

## Hidden danger in Pathology

The recent study done by the Royal College of Pathologists Australasia (RCPA) and the various commissions of inquiry relating to pathology in Canada have shown that Professional Quality Assurance (QA) activities in pathology are essential to providing safe quality medical laboratory services.<sup>1, 2, 3, 4</sup> Professional QA activities and ongoing professional development help ensure that consultations and reports generated by the pathologists are of the highest quality, meeting national and international standards. Never has this been more important than in this age of “onomics”, where pathologists are responsible for integrating new complex test results into patients’ reports, providing a pivotal proactive role in patient care.

As indicated before<sup>5</sup> – “Pathology is unique because the workload of each pathologist is determined mainly by other physicians and users of laboratory services, and there is no inherent limiting factor for individual pathologist workload. For most physicians, time is the limiting factor, for example, availability of operating room time for surgeons, physician’s office hours, and the operating time for magnetic resonance imaging machines. In specialties with inadequate human resources, there are long waiting periods, which is quite common in Canada.” The pathologists, due to professionalism, maybe unwisely, tries to complete the increasing clinical workload at the expense of other duties such as quality assurance, professional development and personal time, results in no “wait time” in pathology. This allows funding agencies to ignore human resources needs in pathology unless a critical incident occurs, which has resulted in multiple commissions in pathology recently. A survey done in early 2000 showed that a high percentage (74%) of departments were understaffed<sup>v</sup>. Recently Pollet and Colgan<sup>6</sup> have shown that the population to pathologist ratio from 1998 to 2008 has increased in spite of the growing workload related to an increase in the number of elderly people in our population and the growing complexity of pathology work.

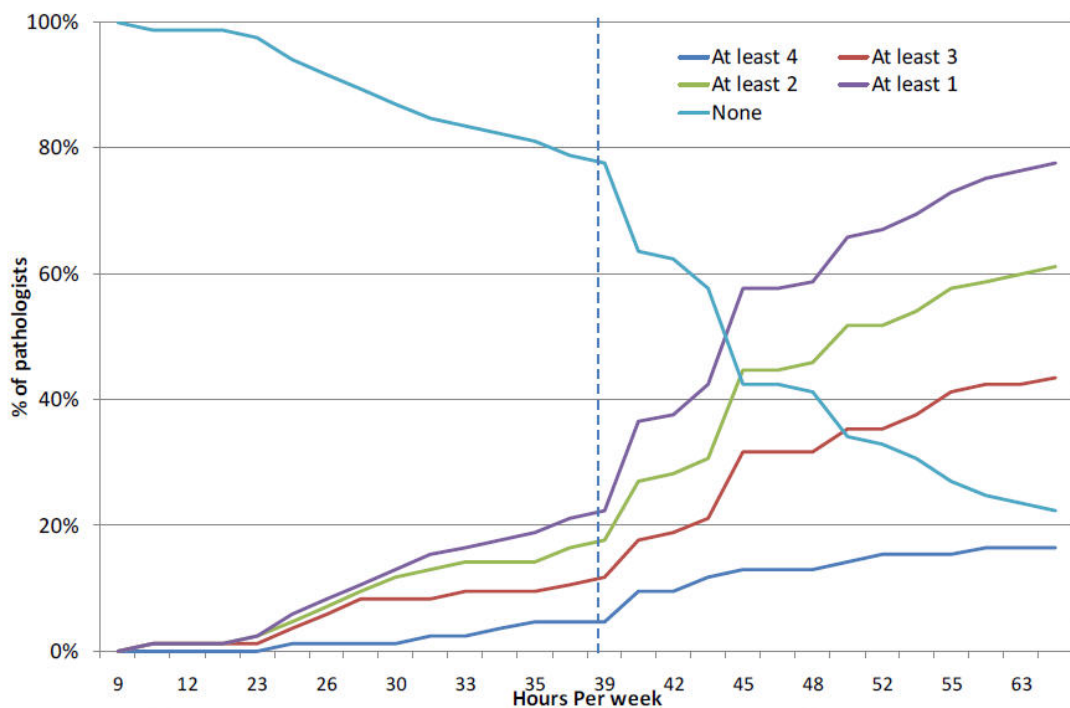
The RCPA studied the relationship between adverse impacts on quality and safety as defined by:

- an increase in turnaround time;
- not always completing QA;
- quality compromises;
- patient care compromises; and
- health and well being of pathologists being compromised.

The RCPA study found a direct relationship between number of hours worked per week and the proportion reporting adverse quality and safety impacts. The adverse quality and safety impacts increased sharply when the pathologists worked more than 39 hrs/week. (Please see Table 1 and Figure 1) Their study also showed that pathologists devote 60% of time to testing, 20% to other medical work (case conferences, autopsies, quality assurance and grossing), and 20% in non-medical work. This is similar to the data found in a Calgary study, which showed that direct clinical work occupies 57.5% of an anatomic pathologist’s time<sup>7</sup> and a PathFocus survey where service work (AP+CP consulting) varies from 47% (University hospital) to 63% (Hospital without residents)<sup>8</sup>.

**Table 1. Quality & Safety index by capacity**

Number of adverse Q&S impacts	Total (96) %	Working below full capacity (20) %	Working at full capacity (52) %	Working above full capacity (22) %
Yes to 3 or more	45	5	50	68
Yes to 1-2	32	45	31	28
None	24	50	19	9



**Figure 1: Quality and safety by hours worked**

It has been proposed that work which requires complex cognitive tasks is ill suited for longer shifts as opposed to work with limited cognitive demands.<sup>9</sup> This may account for some of the inconsistencies between different studies.

The importance of fatigue on complex tasks is also stressed by Dr. Matthew B. Weinger<sup>10</sup> who is the Director, Center for Research and Innovation in Systems Safety (CRISS), Vanderbilt University Medical Center. He states that “Fatigue is particularly dangerous in situations where

- (1) A rare, but very salient signal has to be detected;
- (2) Multitasking and prioritization are key elements of work;

- (3) There is a time gap between when information becomes available and when it has to be used; and
- (4) Creative thought is required.”

More than one of these circumstances can exist concurrently.”

Although most of the work done by pathologists may be routine “textbook” diagnoses, all 4 situations can be encountered at any time making fatigue especially dangerous when a pathologist is looking down a microscope and is required to render a diagnosis. A mis-diagnosis could have a significant impact on patient management.

Some examples include:

- (1) A rare, but very salient signal has to be detected; not recognizing a desmoplastic melanoma in a spindle cell lesion, overlooking adenoma malignum of cervix;
- (2) Multitasking and prioritization are key elements of work; when work is interrupted by a phone call from a physician regarding another case and/or a technologist regarding equipment malfunction;
- (3) There is a time gap between when information becomes available and when it has to be used; when a clinician cannot be reached for more information to clarify a clinical situation and the case is signed out without proper clinical history and information; and
- (4) Creative thought is required; - finding an unusual case with which one is not familiar.

Double blind studies to assess the significance of fatigue and its impact on work are not ethically possible for obvious reasons. Nevertheless there are some studies related to fatigue and its impact on work and on the individual:

- Studies have shown that the 12-hour shifts are associated with difficulties staying awake on duty, reduced sleep times, and nearly triple the risk of making an error.<sup>11 12</sup> The same studies show that working overtime or working more than 40 hours in a week was associated with a statistically significant increase in the risk of making an error.
- Nurses who worked >8.5 to <12.5 are 1.4 times, and those >12.5 hrs. are 1.84 times more like to have Motor Vehicle Crash (MVC) or near MVC compared with shifts less than 8.5 hrs.<sup>13</sup>
- The National Institute of Occupational Safety and Health (NIOSH),<sup>14</sup> states that working more than 40 hours per week (overtime), working extended shifts (more than 8 hours), and working both extended shifts and overtime can have adverse effects on workers’ health. They found that there were deteriorating performance on psychophysiological tests as well as injuries across the studies particularly with long shifts combined with overtime (>40 hrs/week). Physicians are also noted to have deterioration in cognitive performance with long shifts.
- Accident rates increase with the length of work<sup>15</sup>, with accident rates rising after 9 hours, doubling after 12 consecutive hours,<sup>16 17</sup> and tripling by 16 consecutive hours of work.<sup>18</sup> Data from the National Transportation Safety Board aircraft accident investigations also show higher rates of error after 12 hours.<sup>19</sup>
- Hanecke et al found accident risk increased exponentially after the 9<sup>th</sup> hour at work and was highest among workers whose shift began in the evening or night<sup>xvi</sup>T. The authors concluded that shifts that last longer than 8 hours might lead to more worker fatigue and higher risk of accidents. Nurses working 12.5 hours or longer were significantly more likely to report difficulties remaining alert than nurses working fewer hours per day,<sup>14</sup> and they obtained on average 30 minutes less sleep.

- Study on 34 pediatric residents showed that their performance following a night of heavy call was quite similar to performance after drinking alcohol. Reaction times were slowed, errors of commission increased 40%, and on simulated driving test, lane variability and speed were significantly increased after a night of heavy call.<sup>20</sup>
- Interns made 35.9% more serious medical errors during the traditional schedule (extended hours and every third night call) than during the intervention schedule (restricted schedule that reduced work shifts to 16 hours). Both the rate of serious medication errors and diagnostic errors were significantly increased by 20.8% and 5.6 times during the traditional schedule compared to the intervention schedule<sup>21</sup>.
- Working a job with overtime was associated with a 61% higher injury rate compared to jobs without overtime. Working  $\geq 12$  hours per day was associated with a 37% increase in hazard rate, and 60 hr/week with 23% increase in hazard rate. Injury rates increased in a dose-response fashion according to the number of hours per day (or week) that were worked. Injury rates were not affected by type of job or other factors such as gender.<sup>22</sup>
- Meta-analysis of 21 studies showed that there is a link between hours of work and ill health, and that working long hours can be detrimental to health of an individual and his/her family. There was a mean correlation of 0.13 between weekly work hours and ill health.<sup>23</sup>
- Analysis of 27 empirical studies showed that long work hours were associated with adverse health effects (cardiovascular disease, diabetes mellitus, disability retirement, physiological changes, and health-related behavior).<sup>24</sup>
- Two significant nuclear power plant accidents (Three Mile Island and Chernobyl) and the environmentally disastrous grounding of an oil tanker (Exxon Valdez) occurred at night, during early morning hours when vigilance is at its lowest.
- Fatigue-related problems are believed to cost the United States an estimated \$18 billion dollars per year in lost productivity and accidents. More than 1,500 fatalities, 100,000 crashes, and 76,000 injuries annually are attributed to fatigue-related drowsiness on the highway.<sup>25</sup>

These studies underscore the obvious; extended shifts, overtime and fatigue at the workplace, especially with tasks demanding constant attention to detail and where the consequences of errors are high, should be avoided if at all possible. The ever changing standards of care with integrated consultation reports, the proactive role in multidisciplinary patient care and the requirement for continuous professional quality assurance to ensure safe, high quality patient care increase the pathologists' workload.

Although Renshaw and Gould<sup>26, 27</sup> concluded that workload does not correlate with medical errors, they pointed out some limitations of their study and indicated that "it is possible that workload does effect error rate, but at workloads significantly higher than those studied here". The Renshaw study did not address the full scope of quality and safety - unlike the Australian study (RCPA)<sup>1</sup>. The limitations of the study were highlighted by Raab<sup>28</sup>. Other issues related to the study are:

- The workload measurement is the number of cases per day, and does not between differentiate type of cases. All of us will agree, efforts to sign out a routine biopsy are quite different from signing out resections for malignant lesion or cases that need synoptic reporting. As Raab indicated other work done by the pathologists was also not taken into account.
- For an accurate comparison, work done during regular hours should be compared with work done after regular hours to understand the impact of fatigue on errors. To show statistically significant difference in error rate based on monthly case load will be difficult as the errors committed after hours (i.e. after regular 8 hour work, when the pathologist

is fatigued) will be masked by the relatively higher volume of work done during regular hours, unless the error rates are vastly different.

- The study did not indicate if the comparison was between the total work done by all 5 pathologists or between the work done by an individual pathologists during “regular” versus “high” work volume as the “error rate” of individual pathologists in the study varied from 0.1 to 4%. These variables and the small sample making definite conclusions based on the study difficult.
- A high annual workload, much higher than the CAP-ACP guideline based on L4E will result in a sustained daily high work volume and a significant portion of the cases will be signed out when the pathologist is tired.

The CAP-ACP recognizes the essential role of Academic pathology translating basic and clinical research into clinical practice, pioneering new tests and technology, and training much needed pathologists and laboratory medicine professionals. Pathologists with academic appointments and an expectation of academic productivity should have a portion of their time contractually assigned to academic activities. Their service commitment should be reduced to reflect these academic commitments.

The airline industry, using proactive preventive actions, has achieved a situation where accidents are newsworthy due to their rarity unlike in health care.<sup>29</sup> Although health care has emulated that industry to some degree, to reduce medical errors, by introducing check lists and lean principles, we need to take further steps to reduce our error rates. Pathology must continue to follow the lead of the airline industry and define an appropriate workload and hours of work to ensure safe high quality patient care.<sup>30</sup> CAP-ACP Human Resources document(s) have taken such a lead providing recommended appropriate workload for the average pathologist. The original CAP-ACP study has shown that it is the best parameter to measure Pathology workload<sup>5</sup>, and has been tested and validated at multiple sites. For the updated 2014 document, the CAP-ACP Human Resources committee scanned the various models (2011 CAP-ACP<sup>31</sup>, Ontario<sup>32</sup>, Manitoba<sup>33</sup>, UK<sup>34</sup> and Australasia<sup>35</sup>) and made revisions to include quality assurance, academic (research and education) and administrative work into the workload assessment. The revisions will provide a flexible guide to determine the proper human resources (Full Time Equivalent, FTE) needed to meet the multiple demands placed on a pathology department.

The CAP-ACP acknowledges that there are individual variations in work capacity and speed, and stresses that when calculating the human resources required to meet a laboratory's needs, the CAP-ACP recommends an average workload be closely followed. If the workload is consistently high, fatigue is inevitable increasing the likelihood of medical errors. We know that according to recently published studies, Canada has the worst pathologist to population ratio. In Australia there is one pathologist serving a population of 17,829<sup>5</sup>, in the US a population of 19,231<sup>36</sup> and in Canada a population of 27,991<sup>6</sup>.

As stated by Jha et al<sup>7</sup>, “given that medical personnel, like all human beings, probably function suboptimally when fatigued, efforts to reduce fatigue and sleepiness should be undertaken, and the burden of proof should be in the hands of the advocates of the current system to demonstrate that it is safe.” In BC, the Government insisted that the workload be 18.75% more, and in Quebec 67.46% more than the recommended to meet budget targets. The understaffing of pathology is widespread nationally (and internationally) and needs to be remedied before the next “commission of inquiry relating to pathology” is established in yet another province.

## REFERENCES

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- <sup>1</sup> The Royal College of Pathologists Australasia. Impact of workload of anatomical pathologists on quality and safety. January 2011.
- <sup>2</sup> Hon. Margaret A Cameron. Commission of Inquiry on Hormone Receptor Testing. 2009 by Government of Newfoundland and Labrador
- <sup>3</sup> Hon. Mr. Justice Paul S, Creaghan. A report with Recommendations of a Commission of Inquiry into Pathology services at the Miramichi Regional Health Authority. date
- <sup>4</sup> Dr. Barry McLellan (Lead), Dr. Robin McLeod, Dr. John Srigley. Report of the Investigators of Surgical and Pathology Issues at Three Essex County Hospitals: Hôtel-Dieu Grace Hospital, Leamington District Memorial Hospital and Windsor Regional Hospital. July 2010
- <sup>5</sup> Maung, R. What Is the Best Indicator to Determine Anatomic Pathology Workload?, Canadian Experience. *Am J Clin Pathol* 2005;123:45-55
- <sup>6</sup> Pollett AF & Colgan TJ. Canadian Laboratory Physician Supply: Falling Behind. *Canadian Journal of Pathology* 2011, 3(1), 12-17
- <sup>7</sup> Trotter et al. Time Study of Clinical and Nonclinical Workload in Pathology and Laboratory Medicine. *Am. Jour Clin Path* 2009;131:759
- <sup>8</sup> Martin SA, Styer PE. Assessing Performance, Productivity, and Staffing Needs in Pathology Groups, Observations from the College of American Pathologists PathFocus Pathology Practice Activity and Staffing Program. *Arch Pathol Lab Med*, 2006;130:1263-1268.
- <sup>9</sup> Jha AK, Duncan BW, Bates DW. Chapter 46. Fatigue, Sleepiness, and Medical Errors. <http://archive.ahrq.gov/clinic/ptsafety/chap46a.htm> - 26 Sept 2013
- <sup>10</sup> Matthew B. Weinger. Patient Safety Focus. Fatigue and Error; <http://www.aacc.org/publications/cln/2009/january/Pages/safety0109.aspx>, accessed 26 September 2013
- <sup>11</sup> Scott L, Rogers A, Hwang WT, et al. Effects of critical care nurses' work hours on vigilance and patient safety. *American Journal of Critical Care*. 2006 Jan;15(1), 30-37
- <sup>12</sup> Rogers AE, Hwang WT, Scott LD, et al. Hospital staff nurse work hours and patient safety. *Health Affairs*. 2004 July;23(4):202–12. [PubMed: 15318582]
- <sup>13</sup> Scott L, Hwang W, et al. The Relationship between Nurse Work Schedules, Sleep Durations, and Drowsy Driving. *Sleep* 2007; 30(12): 1801-1807
- <sup>14</sup> Caruso CC, Hitchcock EM, Dick RB, et al. Overtime and extended work shifts: recent findings on illness, injuries, and health behaviors. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention National Institute for Occupational Safety and Health; Apr, 2004.
- <sup>15</sup> Schuster M. The impact of overtime work on industrial accident rates. *Indus Relations*. 1985;24(2):234–46.
- <sup>16</sup> Hanecke K, Tiedemann S, Nachreiner F, et al. Accident risk as a function of hour at work and time of day as determined from accident data and exposure models for the German working population. *Scand J Work Environ Health*. 1998;24(Suppl 3):43–8.
- <sup>17</sup> Folkard S, Tucker P. Shift work, safety, and productivity. *Occup Med (Oxford)*. 2003 Mar;53(2):95–101.
- <sup>18</sup> Akerstedt T. Work injuries and time of day—national data. Proceedings of the consensus development symposium entitled Work hours, sleepiness, and accidents; September 8–10; Stockholm, Sweden. 1994.
- <sup>19</sup> National Transportation Safety Board. A review of flightcrew-involved major accidents of U.S. Air Carriers, 1978 through 1990. Washington, DC: NTSB; 1994. NTSB #SS-94-01/PB94-917001.
- <sup>20</sup> Arnedt JT, Owens J, Crouch M, et al. Neurobehavioral performance of residents after heavy night call vs after alcohol ingestion. *JAMA*. 2005 Sept;294(9):1025–33. [PubMed: 16145022]
- <sup>21</sup> Landrigan CP, Rothschild JM, Cronin JW, et al. Effect of reducing interns' work hours on serious medical errors in intensive care units. *N Engl J Med*. 2004 Oct;351:1838–48.
- <sup>22</sup> Dembe AE, Erickson JB, Delbos RG, Banks SM. The impact of overtime and long work hours on occupational injuries and illness: New evidence from the United States. *Occupational and Environmental Medicine*. 2005;62:588–97.
- <sup>23</sup> Sparks K, Cooper CL, Fried Y, Shirom A. The effects of work hours on health: A meta-analytic review. *Journal of Occupational and Organizational Psychology*. 1997 Dec;70(4):391–408.
- <sup>24</sup> van der Hulst M. Long workhours and health. *Scand J Work Environ Health*. 2003 Jun;29(3):171–88.
- <sup>25</sup> Caldwell JA. The impact of fatigue in air medical and other types of operations: a review of fatigue facts and potential countermeasures. *Air Medical J*. 2001 Jan–Feb;20(1):25–32. [PubMed: 11182702]
- <sup>26</sup> Renshaw AA, Gould EW. Correlation of Workload With Disagreement and Amendment Rates in Surgical Pathology and Nongynecologic Cytology. *Am J Clin Pathol* 2006;125:820-822

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- <sup>27</sup> Renshaw AA, Gould EW. Measuring Errors in Surgical Pathology in Real-Life Practice, Defining What Does and Does Not Matter. *Am Jour Clin Pathol* 2007; 127; 144-152
- <sup>28</sup> Rabb SS, Grzybicki DM. Anatomic Pathology Workload and Error, editorial. *Am J Clin Pathol* 2006;125:809-812
- <sup>29</sup> Linda T. Kohn, Janet M. Corrigan, and Molla S. Donaldson, Editors. *To Err Is Human; Building a Safer Health System*. Committee on Quality of Health Care in America, Institute of Medicine, National Academy Press, Washington, D.C.
- <sup>30</sup> FAA Final Rule: Pilot Duty and Rest Requirements, New Regulations Address Pilot Fatigue. <http://aviation.about.com/od/Regulations/a/Faa-Final-Rule-Pilot-Duty-And-Rest-Requirements.htm>, accessed 23 Feb 2014.
- <sup>31</sup> CAP-ACP manpower document 2011
- <sup>32</sup> Work2Quality, Guidelines for Workload Measurement in Pathology Professional Practices, VERSION 1.2, A Proposal for Laboratory Physicians in Ontario. A project of Path2Quality (A collaboration of the OMA Section on Laboratory Medicine and the Ontario Association of Pathologists), September 6, 2012
- <sup>33</sup> Manitoba system (get reference)
- <sup>34</sup> Dr Anne Thorpe (Chair), Dr Mohamad Al-Jafari, Dr Derek Allen, Dr Richard Carr, Dr Tim Helliwell and Dr Scott Sanders. Guidelines on staffing and workload for histopathology and cytopathology departments (3rd edition), April 2012. Working. The Royal College of Pathologists, 2 Carlton House Terrace, London, SW1Y 5AF
- <sup>35</sup> Impact of Workload of Anatomical Pathologists on Quality and Safety. A project funded by a Quality Use of Pathology Grant. Prepared with The Royal College of Pathologists Australasia, Durham Hall, 207 Albion Street, Surrey Hills, NSW 2010
- <sup>36</sup> Robby et al. Pathologist Workforce in the United States, I. Development of a Predictive Model to Examine Factors Influencing Supply. *Arch Pathol Lab Med*. 2013;137:1723-1732