How prepared are students for the various transitions in their medical studies? An Australian university pilot study [version 1]

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Abstract
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Becoming a doctor involves a series of transitions that require medical students to be equipped with the appropriate knowledge, skills, confidence and professional approach at each step. This pilot cross-sectional study canvassed five cohorts immediately after completing Years 1-5 in a five-year undergraduate medical program (Gold Coast, Australia) regarding their preparedness for the next year. The survey, an amalgamation of two validated inventories, was tailored for each year group to include the expected competencies in five areas. Despite a low response, those who did participate provided valuable information regarding their competence and confidence in terms of their interpersonal and intrapersonal skills, their clinical skills, their ability to apply their theoretical knowledge and investigations. Time management and balancing work and their studies were some areas in which support might be needed. Generally, all student felt comfortable with the communication and physical examination skills but up to half of some of the more senior students were not confident towards dealing with a violent patient and about 20% did not feel at ease communicating and assessing a patient with a mental health issue. Students identified two other areas that requiring curriculum interventions: Working with patients who might be using non-allopathic medications and calculating drug doses. As both impact on patient outcomes, a follow-up study is required. Different recruitment strategies need to be investigated.

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Keywords
Preparedness for Practice, Transition, Medical Students, Recruitment, Medical Education, Medical Program, Undergraduate Medicine, Postgraduate Medicine, Intrapersonal Skills, Interpersonal Skills, Clinical Skills, Scientific Basis of Disease, Investigations, Student Perceptions, Clinical Preparation, Confidence.
Introduction

Students undergo a series of major transitions on what is often an arduous journey to becoming doctors. Each stage of their individual journey, first as junior or pre-clinical students, then as clinical students in the real world of medicine, requires them to acquire the appropriate knowledge and develop the skills, professional behaviour and attitudes to advance. It behoves us as academics to not only ensure that students are suitably trained for the next stage of their journey, but that they are also sufficiently confident to make the next transition. While there have been a number of studies investigating the transition to the clinical years and the transition to internship following graduation (Helmich et al., 2012; Barbosi et al., 2016, Barrett, Trumble and McColl, 2017, Monrouxe et al., 2018), much less has been studied in terms of the other transitions on this journey (Kehoe and Illing, 2017, Moro and McLean, 2017).

Undergraduate medical education is generally characterised by three major transitions for many students: From high school to university (Barbosi et al., 2016), from what is often referred to the ‘pre-clinical phase’ to the ‘clinical phase’ (i.e. working with patients in clinical and community settings) (Barrett, Trumble and McColl, 2017), and from medical school to the first year of internship (Wall et al., 2006, Monrouxe et al., 2018). It is also well documented that medical studies and a medical career are stressful, with a greater proportion of medical students and clinicians suffering burnout and depression compared with the general population (Rotenstein et al., 2016, Boni et al., 2018). While the reasons are numerous and include the ‘medical culture’ and exposure to death and dying, medical schools have a responsibility to ensure that students are prepared for the reality of clinical practice (Kothari, George and Hamid, 2018). Implicit in this assumption is that as educators, we need to know how students perceive their preparedness for each transition so that we can either allay their insecurities and, if necessary, provide remediation to address identified shortcomings and concerns. There is evidence suggesting that those distressed at the beginning of their studies continue to be so throughout their careers (Niene and Vainiomaki, 2006). It is therefore imperative to support learners in undergraduate medical programs in particular as they often commence their studies as young school-leavers (Moro and McLean, 2017). A further risk to consider in the future is the introduction of technology in place of clinical or teacher-directed scenarios, particularly in medical anatomy and physiology (Moro et al., 2017a, Moro et al., 2017b), which is effective at enhancing learning although may result in students becoming even less confident when interacting or communicating information in the clinical environment. Researching how students perceive their preparedness for each transition, some of which are major, such as the transition from medical school to the clinical workplace, would thus be a useful exercise. Despite doing well academically, some learners may falter as they transition from the academic years to the clinical arena which involves multiple abilities across broad competencies that include being part of a multi-professional team, interacting and communicating with patients from diverse cultural backgrounds, dealing with difficult patients, being able to undertake a through physical examination and a range of procedural skills, to understand the rationale for ordering laboratory investigations, diagnose, prescribe and also be able to manage their personal and professional lives (Prince et al., 2005; Godefrooj, Diemers and Scherpbier, 2010; Atherley et al., 2016).

It should therefore not come as a surprise that anxiety is more common in undergraduate students, i.e. younger medical students (Hayes et al., 2004). Stress and anxiety in the pre-clinical to clinical transition period is common and has been related to a combination of factors related to maturity, professional socialisation (Helmich et al., 2012; Atherley et al., 2016), workload, time, and organisation of and deficiencies in knowledge (Prince et al., 2005; Hayes et al., 2004.) Students have described entering the clinical arena as being thrown in the deep end (Atherley et al., 2016)) as they struggle to apply theoretical knowledge and training in the patient setting and to develop their clinical reasoning skills.

The last major transition for a medical student is from final year medical school to the first year of an internship. Multiple studies support the understanding that many graduates feel unprepared to start work and that preparedness for work varies substantially between medical schools (Illing et al., 2008). Hill and colleagues (1998) in testing eight key areas of adequacy of undergraduate training for internship reported that students from problem-based learning (PBL) curricula were better prepared across most major domains. Wall and colleagues (2006) noted that new doctors felt ill-prepared and ill-equipped for their new role and, identified that the areas of most concern were those of basic doctoring skills such as decision making, prescribing, treatment and practical skills.

The present study

This study aimed to pilot an online survey designed to canvass all medical students in a five-year programme to identify their perceptions of preparedness for practice for a range of competencies in five domains as they transitioned to the next academic year. The research questions that framed the study were:

- In what competencies and domains did learners perceive that they were well prepared for the next step in their journey?
In what competencies and domains did learners perceive that they were not well prepared for the next step of their journey?

If competencies and domains were identified for which learners believe they were not prepared, these would be raised at the appropriate year level to investigate further with the view to supporting students better for the transition.

**Methods**

**Institutional setting**

The pilot study was conducted at Bond University (BU), Gold Coast, Australia and involved Year 1-5 students in the undergraduate medical programme as well as recent graduates (Year 1 interns). Approximately 80% of students are regarded as ‘school-leavers’ as they enter their medical studies directly from high school or have studied for less than 1.5 years at university. The remaining 20% comprises graduate, usually biomedical science graduates or health care professionals such as nurses, dentists, physiotherapists and pharmacists.

The five-year MD programme at Bond University, Gold Coast, Australia, comprises:

- **Year 1** (two semesters): Guided, hybrid problem-based learning (PBL)
- **Year 2** (three semesters): Hybrid PBL
- **Year 3**: Case-based learning (CBL), using virtual patients delivered by Bond Virtual Hospital (BVH) and simulation (regarded as a transition year in preparation for clinical practice) (McLean, Brazil and Johnson 2014)
- **Years 4 and 5**: Clinical rotations, selectives and electives and the completion of an MD project.

**Study design**

The pilot study being reported is part of a larger cross-sectional study designed to prospectively canvass five academic cohorts of learners (Years 1-5) just before writing their final, end of year assessment and then to follow up a few months later once they had transitioned to the next academic year and were settled. They would then be asked retrospectively about their preparedness. For various reasons, not least difficulty recruiting students, the survey remained open from September of one academic year to January the next academic year. Thus, participants had completed their final assessments and were about two weeks into the next academic year. Thus, although this pilot was intended to gauge prospective perceptions of readiness to practice, students were in Years 2-5 and in their first year of internship following graduation.

**Development of the survey instrument**

Two validated inventories, the Preparedness for Practice Questionnaires (PHPQ) (Hill et al., 1998) and Illing and colleagues’ (2008) cohort questionnaire were combined and modified to span five domains and which reflected the expected outcomes or competencies at the end of each BU academic year (Hill et al., 1998, Illing et al., 2008). Other studies were explored to help define knowledge and skills especially relating to Year 5 and the internship year (Scicluna et al., 2014, 6, Rolfe et al., 2002, Wall et al., 2006) as well as the medical school science and scholar, practitioner and health education and professional themes through which curriculum is designed. While the original wording for most items was maintained, some were modified to reflect the Bond University outcomes. The final surveys comprised five domains (Wall et al., 2006, Illing et al., 2008), similar to the PHPQ framework (Hill et al., 1998):

- Interpersonal skills (collaboration, communication, teamwork)
- Clinical skills (history and physical examination, patient assessment, procedural skills)
- Investigation, management and preventative care, including prescribing and holistic care (clinical reasoning, patient management)
- Scientific basis of disease (knowledge)
Intrapersonal skills (confidence, resilience, dealing with uncertainty, time management, professionalism, ethics)

The questionnaire was designed to assess common themes (20 questions) across the entire cohort. Then, additional questions were incorporated that were specific to each year level. Year 1 graduates answered a total of 22 questions; Year 2, 24 questions; Year 3, 37 questions; Year 4, 55 questions; year 5 47 questions; and PGY1, 54 questions. The questions assessed predominantly inter- and intra-personal skills, combined with individualised cohort-specific queries which reflected increasing expertise and competencies across the domains. This allowed each year to be considered individually and in the future would allow tracking of progression of curriculum, and students’ perceptions of their preparedness for transition prospectively and retrospectively. Respondents were asked to rate how confident they were for each statement on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree.)

Survey delivery
In the first two weeks of the academic year, in January 2017, all Year 2-5 students and Year 1 interns were sent an email explaining the study and requesting their participation. They were also reminded by the investigators during face-to-face sessions. As the survey was online, a note at the start of the survey informed students and graduates that by completing the survey, it was assumed that they had consented to be part of the study in which their anonymity was maintained. Being at the start of the year, the survey asked students to relate to their perceived preparedness for the attributes that they should have developed in the prior year of study. Informed consent was provided from all participants, and Ethics for the study was approved by the Bond University Human Research Ethics Committee.

Results/Analysis

Recruitment and responses
Despite recruiting students in many different ways, e.g. email, personal appeal, etc., the response was poor. Of the 54 students or recently graduated students who initially agreed to participate, 45 responded to a survey with their perceptions towards practice and have been included in this report (Table 1). Participants responded in five domains (set of skills) regarding their preparation for the next phase of their journeys: Intrapersonal, Interpersonal, Clinical Skills, Scientific basis of disease and Investigations.

Perceptions of preparedness
As it is not possible to report all results, only the domains and skills in which learners perceived they were relatively well prepared for practice as well as those they identified as being least prepared will be highlighted.

Interpersonal skills
Irrespective of their academic year level, all participants generally believed that they were well prepared in terms of their interpersonal skills such as communicating with patients and working with and respecting team members (Table 2). An area identified by a considerable number of clinical students that requires attention is dealing with the ‘difficult’ or violent patient. Approximately 20% also identified that they were not prepared for the patient with a mental health issue.

Intrapersonal skills
While students in all five cohorts generally believed that they were well-prepared in terms of most self-management skills (particularly the PGY1s), some differences across the skills and amongst the cohorts were apparent (Table 3). For instance, while students were generally confident that they could express their views clearly and could identify their

| Table 1. Participant profile across the curriculum and into their internship |
|---------------------------------------------------------------|
| **Enrolment status**                  | **Respondents (%)** |
|--------------------------------------|---------------------|
| Pre-clinical                         |                     |
| Commencing Year 2                    | 12 (27)             |
| Commencing Year 3                    | 13 (29)             |
| Clinical                             |                     |
| Commencing Year 4                    | 4 (9)               |
| Commencing Year 5                    | 11 (24)             |
| Internship                           |                     |
| Commencing PGY1                      | 5 (11)              |
| TOTAL                                | 45                  |
learning needs, at least 20-30% of students across all five cohorts found it difficult to balance their personal lives and their studies and being able to cope with stress. Not surprisingly, time management was also identified as something requiring attention. Noted is the decline in students’ perceptions of their learning in legal and ethical issues.

Scientific basis of disease
Table 4 suggests that new Year 3 students felt confident perhaps as they had successfully completed Year 2, a ‘big’ year in terms of content in which all the organ systems are covered, as well as the principles of disease (pathophysiology and pathology). The decline in confidence of Year 4 students may be that once in clinical practice (albeit only a few weeks) they realise how much there is still to know and that it needs to be applied, i.e. being consciously incompetent.

Clinical skills
All cohorts believed that they were well equipped in terms of their history-taking skills (Table 5). Not surprisingly, the new Year 2 students were not confident in terms of their physical examination skills as Year 1 students would not have practiced these skills. The increasing confidence of the clinical students in terms of physical examination is noted, after 25% of the new Year 4 students (first clinical year) indicated they were not prepared. The variation in the ‘simple practical procedures’ is because what was considered ‘simple’ was changed for each cohort and in fact became more complex. For example, in Year 1, blood pressure was identified, while for Year 4 students, suturing was identified as a ‘simple’ practical procedure. That only half of commencing Year 4 students and 64% of Year 5 students were confident carrying out ‘simple practical procedures is somewhat surprising. For Year 4, it can perhaps be attributed to their ‘newness’ to workplace
learning. That only 50% of Year 3 and 73% of Year 4 students did not feel competent performing a mental state examination highlights that some were not confident communicating with a patient with a mental health issue (Table 2).

**Investigation skills**

An area in which where students have expressed an apparent lack of preparedness is in terms of their knowledge of complementary and alternative medicine (CAM) and how this might interfere with allopathic treatment (Table 6). While there is some engagement in PBL cases, students’ responses suggest that this may be too superficial. About 20-25% of senior and new graduates indicated a difficulty calculating drug doses.

| Table 3. Students’ (%) perceptions of their intrapersonal skills |
|---------------------------------------------------------------|
| **Intrapersonal skills:** I am able to: | Commencing Year 2 | Commencing Year 3 | Commencing Year 4 | Commencing Year 5 | Commencing PGY1 |
| .. manage my own time effectively | 83 | 92 | 75 | 82 | 100 |
| .. prioritise tasks effectively | 92 | 92 | 75 | 91 | 100 |
| .. perform leadership roles appropriately | 75 | 92 | 100 | 91 | 80 |
| .. identify my own learning needs | 92 | 100 | 100 | 91 | 100 |
| .. cope with stress caused by my work or studies | 75 | 92 | 75 | 91 | 80 |
| .. balance my studies and personal life | 67 | 69 | 75 | 82 | 80 |
| .. remain calm in difficult situations | 83 | 62 | 100 | 82 | 80 |
| .. express my views clearly | 92 | 100 | 100 | 91 | 100 |
| I am gaining knowledge of legal and ethical issues (e.g. confidentiality, Mental Health Act) | | | | 100 | 73 | 80 |
| I manage my health in order to protect patients and colleagues | | | | 100 | 82 | 80 |

| Table 4. Students’ (%) perceptions of their ability in terms of integrating and applying their theoretical knowledge |
|---------------------------------------------------------------|
| **Academic skills** | Commencing Year 2 | Commencing Year 3 | Commencing Year 4 | Commencing Year 5 | Commencing PGY1 |
| I am able to integrate scientific principles into knowledge of disease | 67 | 92 | 75 | 89 | 100 |
| I am able to apply scientific knowledge to clinical presentations and conditions | NA | 100 | 75 | 100 | 100 | 100 |
**Table 5. Students’ (%) perceptions of their clinical skills competence**

| Clinical skills                                      | Commencing Year 2 | Commencing Year 3 | Commencing Year 4 | Commencing Year 5 | Commencing PGY1 |
|------------------------------------------------------|-------------------|-------------------|-------------------|-------------------|-----------------|
| I can take a patient history                         | 100               | 100               | 100               | 100               | 100             |
| I can perform a systems-based physical examination  | 17                | 100               | 75                | 91                | 100             |
| I can carry out simple practical procedures         | 100               | 67                | 50                | 64                | 100             |
| I can perform a full mental-state examination       | 50                | 73                | 100               |                   |                 |

**Table 6. Students’ (%) perceptions of their ability in terms of a range of investigation skills**

| Investigation skills | Commencing Year 4 | Commencing Year 5 | Commencing PGY1 |
|----------------------|-------------------|-------------------|-----------------|
| .. interpret the results of commonly used investigations | 100               | 100               | 100             |
| .. assess a patient’s problem                           | 100               | 100               | 100             |
| .. formulate a plan to investigate and manage a patient’s problems | 75                | 91                | 100             |
| .. apply knowledge of alternative and complementary therapies and how these may affect other treatments | 50                | 73                | 20              |
| .. apply the principles of promoting health and preventing disease | 100               | 91                | 100             |
| .. apply knowledge of how social and psychological factors impinge on patients’ health and care | 100               | 91                | 100             |
| .. involve patients in the process of assessing, forming and managing their problems | 100               | 100               | 100             |
| .. apply safe prescribing for different types of drugs | 81                | 100               |                 |
| .. calculate drug dosages                               | 73                | 80                |                 |

*NA = not asked (as not an expected competency)*

**Discussion**

Despite numerous reminders and requests to students, including personal invitations, the response to this pilot survey was disappointing. We are not alone as curriculum administrators constantly bemoan the fact that fewer than 25% of students complete the end-of-semester evaluation, making it difficult to implement change. Moving forward, we will need to look at different strategies and perhaps incentives to encourage greater participation (Nair and Merdova, 2008). Involving students as research participants, perhaps as an MD project may be one such strategy.

Not with standing the poor response, this pilot study has provided us with a snapshot of students’ perceptions of their competence (and confidence) for a range of skills in different domains at each transition across a five-year medical program. Overall, from a curriculum perspective, it is satisfying that students believed that for most of the skills, they were prepared for the next stage of their journey, particularly recent graduates. Traditionally, the most emotional transitions are from medical school to the workplace (from Year 3 to Year 4 in the BU Medical Program) and then post-graduation (from Year 5 to interns at BU) (Helmich et al., 2012). With the BU Year 3 being a transition year, with ‘clinical teams’ undertaking ‘ward rounds’ with virtual patients in the Bond Virtual Hospital and with several opportunities to participate in ward simulations as a member of a multi-professional team in the simulation centre (McLean, Brazil and Johnson, 2016), students transitioning to the clinical environment in Year 4 would be prepared for a range of tasks and responsibilities with real patients.
This pilot study has identified areas in the BU Medical Program that required attention. Considering the diversity of the Australian population, with 28% being born overseas, with at least 6.8% originating from Asia or South East Asia (Australian Bureau of Statistics, 2017), any graduating Australian medical student requires a solid foundation of the common CAM and possible interactions with allopathic medications. While BU medical students may have been exposed to CAM theoretically, it was the senior students who were not confident with a patient who may be using alternative therapies. This clearly warrants attention.

With most physicians writing prescriptions for medications, with the need sometimes to adjust doses for age and weight, that about one one-fifth of senior students felt unprepared for this is a red flag that requires addressing as it involves harm to patients. The most likely year would be Year 3, which is the year in which students are applying the theoretical foundations of the previous two years. In the Bond Virtual Hospital, they are suggesting management plans from their ‘patients’ for whom they have discussed a diagnosis or possible diagnoses. The BU medical students are not alone. In South Africa, Harries and Botha (2013) found that only 23% of medical students at the beginning of their third year were competent with these calculations. Sixty-six %, however, achieved competence after an intervention.

Another area in which students identified difficulty was dealing with the violent patient (Oliver, 2011). With medical school is a safe environment with a high level of support, perhaps it would be appropriate to introduce some complexity and uncertainty earlier in the curriculum to develop a better sense of situational awareness (Gregory, Hogg and Ker, 2015). A recent commentary by Shapiro (2018) on ‘violence’ in medicine is a useful article on ‘violence’ as a construct and could be used to underpin open discussions with medical students about the different manifestations of violence in the profession. There should certainly be opportunities for students to, through the use of professional actors, engage with such patients and receive appropriate briefings and debriefings. This might start earlier in the curriculum with situational judgement tests, allowing students the liminal space to discuss their reactions.

To a lesser extent, communicating and assessing a patient suffering a mental illness was also reported to be an area where some students are not confident. Similar strategies as suggested above could be used.

Conclusion
Areas have been identified in which students require additional tuition and support. The most marked in terms of clinical practice include dealing with a violent patient, communicating with a patient who may have a mental illness, calculating drug doses, and being better able to work with patients who may be using CAM. Students may require additional support in terms of the skills related.

Recruitment for medical education research and curriculum evaluation remains an issue, and future studies should aim to enhance participation rates. Strategies need to be investigated to motivate students to participate. As this pilot study has shown, there may be areas of the curriculum that require attention. Better participation is required to ensure that these are indeed issues.

Take Home Messages
- With medical education is a series of transitions, students need to feel confident in terms of their knowledge and skills at each transition.
- Canvassing students’ preparedness for the various transitions should be undertaken, but ways of engaging students need to be sought.

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Declarations

The author has declared that there are no conflicts of interest.

Ethics Statement

This study received approval from the Bond University Human Research Ethics Committee (#15655).

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Trevor Gibbs
AMEE

This review has been migrated. The reviewer awarded 4 stars out of 5

A very well written paper about an important subject. I find it both interesting and disappointing that we are still researching an area than should, one hopes, be standard practice within all schools and relevant in preparation for any accreditation process. Hence I feel that this is a very useful paper and needs to be read by all those involved at a high level in curriculum design, planning and delivery. Curricula are dynamic entities and must respond to the rapidly changing world of health and social care- it is only through structured evaluation of the outcomes and whether they match the real-world needs that we can ensure a healthier community.

Competing Interests: No conflicts of interest were disclosed.

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TAGORE MEDICAL COLLEGE AND HOSPITAL

This review has been migrated. The reviewer awarded 3 stars out of 5

Thanks for inviting to review this article. This article deals with the very important area that is the
competencies that the medical graduate should possess at the end of five year programme. This study is unique because it dealt with all the years which facilitated to compare and highlights the increase or decrease of the competencies or the skills among different years. The skills or domains dealt were inter and intra-personal skills and clinical skills. As our medical council of India, suggests the revolutionary approach, which is the competency based curriculum for each subject involving the domains this study was really useful to me as a medical educator and being the curriculum committee member. This study revealed that the clinical skills include dealing with a violent patient, communicating with a patient who may have a mental illness, calculating drug doses were important areas where the study participants were not confident. Suggestions: 1. Being a pilot study, the less sample size is acceptable, but a larger sample would reveal better results. 2. Please try to include Focus group discussions as a part of the large scale study in future to explore more deeper thoughts on the domains or competencies to be learnt by the students.

**Competing Interests:** No conflicts of interest were disclosed.

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**P Ravi Shankar**
American International Medical University

This review has been migrated. The reviewer awarded 4 stars out of 5

Thank you for the opportunity to review this interesting paper. The methodology of the study has been well described. The authors describe this as a pilot study. One of the challenges for them would to increase the participation of students. The total number of students has not been mentioned and the percentage of students who participated which is presently unknown can be included. The other issue is whether the authors would like to modify their questionnaire after considering the results of the pilot study. The number of questions was high especially for the later years of study. Complementary and alternative medicines (CAM) and its possible interactions with allopathic treatment could be a challenge considering the diversity of individuals who migrate to Australia. Pharmaceutical calculations can also be a challenge though today software can be of great help. The violent patient can be challenging for students and young doctors. The study is well presented. The article will be of interest to a wide spectrum of medical educators.

**Competing Interests:** No conflicts of interest were disclosed.
This review has been migrated. The reviewer awarded 3 stars out of 5

Thank you for inviting me to review this article. The authors provide a review of what is known about the transitions undergraduate medical students face during their educational journey into the profession. To address their research question, they chose to use a survey, however, they were disappointed with the limited participation by students at their institution. Despite this limitation, the authors identified several competencies that students reported not feeling well-prepared to demonstrate. In the discussion, the authors relate their results to their programme. To enhance the significance of these results to the reader, the authors might consider relating their results back to the transition issues they identified in the introduction. This study contributes to our understanding about the challenges medical students face as they navigate the transitions in their programme. I look forward to the reading about the next steps and possible interventions the authors put in place to address the issues identified in their study.

**Competing Interests:** No conflicts of interest were disclosed.