Research

A longitudinal study of mental health morbidity markers in a cohort of 1st year postgraduate medical students
Steven Peterson & Cathy Owen

Antibiotic Activity of Extracts from some Bryophytes in South Western British Columbia
Mark Douglas Russell

Type 2 Diabetes Mellitus, a review comparing Indigenous and Non-Indigenous Australians
Morgan Hee

News and Topics of Interest

Should Boys Receive the Gardasil Vaccination?
Teneille Boyland

Oaths are Good Medicine
Vivek Baskaran

Eating for Two - The common misconception in pregnancy
Matthew Thompson

Gender and the management of cardiovascular disease
Corrine Lu

Guaranteed Internships for all Australian Trained Medical Students
Gert Frahm-Jensen

Altruism, charity and the Alumni of ANU Medical School
David Corbet

Internship at the WHO
Yin Lan Soon

Elective Experiences

Cuzco, Peru
Sankar Manchelle and Esther Han

Honiara, Solomon Islands
Miranda Holmes

Student Education

On departing Plato’s Cave: the philosophical privilege of medical education
Ross Penglase

Essentially Beneficial Mistakes
Konrad Reardon

Rural and Indigenous Health

Banana Snapping: A John Flynn Scholarship
Nadia Coscini

Rural, remote and Indigenous Health.... in your ARMS
Amie Biesenberger and Budhima Nanayakkara

Careers

How did I get here?
Professor Guan Chong
<table>
<thead>
<tr>
<th>Page</th>
<th>Article Title</th>
<th>Author(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Letter from the Editor</td>
<td>Monica Mylek</td>
</tr>
<tr>
<td>3</td>
<td>Dean’s Message</td>
<td>Professor Nicholas Glasgow</td>
</tr>
<tr>
<td>4</td>
<td>A longitudinal study of mental health morbidity markers in a cohort of 1st year postgraduate medical students</td>
<td>Steven Peterson &amp; Cathy Owen</td>
</tr>
<tr>
<td>9</td>
<td>Antibiotic Activity of Extracts from some Bryophytes in South Western British Columbia</td>
<td>Mark Douglas Russell</td>
</tr>
<tr>
<td>15</td>
<td>Type 2 Diabetes Mellitus, a review comparing Indigenous and Non-Indigenous Australians</td>
<td>Morgan Hee</td>
</tr>
<tr>
<td>20</td>
<td>Should Boys Receive the Gardasil Vaccination?</td>
<td>Teneille Boyland</td>
</tr>
<tr>
<td>21</td>
<td>Oaths are Good Medicine</td>
<td>Vivek Baskaran</td>
</tr>
<tr>
<td>22</td>
<td>Eating for Two - The common misconception in pregnancy</td>
<td>Matthew Thompson</td>
</tr>
<tr>
<td>24</td>
<td>Gender and the management of cardiovascular disease</td>
<td>Corrine Lu</td>
</tr>
<tr>
<td>26</td>
<td>Guaranteed Internships for all Australian Trained Medical Students</td>
<td>Gert Frahm-Jensen</td>
</tr>
<tr>
<td>28</td>
<td>Altruism, charity and the Alumni of ANU Medical School</td>
<td>David Corbet</td>
</tr>
<tr>
<td>30</td>
<td>Internship at the WHO</td>
<td>Yin Lan Soon</td>
</tr>
<tr>
<td>32</td>
<td>Cuzco, Peru</td>
<td>Sankar Manchelle and Esther Han</td>
</tr>
<tr>
<td>33</td>
<td>Honiara, Solomon Islands</td>
<td>Miranda Holmes</td>
</tr>
<tr>
<td>34</td>
<td>On departing Plato’s Cave: the philosophical privilege of medical education</td>
<td>Ross Penglase</td>
</tr>
<tr>
<td>36</td>
<td>Essentially Beneficial Mistakes</td>
<td>Konrad Reardon</td>
</tr>
<tr>
<td>37</td>
<td>Banana Snapping: A John Flynn Scholarship</td>
<td>Nadia Coscini</td>
</tr>
<tr>
<td>38</td>
<td>Rural, remote and Indigenous Health... in your ARMS</td>
<td>Amie Rieseberg and Budhima Nanayakkara</td>
</tr>
<tr>
<td>40</td>
<td>How did I get here?</td>
<td>Professor Guan Chong</td>
</tr>
<tr>
<td>41</td>
<td>Personal Notes</td>
<td></td>
</tr>
</tbody>
</table>
I am pleased to present the second volume of the Medical Student Journal of Australia (MSJA). Inheriting the solid foundations laid down by our predecessors, our editorial team took carriage of this project in February 2010 with the challenge of upholding the journal's budding reputation.

The MSJA is a peer-reviewed journal. As such, it allows authors to experience a bona-fide peer-reviewed publishing process: training that all students will benefit from as they launch their medical careers. As the editorial team, we are indeed fortunate that submitting authors and expert peer reviewers (including clinicians and academic staff) treat our journal as a serious endeavour, worthy of their best work. As Chief Editor I enjoyed reading and learning from the submitted articles, and am proud to bring these articles to you for your learning enjoyment.

Being Chief Editor of the MSJA will always be a challenging experience. Our articles are never "stock standard": therefore each article must be reviewed on its own merits. Finding appropriate peer reviewers who will do our research papers justice and add to the learning process requires a tailored approach. Changing current administrative processes – such as encouraging year round submission – will hopefully trigger students to consider publishing as integral to producing any serious written work.

I am indebted to the Editorial Team, without which this journal could not be possible. Their commitment to the journal – with its late nights and its seemingly endless emails and meetings – has provided a solid platform on which to build something enduring and of which we, as a school community, can all be justifiably proud.

I would like to end by thanking all those who submitted their articles, the peer reviewers and our supervisors from the Population Health Team.

We hope you enjoy reading this issue as much as we have enjoyed producing it.

Monica Mylek
Chief Editor, MSJA
I welcome the publication of this next issue of the Journal. Congratulations to all who have worked to bring it together. It is a good thing for the Medical School. I particularly welcome the inclusion in this edition of a focus on indigenous and rural health. These are critically important issues for Australia, and it is good for all of us to be reminded of them.

Academic writing requires authors to think carefully about underlying issues; then express ideas in a careful, logical and methodologically defensible way. It is not easy to do this - it is certainly more challenging than a coming up with a superficial “one liner” about complex matters. Academic writing can be a place for robust debate. This can be unsettling at times - particularly if well argued, evidence supported pieces challenge things we hold dear or disturb our comfort zone. Disturbances like this can be good for all of us. They can challenge our complacency and lead us to new ways of thinking and new ways of acting.

To the authors, thank you for your contributions. I trust that you have learned through doing the writing. To the readers - welcome. I trust you will recognise and appreciate the effort the authors have made. I hope that this Journal continues to be a vehicle for us all to learn and grow.

Professor Nicholas Glasgow
Dean, ANU Medical School
A longitudinal study of mental health morbidity markers in a cohort of 1st year postgraduate medical students

Steven Peterson* & Cathy Owen**

*Medical Student, The Australian National University,
**Professor of Psychiatry, Medical School, The Australian National University

Medical school is not easy. It is well known amongst the profession and laity that medical school is hard work and that medical students are predisposed to mental health issues such as burnout, stress and depression1-3. There are many reasons why this could be so; high academic competition, a heavy workload, financial concerns, living away from home, exposure to suffering and death, the so-called “hidden curriculum” of what happens in real medical settings as opposed to what is correct and ethical, and sleep deprivation are all hypothesised to contribute to stress in medical school1,4. Some stress may well be a motivator for achievement, but excessive levels are expected to impair academic performance and quality of life3. It is further hypothesised that the impact of stressors of medical school will affect greatly the adjustment or otherwise of the intern when (s)he graduates by modifying their attitudes towards medicine and their adjustment to their new role as a doctor5-7. Previous research has found large levels of mental health morbidity amongst medical students at other universities5.

The studied medical school is a relatively young institution, having its initial graduating class in 2007. This medical school has a particular focus on student professional development & pastoral care, and therefore wishes to quantify psychiatric morbidity amongst its students to plan appropriate support services. The aim of the study was to identify the proportions of students displaying elevated levels of psychiatric morbidity and burnout and to examine how this changed during the academic year.

Methods

The study protocol was reviewed and approved by the ethics committee at the University. Medical students gave informed consent and were aware that no identifiable data would be published.

Participants were asked by the researcher before a lecture to participate in a mental health questionnaire, and surveys were also available on an electronic student noticeboard. Students who wished to participate had the option of filling in their questionnaire during a recess between lectures in hard copy or submitting electronically through an electronic student noticeboard. No personal details were recorded, however individual de-identified students could be followed in the raw data by a code comprised of their birthday and home post code. Students had the option of withdrawing from the survey and removing their data by identifying their birthday and home post code to the researcher; this was undertaken on one occasion.

ABSTRACT

Objective: The aim of this study was to investigate changes in mental health morbidity markers of a cohort of graduate medical students across their second semester of study. This will aid in planning appropriate support services to medical students.

Method: A total of 75 Year 1 students completed questionnaires including the General Health Questionnaire (GHQ-12) and the Maslach Burnout Inventory (MBI) up to four times over approximately two month intervals from July 2007 to February 2008.

Results: Significantly high levels of background psychiatric morbidity were recorded, and these levels increased throughout the year. A third of the sample was disproportionately responsible for this increase. Morbidity values returned to below baseline recordings after a summer holiday.

Conclusion: Graduate medical school was perceived as a stressful environment with many students displaying high levels of morbidity that could place them at risk. High stress and thus high risk peaked around assessment periods. However, these values corrected themselves after non teaching periods, stressing the importance of adequate spacing between assessments and the crucial role holidays play in maintaining one's mental health.

Key Words: mental health, medical student.
This project measured mental health morbidity markers longitudinally. Surveys were conducted in July, September and November of 2007, and February 2008. The July and February surveys were conducted immediately following holidays, whilst the November survey was filled out just prior to the end of year exam.

**Participants**

Data for this study was obtained from a cohort of 84 medical students beginning a four year postgraduate medical degree in 2007. The researcher was amongst this cohort and excluded himself from participation. The sample was predominantly female (67%) and the median age was 24. Following the 2nd semester exams in 2007, there was an attrition of 2 students and a new intake of 8 students to make a total of 90 students. To ensure consistency of the project, the results of these new students were not added to the longitudinal components of our study.

**Instruments used & outcome measures**

The surveys contained a consent and information page as well as two tools used for assessing overall mental health. The 12 item General Health Questionnaire (GHQ-12) is a simple screening tool to detect common non-psychotic mental health morbidity such as anxiety and depression (Table 1).

The questionnaire refers to the past three months so measures a person’s state between surveys rather than personality traits. The GHQ-12 was selected as the test has well established validity and has been used in similar research. The standard 0-0-1-1 scoring method was used, with only the last two potential answers (‘most of the time’ and ‘all the time’) scoring a point. Four points out of a possible twelve was our threshold of a positive test as has been used in other studies.

The Maslach Burnout Inventory (MBI) is a widely used measure of occupational related burnout that has been used in similar research on medical students (Table 2).

An updated MBI General Survey (MBI-GS) was used in our research as it measures burnout with work itself as

<table>
<thead>
<tr>
<th>Table 1 Questions comprising GHQ-12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Whilst at university, have you...</strong></td>
</tr>
<tr>
<td>been able to concentrate on what you're doing?</td>
</tr>
<tr>
<td>lost much sleep over worry?</td>
</tr>
<tr>
<td>felt that you are playing a useful part in things?</td>
</tr>
<tr>
<td>felt capable of making decisions about things?</td>
</tr>
<tr>
<td>felt constantly under strain?</td>
</tr>
<tr>
<td>felt you couldn’t overcome your difficulties?</td>
</tr>
<tr>
<td>been able to enjoy your normal day to day activities?</td>
</tr>
<tr>
<td>been able to face up to your problems?</td>
</tr>
<tr>
<td>been feeling unhappy or depressed?</td>
</tr>
<tr>
<td>been losing confidence in yourself?</td>
</tr>
<tr>
<td>been thinking of yourself as a worthless person?</td>
</tr>
<tr>
<td>been feeling reasonably happy, all things considered?</td>
</tr>
</tbody>
</table>

Participants were asked to decide how often this feeling was felt. The options were ‘never’, ‘sometimes’, ‘most of the time’ and ‘all the time’. Either of the two most negative answers scored a point.

<table>
<thead>
<tr>
<th>Table 2 Questions comprising Maslach Burnout inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MBI Questions</strong>: Participants rate how appropriate each statement is on score of 1 to 7.</td>
</tr>
<tr>
<td><strong>MBI domain</strong></td>
</tr>
<tr>
<td>I feel emotionally drained from medical school</td>
</tr>
<tr>
<td>I feel used up at the end of the workday at medical school</td>
</tr>
<tr>
<td>I feel tired when I get up in the morning and have to face another day at uni</td>
</tr>
<tr>
<td>Working at med school all day is really a strain for me</td>
</tr>
<tr>
<td>I can effectively solve the problems that arise in my medical degree</td>
</tr>
<tr>
<td>I feel burned out from my medical degree</td>
</tr>
<tr>
<td>I feel I am making an effective contribution to my classmates</td>
</tr>
<tr>
<td>I have become less interested in medicine since I started medical school</td>
</tr>
<tr>
<td>I have become less enthusiastic about uni since I started medical school</td>
</tr>
<tr>
<td>In my opinion, I am doing well as a medical student</td>
</tr>
<tr>
<td>I feel exhilarated when I accomplish a significant task at medical school</td>
</tr>
<tr>
<td>I have learned many worthwhile things in this degree</td>
</tr>
<tr>
<td>I just want to do my work and not be bothered</td>
</tr>
<tr>
<td>I have become cynical about whether my work contributes anything to my peers</td>
</tr>
<tr>
<td>I doubt the significance of the medical coursework</td>
</tr>
<tr>
<td>At medical school, I feel confident that I am effective at getting things done</td>
</tr>
</tbody>
</table>
opposed to burnout associated with personal interactions at work\(^6\). The measure records Exhaustion (Ex), Cynicism (Cy) and Professional Efficacy (Pe). High Ex and Cy scores, and low Pe scores, are indicative of burnout\(^8\). Burnout is not dichotomous, there is a gradient ranging from high to low levels of burnout. We were interested in those medical students who were in the high (upper third) of that gradient as the MBI-GS guidelines recommend that individuals with scores in the upper third of the reference range could be classified as having “burnout syndrome”. The reference range is based on a population sample of 3727 North American subjects\(^8\).

In our study we defined “mental health morbidity” as having pathologic scores (Ex > 3.19, Cy > 2.19, Pe < 4.10, GHQ > 4 ) on at least three of the four mental health morbidity markers concurrently

**Data Analysis**

The chi square test was used to compare proportions and p values <0.05 were considered statistically significant. The proportions of students who had pathologic scores on each of the mental health morbidity markers were determined, along with the proportion who had “mental health morbidity” (pathologic scores on at least three of the four tests concurrently).

**Results**

All 84 students were offered the chance of participation in each survey. We obtained a response rate of 60/84 (72%) in July, 51/84 (61%) in September, 49/84 (58%) in November and 57/90 (63% - class now 90 students) in February. All respondent data was used to determine the prevalence of mental health morbidity at each time point. Recipients that had responded to all four surveys (26, or 31%) were included in a longitudinal mental health indicator change assessment.

**Mental Health Morbidity Markers**

The number and percentage of students scoring above thresholds on the GHQ-12 and MBI are shown in Table 3.

For the MBI tests, one third of the population would be positive in a normal population, therefore a class average much higher than this would be a cause for concern. In the first survey held five months after starting medical school in July, 30% of students had high Cynicism (Cy), 52% high Exhaustion (Ex) and 64% low Professional efficacy (Pe), the latter two mental health morbidity markers being much higher than expected in our cohort. This initial survey in July showed statistically significant differences between the proportion with elevated scores on indicator responses compared to the reference population for Ex (p=0.003) and Pe (p<0.0001).

Interestingly the number of students who scored low professional efficacy remained constant throughout the four surveys at approximately two thirds of participants (64%, 68%, 65%, 61%). The proportion with three or more raised mental health markers concurrently, the definition of overall mental health morbidity in our study, was about 42% in July and September, then jumped to 59% in November before exams, before declining to 16% in February. (Table 4).

Of the 84 students in the original cohort (90 in 2008), there were 26 who responded to all four surveys. The study examined the mental health morbidity marker progression of these individual students who responded to all surveys. During 2007, student morbidity changes were divided into three roughly equal categories; those that did not display raised mental health morbidity markers indicative of mental health pathology at any time.
of the year (nine students of 26), those that increased from a non-stressed to a stressed state during the year (seven students), and those that were stressed for all of 2007 (nine students). One student had their mental health morbidity levels decline over the course of the year. Amongst the 26 students a dramatic improvement in mental health morbidity levels was observed with the final survey in February. After the summer holidays, 22 of the 26 students’ mental health morbidity markers were either unchanged or had decreased from when they first entered the study nine months previously. Only four of the 26 students had raised mental health morbidity markers at that time point. The changes between November and February were statistically significantly different (p<0.0001).

Discussion

Our results suggest that a large proportion of medical students have transiently elevated mental health morbidity (at least three of four mental health morbidity markers raised concurrently) during the academic year, rising from around 43% mid-year to 59% just before examinations, then declining to only 16% after the long summer holidays. Other studies have shown that students entering medical schools have mental health morbidity levels similar to that of the general population. In this study, the first round of data collection was six months after starting medical school and we found a higher proportion of mental health morbidity. The raised level is consistent with having already started medical school, but further in depth research to examine why the baseline mental health morbidity was raised would be helpful. Almost two thirds of students consistently scored in the elevated range for burnout in professional efficacy, perhaps indicating a lack of a sense of achievement and accomplishment in the degree. Extremely high expectations and competition could foster a misplaced perception of underachievement. These high scores were maintained after the summer holidays, unlike other results that dropped sharply in the February survey. Similarly, the percentage of students who scored high on the exhaustion subscale steadily increased to about two thirds by the November survey. With the end of a long year approaching and imminent exams, it was perhaps unsurprising that this increase was recorded. However the summer break clearly did what it was supposed to, with the proportion of students scoring on the exhaustion subscale more than halving in the February survey. Finally, the levels of elevated cynicism scores were quite moderate until a big jump in the November survey. This is perhaps reasonable when one considers the increased work load and stress associated with the end of the academic year. Cynicism scores dropped substantially after the summer break but not back to their original level. A shift from idealism to cynicism over the course of a medical degree has been noted as an unfortunate occurrence in similar studies on medical students. Mirroring all this is a steady figure that just over half of students consistently scored poorly on the GHQ-12 throughout 2007; that is they consistently appear to have a moderate level of underlying mental health pathology. However this mental health pathology is not indicated in the February results, which show fewer than 20% of students have elevated GHQ scores. Despite this improvement in the final survey, our study does show that mental health pathology amongst this student group was a common and worsening problem as they approached the end of the academic year.

The 26 longitudinal students show the trends in mental health morbidity over the course of this study. Roughly a third of students did not show signs of mental health morbidity at any time over the first three surveys in 2007. A second third showed mental health morbidity during all of that time. Unfortunately we do not know their original mental health status at the start of the medical degree. It is possible therefore that these students would have once displayed no morbidity signs and acquired them during the first semester of medical school. However it is also possible that this third are merely the proportion of the population that has a naturally high stress baseline that medical school may aggravate but not necessarily create. The hard working and high achieving status of those who enter medical school could inflate this high baseline of stress further. The category that may cause the most concern however would be final third of the cohort, those whose levels of mental health morbidity increased throughout 2007, presumably as the demands of medical school took their toll. These people would seem to be most likely to suffer harm from the newly increased level of stress in their lives.

These peaks of increased mental health
morbidity should be taken in reference to the mental stress indicator changes from over the whole study including February 2008. We can see that the vast majority of participants had their mental health morbidity markers return to normal or even drop below their original level from the first survey in July of the first year. The decrease below the original July data is not unsurprising as the July mental health morbidity markers were taken in the middle of the medical school year so stress was probably above a normal holiday baseline. Only four of the 26 longitudinal students increased or maintained an excessive level of psychiatric morbidity over the entire year. This indicates that the increased mental health morbidity observed in November could be transient and associated with end of year assessment as opposed to a permanent change. Further work could focus on just how much of the increased end of year stress can be attributed to the end of year assessment.

It is unsurprising that mental health morbidity markers improved after a two month holiday between the November and February surveys. Perhaps it is surprising just how great the improvement in mental health morbidity markers was after the holiday, as the proportion of students with mental health morbidity more than halves to below the student baseline. It is sometimes argued than students receive too long holidays, and certainly in the latter years of a medical degree the amount of holiday time reduces substantially. However this survey restates the obvious fact that holidays are very good for one’s mental health.

The findings of this study are subject to some limitations. One possible source of bias in the prevalence estimates is that individual students did not respond to every survey. Of the cohort of 84 (90 in 2008) students who could respond, 75 responded at least once but of those only 26 responded on all four occasions. These could well have been more motivated students who were more likely to regularly attend lectures. Additionally it is possible that different groups of students were more likely to be motivated to respond at different times, such as the conjecture that the more worried students would be more likely to attend lectures in November just before the exams and thus disproportionately contribute to the data. The self report questionnaires are open to some interpretation, both the MBI and the GHC-12 have inherent limitations, and no objective measures of psychiatric morbidity were used. The longitudinal sample (n=26) was small and it may not be representative of the larger cohort of 84 students. Our tests operated on a ‘snapshot’ fashion that may not be truly indicative of a student’s long term attitudes. The mental health morbidity identified should be further explored, to identify specific diagnoses such as anxiety disorders and major depressive disorders that may account for the mental health disturbance. However the general trends of the study, suggesting high and increasing levels of transient mental stress prior to exams, are likely to be real.

Medical school has always been hard work, and the teaching environment of the modern medical school is much improved from those of preceding generations10. There is more support and consideration of the stress that will always be a part of this learning environment10. Regardless, our research did identify a small number of students who remained in an elevated stressed state at the conclusion of our research. These students are most likely to be at risk of harm. Medical schools should consider strategies of dealing with these students, possibly by identifying those who score at high levels after holidays and offering therapeutic intervention if required.

We can conclude that transient mental health morbidity is widespread amongst the medical student cohort at peak times of the medical year. Similar findings have been recorded in other studies and there now needs to be consideration of appropriate support for students in this demanding life phase10. Burnout correlates with numerous mental health problems that could both harm a student’s quality of life and potentially impair their development into a competent and compassionate doctor.

Acknowledgements

The authors would like to thank the Medical School class for their contribution.

References


The occurrence of antibiotic substances in bryophytes has been well documented by botanists and microbiologists. However, reports of ethnobotanical research into this plant group are minimal in North America. Zhu et al. (2006) reasons that minute sizes, difficulties identifying species, and a lack of financial incentives have hindered efforts to study bryophytes as antimicrobial agents. Recently, the public demand for herbal medicine and the rise of antibiotic-resistant bacteria have motivated scientists to look for new natural sources with potential pharmaceutical capabilities. Zhu et al. (2006) suggest that bryophytes are one of the most significant and promising sources of antibiotics and biologically active compounds in nature. Historically, a large number of medicinal plants were discovered and used by the aboriginal people to treat illnesses. The application ranged from topical applications, to prevent infection, to internal consumption, facilitating relief from nausea. However, there have been few studies to screen and confirm the medicinal potential of bryophytes in North Americans for antibiotic activity.

Bryophytes represent the second largest group of green land plants after angiosperms, and are taxonomically placed between algae and pteridophytes. The bryophyte group consists of three subgroups: Bryophyta (mosses), Marchantiophyta (liverworts or hepatics) and Anthocerotophyta (hornworts). These groups exhibit an abundant distribution in China, Europe and North America and current estimates suggest that approximately 8000-9000 species of mosses, 6000 species of liverworts and 100 species of hornworts exist worldwide.

Bryophytes are an exotic and captivating species with a unique combination of distinguishing characteristics. Firstly, bryophytes are non-vascular embryophytes. Their non-vascular nature is due to poorly developed conductive tubes that lack xylem tissue. Consequently, bryophytes remain small and flourish in places where there is an abundant water supply. The climate of South Western British Columbia is very wet and humid, with an average of 1100mm of rain per year. Therefore, a plethora of different bryophyte species have evolved in this regions forests and wetlands. Bryophytes in this region are herbaceous plants that grow closely packed together in mats or cushions on rocks, soil, or as epiphytes on the trunks and leaves of forest trees. They lack roots and attach to their environment with rhizoids. However, unlike vascular plants, water and minerals are absorbed chiefly by the thin leaves of the plant as the rain washes through the moss, not from roots. Mosses and liverworts usually have leaves with a thickness of one cell, except along the costa and the alar cells, which facilitate diffusion. Lastly, the characteristic that distinguishes bryophytes from tracheophytes, vascular plants, is the persistent photosynthetic phase of the life cycle is haploid; gametophyte generation occurs rather than the diploid sporophyte generation. The sporophyte typically consists of an unbranched seta, and a single terminal sporangium. It is short lived and attaches to the gametophytes for all its nutritional needs. Furthermore, bryophytes utilize the sporangium for reproduction via sporation but they neither flower nor produce seeds.

Hundreds of medicinal bryophytes have been identified and classified in ethnobotanical literature as potential antimicrobial agents. Many of these species are prevalent in British Columbia. However, few studies have been concerned with an in-depth analysis of the antimicrobial activity and efficacy of phytochemicals in different species of bryophytes from South Western British Columbia. To explore the bryophytic potential in pharmaceutical applications, a quantitative and qualitative screening of S.W. British Columbian bryophytes against Gram-positive and Gram-negative bacteria will be used as evidence for antimicrobial action and efficacy. Lastly, this study aims to determine whether ethanolic and methanolic extracts from similar bryophytes show significant diff-

ABSTRACT

Fourteen crude methanolic and ethanolic extracts of bryophytes from South Western British Columbia were screened for antibiotic activity against three bacterial strains with the disk diffusion method. Sixty five percent of the ethanolic extracts and 43% of the methanolic extract assayed demonstrated visible antibiotic activity against Gram-positive Bacillus subtilis. None of the 14 species of bryophytes extracts, from either of the alcoholic extractions, showed any visible activity against Gram-negative Escherichia coli or Klebsiella pneumoniae. The occurrence of antibiotic substances appears to be more frequent in hepatics. Eighty eight percent of liverworts demonstrated antibiotic activity while only 33% of mosses demonstrated activity. Lunularia cruciata also demonstrated the most significant antibiotic activity of all the bryophytes tested.

Mark Douglas Russell
Medical Student, The Australian National University

Bryophytes are non-vascular embryophytes. Their non-vascular nature is due to poorly developed conductive tubes that lack xylem tissue. Consequently, bryophytes remain small and flourish in places where there is an abundant water supply. The climate of South Western British Columbia is very wet and humid, with an average of 1100mm of rain per year. Therefore, a plethora of different bryophyte species have evolved in this regions forests and wetlands. Bryophytes in this region are herbaceous plants that grow closely packed together in mats or cushions on rocks, soil, or as epiphytes on the trunks and leaves of forest trees. They lack roots and attach to their environment with rhizoids. However, unlike vascular plants, water and minerals are absorbed chiefly by the thin leaves of the plant as the rain washes through the moss, not from roots. Mosses and liverworts usually have leaves with a thickness of one cell, except along the costa and the alar cells, which facilitate diffusion. Lastly, the characteristic that distinguishes bryophytes from tracheophytes, vascular plants, is the persistent photosynthetic phase of the life cycle is haploid; gametophyte generation occurs rather than the diploid sporophyte generation. The sporophyte typically consists of an unbranched seta, and a single terminal sporangium. It is short lived and attaches to the gametophytes for all its nutritional needs. Furthermore, bryophytes utilize the sporangium for reproduction via sporation but they neither flower nor produce seeds.
ferences in the relative antimicrobial activity.

Materials and methods

Plant Collections:

Samples of all tested plants were collected by M. Russell and S.M. Ellis from the field in Vancouver, British Columbia. The collections took place from October to November 2007. Bryophytes typically grow in close association with each other. Therefore, homogenous patches were desired with fresh tissue void of dead or dying material. Reproductive organs were used in identification. In addition, bryophytes in flower were preferentially collected to insure correct identification. Other tested plant species, were collected from homogenous plant populations. Any part of the plant may contain active components. Therefore, the whole organism was collected wherever possible. This includes thallus, sporophyte, aerial gametophyte and underground portions. Since different populations of the same species may exhibit different antimicrobial activity, the time and place of collection, and habitat were recorded (Table 1). All samples were preliminarily washed to remove contaminants. Once rinsed, plants were kept in sealed paper bags, and placed in the refrigerator to prevent the subsequent drying or decay.

Preparation of Biologically Active Extracts:

Screening of potential antimicrobial plants requires crude aqueous or alcohol extracts and fine organic extraction methods. Since nearly all of the identified biologically active or antibiotic substances from plants have been identified as aromatic or saturated organic compounds, it was most efficient to obtain the compounds through ethanolic or methanolic extractions.

Alcoholic Extraction Procedure:

Before extraction all plant material collected was washed with distilled water to remove any adhering soil or extraneous material. Plant parts were then air dried until water content was negligible and then ground into a fine powder.

Methanolic extraction:

One and half grams of the ground material were extracted in 25ml of methanol over 24 hours. The homogenous surface liquid of the crude methanolic extracts was used to impregnate the diffusion discs with antibiotic activity.

Ethanolic Extraction:

One and a half grams of each sample organism were separately shaken in 25 mL of 95% ethanol overnight. The homogenous surface liquid of the crude ethanolic extracts was used to impregnate the diffusion discs with antibiotic activity.

Six mm sterilized filter paper discs were then impregnated with the approximately nine drops of the homogenous extract. They were then allowed to dry at room temperature. All extracts were stored at room temperature.

Antimicrobial Activity:

The disc diffusion assay technique was used to evaluate antimicrobial activity. The bacteria used were Bacillus subtilis, Escherichia coli, and Klebsiella pneumoniae. A final inoculum of bacteria was obtained at 100μl of suspension containing 10.8 CFU/ml of bacteria. This was spread on sterile Mueller Hinton Agar (MHA). Six mm sterile filter paper discs were impregnated with extract and placed on seeded agar. Antibiotics were used as positive controls against the bacteria. The three antibiotic drugs, Streptomycin, Penicillin, and Tetracycline were used at a concentration of 10μg/disc. Plates were incubated for 36 hours at 37°C and the diffusion inhibition area surrounding the discs were measured in mm and recorded at the end of the incubation period. All assays were carried out in triplicates.

Results

Fourteen crude methanolic and ethanolic extracts of bryophytes from South Western British Columbia were screened for antibiotic activity against three bacterial strains. The botanical names of the plants tested, habitat and collection date are listed in Table 1. The screening results are listed in Table 2 and 3 for ethanolic and methanolic extractions respectively. All extract activity was standardized using comparable amounts of dried plant material and quantities of alcoholic extraction medium.

Sixty five percent of the ethanolic extracts and 43% of the methanolic extract assayed demonstrated visible antibiotic activity against Gram-positive Bacillus subtilis. None of the mosses showed any antibiotic activity when extracted with methanol. Bartramia pomiformis, Leucogenes acanthoneuron, Frullania nisquallensis showed antibiotic activity when ethanolic extractions where used but not when methanolic extracts were used. All other species showing antibiotic activity were common among ethanolic and methanolic extracts. The average inhibition zone in ethanolic extracts ranged from 1.0mm (Lepidozia reptans) to 2.8mm (Lunularia cruciata), with an average of 1.42mm of inhibition. The average inhibition zone in methanolic extracts ranged from 1.0mm (Lepidozia reptans) to 2.6mm (Lunularia cruciata) with an average of 1.93mm of inhibition.

None of the 14 species of bryophytes extracts, from either of the alcoholic extractions, showed any visible activity against Gram-negative Escherichia coli or Klebsiella pneumoniae. The only exception was Polytrichastrum alpinum, which showed indeterminate antibiotic response. Alcoholic extracts from Conocephalum conicum, Sphagnum palustre, Hylocomium splendens and Atricum selwynii showed no

[1] Preferential selection may cause bias in random sampling.

[2] Madsen and Pates (1952) noticed that air drying of the materials of Sphagnum portoricense resulted in a loss of antibiotic activity. The amount of lost activity is dependent on the compounds extracted and the length of drying time.
Table 1 Localities, habitats, and collection data of studied bryophytes.

<table>
<thead>
<tr>
<th>Species</th>
<th>Date</th>
<th>Locality</th>
<th>Habitat</th>
<th>Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liverworts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marchantia polymorphia</td>
<td>November, 14th, 2007</td>
<td>Canada, Vancouver, UBC Grounds</td>
<td>On highly saturated soil</td>
<td></td>
</tr>
<tr>
<td>Frullania nisquallensis</td>
<td>November, 7th, 2007</td>
<td>Canada, Vancouver, Pacific Spirit Park</td>
<td>On conifer trunk and branches</td>
<td></td>
</tr>
<tr>
<td>Lepidzia reptans</td>
<td>November, 7th, 2007</td>
<td>Canada, Vancouver, Pacific Spirit Park</td>
<td>On decaying wood</td>
<td></td>
</tr>
<tr>
<td>Scapania bolanderi</td>
<td>November, 7th, 2007</td>
<td>Canada, Vancouver, Residence</td>
<td>On conifer bark and stumps / Shaded areas</td>
<td></td>
</tr>
<tr>
<td>Conocephalum conicum</td>
<td>November, 7th, 2007</td>
<td>Canada, Vancouver, Lynn Canyon</td>
<td>On highly saturated inorganic soil / Sandy</td>
<td></td>
</tr>
<tr>
<td>Plagiochila porelloides</td>
<td>November, 18th, 2007</td>
<td>Canada, Vancouver, Pacific Spirit Park</td>
<td>On rock, log and trees</td>
<td></td>
</tr>
<tr>
<td>Porella cordanaana</td>
<td>November, 22nd, 2007</td>
<td>Canada, Vancouver, Pacific Spirit Park</td>
<td>On tree trunk and branches</td>
<td></td>
</tr>
<tr>
<td>Lunularia cruciata</td>
<td>November, 7th, 2007</td>
<td>Canada, Vancouver, Pacific Spirit Park</td>
<td>On moist soil</td>
<td></td>
</tr>
<tr>
<td>Mosses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sphagnum palustre</td>
<td>November, 7th, 2007</td>
<td>Canada, Vancouver, Pacific Spirit Park</td>
<td>On saturated fens and in bog areas</td>
<td></td>
</tr>
<tr>
<td>Bartramia pomiformis</td>
<td>November, 18th, 2007</td>
<td>Canada, Vancouver, Lynn Canyon</td>
<td>On moist shaded cliff-faces</td>
<td></td>
</tr>
<tr>
<td>Leucolepsis acanthoneuron</td>
<td>November, 7th, 2007</td>
<td>Canada, Vancouver, Pacific Spirit Park</td>
<td>On logs, boulders and soil</td>
<td></td>
</tr>
<tr>
<td>Hylocomium splendens</td>
<td>November, 18th, 2007</td>
<td>Canada, Vancouver, Pacific Spirit Park</td>
<td>On western hemlock in rich soil</td>
<td></td>
</tr>
<tr>
<td>Atricum selwynii</td>
<td>November, 7th, 2007</td>
<td>Canada, Vancouver, Lynn Canyon</td>
<td>Shaded moist soil areas</td>
<td></td>
</tr>
<tr>
<td>Polytrichastrum alpinum</td>
<td>November, 18th, 2007</td>
<td>Canada, Vancouver, Lynn Canyon</td>
<td>Shaded moist soil and rock areas</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Antibiotic activity in disc diffusion assays of bryophytes from South Western British Columbia and reference antibiotics. (All extractions were performed with ethanol)

<table>
<thead>
<tr>
<th>Species</th>
<th>Gm -ve Escherichia coli</th>
<th>Gm -ve Klebsiella pneumonia</th>
<th>Gm +ve B. subtilis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liverworts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marchantia polymorphia</td>
<td>-</td>
<td>-</td>
<td>2.0mm</td>
</tr>
<tr>
<td>Frullania nisquallensis</td>
<td>-</td>
<td>-</td>
<td>1.1mm</td>
</tr>
<tr>
<td>Lepidzia reptans</td>
<td>-</td>
<td>-</td>
<td>1.0mm</td>
</tr>
<tr>
<td>Scapania bolanderi</td>
<td>-</td>
<td>-</td>
<td>1.2mm</td>
</tr>
<tr>
<td>Conocephalum conicum</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lunularia cruciata</td>
<td>-</td>
<td>-</td>
<td>2.8mm</td>
</tr>
<tr>
<td>Plagiochila porelloides</td>
<td>-</td>
<td>-</td>
<td>1.3mm</td>
</tr>
<tr>
<td>Porella cordanaana</td>
<td>-</td>
<td>-</td>
<td>1.2mm</td>
</tr>
<tr>
<td>Mosses</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sphagnum palustre</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bartramia pomiformis</td>
<td>-</td>
<td>-</td>
<td>1.2mm</td>
</tr>
<tr>
<td>Leucolepsis acanthoneuron</td>
<td>-</td>
<td>-</td>
<td>1.0mm</td>
</tr>
<tr>
<td>Hylocomium splendens</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Atricum selwynii</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Polytrichastrum alpinum</td>
<td>+**</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reference Antibiotic Drugs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streptomycin</td>
<td>9.3mm</td>
<td>6.0mm</td>
<td>8.7mm</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>5.7mm</td>
<td>12.0mm</td>
<td>8.0mm</td>
</tr>
<tr>
<td>Penicillin</td>
<td>7.0mm</td>
<td>5.5mm</td>
<td>7.0mm</td>
</tr>
</tbody>
</table>

*Antibiotic activity represented by the mean width of the inhibition zone (mm) surrounding the disc. **A positive sign ‘+’ indicates an indeterminate amount of antimicrobial activity.
visible activity against any Gram-positive or Gram-negative bacteria. The occurrence of antibiotic substances seems to be more frequent in hepatics than in mosses, since the former case 7 of 8 species, or 88% had antibiotic activity, but in the latter case only two of six, or 33% had antibiotic activity[**].

All the reference antibiotics showed dramatic activity against all the Gram-positive and Gram-negative bacteria. Streptomycin appeared most effective against E. coli, 9.3mm of inhibition, tetracycline appear most effective against K. pneumoniae, 12.0mm of inhibition, and Penicillin appear equally effective against B. subtilis and E. coli at 7.0mm of inhibition. The reference antibiotics showed a range of 5.5mm to 12.0mm of inhibition, with an average of 7.68mm.

Discussion and conclusions:

Ethanolic extraction vs. Methanolic extractions

The preliminary results of screening the alcoholic extracts of 14 species of bryophyte tested against three species of bacteria showed that there is a distinct difference between the antibiotic activities of the tested species in relation to the extraction method used. Sixty five percent of species showed antibiotic activity when ethanolic extraction is used, in comparison to 43% of species for methanolic extractions. In addition, none of the mosses showed any antibiotic activity when methanolic extractions were used. For example, Bartramia pomiformis, Leucolepsis acanthoneuron, Frullania nisquallensis showed antibiotic activity only using ethanolic extraction. This suggests that specific antibacterial compound(s), effective against the selected bacterial species, tend to be isolated more effectively from liverworts and mosses using ethanol. Table 4 lists some of the known compounds which have been extracted from methanolic and ethanolic extracts. The bolded compounds are partitioned exclusively by the particular solvent.

Further investigation would be required to determine if a polyacetylene, sterol or propolis found in the mosses, and liverworts are responsible to the antibiotic nature of the species. Furthermore, this also suggests that one antibiotic compound may be responsible for the antibacterial qualities

<table>
<thead>
<tr>
<th>Table 3 Antibiotic activity in disc diffusion assays of bryophytes from South Western British Columbia. (All extractions were performed with methanol)[††]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liverworts</td>
</tr>
<tr>
<td>Marchantia polymorpha</td>
</tr>
<tr>
<td>Frullania nisquallensis</td>
</tr>
<tr>
<td>Lepidozia reptans</td>
</tr>
<tr>
<td>Scapania bolanderi</td>
</tr>
<tr>
<td>Conocephalum conicum</td>
</tr>
<tr>
<td>Lunularia cruciata</td>
</tr>
<tr>
<td>Plagiochila pelliformis</td>
</tr>
<tr>
<td>Porella cordaiana</td>
</tr>
<tr>
<td>Mosses</td>
</tr>
<tr>
<td>Sphagnum palustre</td>
</tr>
<tr>
<td>Bartramia pomiformis</td>
</tr>
<tr>
<td>Leucolepsis acanthoneuron</td>
</tr>
<tr>
<td>Hylocomium splendens</td>
</tr>
<tr>
<td>Atricum selwynii</td>
</tr>
<tr>
<td>Polytrichastrum alpinum</td>
</tr>
</tbody>
</table>

*Antibiotic activity represented by the mean width of the zone of inhibition in mm.

Table 4 Known active compounds extracted with solvents

<table>
<thead>
<tr>
<th>Ethanol</th>
<th>Methanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tannins</td>
<td>Anthocyanins</td>
</tr>
<tr>
<td>Polyphenols</td>
<td>Terpenoids</td>
</tr>
<tr>
<td>Polyacetylenes</td>
<td>Saponins</td>
</tr>
<tr>
<td>Flavonol</td>
<td>Tannins</td>
</tr>
<tr>
<td>Terpenoids</td>
<td>Xanthosynes</td>
</tr>
<tr>
<td>Sterols</td>
<td>Totarol</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>Quassinoids</td>
</tr>
<tr>
<td>Propolis</td>
<td>Lactones</td>
</tr>
<tr>
<td>Phenones</td>
<td>Polyphenols</td>
</tr>
</tbody>
</table>

[**] Results pertain to ethanolic extracts.
[††] All extractions were performed with methanol
of a genus or species. This clearly demonstrates the importance of using a multitude of extraction compounds and methods to isolate antibiotic compounds. A failure to do so could result in an inability to retrieve valuable information, and incorrectly dismissing potentially beneficial species. McCutcheon et al. (1992) suggests that when a relatively limited number of bacteria are used to screen for antibiotic qualities, potentially beneficial species can be overlooked.

**Activity of liverworts and mosses**

The occurrence of antibiotic activity definitely appears to favour liverworts (88% activity) over mosses (33% activity). This suggests that detectable antibacterial compounds are present in most taxa of liverworts.

Liverworts also demonstrated the greatest inhibition zone. For example, Lunularia cruciata, Plagiochila porelloides and Marchantia polymorpha showed inhibition zones greater than 2.0mm, depending on the extraction method. These values are approximately one third of the inhibition of reference antibiotics. Zhu et al. (2006) suggests that the reason for this is the diverse cellular oil bodies that are found in 90% of liverworts. The cellular oil bodies contain vast array of lipophilic terpenoids, aromatic compounds, and acetogenins which may be responsible for the extraordinary array of bioactivities and medicinal properties.

Presently, over 400 new compounds have been isolated with potential antibiotic qualities. Furthermore, Asakawa (2007) suggests that oil bodies are easily extracted with alcoholic extraction methods, while the other classes of bryophytes lack oil bodies, making antibiotic activity more difficult to extract.

**Bacterial sensitivities**

Gram-positive bacteria, B. subtilis, showed the greatest sensitivity to bryophyte extracts, while Gram-negative showed none or indeterminate sensitivity to bryophyte extracts. Physiologically, Gram-negative bacteria have an outer membrane while the Gram-positive bacteria only have peptidoglycan layer. The outer membrane is responsible for protecting the bacteria from an array of different antibiotics, detergents, and enzymes that would normally damage the inner member or peptidoglycan cell wall.

The effectiveness of liverworts and mosses, solely against Gram-positive bacteria supports the notion that they are more vulnerable. On the other hand, McCutcheon et al. (1992) states that there are few known natural antibiotic compounds with a high antibacterial activity against Gram-negative bacteria, which parallel our results. McCutcheon et al. (1992) also states that Gram-negative bacteria K. pneumoniae is particularly resistant to antibiotic therapy. Further research will be needed to confirm indications that P. alpinum has antibiotic activity against E. coli.

**Antibiotic activity**

Recent studies indicate evidence of antibiotic properties of some bryophyte species, incongruent with my results. For example, Castaldo-Cobianchi(1988) showed high antibacterial activity of Conocephalum conicum against pathogenic bacteria. Atricum selwynii and Sphagnum palustre have also shown activity against a variety of Gram-positive and Gram-negative bacterial species. Lastly, Hylocomium splendens has shown antibiotic activity against nine Gram-positive bacteria. In our study, none of these species displayed any activity. According to the literature, all of these species should have shown some antibiotic activity against B. subtilis. Therefore, potential differences in seasonal collection, locality, or extraction and experimental procedure may have been factors that manipulated the results. For example, a potential source of experimental error in the current experiment was failing to use filtration devices or rotoevaporation to isolate our antibiotic compounds. This may have affected our results. Therefore, further studies will be needed explore the factors affecting bryophyte activity.

**Further Directions**

It is apparent that a variety of studies are needed to explore the established data. Therefore, further studies could include performing more antibiotic screenings with larger variety bryophytes, against a huge variety of potential bacterial species. This would provide evidence to support current results. Furthermore, re-testing bryophytes that performed differently from documented results could allow for greater understanding of the factors affecting activity. This would also allow one to test for broad spectrum antibiotic and narrow spectrum antibiotics. Once significant antibiotic activities have been isolated, MIC and MBC would be performed to determine antibiotic efficacy.

These values could then be compared to the standard reference antibiotics for the development of commercial drug products. In addition, isolating the antibiotic compounds by Nuclear Magnetic Resonance and Mass Spectrophotometry allows for examination of compound structure. This could lead to further studies in synthetic production or chemical development. Also, these compounds would be subjected to animal and human studies to determine their effectiveness on whole-organism systems, including toxicity and normal microbiota studies. Animal and human studies would also include infection prevent and treatment.

**Acknowledgements**

I would like to gratefully acknowledge Dr. S.M. Ellis for providing expertise and laughter throughout this project and field collections, and to Amy Singleton-Polster for her peer-criticisms. Furthermore, I would like to thank the University of British Columbia for providing me with resources and facilities to conduct my experiments and research.
References

Indigenous Australians have lower standards of health compared to non-Indigenous Australians. Apart from genetics and its role in disease aetiology, this poor health is associated with factors not shared by the rest of the population. With urbanisation and the adoption of more sedentary lifestyles, there has been an upsurge in the prevalence of lifestyle diseases affecting the Indigenous population, including type 2 diabetes mellitus (non-insulin dependent). This upward trend in recent decades far exceeds the same epidemic seen in the rest of the Australian population.

The World Health Organisation defines diabetes by the level of hyperglycaemia. Currently, the diagnostic criteria for diabetes mellitus are a fasting plasma glucose ≥7mmol/L or 2-hour plasma glucose ≥11.1mmol/L following a glucose tolerance test. These criteria describe a group with relative insulin resistance resulting from failure of pancreatic islet β-cells to compensate for hyperglycaemia. The complications associated with diabetes includes microvascular and macrovascular damage; specifically retinopathy, nephropathy and ischaemic heart disease and stroke. These relate to the duration of diabetes and are worse with earlier onset.

Diabetes is a key contributor to an increasing health burden of chronic diseases. In 2002 the overall diabetes prevalence was 7.4%. Incidence and prevalence of diabetes among Indigenous people ranges 2-4 times of other Australians and higher in some communities (6 times among some Torres Strait Islanders). These systematic differences in health within a country represent a pressing “health inequity” which can potentially be avoided.

The patterns and burden of type 2 diabetes in Indigenous and other Australians

The majority of the Indigenous population (76%) lives in major cities or regional centres. Despite this, there have been few studies examining the trends in diabetes in urban areas. There have been no comprehensive national studies, comparable to the 2002 AusDiab Study that took blood samples on Indigenous Australians. Such data is needed to accurately assess the health burden associated with diabetes and its complications in Aboriginal and Torres Strait Islanders. Nevertheless, diabetes is known to be a significant health burden in Indigenous and other Australians. Figures from the National Aboriginal and Torres Strait Islander Health Survey (2004-5) reported an overall prevalence of diabetes to be 6% in the Aboriginal community (Figure 1). Statistics based on self report data showed Indigenous people were 3.4 times more likely to self-report some form of diabetes.

The greatest difference in prevalence between Indigenous and other Australians occurs between the ages of 35-44 and 45-54 years, when rates were approximately 5 times that of non-Indigenous Australians. It is clear that the prevalence of diabetes increases rapidly from 35 years and onwards.

To put this into perspective, the Indigenous health gap (the difference in Disability-Adjusted Life Years (DALYs) between...
Indigenous and the total Australian population) accounts for 59% of the total burden of disease for Indigenous Australians (Table 1). Significantly, 70% of this health gap is explained by non-communicable diseases\(^1\), not seen in Indigenous Australians before European colonisation. Diabetes contributed 12% to the Indigenous health gap, especially in those aged 35 and over. There is a disproportionate amount of the Indigenous health gap (40%) experienced by those in remote areas (where 24% of the population lives). Diabetes was nearly twice as prevalent in remote areas (9%) than in non-remote areas (5%) in 2004-5\(^1\). It is evident that Indigenous Australians have more DALYs resulting from diabetes than in the total population.

The age of onset of diabetes in Indigenous Australians is earlier. Davis and colleagues\(^1\) found that the age of diagnosis in Aboriginal patients averaged 14 years younger than Anglo-Celt patients. The duration of diabetes was similar in both groups. There was no significant difference in the proportion of each group that died prior to follow-up but age of death in the Aboriginal group was 18 years younger\(^1\). It should be noted that in this study there were few (n=18) in the Aboriginal compared to the Anglo-Celt group (n=819) so, the figures may not accurately represent the underlying population. However, this suggests a worrying disparity in the health status of Australians.

### Table 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular disease</td>
<td>4.5</td>
<td>5.1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>4.4</td>
<td>6.0</td>
</tr>
<tr>
<td>Intentional Injuries</td>
<td>3.9</td>
<td>5.3</td>
</tr>
<tr>
<td>Unintentional Injuries</td>
<td>2.4</td>
<td>2.9</td>
</tr>
<tr>
<td>Chronic respiratory disease</td>
<td>2.5</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Source: Gracey & King\(^2\)

### Risk factors of importance

Classically, risk factors for disease have been classified as modifiable (lifestyle) and non-modifiable (age, sex and genetics). Increasingly, social determinants have been recognised by epidemiologists as contributing to inequalities of health status. These factors are often superimposed on a background of genetic susceptibility to diabetes. Health and illness seem to follow a social gradient whereby people of a lower socio-economic position have worse health than those of higher socio-economic status (SES)\(^1\).

Body mass index (BMI) and age are the strongest predictors of diabetes in Indigenous and other Australians\(^1\). BMI is related to genetics, lifestyle and the "nutrition transition"\(^1\) that has accompanied the change to a more sedentary lifestyle. These factors have contributed to the current obesity and chronic disease epidemic. As discussed by Brimblecombe et al\(^6\), there seems to be a dose-response relationship between BMI and diabetes risk (Figure 2). In addition, those who are lean (BMI <22 kg/m\(^2\)), especially younger people have a lower diabetes risk profile\(^16\).

Prevalence is highest in the middle aged (45-54 years) whilst the oldest age group has a lower prevalence (may be due to a cohort or survivor effect).

Poor diet is a risk factor that stems from social disadvantage and poverty. Prior to colonization, Aborigines lived as hunter-gatherers whose diet included a variety of healthy foodstuffs. Physical activity was a regular part of day-to-day living\(^4\). With the transition to a western lifestyle comes a diet of inferior nutrient quality that is energy dense, high in fat, salt, sugars and low in fibre\(^3\). There is a significant linkage between poor diet, obesity and poverty. Fresh fruits and vegetables and lean meats have limited availability and are more expensive than calorie rich foods\(^14\). There is also a poorer general understanding of nutrition and health in Indigenous people.
At the most basic level, Indigenous Australians do not have the same quality of life or SES as other Australians. The basic causes of illness are the same in Indigenous and non-Indigenous peoples, but the burden of disease, disability and death is consistently higher in Indigenous people\(^2\). Diabetes has been found to be considerably more common among those with lower SES status\(^1\) (Table 2). However, the study sample was volunteer-based and may have been subject to selection bias if those with low SES and diabetes were more likely to participate.

For all characteristics, groups with lower SES had a higher proportion of individuals with type 2 diabetes.

When diabetes was first reported in Indigenous communities, it was attributed to a genetic susceptibility. Neel\(^1\) hypothesised that the diabetic gene was “thrifty”, conferring a survival advantage in food shortages\(^1\). This genotype then, renders one susceptible to obesity and diabetes in the modern day. However, it is clear that the coexistence of obesity and type 2 diabetes due to Western lifestyle is not limited

---

**Table 2** The demographic and socio-economic characteristics of participants (n=777) with regards to housing tenure, household income or employment status and the relative odds of diabetes.

<table>
<thead>
<tr>
<th>Socio-economic characteristic</th>
<th>Number</th>
<th>% with diabetes</th>
<th>OR, adjusted for age and sex (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Housing tenure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owned/being purchased</td>
<td>335</td>
<td>12.5</td>
<td>1</td>
</tr>
<tr>
<td>Rented or other</td>
<td>442</td>
<td>20.6</td>
<td>2.62 (1.66-4.13)</td>
</tr>
<tr>
<td><strong>In full time employment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>343</td>
<td>12.0</td>
<td>1</td>
</tr>
<tr>
<td>No</td>
<td>434</td>
<td>21.2</td>
<td>3.07 (1.94-4.87)</td>
</tr>
<tr>
<td><strong>Gross weekly income per household member ($)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-199</td>
<td>298</td>
<td>19.1</td>
<td>3.55 (1.61-7.83)</td>
</tr>
<tr>
<td>200-499</td>
<td>224</td>
<td>14.7</td>
<td>1.83 (0.81-4.13)</td>
</tr>
<tr>
<td>500+</td>
<td>90</td>
<td>11.1</td>
<td>1</td>
</tr>
<tr>
<td>Not reported</td>
<td>165</td>
<td>20.0</td>
<td>5.7 (2.38-13.66)</td>
</tr>
</tbody>
</table>

Source: Cunningham et al\(^1\)

---

**Figure 3** Postulated multifactorial model describing the social and environmental determinants of type 2 diabetes in Indigenous Australians.
to Indigenous people. More recently, Barker and colleagues (1992) showed that poor nutrition and growth in utero or during infancy carries increased risk of developing diabetes later in life. Indigenous children have high rates of low birth weight which (along with obesity in adulthood) is associated with insulin resistance although the physiological mechanism remains unclear.

The multifactorial model and the interaction of risk factors

In almost all studies on diabetes involving Indigenous Australians, the risk in both sexes is excessive relative to other Australians. For example, Aboriginal women and men have a higher predicted likelihood of developing diabetes than their AusDiab study counterparts, even at normal or low levels of body size. Therefore, other factors contribute to diabetes risk that exists beyond an individual's lifestyle and clinical data. An individual's genetic profile, factors in early life, poverty (and its high associated disease burden) and psychosocial mediators are likely to contribute. Many of these are associated with social disadvantage. Below is a postulated multifactorial model of how such determinants of type 2 diabetes may interact (Figure 3).

At first it may appear to be a complex model but when broken down there are two categories that affect whether the outcome is disease. Firstly, there are the proximal factors that directly concern the individual. These include the changes associated with more sedentary lifestyles and “Westernised” diets, leading to excess weight gain and obesity. However, more distal forces operating at a community or societal level affect these variables. Historically, Aboriginal people have been subjected to socio-economic and political marginalisation and racial prejudice. These conditions have detrimental flow on effects on education and job opportunity leading to subsequent poverty. These risk factors are amplified by remoteness. Limited access to health care facilities and under-investment in infrastructure in rural communities only broadens the Indigenous health gap.

Of course, such a multifactorial model does not apply equally to all Indigenous Australians. As is the case with any population, there will be a certain amount of heterogeneity with a significant genetic admixture. Therefore, such a model of disease cannot be regarded as universal due to varying genetic predisposition, background and circumstance.

There are many factors operating to cause diabetes, many of which operate beyond the individual from a much wider social and cultural context.

How the two population groups differ in terms of causality

As is the case around the world, there are “wide disparities between the health status of Indigenous and non-Indigenous peoples within the same country.” Such health inequality in a developed country such as Australia is undeniable and certainly avoidable. Indigenous Australians experience a health disadvantage for almost all diseases and risk factors (like tobacco smoking, high BMI and physical inactivity) at all ages, men and women, in remote and non-remote areas. There are a number of reasons that could explain this situation, that extend beyond the shift towards a more sedentary lifestyle.

The many risk factors for type 2 diabetes shared with other Australians are only compounded by the social disadvantage experienced by Indigenous Australians. This includes poverty secondary to high unemployment, dependency on social welfare, poor educational attainment, overcrowded living conditions and inferior housing, poor community infrastructure and water supply and poor standards of hygiene. These greater socio-economic factors are not seen in the majority of the Australian population and are detrimental to the health and wellbeing of Indigenous people.

Another important factor affecting the type 2 diabetes health gap is access to and affordability of quality health care. Such a discrepancy is exacerbated by late presentation, complicated illness, poor compliance and inadequate follow-up. Many communities of rural Australia struggle with accessibility to health promotion and screening programs. Other high risk factors such as cigarette smoking and alcohol consumption contribute to the complications of chronic disease and are more prevalent in the Indigenous population. Psychosocial factors like stress, racism and discrimination and the legacy of dispossession are likely to have further negative impacts on health regardless of SES.

Possible prevention strategies

It is important to emphasise that type 2 diabetes is largely preventable and that the health burden can be reduced in the Indigenous population. The most appropriate measures would need to involve a whole government and multiple sector approach, in consultation with Aboriginal elders, their respective communities and Aboriginal organisations. Stress should be placed on prevention strategies that are effective and sustainable. Their success depends heavily on continued community engagement.

One major aspect of prevention is to tackle the drivers of the obesity epidemic. Children would see the greatest benefit
of risk reduction measures (primary prevention) targeting the prevention of obesity with healthy diet and exercise. Programs implemented through school canteens can offer healthy options that provide much of the recommended daily intakes for key nutrients. This kind of approach can be viewed as investing in the health of future generations. However, there are greater socio-economic issues at play that need to be addressed, concerning the children who do not or cannot attend school (who may be at a higher risk of later comorbidity); this lies beyond the scope of this paper.

A key factor that would help to reduce the incidence of diabetes would be to encourage weight control. Previous studies have found that regular physical activity built into daily routines and selecting foods with good nutritional value are effective measures. A possible form of secondary prevention could be to have regular, cost-effective diabetes screening, such as fasting blood glucose measurements. Tertiary measures could reduce the likelihood of diabetes progression and the development of long-term sequelae through educational programs on drug compliance and ongoing clinical care. However, there are significant gaps between the evidence and actual practice. Whatever action is taken, it is clear that Indigenous people should be actively encouraged and empowered to take responsibility for their health and wellbeing.

Conclusion

Indigenous Australians have a chronic disease health burden including type 2 diabetes that is many times greater than that of their non-Indigenous counterparts. This health inequity stems from fundamental social and environmental determinants superimposed on genetic factors. Coupled with poor nutritional status and the adoption of western lifestyles, Aboriginal and Torres Strait Islanders experience much higher rates of type 2 diabetes. Rather than viewing this situation as a failure, it should be seen as the potential to make leaps and bounds in the way of health gains for Indigenous Australians.

References

The cervical cancer vaccine Gardasil has experienced controversy in recent times with questions raised about side effects and expense. Despite these concerns it has had an uptake of over 85% in female school students since the introduction of the vaccination program in 2007. Now the next target group for the vaccine is boys and scientific data is now mounting for a male immunisation program. So should the federal government implement such a program and would it be cost effective?

The Gardasil vaccination provides immunity from the human papillomavirus (HPV) which causes cervical cancer in women. However, HPV does not only cause diseases in women, it also causes diseases in men including, genital warts and cancers of the penis, anus and throat. Over 28,000 male cancers worldwide are attributed to a single strain of HPV. One argument for a male immunisation program is to prevent such diseases in men. A small study in Mexico in 2007 showed that the HPV vaccine was 90% effective in treating genital warts caused by HPV in men, and these men remained disease free 1 year after receiving the vaccine.

Another reason for a male immunisation program is to stop men from passing the virus onto women. But with such a high uptake rate of the vaccine in women aged 12-26, how many more infections and cancers are going to be prevented by immunising men as well? However, some would argue that immunising men would also increase the responsibility that they hold over their sexual health and that of their partner’s, as for too long this has been a burden for women. One example of a gender specific immunisation program was for rubella, in which only women were immunised to prevent infections in pregnancy and the development of congenital abnormalities in their unborn child. This program was then adjusted in 1994 to incorporate teenage boys to prevent them from passing the infection onto non-immune women, and now the rubella vaccine is part of the National Australian Immunisation Schedule. This type of immunisation program develops what is known as herd immunity, where a population is immunised to prevent infections and protect the vulnerable people in our community. Herd immunity is one of the desired outcomes for many of the vaccines that are incorporated in the immunisation schedule.

If the federal government were to extend the Gardasil vaccination program to include boys what would be the cost to the tax payer? The vaccination and catch up programs for girls cost the government $436 million dollars from 2006-07 to 2009-10. But how much a male program would cost would depend on cost-effectiveness and vaccine uptake.

A reduction in the cost of the vaccine would make it more favourable for the government to vaccinate both girls and boys as it will become a cost effective way for preventing HPV related disease. An Australian research paper from 2007 examined the cost-effectiveness of the vaccine use in boys, and they concluded that immunising boys would not be a cost-effective way to reduced HPV infection in women due to the high take-up of the vaccine in this group. However, the cost-effectiveness in preventing diseases in men has not been yet examined.

Since Gardasil has been promoted as a cervical cancer vaccine, there would be some doubts of the successful uptake of the vaccine in males. It would be essential for the government to appropriately educate parents as to the benefits for their son receiving the vaccine. If this can be done successfully then it would be reasonable to assume that expanding the current program to also incorporate boys could be successful with a similar uptake rate to those of girls. However, the success of a catch up program analogous to the one that recently ceased for 18-26 year old women would be doubtful in men.

Still the question remains, should boys be immunised against the human papillomavirus? There are many benefits for immunising boys such as decreasing HPV related diseases and cancers, preventing them from passing the infection to women and developing herd immunity to protect the people at risk. But there are also some hurdles associated with developing an immunisation program for boys. The cost of implementing the program for boys at this stage still outweighs the benefits. Until the cost of the vaccine reduces and a more cost-effective program can be developed, it would be hard to convince the government to implement such a vaccination program.
A common feature of medical schools is the recital of an oath upon graduation. This is a cherished tradition for many medical students and their families, as university is left behind and the real world beckons. Oaths are linked with the public image of medicine as a profession, best illustrated by the presence of the Hippocratic Oath in popular culture1. They also have a symbolic role in the professional regulation of doctors. Notwithstanding, the importance of these oaths has been debated in many quarters. Here, I seek to add a medical student perspective to this debate.

Oaths are used during the graduation ceremonies of many Australian medical schools2. These schools display considerable variety in oath type and delivery. In particular, there is a strong trend towards faculty design or modification of oaths2. The faculty of medicine at the University of New South Wales (UNSW) allows its graduating students to design their own oath3. These developments ought to be encouraged because they reflect the changing attitudes within society and within medicine. It is no longer tenable to recite historic oaths, such as the Hippocratic Oath, because they do not reflect the reality of modern medical practice. For example, it is no longer appropriate to accept the Hippocratic notion that all medical students and doctors are male. Even the relatively modern Declaration of Geneva, has been modified by the University of Adelaide for its ceremonies while the UNSW oath of 2000 contains a commitment to personal wellbeing2.

Despite the changing content of oaths, some commentators have taken a step further and questioned the need for having these oaths at all4. They argue that current oaths are just a formality and do not carry any real value for professional regulation4. Besides, how could oaths keep up with the limitless complexity of modern medicine anyway2?

As a medical student, I accept the truth in these statements but I still feel that oaths are a necessary part of our education. They have symbolic meaning and represent a public commitment to uphold a set of values5. Whilst legislation formally governs our roles and responsibilities, the oath is a more potent reminder of the timeless profession we are about to join. It sets an ideal to which we should aspire to in our professional lives.

As medical practice becomes increasingly complex, it would be wise to remember the fundamental values of our profession. Legislation alone will not do this. There is also a need to instil inspiration in medical students and remind them of these values. An oath, although ever changing, would be an excellent way to do this.

References
3. Pellegrino ED. Medical commencement oaths: shards of a fractured myth, or seeds of hope against a dispiriting future?. MJA. 2002;176:99

Oaths are Good Medicine

Vivek Baskaran
Eating for Two - The common misconception in pregnancy

Matthew Thompson

Pregnancy is a time when most women are thinking more about their general health, and consequently many women make positive changes to their health such as quitting smoking and curtailing alcohol consumption. The majority of women spend considerable time throughout their pregnancy interacting with midwives, GPs and obstetricians and this increased interaction with the health care community presents an opportunity for health care professionals to positively reinforce changes to behaviour made by women during pregnancy. An important and often overlooked consideration for a healthy pregnancy is obesity and weight gain in the expectant mother.

The prevalence of obesity is increasing and over 35% of Australian women aged 25-35 years are overweight or obese. Obesity in pregnancy contributes significantly to morbidity and mortality in mother and baby as well as significantly impacting on an already stretched health care system. Pregnancy itself promotes obesity owing to gestational weight gain and inadequate weight loss between pregnancies. Obesity is also associated with increasing parity in mothers.

Obese women are around three times more likely to develop hypertensive disorders of pregnancy and gestational diabetes and about twice as likely to require a caesarean delivery. These women also suffer from adverse events associated with delivery including increased anaesthetic complications and infection. Obese women are also over five times more likely to develop venous thromboembolism (VTE) (adjusted OR 5.3, 95% CI 2.1-13.5).

There is also great concern for the health of the foetus in obese women as the risk of stillbirth among obese women is doubled (OR 2.07, 95% CI 1.59-2.74) and there was a 3.4 fold increase in birth defects found in morbidly obese women in an Australian study. At the time of birth, babies born to obese mothers are more likely to have high birth weight, be born prematurely, be in respiratory distress (OR 1.71, 95% CI 1.38-2.11), require increased resuscitation (OR 1.75, 95% CI 1.26-2.43) and require admission to intensive care (OR 2.77, 95% CI 1.67-6.94).

There are also consequences in later life which need to be considered. Children born to obese mothers are twice as likely to be obese by 2 years of age and there is an increased risk of metabolic syndrome in later life.

The health care system is heavily impacted by the consequences of obesity in pregnancy. Obese mothers require more prenatal care and intervention during delivery and require more treatment for maternal complications including infection, VTE and haemorrhage. There is an increased mean hospital stay from 2.4 days for ideal BMI to 3.3 days for morbidly obese women. More intense midwifery is also required and heavy lifting in the workplace may require expenditure on specialised equipment and result in a higher incidence of workplace injuries.

Many women are unaware of the implications of obesity in pregnancy and are unsure of what their ideal weight gain should be during pregnancy. In 2009 the Institute of Medicine (National Research Council) in the USA updated their nearly two decade old guidelines on weight gain during pregnancy. The new guidelines (Table 1) differ in that they stipulate a specific, relatively narrow range of recommended weight gain for obese women. Obese women are recommended to gain a staggering 6.5-7 kg less weight during their pregnancy than women of a healthy BMI.

Table 1 Recommendations for Total and Rate of Weight Gain during Pregnancy, by Pre-pregnancy BMI

<table>
<thead>
<tr>
<th>Pre-pregnancy BMI</th>
<th>Total Weight Gain (kg)</th>
<th>Rates of Weight Gain* 2nd and 3rd Trimester Mean (range) in kg/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (&lt; 18.5 kg/m²)</td>
<td>12.5–18</td>
<td>0.51 (0.44–0.58)</td>
</tr>
<tr>
<td>Normal weight (18.5–24.9 kg/m²)</td>
<td>11.5–16</td>
<td>0.42 (0.35–0.50)</td>
</tr>
<tr>
<td>Overweight (25.0–29.9 kg/m²)</td>
<td>7–11.5</td>
<td>0.28 (0.23–0.33)</td>
</tr>
<tr>
<td>Obese (&gt; 30.0 kg/m²)</td>
<td>5–9</td>
<td>0.22 (0.17–0.27)</td>
</tr>
</tbody>
</table>

Source: Rasmussen

*Note: The rates of weight gain are for the second and third trimesters of pregnancy.
Key recommendations from the new guidelines include:

- Provide counselling on diet and exercise as well as access to contraception to all overweight or obese women in order to help them achieve a healthy weight prior to conception.
- Offer services to all pregnant women including advice on diet and exercise in order to help them achieve gestational weight gain within the new guidelines.
- Offer services to postpartum women to help eliminate postpartum weight retention and achieve a healthy weight to improve long term health and healthy weight prior to future pregnancies.

Discussion of weight in overweight or obese women in a clinical scenario can be challenging for any health care professional and confronting for the expectant mother. However, obesity is a modifiable risk factor and presents an opportunity for health workers to improve maternal and neonatal outcomes.

The evidence is too strong to ignore. Overweight and obesity pose a significant risk to mother and baby and impact heavily upon the health care system. The first step in addressing this problem is for health care providers to educate women by letting them know that these new guidelines exist and secondly to facilitate healthy weight gain during pregnancy and return to pre pregnancy weight following birth.

References

Healthcare as a domain has been particularly slow to recognize the complexities of the impact that gender has on health. Until recent years, women were under-represented in clinical research and medical literature was biased toward a male-based gender perspective. Men were studied as the subject of research and results published as applicable to both men and women, skewing data and optimal management of health and disease in women.

The World Health Organisation (WHO) drew attention to this inadequacy on a global scale in 2002 with the release of the Madrid Statement, stating that in order to achieve the highest standards of health, policies had to reflect the different needs of each gender. Cardiovascular disease, which includes coronary artery disease, cerebrovascular disease, and congestive heart failure, is one area of population health where gender impacts significantly on health and disease outcomes. It is one area that is benefiting from gender specific research and policy. The National Heart Foundation’s Go Red For Women campaign has recently given publicity to the gender disparity in cardiovascular disease. At present cardiovascular disease is the primary cause of death for women in the western world. In Australia, it is responsible for 39% of deaths each year in women, as compared to 34% in men.

Data from the National Heart Foundation and the Australian Institute of Health and Welfare indicates that whilst women in Australia are living longer, they are also burdened with high levels of disease and disability in the later years of their lives. Cardiovascular disease is responsible for a large part of this; particularly the high case-fatality with increasing age (such as the over 75 years age group). This trend is also documented in statistics from the United Kingdom and America. Women generally live longer, present with cardiovascular disease later than men and then are more likely to die with cardiovascular disease - either as a primary presentation, or in concert with other comorbidities. These poor outcomes in women's cardiovascular health are complex and are not only related to age and co-morbidity status, but also to altered pathophysiology, atypical presentation and management.

Outcomes are additionally complicated by women continuing to be quite unaware of their risk of mortality from cardiovascular disease; many women believing that breast cancer poses a higher risk. In Australia, breast cancer is the 5th highest cause of death in women, whilst coronary heart disease and stroke are the top two causes of death.

It is known that sex differences affect the presentation of cardiovascular disease in terms of clinical symptoms and that diagnostic processes, therapeutic interventions and pathophysiology differ to that of men. Underlying atherosclerotic processes are recognized as being the same, but significantly, women are protected by oestrogen prior to menopause. Oestrogen protects vessels and reduces the atherosclerotic process somewhat by increasing endothelial stretch, and providing the protective benefits of an anti-inflammatory and antioxidant. It also acts to reduce cellular hypertrophy. These protective benefits are opposed by factors such as anaemia, smaller diameter coronary arteries, and autoimmune or inflammatory disorders, which have a higher incidence in women. These factors influence the presentation of the disease, as well as the treatment women are given.

Whilst women may present with chest pain, they may also present with atypical symptoms more often than men. In addition, they more commonly have non-Q-wave myocardial infarction (MI) compared to men, who more commonly have ST elevation MI, and more commonly are treated for psychosomatic illness instead of cardiovascular disease.

The reasons for high case fatality and poor outcomes in women do not only include a later age of onset of the disease and suboptimal treatment. Psychological factors, such as depression and anxiety are linked to poorer outcomes in primary, secondary and tertiary levels of disease.

Depression has an insidious effect from the outset of disease development – it constitutes a barrier to physical activity and reduction of modifiable risk factors. Depression and anxiety also predispose to myocardial infarction and the recovery of an acute event; women who have depressive illness are
more likely to die from an event in the first instance or within the first year following. They are also more likely to have a second myocardial infarction within years after their first event. Traditionally, risk factors for cardiovascular are divided into modifiable and non-modifiable categories.

Modifiable risk factors include:

* Smoking
* Alcohol abuse
* Diets low in fruit and vegetable intake
* Physical inactivity
* Hypertension
* Hyperlipidaemia
* Being overweight or obese

Non-modifiable risk factors include increasing age/age over 55 years, family history of coronary heart disease, prior personal history of coronary heart disease and male gender. It is perhaps the inclusion of the ‘male gender’ that adds to the perception in women and clinicians, that women are not at risk.

Further to the lists, type 2 diabetes mellitus, is a potentially modifiable risk factor important in that it can increase cardiovascular risk three-fold. Modifiable risk factors need to be targeted at all levels of preventative/population health intervention. The National Heart Foundation of Australia states that all Australians, men and women alike, should aim to reduce or remove the risk factors that they can change. This is in keeping with the shift in American literature also and the movement to raise general awareness of cardiovascular risk in women.

Lifetime risk factors for the development of cardiovascular disease bridge the gender divide; women and men are identified as having the same modifiable risk factors and this is where focus for primary and secondary levels of health care intervention should begin. It is important to continue to disseminate the message of different cardiovascular disease pathways between men and women; to raise awareness in the population and health care sector, through continued research, that the presentation of coronary disease can be atypical in women.

It is hoped that this will help improve clinical management and reduce both morbidity and mortality over time from cardiovascular disease, including the recovery period and improve longer-term survival with reduced disability.

References

Every year international students make up a significant proportion of graduates from Australian medical schools. The number of international student graduates has increased from 144 students out of a total of 1,400 graduating in 1999 to 401 out of a total of 2,139 students in 2008. This equates to a percentage increase from 10.3% in 1999 to 18.7% in 2008. The President of the Medical Deans Australia & New Zealand (MDANZ), Professor James Angus, reports that up to 70% of international students at some medical schools desire to work in Australia upon completion of their degree.

To qualify for a temporary work visa in Australia, an employer must sponsor the newly fledged doctor for the duration of the one-year internship. Permanent residency visa options only become available upon completion of the internship and the attainment of full registration as a medical practitioner. International students who fail to secure sponsorship for their internship will not be eligible to stay in Australia and will have to leave the country before expiry of their student visa.

It has been known for several years now that the increased intake of medical students would eventually lead to increased demand for internship positions. The total number of graduating medical students in Australia is predicted to rise from 1,335 in 2006 to 3,108 in 2014. The Australian Health Ministers agreed in February to guarantee internships for all Commonwealth-funded medical students. International and domestic full-fee paying students have so far not received any guarantees that they will be able to undertake an internship in Australia on completion of their degree. Although this may not have been a problem in the past when there were more intern positions than graduates, it has the potential to prevent international students from completing their medical training by not employing them as interns in Australia. It is also important to keep in mind that international students are not guaranteed an internship in their country of origin.

International students contribute significantly to the economy of Australian universities, spending in total somewhere around $200,000 to $300,000 in tuition fees, depending on which university they attend and the duration of the medical degree. MDANZ contends that the revenue raised from international students supports the universities and assists in providing better education for local students.

Australian education is a valued commodity and it is the possibility of being able to live and practice medicine in Australia that attracts a number of these students. MDANZ fear that if international students are not guaranteed internships it will lead to a decline in the number of students choosing to study medicine in Australia.

Some may argue that the Australian State Governments have an obligation to ensure that Australian students are offered internship positions before international students, and that
international students in fact should not be guaranteed employment in Australia on completion of their degree as they may choose to return to their country of origin should they be offered an internship there. Professor Angus, on the other hand, insists that the intern training is an extension of the degree and that it is essential to become a qualified doctor.

I am of the same opinion as Professor Angus, and maintain that it is in the interest of the Australian government, and the Australian people, to ensure that the international students who wish to work in Australia are guaranteed an internship here in order to gain full registration. It is an attractive solution as these graduates are Australian trained; they have had at least four years exposure to the Australian culture and will therefore be well equipped in interacting with Australian patients. Finally, a guarantee will ensure that Australia remains competitive in offering medical education as a commodity by continuing to attract overseas students.

References


In my pre-medical life I worked primarily in the performing arts as a composer, musician and dancer. In line with the findings of the 2001 Australia Council for the Arts artist survey “Don’t give up your day job”, I never earned more than the average income of $37,000 and often earned a lot less. Despite having had little economic wealth I feel like I have lived a very rich and privileged life and, foregoing unforeseen mishaps, it’s likely that will continue. With this in mind, coming into medicine I was acutely aware of the potential for establishing an income stream that would be well above that I was accustomed to. What worried me a little was the prospect of the ubiquitous compulsion of acquisition that seems to accompany an increasing income.

In discussion with my partner we considered giving more money to charity when our income was higher than a certain amount. These discussions have led to more thinking about what is a good amount of money to give to charity and also about how effective donations to charity can be. For some time I have been dwelling on the idea that medical students, as a cohort, have a huge earning capacity in our future working lives. And with this capacity for earning there is also an increased capacity for giving.

While there is no doubt that altruism plays an important role in drawing people to medicine, and for many keeps them in medicine, there is an acknowledged decline in this quality over the duration of one’s career. It has also been noted that as a tenet of professionalism, the quality of altruism has been present in medicine since the development of the Hippocratic oath and contributes to the trust embedded in the doctor-patient relationship.

Sadly, there are reports of this quality languishing under the pressures of time, resources and an increasingly litigious society. While there is a difference between altruism and philanthropy, they are closely linked. Indeed, it is difficult to imagine someone who aspires toward altruistic beliefs expressed through their actions not finding a way to be philanthropic in that area as well. And, perhaps, the reverse is also possible. By embracing philanthropy on a personal level perhaps it is possible to revitalise the notion of altruism.

In the last 12 months I have been pleased to see the emergence of two very distinct approaches to encouraging personal philanthropy, both based on a philosophical approach to inequity. The first is by the prominent, and some would say divisive, Australian academic Peter Singer whose recent book The Life You Can Save has an accompanying website to encourage people to donate a regular proportion of their income. His argument appeals to moral behaviour and seeks to change the culture of giving by setting a standard for amounts to donate based on income. You can read about it at: http://www.thelifeyoucansave.com

The second is by British philosopher Toby Ord, who has committed to giving away any income above a base level he has set for himself for the rest of his income earning life. While he encourages this, he also has a more moderate approach of committing to a percentage of income donation scheme – again in an ongoing fashion for the rest of one’s working life. This approach is flying under the banner of Giving What We Can and, with the support of a small team, he has also researched the cost effectiveness of certain campaigns and organisations to determine their efficacy. The data he provides and the interactive features that show you what difference a small percentage of your income can make are compelling and inspiring. You can read more about it at: http://www.givingwhatwecan.org
There is similarity between the two organisations that is worth pointing out. One is that they both acknowledge that there is a need to change the culture of giving – or to put it another way, they recognise that establishing a culture of giving begets more giving. The other is that by making a joint effort the combined philanthropy of individuals has the ability to create greater change. Our giving power as a group is a far greater force than as an individual.

So far, in the short history of the ANU Medical School, it has been shown that we are a generous bunch. Through various student organisations and activities run by medical students we have seen the emergence of ANU Red, the establishment of the Fiji Village Project, the annual Movember and Shave for a Cure hairy exploits, refugee computer skills tutoring at the migrant resource centre, rural health initiatives, the med revue profits going to charity, and countless other worthy causes being supported. This kind of activity places us all in high regard and it is worth acknowledging the efforts of students from all previous years that have contributed in this way. So where is this all leading?

I am hoping that we can further a culture of giving that is directly related to our role as doctors and as graduates of the ANU Medical School. Using some very simple mathematics and conservative estimates of salaries of earnings as junior doctors, it is possible for ANU Medical School Alumni to raise more than $250,000 in our first three years working by donating just one percent from our salaries. In real terms, this amounts to less than one percent because donations to a registered charity are also a tax-deduction, thus reducing the taxable income of the giver.

The following graphs give an idea of the amount of money we could give as a cohort while donating only 1% of our income. This is based on having an annual gross income of $54k, $64k and $74k for each subsequent year with only 80 PGY1, 75 PGY2 and 70 PGY3 places as a conservative estimate in the event of unexpected attrition. Hopefully there will be even more numbers though and higher salaries in the years to come!

To put this in perspective, during our Internship year if we donate 1% of our income – which will be at least $54,000 – and extract the benefit of a tax deduction it amounts to a donation of $378 over the entire year. This works out to about $7.26 a week, or the equivalent of 2 cups of coffee a week, or a sandwich for lunch, or the weekend newspapers, or 1 schooner of beer. In short, it’s an affordable proposition. While it’s important to acknowledge that many people feel they are unable to give to charity because of debt, loans, family commitments, and a range of other reasons, it is possible to budget in an amount for charity into any future plan.

In raising this idea within the graduating class of 2010 there have been a number of suggestions about how this could be organised, as well as a number of concerns about both the concept and the implementation. What I hope to see happen in the coming months is a group of students meeting to collaborate on finding a model that will suit the majority of medical students, with the primary aim of being able to cultivate a culture of giving that is representative of the Alumni of ANU Medical School.

I envision that the charities to be supported would be aligned with efforts in key health areas in both developing countries and within Australia. This could involve a pledging model as shown by the previously mentioned websites, or the establishment of a not-for-profit organisation that selects a range of charities to donate to, or something altogether different. What eventuates may be vastly different from the 1% example I have provided.

As future doctors we have a huge earning capacity as well as a unique set of skills to be able to share with the world. Allowing philanthropy to become an embedded trait in our graduates has the potential to benefit the recipients of donations as well as enhance the reputation of everyone who attends our course. The details of how this can happen are up for grabs, and I am confident that whatever emerges out of this process will be beneficial to many people.
April 7 marks World Health Day and the birthday of the World Health Organization (WHO) which was established in 1948. World Health Day 2010 sees the launch of the year-long focus on urbanisation and health. In Geneva, WHO interns and staff celebrated with cake and we sang “Happy Birthday WHO” in the WHO executive board room with our Director General, Dr. Margaret Chan in lead vocals.

The campaign is part of WHO’s wider role as the leading authority on the direction and coordination of international health within the United Nations’ system. WHO’s headquarters in Geneva, Switzerland is divided into nine clusters* and within the clusters are numerous departments and units. Currently, WHO has a six point agenda which involves promoting development, fostering health security, strengthening health security, harnessing research, evidence, information, enhancing partnerships and improving performance. WHO’s success under Dr. Chan’s leadership will be measured by the impact of its work on women’s health and health in Africa.

Interns can be found working in one or several of the units/departments within the nine clusters on various WHO projects. Every intern’s experience is different and it varies depending on projects, departments, supervisors and interest areas. The work of an intern is as diverse as the interns themselves. WHO interns are selected from all over the world with many different backgrounds such as medicine, bioethics, chemistry, health economics, statistics and communications just to name a few. However, there is a noticeable under-representation of interns from developing countries. This is largely because WHO internships are from six weeks to six months and is an unpaid position in one of the most expensive cities in the world.

There are a couple of ways to get a WHO internship. Firstly, there is the official WHO website application process which requires you to complete an online application form and then an interview. In my experience, this process is the most competitive and time consuming option because the WHO receives thousands of applications a year and you can wait between 3 to 12 months before you hear anything from the organisation. Since arriving I have learned of an alternative route. Many interns actually get their internships by directly-applying to WHO departments/units or WHO staff members they want to work with through their university or their personal contacts. This option seems the most efficient way of getting a WHO internship but it can be difficult if you do not have the right contacts within the organization.

My WHO internship is for three months and I work in the Information, Evidence and Research (IER) cluster within the Knowledge Management and Sharing (KMS) department in the eHealth (EHL) unit. Within the eHealth unit, my role is to update and redevelop the website of the Africa Health Infoway (AHI), which is an Information and Communication Technology (ICT) based network of knowledge services that facilitates knowledge sharing at district health facilities in low-resourced countries. The AHI service aims to provide info-structure/connectivity, knowledge services and ICT based capacity building to district health facilities in under resourced countries.

I am also currently working on the Knowledge Centers for Better Healthcare (KCBH) pilot project in collaboration with...
the Global Health Workforce Alliance (GHWA). The KCBH pilot project involves equipping Knowledge Centres (KC) within district hospitals in Oromia and Southern Nations in Ethiopia with computers, internet connectivity and knowledge resources to facilitate their access to up-to-date health information. I am involved in the development of the KC information access portal and compiling the eHealth resources for the KC.

So far my internship has been an incredible learning experience. The internship really gives you an opportunity to come face to face with the realities of tackling global health issues within a large international organisation. Like many other organisations the WHO struggles with limited resources, time constraints, bureaucracy and politics, and as an intern you get to experience this first hand. However, there is also a strong sense of mission, a lot of good will, a collaborative atmosphere and ambition that drive projects ahead.

A distinctive feature of WHO is the cultural diversity of the working environment. WHO staff are from all over the world and speak at least one or more of the WHO/UN working language of English, French, Arabic, Chinese, Russian and Spanish. This diversity is also reflected within the intern population. At my intern induction there were at least 15 different nationalities in the room and the majority of interns are at least bilingual.

As a WHO intern you also get to participate in many training sessions and discussion seminars which help to expand and develop your public health knowledge. Since arriving I have attended training sessions on Health and Human Rights and lunchtime seminars on a range of topics from Google translation to disaster epidemiology. Also, if you are proactive, there are many opportunities for career development and networking; with many WHO staff happy to offer their time to talk to interns and provide career advice. Since starting my internships I have had an opportunity to talk to WHO staff working in areas such as bioethics, health law, clinical pharmacology and eHealth.

It is not all work at the WHO. The internship is also an incredibly social experience with at least 100 interns working at the WHO at any one time. There is a very active WHO Interns Board (similar to ANU Medical Student Society) that organises many activities and functions. In my short time here, we had a private tour of CERN (home of the large hadron collider), weekly lunches at different UN organisations and a number of day outings around Geneva and different Swiss cities. Overall, life as an intern at the World Health Organization (WHO) headquarters in Geneva, Switzerland is an incredibly positive experience and something I would recommend anyone interested in working in the area of public international health to pursue.
We went to Cuzco, Peru for our elective. Cuzco is roughly 3500m above sea level, high up in the Peruvian Andes, making it one of the highest cities in the world. It was once the capital of the great Inca empire and having survived many wars, invasions and earthquakes, it is now home to nearly 350 000 inhabitants. The town is also the ‘gateway to Machu Picchu’ and so it has one of the largest tourist fluxes of any city in the world. Unfortunately, December through to February is the wet season in Peru, so expect a lot of rain (it rained every single day for at least 30 days non-stop when we were there). It is well worth investing in a good raincoat and umbrella.

We decided to organise our elective through a UK-based company called Medics Away (http://www.medicsaway.co.uk/index.php). They offer several types of elective packages with the standard hospital placement and accommodation for one month running at about AUD$1800. To this, you can add Spanish lessons and various adventure activities, depending on how much cash you have. We went with just the hospital placement and accommodation. We organised our Inca trek and Spanish classes separately as it worked out cheaper overall. The accommodation provided by the company was nice, clean, comfortable and close to the centre of town.

The hospital we were attached to was called Hospital Antonio Lorena. This modestly sized teaching hospital serves Cuzco and the neighbouring regions and offers most specialties for elective students except infectious diseases (for which, we would recommend Lima). We spent one week in each of four rotations: paediatrics, obstetrics & gynaecology, general medicine and emergency.

Understanding and being able to speak Spanish is essential and Spanish lessons are highly recommended for you to get the most out of your elective. In the end, the elective was as much about learning Spanish as it was about learning medicine. We spent the mornings at the hospital and the afternoons at Spanish lessons. We hardly knew any Spanish before we left Australia, and this did not help us on the ward rounds. The senior doctors really didn’t know any English, and the junior doctors weren’t much better. This made it quite challenging yet quite entertaining at the same time as fellow students and the local doctors practised their non-verbal communication skills. Furthermore, most people living outside of the big cities only speak Quechua (the native language of the region), which most local doctors didn’t understand either!

A visit to Peru is not complete without eating their famous cerviche (raw fish marinated in lemon juice), drinking their famous Chicha morada (a mildly alcoholic drink made from purple corn) and walking the classic Inca trail to the famous ruins of Machu Picchu. If you’re really adventurous, you can also try the famous roast guinea pig (we weren’t that adventurous!). In summary, with a bit of Spanish up your sleeve, an elective in Peru can be a fantastic experience, we highly recommend it!
Shanti Narayanasamy and I boarded our plane in Brisbane, bound for Honiara, the Solomon Islands’ capital, armed with enough chlorhexidine to bathe a small population. Between the handwash, masks and gloves, we almost pushed ourselves over the luggage limit - but we felt prepared, and we knew Professor Ashley Watson, Infectious Diseases doctor and our clinical skills supervisor, would be proud.

Upon arrival we found our accommodation, the St Agnes Mother’s Union, a church rest house with running water and power and lovely staff, and assessed our new location. In retrospect, we arrived at an interesting time - exactly before the Christmas and New Year period in this very religious country. Whilst there were strictly regulated holidays for workers over this time, hence a hospital with fewer staff and a closed laboratory, Honiara became exceptionally busy as many Solomon Islanders came to see family and perhaps downed one too many solbrews. Staying next door to a local pub, we were privy to these events, as well as the complete back catalogue of ABBA on repeat. At these times, ear plugs came in very handy.

We did our elective placement at the National Referral Hospital, affectionately known as ‘number 9’ which has 400 beds and a number of Surgical and Medical wards including General and Orthopaedic surgery, Internal Medicine and Tuberculosis (TB), Gynaecology, Paediatrics and Emergency Medicine. Not only was arriving in Honiara a new experience, but walking into the hospital was exceptionally eye-opening and at times heartbreaking.

I spent time on both the Internal Medicine and Paediatrics wards during my placement. There was a myriad of pathologies across all age groups. In particular, the prevalence of TB was staggering. On our first ward round in the General Medical ward about 60-70% of patients had TB of some form and this did not even take into consideration the separate TB ward. Exposure within families and beyond is a large population health issue and there were a number of paediatric cases within the hospital. In addition I saw cases of malaria, leprosy, impetigo, shingles, many congenital abnormalities such as Down and Apert syndromes as well as a case of kwashiorkor in perhaps the most miserable child I met. There were many heart murmurs to hear in children who had no opportunity for surgical repair as well as a myriad of chest signs in the majority of patients with pneumonia or TB. Late presentations of chest and abdominal malignancies meant there were patients with significant ascites and pleural effusions, allowing many opportunities for ascitic taps and chest drains.

Despite the devastatingly under-resourced health care system, there were things that impressed me about the people of the Solomon Islands. The bedside manner of some of the doctors was quite inspiring. They would listen carefully to the questions and concerns of the patients and their families and often sit on the bed and put their arm on a patient’s shoulder whilst gently explaining what was happening. Their clinical skills were also very impressive and they reminded us that they had no CT or MRI to help them with their diagnosis! The stoicism of the patients was incredible. People would not present until they literally could not walk properly due to their shortness of breath or ascites and when they were finally treated and cared for I never heard a single complaint. There seemed to be a sense of calmness about pending illness progression and challenges and a great acceptance that what will be, will be. In addition, the bonds within families were obviously incredibly strong. A patient would often be accompanied in the ward by their entire family. They would bring them food, blankets and often share their bed. This sense of support for the person in hospital was very powerful.

The experience we had was at times very challenging, but overall it was incredibly worthwhile and I cannot have imagined gaining such insight into the health system in a developing country through any other means. Textbooks and pictures could not have prepared me for what I would see and carry with me for a lifetime.
Plato’s Allegory of the Cave is apt for the experience of medical students during their education. For not only does this tale gloriously capture the wonders of knowledge, of which students of medicine experience in abundance, it also speaks of the obligations of the holders of such knowledge; that is, to serve those who do not have a similar privilege. In learning of Plato’s Cave, students not only appreciate the magnitude of their learning but they understand its purpose at the humanistic core of medicine: that is beneficence towards their fellow humans.

Amongst the first things a medical student will learn is to demarcate a sign from a symptom, where the sign is the objective observation of a medical practitioner whilst the symptom is part of the patient’s subjective experience of disease (for example, a patient experiences pain whereas a doctor would elicit tenderness). Thus begins the many signs and symptoms that one must learn to attach to the vast pathological tapestry that exists in medicine. One of the most important signs, however, is one most often observed by the teachers of medicine rather than its students: when a student finally makes a grasp of a concept, or for example, feels a pulse for the first time, the tutor will accurately describe this as the ‘eye’ sign – the student’s brow will ascend and the eyes lighten with simultaneous wonder and understanding. Therefore, given the nature of the study of medicine, one tends to spend much of the time wearing this curious expression. Notwithstanding the image I have just portrayed, this is an important analogy of what I believe a medical education imparts upon those who experience it: a movement from a period of relative intellectual and spiritual darkness, into one of light.

At this point I must stress that medicine does not have the monopoly on epiphany, for those revelatory forces within medicine are, in essence, drawn from those in life. Medicine, however, offers up its own peculiar buffet for its devotees to feast upon. Using the allegory of Plato’s Cave, I will show that the very process of a medical education is an operation in enlightenment that carries a moral caveat.

Plato believed that truth was gained from looking at universals, or theories, and that people had to travel from the visible, tangible world, to an intelligible, or invisible realm of reason, to begin to discover the truth of things. To illustrate this point, Plato uses three allegories in his work Republic, of which the last, the Cave, is the most famous. Here he describes a group of people held in bondage since childhood within a cavern. Their only source of light is a fire behind them, and their bodies are restrained so that the only knowledge of the visual world is that of shadows cast upon the wall of the cave in front of them. This group represents humankind, whose prison is the tangible realm, on which only belief or opinion is based.

Plato then asks, what if a prisoner were to escape his chains and feast his eyes upon the world; at first the light of the fire, and then in particular the wondrous stars, sun and seasons he would discover above ground. Our former prisoner has, in essence, learned of the true source of light, or indeed the true nature of his world. This journey is a metaphor for the discovery of knowledge, and therefore, truth.

The experience of medical training could be likened to emancipation from a spiritual and intellectual cavern, devel-
oped through the academic and moral rigors of study. The reason for this, I believe, is that medicine is privileged to be the unique unison of studies into the science of humanity and the nature of humanity, both of which are bestowed rich philosophical inheritances.

The pursuit of knowledge is wholly analogous to the structure and nature of scientific thinking. Plato argued that a true philosopher is one who loves and possesses knowledge as opposed to mere belief or opinion, which is seen as fallible and deficient. Knowledge is further defined as the truth of things where a philosopher can therefore see each thing 'in itself, in its permanent and unvarying nature'. It can be argued that Plato goes on to advocate the method of theory or hypothesis. The finer detail of the philosophy of scientific thinking has been debated since, by Popper and many others, yet the ideal that a theory will be as great an approximation of the truth as the human mind can conjure has remained the bedrock of scientific knowledge.

Medicine then, it seems, is worthy education for this definition of a philosopher, as a medical student cannot but help to love knowledge, for a love of knowledge is necessary for continuing success in medicine. A healthy curiosity is central to survival for a medical student, in exams or on the wards.

Secondly, medicine operates within the philosophy of scientific thinking. Medical students of the current epoch are extremely lucky to be educated within a culture of scientific enlightenment; specifically through the likes of evidence-based medicine. Such advances have been a paradigm shift from a culture of relatively blind tradition and entrenched values, to a system of best treatment based upon scientific best practice; of hypothesis, falsification and probability. Students need no longer to struggle to reconcile logic with tradition. Indeed, we are encouraged to seek out what really is best practice, i.e. what is the truth behind a clinical decision. Coupled to this is the classical components of medical studies: physiology, anatomy, pathology etc, which all serve to reveal the truth of our bodies' operation; in a move both simple and complex, we discover the nature of our scientific selves.

So we have seen that the medical student has made the first steps towards understanding the science of humanity. Yet we are also privy to the nature of humanity. I see this as less tangible than the 'intelligible' realm of knowledge; indeed it is difficult to construct completely watertight theories that are fit for our natures. Despite this fact, the pursuit of truth, of exposing the human condition, should remain a core ideal for aspiring doctors. I believe it to be a very personal journey towards this understanding, where experience, learning and thinking all serve to develop the truth for ourselves as to what constitutes such abstracts as happiness or sadness, love or hate, just as Plato debated the nature of beauty in Republic.

In amassing such experience and piecing together the collage of our understanding of human experience, the medical student is indeed blessed with variety. We observe the most joyful and darkest moments in human existence. We dwell with sickness, death and suffering yet witness and provide the means for a return to wellness, wholeness and happiness. None of these experiences are to be discounted, for they continually shape our knowledge of human nature.

Once Plato had used the Cave to demonstrate knowledge, he furthered this line of thought to derive ‘goodness’ from this knowledge, believing that goodness flows from truth. In the context of medicine, we have come to know goodness as beneficence; therefore it is this beneficence that is the endpoint of our knowledgeable labours. From science, it is best practice; it is thus our ethical responsibility to be as knowledgeable as possible, for from this the greatest amount of good may flow. From our study of human nature, it is consideration of the patient, a respect for their needs, autonomy and dignity. Knowledge of our science, united with knowledge of our nature, empowers us with maximal potential goodness.

So we can see that medical students are set upon the path of discovering truth and through truth, goodness. However, I will extend this experience somewhat further: that this entire process lends to those studying and practising medicine, that philosophical Holy Grail: a sense of purpose and meaning.

This is explained by the final part of Plato’s allegory. To Plato, the fundamental message of the Cave was that philosophy is a way of life: that with the pursuit of truth comes the responsibility of service to those who are less privileged – those still imprisoned within the cave. Thus, he stated that it is the onus of the free to once more descend into the cave and assist their fellow humans.

To those in medicine, this is an important conclusion. This allegory provides meaning to the prosaic and confirms the ultimate role of the doctor within the community as one of service. It also demonstrates to the student the responsibility they will one day acquire: as teachers to a subsequent generation of students. As we leave our intellectual and moral caves, be certain that we are not absolved from this duty: to strive for truth in our studies of human nature and science, and with that knowledge, serve our fellow humans with goodness.

With thanks to

Dr Graeme Moller for describing the ‘eye’ sign

References

Essentially Beneficial Mistakes

Konrad Reardon

For every medical student, amidst the flurry of anatomy, physiology and biochemistry there is a quiet thought: “One day, I’ll have a sick patient in front of me…” There is usually a moment of panic followed by the next question:

“Where would I start?”

You should start with the basics – the things that past experience has shown to work…

No medical degree today is complete without a reference to Evidence-Based Medicine (EBM). It may not be examinable, but EBM permeates many aspects of the course. At first, EBM really seems like “recipes” derived from complicated statistics and endless randomized control trials. EBM does include statistics but only as a way of being intuitive by numbers, a tool allowing both the bewildered student and the experienced clinician to draw on the best and the worst ideas from hundreds of years of medical practice.

The roots of EBM can be traced back to Galen1, but its most recent definition is “conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients2”. EBM promises to satisfy the tenets of beneficence, non-maleficence, justice and patient autonomy – after all, with sufficient scientific evidence we guarantee the best possible outcome with the fewest possible side-effects, as well as ensuring that everyone is treated on an equal basis while simultaneously empowering patients to exercise their right to refuse treatment.

Clearly a win-win situation – except that many clinicians argue over the definition of “best evidence” and question whether EBM can apply to individual patients3. Recent reactions against the ascendancy of randomized control trials4 and the persistent depiction of EBM as “cookbook” medicine depriving patients of their human right to be treated as individuals continue to turn many clinicians against the ideas of EBM. To a medical student, the argument may only be of abstract interest in a course dominated by examinations of more concrete knowledge. But there is still that sick patient waiting. Maybe it is useful to be able to answer the questions in Table 1.

EBM has its faults, but it is still a good start. University teaches us to think like doctors – to distinguish between normal physiology and disease. But the world is full of medical information – tens of thousands of articles are written each year! The physicians teaching in medical courses have seen thousands of patients and have a wealth of experience to critique the literature and inform their professional intuition.

Students should not lose heart though – EBM can give them the systematic review of the essentially beneficial mistakes of the past that they need to put everything in perspective.

Table 1 EBM Survival Guide

<table>
<thead>
<tr>
<th>Question</th>
<th>Basic Steps to answering the question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can I use this test to make a diagnosis?</td>
<td>1. Start with pre-test probability An index of suspicion informed by the overall clinical picture – age, observations physical signs, symptoms and prevalence1. Indicates which test should be used. 2. Look at the sensitivity and specificity of the test: Gives the chances of disease being present based on a positive or negative result from the test used4. 3. Use the likelihood ratio: The relationship between sensitivity and specificity which allows us to work out how strong the diagnosis would be based on the test result4.</td>
</tr>
<tr>
<td>Will this treatment work?</td>
<td>1. Find the Absolute Benefit Increase (ABI) Answers the question – “how many more actual cases improved with the new treatment versus the old treatment (or placebo)?” ABI is the most direct measure of the success rate of a treatment as determined in a clinical trial5. 2. Use the ABI to calculate the Number Needed to Treat: This is the simplest indication of the usefulness of a treatment; the number of patients who must receive the treatment before a successful outcome is achieved6.</td>
</tr>
<tr>
<td>How good is the evidence?</td>
<td>1. Look at the number of authors who have written the article: The more authors the better. 2. Look at the number of times the article was cited: The higher the number the better. 3. Where was it published? Major medical journals such as BMJ, JAMA are better. 4. When was it published? The sooner the better. 5. Who is the author? Is the author well respected? 6. What type of article is it? A systematic review is better. 7. Why was it written? (Conflict of interest) 8. How many authors have cited this research?</td>
</tr>
</tbody>
</table>

References

These were the words of Graheme Celledoni – a Mourilyan banana farmer who broke the Guinness World Record for the most bananas broken in a minute, snapping 96 bananas in front of a very supportive crowd at The Innisfail Show last July. The previous world record was held by Ashrita Furman who had previously broken 94 bananas. This year, Mr. Celledoni snapped 99 bananas but three were ruled out because of technicalities - the banana skin was still left attached.

Welcome to the festive atmosphere of The Innisfail Show which travels to the town every year on the last Friday of the July school holidays. The show travels along the eastern seaboard of Queensland and up across the top of Australia finally culminating in Darwin. The show brings with it the showbag sellers, the dodg’em cars, a Ferris wheel, ghost town and games stands. They bring fun and festivity to the town, plus the added pleasure of an exclusively regional public holiday.

But the fabric of the show is created by the town itself. There were amazing handmade intricate quilts alongside original fashion designs featured with standout craftwork pieces. The shelves were lined with different types of cakes and pastries vying for pride of place along traditional or diverse takes on homemade jam. There were even prizes for the heaviest pumpkin, the perfect zucchini, the best carrot, and the most rounded, cleanest potato.

Around the corner I was greeted with a spectacular display of flowers, defiantly blossoming in the thick of winter; carnations, orchids, roses, daffodils and gerberas. All of which were carefully tended to bloom to their full potential, competing with others for first prize or a high commendation. Next up was a series of presentations by the local schools and community groups followed by a blaze of colours that is the collage of the overwhelming flow of entries for the photographic competition. For a whole week leading up to the event, everyone working and coming into the doctor’s surgery had been talking about their plans to go to the show, or at least plans to enjoy the long weekend. Every child got free entry on Thursday night and there were to be fireworks both nights.

Returning to Innisfail for the first time in the middle of winter, and not the wet season with the torrents of rain and wind which usually accompanied my previous stays through the John Flynn Placement Program, was a definite highlight.

The pattern of life continued normally, humming and bustling along. Children were on school holidays, some farmers were moaning about prospective rain ruining their crops (compared to the rest of the country), everyone had the flu or sniffles (albeit with concerns of whether it was H1N1, leptospirosis or dengue fever) and some hospital services had been put on hold because of the holidays. This built up the list for colonoscopies and endoscopies needed locally, all the more personal because the patients were seen that day.

Every time I’ve come back to Innisfail I’ve formed more of an attachment with the community and people living and working there. It’s nice to return, and interesting that the more time passes, it stays the same. It’s not just a country town but a thriving community that with the same underlying issues that everyone faces, with the exotic variant that tropical country Queensland can provide including breaking world records in banana snapping.
Rural and Indigenous health in Australia is a hot topic. Certainly, one of the biggest issues is the clear disparity between urban and rural Australia in terms of a number of health determinants. These include isolation, workplace shortage, workplace retention and lack of key services, just to name a few. To address these issues, a number of key incentives were devised by the Australian Federal Government, such as scholarship places, rurally bonded contracts for students and recently, increasing the number of GP and specialist training posts. At a grassroots level, much work can be done to address these issues by promoting the message of rural, remote and indigenous health to students who are currently enrolled in, or who have an interest in joining the health workforce.

The ANU Rural Medical Society (ARMS) was established in 2004, by the first intake of medical students at ANU, to promote rural and Indigenous health. ARMS is a student run club functioning as part of the National Rural Health Students’ Network (NRHSN), a body of 29 Rural Health Clubs. As part of the NRHSN, ARMS participates in events with other member rural clubs representing all health disciplines from universities around Australia. Our nearest neighbour club is CRANC from the University of Canberra and ARMS frequently runs joint events with CRANC. To learn more about the NRHSN and other rural clubs around Australia check out www.nrhsn.org.au

ARMS receives funding from the Commonwealth Department of Health and Ageing and the Australian Defence Force, independent sponsors such as MDA and from membership which is open to all ANU medical students. ARMS currently has 144 members who, through their membership, are invited to participate in exciting events such as the annu-
al Yarralumla Woolshed Bushdance, snow and surf trips, academic speaker nights, first aid skills courses, rural photo exhibitions, horse trail rides, car and bike maintenance courses, movie nights and rural driving skills courses.

ARMS members also volunteer their time and experience to participate in health education and health screening at rural shows, community health stalls and Indigenous festivals. This serves the dual purpose of promoting health in rural and Indigenous communities as well as facilitating students’ rural health exposure.

In addition ARMS runs rural high school visits to encourage rural students to consider undertaking a career in health. To further remove barriers faced by rural students and facilitate their transition to tertiary education ARMS has begun tutoring and mentoring schemes in Cooma and plans to expand this to other rural areas in the future. For more information about ARMS and our upcoming events check out the ARMS website at http://arms.asn.au/

Table 1 ARMS Events 2010

<table>
<thead>
<tr>
<th>Month</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>March</td>
<td>13th: Cooma Rural Show</td>
</tr>
<tr>
<td></td>
<td>15th: Binalong Men’s Healthy Lifestyle Evening, Binalong</td>
</tr>
<tr>
<td></td>
<td>19th: Nominations close for ARMS committee</td>
</tr>
<tr>
<td></td>
<td>20th: Bombala Rural Show</td>
</tr>
<tr>
<td></td>
<td>21st: Rural High School Mentoring Trip, Cooma</td>
</tr>
<tr>
<td></td>
<td>20-21st: Goulburn Rural Show</td>
</tr>
<tr>
<td></td>
<td>27-28th: Yass Rural Show</td>
</tr>
<tr>
<td>April</td>
<td>Early April: Indigenous mentoring trip</td>
</tr>
<tr>
<td></td>
<td>8-10th: National Rural Leadership Development Seminar, Wollongong</td>
</tr>
<tr>
<td></td>
<td>9-14th, 18-23rd: Northern Territory 2010 Rural High School Visits Program, NT</td>
</tr>
<tr>
<td></td>
<td>16th: ARMS Annual General Meeting, Canberra</td>
</tr>
<tr>
<td>May</td>
<td>1st: Bungendore Skills Day, Bungendore</td>
</tr>
<tr>
<td>July</td>
<td>15-17th: National University Rural Health Conference, Alice Springs, NT</td>
</tr>
</tbody>
</table>

Membership to ARMS is not only a way of meeting fellow students and gaining hands on experience but also opens up a range of scholarship and conference opportunities. Each year ARMS sends along members to the National University Rural Health Conference (NURHC).

This conference is designed to connect multiple disciplines and generations of health professionals, along with some of the country’s foremost rural and remote health bodies.

ARMS, as a member of the NRHSN, also has access to funding to attend conferences around the country through the Conferences of National Significance Program. If you are a member of ARMS and are seeking assistance to attend a conference please visit for more details at http://www.nrhsn.org.au/site/index.cfm?display=39664

Below were a few events that ARMS planned during the first half of 2010.
My ambition was to be a lawyer. That was unacceptable to an old-fashioned Chinese father, so I journeyed forth to a foreign country at the age of eighteen to achieve the family’s goal of my becoming a doctor. Australia was magnanimous in embracing the Colombo Plan, a vision based on charitable aids, which included providing university training for engineers, doctors and teachers for the under-developed countries in Asia. I was a recipient of such largesse and following matriculation, entered Monash Medical School.

Following the pre-clinical years, I accepted a scholarship to do research for a year towards a B.MedSc (Honours) in Physiology. After an exhilarating year which resulted in my thesis being published in Nature and another in British Journal of Pharmacology, I then completed my medical course with MBBS (Honours). After a year of sleep-deprived internship and another of teaching anatomy at Monash, I became the first Monash graduate to pass the gruelling Part I of the FRACS. My life hit a brick wall when I was offered an unsolicited registrar position by the Chairman of Examiners, who was from “the other university”. I was called up, chastised and told to train under my own professor or else it would be best to leave the country - this cannot happen nowadays. So I left, to become a Fellow at the Mayo Clinic for 4 years, completing the requirements for general surgery. I planned to specialize in liver transplantation and was arranging to move to England, when I was tapped on the shoulders by my mentor, an inspiring surgeon who later became President of the American College of Surgeons. “Would you be interested to stay at the Clinic as a surgeon in head and neck section?” he asked. Few ever turn down such an offer. Arrangements were made at Mayo for me to train and qualify for the Boards in Plastic Surgery prior to becoming a consultant.

I trained in plastic surgery for a year. A personal crisis arose to cut short my time at Mayo. My mother was dying from lung cancer and would like me to come home. It was a heart rending exercise to have to choose between career and family. As always, the family came first. My wife, and two children and I left America and returned home, for me after an absence of sixteen years.

Idealism to serve my homeland gradually metamorphosed into disillusion and angst, when as a member of the minority race, I became convinced that the national policy of discrimination in my country would never change in my lifetime. It was yet another choice to make. I chose to come to Australia, over America, for a more peaceful life. I had prepared for this possibility, to migrate, having taken out the fellowships by examinations of America, Canada and Australia. My classmate, Paul O’Brien, who became Professor of Surgery at Monash visited me in Sarawak. I confided in him, that I was making a move to Australia. He offered me a job at Monash, in his department, but I was not that keen to return to the grey clouds of Melbourne. He then phoned the Chairman of Surgery at Royal Canberra, his previous registrar, to arrange a job for me here. I visited Canberra in 1988 and fell in love with the idyllic weeping willows gently swaying and drooping over the stagnant stream, quietly running through the campus of the ANU. I found it to have such peace and tranquillity in a nice clean city. I wanted to live, work and set roots here.

I commenced practice in General Surgery and became a Visiting Medical Officer to the Royal Canberra and Woden Valley Hospital. In my years of practice, I never lost touch of the precepts instilled in me from Mayo, that the patient is the very reason for our existence as surgeons.

Teaching came when Sydney established a Clinical School, and I was immersed in teaching surgery until a professor was appointed the job. ANU Medical School succeeded the Sydney campus with a new Professor of Surgery, who after a few months, left for “the city life”. I was then approached to set up the department and implement the teaching for the new medical school. Three cohorts of graduates confirmed that the doctors we produce are just as well trained as those from other medical schools.

Surgery is a demanding discipline, and brooks no competing outside interests. Rewards come from seeing rapid recovery in sick patients, sorrows from realising your own mistakes, which may be unforgiving. Surgeons are hardened to the sound of the phone in the early hours of the morning, ringing for help with the living or news of dreadful death. To be ever vigilant and ready calls for constant renewal and learning to keep ahead of progress in the field. Sacrifices are too often made on family time but it is still the pre-eminent life saving specialty.