to support their well-being and personal development. People with disabilities, regardless of their age and background, are able to resume their education and receive sufficient training for employment. [10] In short, the foundation plays a significant role in the rehabilitation phase of disaster management.

In all these aspects, this course provided an interdisciplinary learning experience related to all phases of the disaster cycle; from the aforementioned disaster simulations, interactive lectures and skills training, to field trips and group discussions to allow self-evaluation. It is thus a program that accurately reflects the real-world dynamics that determine our responses to disaster situations.

An Australian learning experience

So how does this all relate to back here in Australia? Australia is lucky enough to escape the Pacific Ring of Fire but let us not forget that this beautiful country is still very much plagued by many other calamities. It does not take long for one to look back at the memories of the south-eastern Australian heat wave that caused over 300 fatalities or the Victorian bushfires that claimed almost 200 lives. [11,12] Australia has a long-established reputation as a country that provides assistance in disaster response and reconstruction to various countries, especially those in the Asia-Pacific region. Nevertheless there is an apparent dearth of emphasis on the training of these skills in Australian medical schools. Instead, training is mostly available through emergency relief organisations such as the Red Cross, Caritas and RedR. Given this, it is not hard to imagine a scenario where disaster management is integrated into the curriculum of medical schools to give students an early exposure to this specific branch of medicine.

There have been several studies that have shown improved learning outcomes for medical students undergoing disaster medicine training. One such Italian study by Ingrassia *et al.*, [13] in a context similar to that of the WHO-approved Indonesian summer course, found improvement in final year students in terms of disaster medicine knowledge, triage skills and enthusiasm for further learning. This was despite a lack of significant improvement in theoretically-assessed knowledge. However, a more recent US study did find significant improvement in theoretical assessments before and after practical skills training – perhaps due to the performance-based characteristic of the training. [14] And the most recent study, coming from the University of California Los Angeles, found that the multidisciplinary training of medical students in disaster medicine by experienced practitioners motivated students,

refocused the medical school's service to the community and provided interaction between the many levels of government and community in a country not dissimilar to Australia's in terms of potential hazards. In all these studies, there is unanimity in recommending disaster medicine incorporation into the medical curriculum. [14-15] In 2003, the American College of Emergency Physicians recommended medical students, in addition to physicians, attain proficiency in response to disastrous events; [14] so why not the same in Australia, where we potentially face similar, if not more severe, disasters in the context of climate change?

There have been moves towards recognising disaster medicine training as a valued commodity. The Emergency South Australian Conference has involved the disaster management training of health professionals across the entire spectrum of doctors and allied health staff in the field of emergency medicine. However, such conference opportunities are limited for medical students - being primarily aimed at those already specialised in the field. Medical students thus miss out on valuable opportunities to expand their knowledge-base to deal with potential disaster situations, should they occur. There have been valuable attempts at addressing this through the Emergency Medical Challenge, an integral part of the Australian Medical Students' Convention, and the AMSA Global Health Conference Challenge Day. These give students a taste of what it is like to participate in triage, emergency relief and stabilisation; and are much appreciated by students across Australia. But for the medical students of today to be adequately prepared for the 'what if' scenarios that we may face as future doctors – be it bushfires, floods or cyclones – the role of standardised disaster medicine training in medical student education should be properly recognised.

The reality

So what will it all mean on an individual level for medical students who may face the difficult prospect of being caught in a disaster, however rare that may be? One must not forget medical students are of course, human beings. One would expect that students would be caught too, in the initial period of shock that tends to follow abrupt disasters. Indeed, this was thoroughly and embarrassingly reflected in the Sardjito Hospital experience. But, as students tended to find through the duration of the training course, knowledge, attitude and conduct in simulated disasters progressively and quantitatively improved. This improvement was shown in the final assessment, a scenario with similar characteristics to the first assessment in Sardjito Hospital – an unknown environment, makeshift communication lines, panicky patients and a myriad of potential injuries, ranging from the mundane to the life-threatening.

This time, after two weeks of intensive education in theory, protocols and foundation ethics, the initial period of shock for the assessed students was drastically reduced. The skills ingrained in leadership, communication, basic triage, stabilisation and transport proved valuable in cutting the time of panic down from minutes to seconds – a difference medical students know can prove crucial in an emergency. But the difficulties in performing under duress cannot be overlooked. Some students, in the heat of the moment, missed gradual changes in patient's vital signs, leading to potentially dangerous complications later on. Others, too focused on transport or treatment, neglected patient stabilisation. This resulted in mishandling of the patient, causing them to fall from their stretcher and collapse onto the ground. And for one other set of students, the contention came to be in leaving particular victims beyond rescue, and rescuing those out of the danger zone deemed recoverable. It brings up another potential flashpoint for the individual medical student in a disaster situation; the ethics of that momentous instant in deciding which patients are believed to be beyond care and those that are not.

These were all lessons that were taken on board by all students in the debriefing session that followed, and will surely be decisions faced by all medical students regardless of any standardised training course, such as that mentioned. But such individual difficulties are not unmanageable. They can be overcome with prior teaching and experience. These are skills that can be gradually learnt, through ethics tutorials, critical thinking scenarios and practical experiences that get students to think outside of the box of what could happen, not of what does happen as in textbooks.

The wider world

Not only will incorporation of disaster medicine into school curricula provide solid knowledge bases for participants to develop into the future, it will also allow greater collaboration with the community that medical students serve, and be flexible enough to allow interdisciplinary training across varying curriculums. And isn't that what the changing fabric of our society now demands?

Though many lives can be saved through preparedness, evacuation protocols and early warning systems, there is always more that can be done, as seen unfortunately in the case of the 2009 Victorian bushfires. Such hazardous scenarios demand the flexibility, cross-professional communication and individual leadership training that disaster medicine-oriented curricula can provide. Even in the region of the Asia-Pacific, where Australia is seen to naturally take a humanitarian leadership role, expertise in disasters is relegated to a niche level. But as found in Indonesia during the summer course in disaster medicine, any individual can learn life saving disaster-oriented skills and work together with people from across different cultures and disciplines. Medical students, as future health practitioners, are in the especially privileged position of having the clinical knowledge, professionalism and ethical training to deal with casualties on a mass scale. This is reason enough why training in disaster medicine can be so valuable. With the required knowledge in international law, human rights and cross-cultural understanding that can already be found in Australian medical curricula, it is not hard to imagine a competency-based addition to an education system already geared to producing high quality doctors in this corner of an increasingly interconnected world.

In the past year, torrential floods ravaged Pakistan in the worst natural disaster in a generation, landslides destroyed entire villages in China and over 600 wildfires burnt through Russia into the radioactive fallout zone of that other disaster of yesteryear, Chernobyl. The impacts of climate change loom upon the horizon, and the critical evaluations of the Australian response to the Victorian bushfires continue. It is not surprising that the world needs future leaders in disaster management; people who, in that moment of shock immediately after a catastrophe, can provide logical and inspirational direction. The question then is: will you be able answer the call when that need arises?

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Figure 3. *Disaster management requires interdisciplinary and cross-cultural cooperation under difficult circumstances. Here, course participants of different backgrounds work closely together to achieve success by triaging and stabilising the patient quickly and efficiently.*

for their assistance. The authors would also like to dedicate this article to the lives lost in the 2010 eruption of Mount Merapi, and the staff and students at Gadjah Mada University who aided those in need.

Conflicts of Interest

None declared.

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Better preparing Australian medical graduates: Learning from the New Zealand model of trainee interns

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The New Zealand experience of preparation

In New Zealand, the trainee intern (TI) year is a clinical apprenticeship year undertaken in a hospital under the aegis of a medical school. It is undertaken in the final year of medical school and comprises eight clinical attachments (Table 1). The year aims to provide learning in the work environment with limited clinical responsibility. Trainee interns are paid an annual stipend (60% of a house officer's salary) from the New Zealand government via the education budget; however, the year remains under the jurisdiction of the medical school and thus retains an education focus. Although required to be supervised, TIs contribute to service (taking on approximately one-third of the patient load) and often stay on after graduation in their respective hospitals for postgraduate year one (PGY1). [1,2] Formal education and rotation assessment occur continuously throughout the year.

Table 1: *Attachments during the trainee intern year. [2]*

Rotation	Weeks
Medicine	8
Surgery	8
Paediatrics	4
Obstetrics and gynaecology	4
General practice	4
Psychological medicine	6
Medical and surgical reserve	2
Electives	12

In Australia, there is no equivalent transition from medical school to internship and this transition may be overlooked. Medical graduates switch from enjoying little or no clinical responsibility to suddenly being accountable for the safety and management of a large number of inpatients. This precipitous change of role affords minimal time for satisfactory adaptation and preparation for the stress associated with internship. Some medical schools have attempted to soften this transition by introducing pre-internship terms into the curricula. [3]

Transitional stress from medical student to intern

The transition from university to workplace, with accompanying increase in professional responsibilities, is inherently challenging for most graduates. The reality of being personally responsible for patients can induce stress, psychiatric morbidity (including depression and anxiety) and burnout. [4] In a prospective longitudinal study of 110 interns who had graduated from the University of Sydney, 70% of interns met criteria for a psychiatric disturbance on at least one occasion during PGY1. This level of stress leads to decreased effectiveness at work and a reduced level of patient care. [4,5]

Some identified stressors include newly gained responsibility, managing uncertainty, working in multi-professional teams, experiencing the sudden death of patients and feeling unsupported. The stress of transition can be reduced with early clinical exposure, including

opportunities to act in the role of a junior doctor. [6]

Lack of preparedness for internship

Despite extensive research and frequent appraisal of medical curricula, junior doctors still perceive gaps in their preparation for internship. In one survey of interns, medico-legal aspects and resuscitation skills were identified as areas where interns felt inadequately prepared. [7]

Procedural confidence is positively correlated with exposure to procedures. [8] Formal theoretical teaching that is disconnected from direct clinical cases is perceived to be of limited value in clinical years. [9] A substantial proportion of medical students in Australia enter their intern year without adequate procedural skills experience. [10-12] This lack of experience is a significant stressor for many junior doctors.

Prescribing medications is an essential task for an intern. In one Australian study, interns about to commence clinical practice demonstrated significant deficits in prescribing regular medications, initiating new therapies and prescribing discharge medications. They were particularly poor at prescribing Schedule 8 medications.

Less than half of the participants agreed that they felt adequately trained to prescribe medications in their intern year and not one of the participants strongly agreed they were completely prepared. [13] Junior doctors have also been shown to perform poorly in calculating drug doses, one of the most common prescribing errors and a significant contributor to morbidity and mortality among hospital patients. [14,15] Many medical students would testify that although these are skills which are able to be taught in the classroom, they can only be learnt effectively from familiarity and experience on the wards.

In Australia, there are significant barriers to student access to patients. [16,17] As a TI, with greater responsibility within a team, a commensurate increase in opportunities for clinical encounters with patients would follow. Students in the TI role would be entitled, indeed required, to participate. In addition, the role of TI would offer greater familiarisation with clinical documentation, an important aspect considering the substantial proportion of time interns spend performing administrative duties and the importance of good record keeping. [18]

In New Zealand, there is evidence that TIs feel better prepared to practice. At the end of the trainee intern year, 92% of students felt prepared to be a junior doctor, versus only 53% at the end of year five. [19] This is a substantially higher proportion than that found in a similar study of final year medical students in Australia (64%). [20] While it is acknowledged that such data regards perceived and not measured competence and performance, it does provide reassurance that the TI year may ease the transition to the junior doctor role. [21,22]

Financial impact of final year medicine

After time management issues, medical students rank financial pressures as the main factor causing stress during their medical degree. [23] In particular, compulsory rural placements and elective placements, where the student is absent from their regular place of employment, can be a significant financial burden for medical students. While many medical schools support students at rural sites with free accommodation and travel reimbursements, the loss of income for up to two months while away makes ongoing living expenses, such as rent at their base site, as well as other necessities, difficult to afford. The stipend associated with the TI program would reduce this financial stress considerably.

In addition to remunerating students for their work, there are other benefits of receiving a salary. The fact that TIs are recognised as paid staff places a responsibility on them to perform well, and in doing so, prepares them more adequately for internship. [2] In Australia, anecdotal evidence suggests that even in their final year, medical students are frequently pushed aside, relegated to the position of observer or made to feel like a nuisance rather than a useful component of their respective teams.

Contribution of trainee interns

There is evidence that TIs positively contribute to patient care. [24] In New Zealand, they are expected to manage approximately one-third of the patient load, providing much needed relief for interns. The advantages of TIs extend beyond metropolitan hospitals. In rural areas, final year students have been credited with making a net contribution to the system and augmenting the local workforce. [25] TIs also had a positive impact in general practice, with demonstrated improvement in the quality of both patient care and communication. [24]

Conclusion

An effective medical education continuum, involving active ward involvement will better prepare graduates for PGY1. Empowering medical students by establishing a paid trainee intern year (undergraduate courses) or rotation (postgraduate courses) could translate into increased proficiency in working within a multidisciplinary team, greater confidence and improved clinical ability. This term, prior to commencement of internship, would offer a smoother transition between student and junior doctor, affording greater responsibility and providing increased practical experience to medical students. Further discussion and debate about the most effective path to prepare final year medical students for internship is needed, with serious consideration of a paid trainee internship term in all Australian medical schools, suited to the Australian context.

Conflicts of Interest

None declared.

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Contemporary rural health workforce policy in Australia: Evidence-based or ease-based?

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Introduction

Australia has a history of a rural health workforce shortage. This shortage was originally perceived to be within the context of an overall oversupply of health practitioners throughout Australia, an assumption that is now believed to be erroneous. Likewise, interest group support for Government policy responses to the maldistribution has waned over time. Regardless, Australia has consistently experienced a shortage of health workers in rural areas.

This article critiques the development of contemporary rural health workforce policy in Australia against theories of policy development, highlighting the introduction of section 19AB (the "ten year moratorium") in 1996 to the Health Insurance Act 1973 as a turning-point for the selection of policy instruments.

The Australian Healthcare System

Medicare is Australia's universal healthcare system. The provision of medical care by medical practitioners in Australia is regulated through Medicare Provider Numbers (MPNs). A doctor must obtain a MPN in order to charge fees for professional services rendered outside of salaried hospital positions. [1]

In 1996, the Australian Federal Government introduced an amendment to the Health Insurance Act 1973 (the Act), restricting access to MPNs by foreign graduates of an accredited medical school (FGAMS; a term which includes international students studying at Australian medical schools) and overseas trained doctors (OTDs). For simplicity, this article will hereafter use the term OTD to refer to both OTDs and FGAMS. Under the amendment, OTDs must wait a minimum period of ten years from the date of their first Australian medical registration before being eligible for a MPN. This requirement, introduced under section 19AB of the Act, has subsequently been referred to as the "ten year moratorium."

By 1999, Government policy began to utilise section 19AB exemptions as a means to address rural health workforce shortage. OTDs willing to work in Districts of Workforce Shortage (DWS) were given access to MPNs. [2] These DWS are determined by the Federal Government's Department of Health and Ageing (DoHA), and consistently have primarily been rural and remote areas.

Policy introduction: The Ten Year Moratorium

Issue identification

The introduction of section 19AB was undertaken within the context of a perceived oversupply of urban doctors and ballooning costs to the Government through Medicare's fee-for-service system. [4-6] These costs were a result of the introduction of Medicare in 1984, which caused private health insurance rates to plummet, shifting responsibility for healthcare costs from individuals to the Federal Government. [7] Accordingly, the bill introducing the moratorium was the consequence of a 1996 Budget decision. [8]

Policy analysis and policy instruments

In line with the budgetary issues identified, the express goal of the policy was to "reduce one of the major growth pressures on Medicare, making it more sustainable in the longer term." [9]

The Government was therefore preoccupied by the first of two

fundamental parameters in healthcare: cost and equity of access. [10] Although by 1996 the rural medical workforce shortage was well documented, the focus on cost was justified by the perception that the shortage was due to misdistribution in the context of overall oversupply. [9,11] The Health Minister stated that it was ridiculous to recruit OTDs for areas of need when there were Australian Trained Doctors (ATDs) who could provide services there. [12] Additionally, there was a strong belief by the Department of Health and Family Services that healthcare costs would increase in proportion to the number of doctors. [13]

While the goal could be achieved in many ways, framing the issue as doctor oversupply led to the preference for a supply-side solution. In the words of then Health Minister, Dr. Michael Wooldridge, "Health has a demand curve that is relatively inelastic. People will demand much of it, regardless of the price. If we wish to keep that affordable, which it is barely, then we have... to look at the issue of supply." [14]

In light of the urgent nature of the budgetary issue, the Government was not willing to impose quotas on the numbers of medical students training in Australia as the six year delay in the impact of such a policy was simply too long. [15]

The Government initially sought to restrict MPNs by requiring ATDs to undergo postgraduate (specialist) training in order to access MPNs. Section 19AB was only introduced in a change to the Health Insurance Amendment Bill (No 2) 1996 (the Bill) after it had already been presented to parliament. [5] This is of interest when taken with the Health Minister's claim that the principal savings from the Bill would come from the OTD provisions. [15] Unsurprisingly, Dr. Wooldridge went on to say that the Government had not quantified these savings. Perhaps, with cynicism, this is symptomatic of an over-confident governing Coalition neglecting complete policy analysis.

Althaus, Bridgman and Davis [3] describe five analytic frameworks for policy: economic, legal, social, political and environmental. The primary decision parameters in this case lay within the economic framework. Analysis using other frameworks also reinforced the view that Australia's health budget could be best controlled by decreasing doctor numbers through restricting access to MPNs. [4]

Under legal and social considerations, when questioned why the Government did not reimpose a quota to restrict OTD access to the Australian Medical Council examinations, the justification given was

that the imposition of a quota on OTDs who were actively recruited by Australia would be unfair and discriminatory against a large number of Australian citizen OTDs. [14]

Under the political framework, it was questioned how the governing Coalition could reconcile a restrictive policy with their liberal economic ideology. The Government considered health a special case due to its inelastic demand curve and the disparate knowledge levels between consumer and provider. [15] Such a case was deemed inappropriate for a competitive market model. Furthermore, while the newly elected Coalition was less adverse to alienating the ethnic lobby in targeting OTDs than the previous Labor Government, party ideology alone is unlikely to have accounted for the selection of policy instruments given that the Labor Party "berated the Government for not implementing even tougher rules limiting the rights of OTDs." [6]

Finally, the Government utilised the political defence that the moratorium was bringing Australia into line with the policies of comparable countries. [12] Thus the proposed solution stood: restrict OTD access to MPNs.

Consultation

Consultation on the proposed moratorium was largely left to the Senate Community Affairs Legislation Committee to undertake in preparing its report to the Senate.

This committee received 96 submissions, including submissions from the Australian Doctors Trained Overseas Association (ADTOA), the Australian Medical Students' Association (AMSA), the Australian Medical Association (AMA), the Royal Australian College of General Practitioners (RACGP), the Rural Doctors Association of Australia (RDAA) and the Department of Health and Family Services. Its report concluded that the OTD measures were widely supported. [13]

While the Labor opposition report aired concerns that the moratorium would aggravate the rural health workforce shortage, [16] the primary concern of the Australian Democrats was the inadequacy of workforce data essential to planning for a rural medical workforce. [17]

In ignoring concerns highlighted in a number of submissions, and in announcing that "there will be a ten year moratorium" prior to amendment of the Bill to include this moratorium, [12] it is reasonable to conclude that the Government viewed consultation merely as a tool to validate the policy. This tokenistic approach to consultation detracts from its potential value in testing the strength of the Government's policy analysis.

Coordination

The coordination stage of policy development involves ensuring that policy is consistent and coherent across the many activities of a government. This typically involves certification of costings as accurate by a central finance agency. [3] Costings for the impact of section 19AB were deemed unnecessary [15] and so such a certification was not possible.

The ten year moratorium is also peculiar in that the policy problem was initially identified by the Treasury in budgetary discussions, while the policy solution was developed within the health portfolio. [7] Thus the policy arose from coordination itself. Despite this, the level of subsequent coordination for this policy appears to have been minimal.

Decision

In Australia, cabinet decisions are pivotal to policy development. The Government's fait accompli attitude to consultation and debate on section 19AB supports this description.

However, this view understates the influence of the Opposition. The Opposition raised this issue during debate on the Bill: "It seems that Ministers are oblivious to the fact that it is Parliament that makes the law and not Ministers. It [publicly announcing legislative changes before debate with voting having taken place] is a practice which holds the Parliament, and thus the people, in contempt and it is wrong in principle in that it encourages retrospective legislative provisions." [14] Indeed, it was only with support from minority parties in the Senate that the Bill passed.

Implementation and evaluation

The estimates of the Australian Medical Workforce Benchmarks study which underpinned the notion of a workforce oversupply were soon called into question. [18,19] In 1997 it was already predicted that the Government would succeed in reducing costs to Medicare, but at the expense of exacerbating the rural health workforce shortage. [6]

Australia had experienced a decade of medical workforce policy aimed at reducing supply, [20] including the capping of medical school places and reducing migration [21,22] when the workforce should have been growing in line with population growth. [23] It soon became apparent that areas of need would not be filled by ATDs. [24] Evaluation of the moratorium policy thus turned to how Government could remedy its mistake. This marked the beginning of a decade of incrementalist Australian rural health policy.

Subsequent developments

In 1999, the 5 Year OTD Scheme was introduced at the Australian Health Ministers' Conference. [25] This scheme waived the remaining balance of time on MPN restrictions for an OTD who had completed five years of general practice service in a DWS. [26]

Already in 1999 it was observed that the rural health debate had become centred on the role of medical practitioners, possibly due to framing of the issue by interest groups, and that a focus on public health infrastructure was lacking. [27] The Government defended this on account of its direct role in funding medical services through Medicare, while allied health was a State responsibility. [28] The division of powers between Federal and State Governments is a major constraint on policy instruments selection. Regardless, a plethora of alternative policy instruments were neglected in favour of utilising the existing moratorium framework.

Subsequent policies, such as More Doctors for Outer-Metro Measure in 2002 and Medicare Plus in 2003, further deepened the reliance on the moratorium as an instrument for addressing the rural health workforce shortage. [29] The haphazard approach of adding policies to patch defects in previous policies resulted in, by 2004, "a bewildering array of Australian policies and guidelines, differing surveillance and stewardship of OTD programs; enormous inconsistencies in terminology, lack of national coordination; with poor communication." [23]

The current situation

It is estimated that 41% of the Australian rural workforce is currently composed of OTDs. [30]

The AMA, AMSA, RDAA and RACGP no longer support the moratorium. [31-34] Loss of support for the moratorium is largely due to its failure to establish a stable rural health workforce, the questionable ethics of recruiting doctors from developing countries, and the inappropriateness of sending those who are often the least equipped to live and work in rural locations without adequate social and professional support. The ADTOA goes further in labelling the moratorium a blatant form of discrimination which contravenes the international charter of Human Rights. [35]

Reflection: Approaches to policy development

What does the progression of rural health workforce policy, leading to the current reliance on OTDs to service rural areas, say about the processes used to develop health policy in Australia?

The policy cycle

Althaus, Bridgman and Davis [3] advocate for the use of the policy cycle as a prescriptive notion, where policy development undergoes issue

identification, policy analysis and instrument selection, consultation, coordination, decision, implementation and evaluation. New issues identified in evaluation completes the policy cycle. This approach is the standard model of policy development taught in Australian policy studies.

The value of the policy cycle approach in the context of health policy development lies in its ability to disaggregate the complexity of the health system improvement into manageable steps. However, good process does not guarantee good policy. The policy cycle says little about the approach within each of its stages. For example, the inadequate/inaccurate evidence base used to justify the introduction of section 19AB, and the subsequent incrementalist mindset in policy analysis and instrument selection to address the rural health workforce shortage, both contributed to the eventual failure of contemporary rural health policy in Australia, despite use of the policy cycle.

Incrementalism

Under incrementalist conceptions of policy development, problems are addressed through small changes to existing programs and policy instruments. [3] However, in this case, the use of OTDs had become "a substitute for effective planning." [36] Dror [37] thus describes incrementalism as an ideological excuse for inertia and anti-innovation. Although the rural health workforce shortage is a complex problem that may "require a tentative solution to be understood," [38] the continued use of incremental solutions seen in Australia does little to solve the root problem.

Rationalism

A rational model of policy development requires agreement on goals and a clear understanding of methods. [3] Such an environment often exists in health policy. In the era of evidence-based medicine (EBM), both practitioners and the public expect an evidence-based health policy (EBHP) approach. Davies and Nutley [39] give the view that 'the research community in healthcare is truly global, and the drive to evidence-based policy and practice is pandemic.' Within Australia, the Rudd Government and its utilisation of the National Health and Hospitals Reform Commission clearly shifted the focus to the EBHP approach. Banks [40] observed that evidence-based policy is gaining momentum in Australian policy following "explicit endorsement by the Prime Minister and senior Ministers."

However, substantial reform in the name of rationalism but on the basis of flawed analyses or in the context of inadequate resources for implementation, may be dangerous in the healthcare setting. As Lindblom, [41] one of the early developers of incrementalist theory, later states, the size of step in policy making can be arranged on a continuum from small to large. Policy need not be at either extremity of this continuum.

Mixed-scanning

Etzioni [42] proposes such an alternative. His method of 'mixed-scanning' utilises overarching fundamental decisions combined with smaller incremental decisions that test and/or prepare for larger changes. Etzioni argues that rationalism is utopian and requires greater resources than decision-makers command, and that incrementalism ignores innovations while overlooking the fact that incremental decisions are made within the context of more fundamental policy shifts. Mixed-scanning limits the details required in fundamental decisions while avoiding the stagnation that accompanies incrementalism.

Whilst mixed-scanning is a logical approach, Etzioni overstated its departure from prior practice or thought. [43] In the light of Lindblom's description of a continuum of incrementalism to rationalism, Etzioni's argument for rationalistic models to be "rejected as being at once unrealistic and undesirable" seems to create a false dichotomy between rationalists and incrementalists in order to categorically deny their worth. For example, EBHP is a rational but non-comprehensive approach, just as EBM is not an insurmountable task for its practitioners. Mixed-scanning is essentially a practical application of Lindblom's acknowledgement that policy steps lie on a continuum.

Regardless of Etzioni's innovative significance, it would be imprudent not to consider the diminishing marginal utility of hard rationalism in comparison to mixed-scanning. A flexible application of the mixed-scanning approach is undeniably more cost effective.

Conclusion

In the development of Australian rural health policy, the mixed-scanning model should ideally be utilised to develop evidence-based policy within the overall process of the Australian policy cycle. Although this would require an increased self-awareness of approaches to policy from Australian politicians and public servants, perhaps it can remedy the ongoing rural health workforce shortage that is the legacy of our incrementalist past.

Acknowledgements

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Conflicts of Interest

None declared.

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Delays in adoption of statins on the Pharmaceutical Benefits Scheme: Reflections of a John Snow Scholar

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Michael came to medicine from a background of pharmacy. He was the Western Australian winner of the John Snow Scholarship for 2010. His research interests include endocrinology, preventive cardiovascular medicine, public health and clinical pharmacology. He hopes that some career can eventually be synthesised out of these!

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The evidence for using statins in diabetic patients with normal cholesterol levels to prevent myocardial infarction or stroke was firmly established in 2002 with the publication of the Heart Protection Study. This large, prospective controlled trial found a relative risk reduction attributable to statins of around 25% in this and other population groups. [1] Statins were not subsidised for this indication in Australia until 2006. [2] I conducted a research project that sought to quantify the effect of this delay in terms of the number of cardiovascular events that might otherwise have been prevented if the subsidy for statins had occurred in 2002, when the evidence for this indication became available.

Completion of the project provided me with a more complete understanding of the use of the breadth of data sources available to synthesise an answer to the research question: what was the impact of the delay in subsidising statin drugs for diabetics with normal cholesterol from 2002 to 2006, in terms of cardiovascular outcomes? It also gave me valuable insights into the public health implications of the decisions of Medicare Australia relating to the funding of drugs, such as those for lowering cholesterol for the primary or secondary prevention of cardiovascular disease.

As an unusual research question, for which I could find little precedent in the published literature, it posed a challenge in terms of designing some means of answering it and required a creative approach. I used baseline cardiovascular risk data from the United Kingdom Prospective Diabetes Study, [3] statin-related risk reduction data from the Heart Protection Study, [1] and epidemiological data from the Australian Bureau of Statistics' National Health Survey. [4] For one part of the study I also referred to unpublished data from the Perth Risk Factor Survey.

In order to integrate these data to provide an answer to my research question, I had to learn statistical methods and familiarise myself with software that I had never previously used, which was also very challenging and at times frustrating, although good supervision helped to somewhat offset this! I have no doubt that the skills learned will be of use in the future. I then had to present my research methodology and findings in the format of a journal article.

The project allowed me to learn about access to pharmaceuticals in Australia and how the decision-making process is conducted for subsidising medicines for particular patient groups. I gained a much better understanding of the relative effect size for drugs aimed at reducing cardiovascular risk in patients with high baseline risk compared to patients with low baseline risk. I also came to appreciate the trade-off between cost (and in some other cases, adverse effects) and benefits of a drug. If the cost outweighs the benefit, access to the drug may not be feasible or defensible from a public funding perspective. It can be difficult to determine how much society is prepared to pay to prevent a particular health outcome as this will depend on many economic, social and attitudinal factors. A detailed

analysis of health economics was not within the scope of my paper, but writing and reflecting on the paper has prompted me to wish to conduct further research on this subject.

Writing the paper has broadened my understanding of and interest in public health. One aspect in particular included is the concept of a government health insurance provider as a facilitator of treatment; and conversely, its non-subsidy of a treatment as a barrier to evidence-based health care. In particular, while the Pharmaceutical Benefits Scheme (PBS) in Australia does not constitute clinical guidelines for best practice itself, it should facilitate the adoption of current evidence within the limits of what the taxpayer can reasonably fund. It should be able to do this in a timely fashion, and should be able to do so independently.

In other words, the non-subsidisation by the PBS of a medicine that is cost-effective in a particular group represents a barrier to healthcare. This is not something that I found well characterised in the literature to date, possibly because the PBS has been overwhelmingly a facilitator of access rather than a barrier. Nonetheless, examples appear to exist of indications for medicines that are not PBS subsidised, despite clear evidence for benefit. One reason for this might be that PBS listing is driven by applications to the Pharmaceutical Benefits Advisory Committee (PBAC) by sponsors of drugs. Drugs that are off-patent or are otherwise less profitable to their sponsors may therefore not come before the PBAC for consideration.

Overall I learned a great deal in completing this project about epidemiological study design and the use of statistics; about the subsidisation process for drugs in Australia and the public health implications thereof; and of the complexity of political, economic, corporate, societal and medical research factors involved in providing preventive healthcare in Australia.

I was delighted to be selected as the Western Australian finalist for the Australasian Faculty of Public Health Medicine's John Snow Scholarship, and I thank it for the opportunity to present my work at the 2011 Royal Australasian College of Physicians' annual conference in Darwin. I would encourage others to consider completing a research project in the area of public health.

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Apley's Concise System of Orthopaedics and Fractures

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Renae completed a Bachelor of Science at the University of Queensland prior to commencing Medicine. Since then she has done extensive work as an anatomy demonstrator in a variety of courses. She is in her final year of Medicine and keenly interested in orthopaedics.

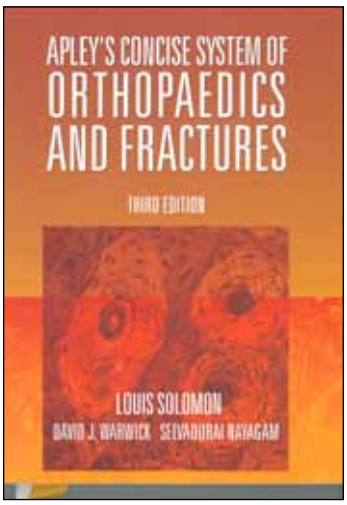
Solomon L, Warwick D, Nayagam S. Apley's Concise System of Orthopaedics and Fractures. 3rd ed. London (UK): Hodder Arnold; 2005.

RRP AU$52.65

The 2006-2007 Australian Hospital Statistics demonstrated that fractures alone accounted for 173,410 separations from Australian Hospitals. [1] As such, all interns will see a potential orthopaedic patient at least once in their Emergency rotation and will require a sound knowledge of orthopaedics. Like all medical fields, knowledge is gathered from clinical rotations, doctors and peers. However, this learning will need to be supplemented with textbook study. One of the most popular medical student level textbooks for orthopaedics is *Apley's Concise System of Orthopaedics and Fractures*. Currently in its third edition, Apley's provides 390 pages of musculoskeletal medicine ranging from the classification and management of basic fractures to more obscure genetic conditions such as brittle bone disease.

Apley's is separated into three general categories: General orthopaedics, Regional orthopaedics and Fractures and joint injuries. Each Orthopaedic condition is explained in the time-honoured method of history, examination findings, imaging and investigation findings, and management. This provides medical students with a well-structured and concise guide to the signs and symptoms of each specific condition. Furthermore, for some of the more common musculoskeletal conditions, such as osteoarthritis, considerable time has been donated to the pathophysiology and both the operative and non-operative treatment options.

One of the criticisms of this text is that there is information on some of the more obscure genetic orthopaedic conditions, unlikely to be useful in the acute setting. The section on fractures is detailed and provides information on the different types of fractures possible for every bone. For the average medical student on a standard orthopaedic rotation, it is unlikely that they will remember all of the specifics of each fracture type and eponyms, let alone their management. Further, Apley's provides minimal therapeutic drug classification and doses for the management of some of the medically treated orthopaedic conditions.



A sufficient grounding in orthopaedics is essential for any intern. A significant proportion of this textbook is dedicated to fracture diagnosis and management, invaluable for the Emergency Department setting where acute traumatic injuries are more commonly treated, rather than progressive chronic conditions. *Apley's Concise System of Orthopaedics and Fractures* provides an easy-to-read textbook for students wishing to learn the basics of the diagnosis and management of common orthopaedic conditions.

Conflicts of Interest

None declared.

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Good Medical Practice: Professionalism, Ethics and Law

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Kathryn is a former solicitor who saw the error of her ways. She quit her job and sold her house to study medicine; let's hope it works out for her.

Breen KJ, Cordner SM, Thomson CJH, Plueckhahn VD. Good Medical Practice: Professionalism, Ethics and Law. Port Melbourne: Cambridge University Press; 2010.

RRP: $75.00

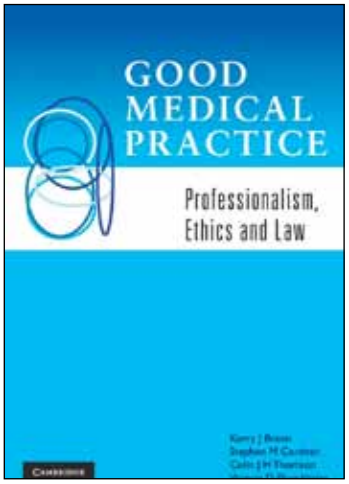
Anyone brave enough to write a textbook about Australian law quickly runs into an almost insurmountable obstacle: federalism. In effect, Australia has nine jurisdictions. The number of activities that are illegal in one jurisdiction (usually Queensland) whilst positively encouraged in another (usually the ACT) is myriad. Producing a textbook for a national audience that covers these jurisdictional variations comprehensively without boring the reader senseless is a challenge.

Not satisfied with simply exploring the complexities of the Australian legal system as it affects medical practice, however, the authors of Good Medical Practice: Professionalism, Ethics and Law decided to examine ethics and professionalism as well. Drawing together these three systems that govern appropriate conduct was surely a Herculean task, but it has resulted in a thoroughly readable and useful book.

The authors' decision to combine ethical, legal and professional principles has allowed them to distil key concepts and provide comprehensive, practical guidance without overwhelming the reader. For example, a chapter on the complex legislative regimes surrounding the issue of privacy could usually be expected to leave the reader confused, or possibly even sobbing. Here, the heavy legal content of the chapter is rendered almost redundant by the authors' perceptive preface that doctors who adhere to ethical principles of preserving patient confidentiality are unlikely to fall foul of privacy law. If you choose to stop reading after that point is made, you probably already know enough to avoid a major problem.

This "all-in-one" approach acknowledges the interaction between law, ethics and being a good doctor. It is the key to the success of this book. Complex legal and ethical ideas are conveyed succinctly, within the framework of practical advice on how to conduct oneself professionally. The authors' tips on preventing unfortunate outcomes – such as formal complaints, lawsuits or drug-fuelled meltdowns – are sensible and worth reading even if you skip just about everything else.

First-year medical students and international graduates will find the chapter explaining the ins and outs of Australia's health system valuable; a chapter on the professional responsibilities and regulation of other health care workers is also useful for those experiencing their first exposure to multi-disciplinary teams. Chapters covering issues relevant to clinical research, prescribing, entering practice, and the ethical allocation of health care resources are likely to be useful to later-year students and junior doctors.



There are a few problems with the text, however. For example the chapter on the Australian legal system appears towards the end of the book. I'd suggest reading it first, to avoid confusion when legal terms are encountered. In addition, unfortunate timing has meant that the chapter on the regulation of the profession does not address the new regime of national registration, but the general principles it outlines are still relevant.

Overall, the book is well-structured, easy to use, and succinct without sacrificing clarity. For those who would like more information, there are some good resources suggested at the end of each chapter. For the most part, however, it will be unnecessary to consult an additional text if one requires simply a good working knowledge of relevant ethical and legal principles.

It is perhaps disappointing that a book exploring ethical concepts is not more thought-provoking (in this line, I'd recommend Annas' excellent, if somewhat dated, book [1]), but it seems that the authors have elected to guide rather than challenge their readers. In this they have been successful.

In short, Good Medical Practice delivers exactly what its title promises: succinct information about the ethical and legal responsibilities of medical practitioners (and students) within a broader professional context. The intended audience of medical students and junior doctors is likely to benefit from some time spent reading this book.

Conflicts of Interest

None declared.

Reference

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