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INTRODUCTION

As part of the AMA Safe Hours Project, a project was conducted which examined the issue of extended hours of work and learning.

The broader Safe Hours Project aims, essentially, to develop a reform package and national standard, which will establish agreed hours of work and rostering, consistent with occupational health and safety standards, for hospital doctors.

The extended hours and learning project addressed the following research questions:

- Q.1 What are major features of the Australian postgraduate vocational and pre-vocational medical training experience?
- Q.2 What are the learning processes involved in hospital-based medical training?
- Q.3 What is the impact of fatigue on learning processes involved in hospital-based medical training?
- Q.4 Taking into account knowledge of fatigue/human performance and learning, what is the impact of extended work hours, sleep-deprivation and fatigue on the hospital-based medical training process?
- Q.5 Taking into account knowledge of fatigue/human performance and learning, what is the likely affect, if any, on the reduction of hours of work on the effectiveness of the learning process, the quality of the training experience and the training techniques employed in hospital-based medical training?

The report is presented in two volumes. Volume one, this volume, provides an overview. Volume two, a detailed discussion of the methodology, literature review, including a bibliography, and hypotheses generation, is available on request from the AMA.

METHODOLOGY

A draft literature report was compiled in relation to research questions 1 to 3. Responses to questions 4 and 5 were formulated by conducting a focus discussion group with experts from the following areas: education, occupational health, health administration and medical education.

FINDINGS

Q.1 What are major features of the Australian postgraduate vocational and pre-vocational medical training experience?

The following description is drawn from an overview provided in the first report of the Medical Training Review Panel in August 1997.

Following graduation, all States and Territories in Australia require the completion of an intern year. During this year medical graduates work under supervision, mostly in public teaching hospitals. Registration through one of the State or Territory Medical Boards follows, if this year is completed successfully.

Most medical practitioners usually continue to work in the public hospital system for another one or more years, as yet not streamed into specialist areas.

The training they receive during this period varies between States and Territories. New South Wales, Victoria and Queensland provide 'relatively structured' generalist training programs.

After the early years, described by the Medical Training Review Panel as pre-vocational years, medical practitioners must make a career choice. Options available to them are:

- immediately pursue specialist or general practice vocational training
- work in a non-specialist salaried position
- work in a non-clinical position
- leave the Australian health care system (either temporarily or permanently).

Specialist or general practice vocational training is provided by one of the 12 major Medical Colleges.

Q.2 What are the learning processes involved in hospital-based medical training?

Four groups of literature were identified and consulted in considering this question:

- general learning theory
- vocational learning

- professional learning
- intern/resident experience and effectiveness of hospital-based training.

Major findings from each of these areas are presented below.

General learning theory

Three competing theories were identified: behaviourist, cognitive and humanist.

Behaviourist theory, e.g. Pavlov and Skinner, is based on a mechanistic view of the world in which a person is a reactive, passive robot who responds predictably and unthinkingly to stimulation. Learning arises from repeated feedback from the teacher, until the feedback comes from the increasing level of performance of the skill itself. The aim of learning is to correct behaviour.

Cognitive views and those which link **cognitive** and **behaviourist** views of learning have enhanced understandings of features contributing to the process of learning. These include a perspective that learning is an active, interpretive, idiosyncratic experience. The importance of self-efficacy as an influence in the learning processes is recognised by this school of thought.

Humanist learning perspectives, which underpin the adult learning experiential approach, recognise the importance of experience, as opposed to formal instruction, in the process of learning. This view recognises that adults undertake learning activity when they have a need to know (e.g. when they confront a problem) and have a capacity for self-directedness in their learning. This view, like the cognitive perspective, also recognises the idiosyncratic nature of learning, and supports the perspective that learners have individual learning style preferences and strengths which can be pursued through self-directed learning approaches as well as more cooperative learning activities. An outcome of this is that learning programs need to be able to accommodate such diversity of preferences.

Vocational learning

The vocational learning literature describes a change in learning needs which has paralleled a change in work roles, in recent decades. Previously, performing tasks was emphasised in job descriptions; now job descriptions have been enlarged and emphasise problem solving.

It has been argued that medical practitioners are no exception. Changing demographics and pattern of disease, new technologies, changes in health care delivery and increased consumerism have combined to create new challenges for the medical profession, to which medical education must respond.

Even if that argument is not accepted, the vocational learning literature is useful, as the increased complexity of work roles in general has meant the development of a

theoretical base for vocational learning, more in keeping with the needs of medicine, e.g. acquisition of technical expertise and the cognitive apprenticeship model, described below.

Acquisition of technical expertise. In 1989 Gott proposed three different kinds of knowledge which are required to work in real world situations:

- procedural (how-to-do-it) knowledge
- declarative (domain) knowledge of the object (system or device knowledge)
- strategic (how-to-decide-what-to-do-and-when) knowledge.

Common sense, supported by some evidence, would support that the early vocational training years are important for the acquisition of declarative (system) and strategic (what to do and when) knowledge in medicine.

Cognitive apprenticeship model. Developed by Farmer, Buckmaster and Legrand in 1992, this model describes a cognitive apprenticeship model. It is an appropriate model for learning by trainee hospital Medical Officers, and as such, provides a description of what needs to happen between the teacher (usually the registrar or consultant) and the learner, for effective learning to occur. The model has five phases:

1. Modelling by teacher.
2. Learner approximates models' activity, articulates while doing so, then reflects on differences between their performance and the model's. Teacher provides feedback and coaching.
3. Learner begins to approximate model activity and receives further coaching and support.
4. Learner can do task, self-directed learning begins.
5. Learner and teacher discuss generalisability and transfer.

The vocational learning literature emphasises the importance of the social environment. This is as important to medicine in hospitals as it is everywhere. Writers such as Vygotsky (1978) describe three dimensions to this:

- immediate social relationships, e.g. between intern and registrar
- distal social relationships, e.g. values which prevail in the hospital
- community of practice – the medical profession is recognised as being a highly socialised one.

Professional learning

Literature on professional learning is sparse. One concept from this literature, however, considered as being useful in understanding how trainee Medical Officers learn, is that of implicit knowledge. Boreham (1994) identified three types of implicit knowledge:

- impossible to verbalise and unavailable to consciousness
- impossible to verbalise and available to consciousness
- can be verbalised and is available to consciousness, but not usually made explicit.

The apprenticeship model of training is appropriate for the transfer of implicit knowledge.

Intern/resident experience and effectiveness of hospital-based medical training

The Committee of Inquiry into Medical Education and Medical Workforce (1988) reviewed the literature on intern/resident learning experience. The report was critical of learning opportunities provided, pointing to:

- emphasis on service role
- lack of supervision, feedback and assessment
- lack of planning for learning during internship as a part of a continuum from undergraduate to further training
- uneven or inappropriate experience.

These conclusions were supported by a large South African study which reported that 71% of interns did not have time to read around their cases.

However, a study commissioned by the Australian Medical Association and conducted by Coopers & Lybrand in 1998, found that there was little difference in the time spent on formal education and independent study between junior doctors who worked 50 or more hours per week, and those who worked less than 50 hours per week. Both were low (one hour on formal education and four to five on independent study), however, the study was conducted at the end of the year, when education activities are traditionally quiet.

The Medical Training Review Panel in 1997 reported that there have been efforts to make hospital-based training more structured in some States, but, by the nature of its recommendations, it implied there is considerable scope for improvement.

There is a small literature on excellence in clinical training. Studies which have examined the characteristics and techniques of clinical teachers, nominated by other

teachers and students as excellent, have found that these are consistent with vocational learning theory. For example, excellent teachers view learners as collaborators and involve them, are open to learners' opinions, can admit when they feel vulnerable in the teacher-learner encounter, focus on critical issues and provide feedback.

Accordingly, in relation to question 2, the following conclusions were reached. From learning theory it would appear that apprenticeship style of training provided for hospital-based trainee Medical Officers has many advantages:

- it is conducted in an authentic setting
- it is problem-based and focuses on what the learner needs to know
- it involves collaboration with peers and experts
- it provides opportunity for practice and feedback.

Excellence, where reported, is consistent with theory (cognitive apprenticeship model). However, evidence available suggests that while some States and Territories and some Medical Colleges have been active in improving their training programs, the experience of many junior Medical Officers is not consistent with best practice. Problems include:

- the domination of the service role
- guidance and feedback (scaffolding) are lacking.

Q.3 What is the impact of fatigue on learning processes involved in hospital-based medical training?

This literature confirms that the trainee hospital Medical Officer phase is characterised by long working hours and heavy workloads which, from a common sense perspective, and the perspective of a number of writers, is not conducive to high quality work performance or systematic learning.

- Studies examining the effects of sleep-deprivation and fatigue in Medical Officers (and other occupations) have not conclusively reported negative effects in terms of work/task performance, although these studies do consistently indicate a negative effect on mood or emotional state. Empirical evidence of negative effects on learning of these factors are even less substantially established through the very small number of studies addressing this relationship.
- The empirical literature available has not distinguished between the effect of fatigue on learning once in a learning situation, and the readiness to undertake voluntary self-directed learning. It is quite possible that the impact on mood and emotional state would have a negative effect on motivation to do so. Evidence to support this view is provided by studies that reveal interns and residents undertake little or no reading (which could be seen as fitting into the category of voluntary or

self-directed learning) around their cases during this period of learning. However, contrary evidence is provided by a study by Coopers & Lybrand which found that there was little difference in the time spent on formal education and independent study between junior doctors who worked 50 or more hours per week and those who worked less than 50 hours per week.

Q.4 *Taking into account knowledge of fatigue/human performance and learning, what is the impact of extended work hours, sleep-deprivation and fatigue on the hospital-based medical training process?*

It was concluded that, based on the literature, extended hours of work, sleep-deprivation and fatigue probably have a negative impact on hospital-based medical training. Possible explanations for this are:

Hypothesis 1: Extended hours result in less dedicated learning activity

Dedicated learning activity refers to formal education and independent study. By that is meant learning arising from activities other than on-the-job experience, guidance and feedback.

As described in the discussion in relation to research question 3, evidence on whether extended hours are associated with less self-directed learning activities such as reading, or attending formal education sessions was contrary.

If it is accepted that there is an association, two possible mechanisms were identified:

- Extended hours of work results in less time being available for formal education and independent study.
- Fatigue associated with extended hours leads to a lack motivation for self-directed learning through depressed mood state and reduced self-efficacy.

Hypothesis 2: Fatigue leads to a reduced focus and therefore decreased learning

The professional development literature, including the medical profession in particular, shows that central and peripheral information is required for learning. The fatigue and performance literature shows that fatigue results in focusing on central tasks.

Hypothesis 3: Opportunities for effective learning are reduced during extended hours

Extended hours of work are likely to cover times when the elements required for learning via the cognitive apprenticeship model, e.g., model practice, scaffolding, coaching and critical reflection, are least likely to be available. Hence the conditions during extended hours may not be associated with effective learning.

Q.5 *Taking into account knowledge of fatigue/human performance and learning, what is the likely affect, if any, on the reduction of hours of work on the effectiveness of the learning process, the quality of the training experience and the training techniques employed in hospital-based medical training?*

It was concluded that, based on the literature, it was more likely that reduced hours of work would have a positive or neutral effect on learning, than a negative effect. Possible explanations for this are:

Hypothesis 1: a reduction in hours as a positive effect on learning

Common sense would suggest that fewer hours working would make more hours available for formal education and independent study. However the Coopers & Lybrand study, mentioned earlier, indicated that reducing working hours alone, to less than 50 hours per week, may not be sufficient to increase time spent on self-directed learning. Although it is noted the study was conducted at the end of the year, traditionally a quiet time for formal education, and 50 hours per week is still quite a long working period by industry standards.

However, there is another mechanism by which this positive effect could be achieved. The fatigue and learning literatures indicate that reducing hours may lessen fatigue, which in turn could relieve depressed mood states and improve self-efficacy, and thus improve the effectiveness of learning on-the-job.

It should be noted however, that fatigue can be a product of more than sleep-deprivation. The nature of the work itself, the load of work to be achieved even within reduced hours, may create a state of fatigue that is as problematic for learning as that induced by sleep-deprivation occasioned by long hours of work.

Hypothesis 2: a reduction in hours has no effect on learning

The literature supports that intern, resident and registrar positions provide considerable potential for effective learning. Findings of the Doherty Report in 1988 and the Medical Training Review Panel in 1997 indicate that this potential is not being realised however.

It is hypothesised that the quality of the learning experience in the hospital-based context may be a greater influence over the effectiveness of learning by trainee hospital Medical Officers than the hours worked. If so, and the hours worked remained the same, or were reduced, without the provision of systematic structured training programs and expert supervision which allowed learners opportunities to observe model practices, be coached and assisted in learning, the learning process and learning experiences of Medical Officers would not be improved.

Hypothesis 3: a reduction in hours has a negative effect on learning

This hypothesis is one that is often put forward as an argument against reducing the hours of hospital-based Medical Officers.

The assumption underlying this argument is that learning is directly related to doing, i.e. performing the service function. The model of learning most appropriate to this situation is cognitive apprenticeship. However, there is evidence that the elements of this model, e.g., model practice, scaffolding, coaching and critical reflection, are often not present. Logic would suggest, this is especially after usual hours of work.

If the amount of learning being gained in relation to the potential learning from hospital experience is low, then reducing the hours of that experience should not have a dramatic effect on learning. Furthermore, it is likely that this could be more than offset by improving the quality of the training experience.

CONCLUSION

The general learning, vocational and professional learning literatures have information relevant to the issue of extended hours and learning, but little information specifically on the research questions posed.

According to the learning literature, hospital-based training as it is currently organised, has plenty of potential for effective learning. Although the need to make medical hospital-based training more structured has been widely recognised, since the Doherty Report in 1988, efforts to make improvements have varied between States and Territories and Medical Colleges.

Extended hours, in the view of the authors, are likely to have a negative impact on learning. From the literature, the following hypotheses are proposed to explain the mechanisms by which this effect could occur:

- less time for self-directed learning, an important technique for trainee hospital Medical Officers
- reduction in motivation for self-directed learning as a result of fatigue
- lack of availability of coaching and feedback during the extended hours,

i.e. outside usual hours.

A reduction in hours (to a more normal level), in the view of the authors, is more likely to have a positive or neutral effect on learning, than a negative effect.

Possible mechanisms by which a reduction in hours would have a positive effect on learning are:

- more time for training activities
- a reduction in fatigue, which may lead to improved learning by improving mood state and self-efficiency.

However it was considered that it is unlikely that the quantity of hours worked is directly related to the quantity of learning. The quality of the learning experience is likely to be a significant confounding variable.

Finally it was considered that if there was a loss of learning associated with a reduction in working hours, it could probably be more than offset by improving the quality of the learning experience.