Work-related musculoskeletal discomfort and injuries in Australian optometrists

Author:
Long, Jennifer Anne

Publication Date:
2012

DOI:
https://doi.org/10.26190/unsworks/15933

Jennifer Anne Long

Bachelor of Optometry (Hons) Master of Safety Science

Work-related musculoskeletal discomfort and injuries in Australian optometrists

A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

October 2012

School of Optometry and Vision Science

The University of New South Wales, Sydney, Australia

THE UNIVERSITY OF NEW SOUTH WALES

Thesis/Dissertation Sheet

Surname or Family name: LONG

First name: Jennifer

Other name/s: Anne

Abbreviation for degree as given in the University calendar: PhD

School: Optometry and Vision Science

Faculty: Science

Title: Work-related musculoskeletal discomfort and injuries in Australian optometrists

Introduction: Work-related injuries and discomfort have been reported in Australian optometrists. More severe injury and discomfort may result in a reduction in work hours, task substitution or practitioner attrition from the workforce.
Purpose: This thesis describes work-related discomfort reported by Australian optometrists and proposes strategies for reducing discomfort in the profession.
Methods: The investigation consisted of multiple stages including an online questionnaire based on the Nordic Musculoskeletal Questionnaires, telephone interviews, on-site observations and surveys. Participants included optometrists in clinical practice, undergraduate optometry students and optometry teachers.
Results: Females, young optometrists and those conducting a high number of consultations per day have a higher risk of reporting work-related discomfort. The risk of severe discomfort (discomfort present for more than 30 days) is increased by performing repetitive tasks and continuing to work while injured. The most common sites of discomfort reported were the neck, shoulder and lower back. The most commonly cited tasks contributing to discomfort were using the phoropter and the slit lamp. Senior optometry students reported similar patterns of discomfort to experienced practitioners and were more likely to rate patient comfort more important than personal comfort when performing clinical procedures. The on-site observations highlighted vast differences in consultation room designs, types of equipment and style of practice which impact on comfort. This potentially makes it difficult to develop general guidelines for clinical optometrists. Interview participants were open to receiving information on how to improve their comfort at work, but this information should be disseminated via multiple communication channels to cater for different learning styles. A participatory ergonomics approach may also work if modified to ensure acceptance in a small business healthcare setting.
Conclusion: Work-related physical discomfort in optometrists can be reduced by addressing job, equipment and consultation room design and by providing guidelines to optometrists in clinical practice, e.g., written and online information packages and professional development at conferences. There is also a role for raising awareness of physical comfort issues in optometry students so that future members of the profession develop good working habits before it affects their ability to practice.

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PREFACE

This thesis is a portfolio of publications.

I certify that I have performed the majority of the study design, data collection and writing contained in each publication in this thesis and that reproduction in this thesis does not breach copyright regulations. The contribution I have made to each publication is itemised in the following table:

Paper	**JL % contribution**
Long J, Burgess-Limerick R, Stapleton F (2012) Work-related musculoskeletal discomfort and injuries in Australian optometrists. *Work* 41: 1864 – 1868.	79%
Long J, Naduvilath T, Hao L, Li A, Ng W, Yip W, Stapleton F (2011) Risk factors for physical discomfort in Australian optometrists. *Optometry and Vision Science* 88(2): 317-326.	45%
Long J, Yip W, Li A, Ng W, Hao LE, Stapleton F (2012) How do Australian optometrists manage work-related physical discomfort? *Clinical and Experimental Optometry* 95 (6): 606-614.	60%
Long J, Burgess-Limerick R, Stapleton F (under review) Personal consequences of work-related physical discomfort: an exploratory study. Submitted to *Clinical and Experimental Optometry,* reviewers comments received and addressed.	77%
Long J, Burgess-Limerick R, Stapleton F. Work-related discomfort in the optometry profession – whose responsibility? *Ergonomics Australia* 2012, 10:6 (5 pages).	85%
Long J, Burgess-Limerick R, Stapleton F. What do clinical optometrists like about their job? *Clinical and Experimental Optometry*, in press.	80%
Long J, Burgess-Limerick R, Stapleton F (2010) Acceptance of participatory ergonomics in a healthcare setting. Proceedings of the 46th Annual Conference of the Human Factors and Ergonomics Society, 31st October – 3rd November 2010, Sunshine Coast, Queensland. Page 43-52.	75%
Long J, Burgess-Limerick R, Stapleton F. (2011) Toward a more comfortable profession – disseminating ergonomics information to Australian optometrists. *Ergonomics Australia* 2011 7:1 (6 pages).	75%
Long J, Ko YL, Lau C, Burgess-Limerick R, Stapleton F. (2011) A three way strategy for reducing work-related discomfort in optometry students. *Ergonomics Australia – HFESA 2011 Conference Edition* 2011 11:6 (6 pages).	65%
Long J (2012) Optometry – a comfortable job for life: a review. *Optometry in Practice* 13(1) 33-44.	100%

J Long

Jennifer Long 23rd January 2013

ABSTRACT

Introduction: Work-related injuries and discomfort have been reported in Australian optometrists. More severe injury and discomfort may result in a reduction in work hours, task substitution or practitioner attrition from the workforce.

Purpose: This thesis describes discomfort reported by Australian optometrists and proposes strategies for reducing discomfort in the profession.

Methods: The investigation consisted of multiple stages including an online questionnaire based on the Nordic Musculoskeletal Questionnaires, telephone interviews, on-site observations and surveys. Participants included optometrists in clinical practice, undergraduate optometry students and optometry teachers.

Results: Females, young optometrists and those conducting a high number of consultations per day have a higher risk of reporting work-related discomfort. The risk of severe discomfort (discomfort present for more than 30 days) is increased by performing repetitive tasks and continuing to work while injured. The most common sites of discomfort reported were the neck, shoulder and lower back. The most commonly cited tasks contributing to discomfort were using the phoropter and the slit lamp. Senior optometry students reported similar patterns of discomfort to experienced practitioners and were more likely to rate patient comfort more important than personal comfort when performing clinical procedures. The on-site observations highlighted vast differences in consultation room designs, types of equipment and style of practice which impact on comfort. This potentially makes it difficult to develop general guidelines for clinical optometrists. Interview participants were open to receiving information on how to improve their comfort at work, but this information should be disseminated via multiple communication channels to cater for different learning styles. A participatory ergonomics approach may also work if modified to ensure acceptance in a small business healthcare setting.

Conclusion: Work-related physical discomfort in optometrists can be reduced by addressing job, equipment and consultation room design and by providing guidelines to optometrists in clinical practice, e.g., written and online information packages and professional development at conferences. There is also a role for raising awareness of physical comfort issues in optometry students so that future members of the profession develop good working habits before it affects their ability to practice.

ACKNOWLEDGEMENTS

Writing this thesis was akin to running a marathon. It required physical and mental fitness, stamina and a strong desire to finish. Completion was assisted with the support of many people behind the scenes. There was even a cheer squad!

My husband, Ross, encouraged me to take up the challenge of this race and to enrol in the PhD program. He has also been running along beside me, urging me to keep going “You can’t give up. I want to be married to a doctor”, even when I was tired and would have preferred to sit on the ground and rest.

I am indebted to my supervisors Professor Fiona Stapleton and Professor Robin Burgess-Limerick. Fiona has been a great coach, helping me hone my writing skills to enable publication of the papers in this thesis, teaching me the ropes for working in an academic environment and insisting that I present my work to international audiences. Robin has been a valuable sounding board for ideas, especially when the path ahead diverged and there was uncertainty about which was the best direction to travel.

Like a true modern sporting event, I received sponsorship. The Australian Government provided me with an Australian Postgraduate Award Scholarship. I received financial assistance from the University of New South Wales (Postgraduate Research Support Scheme), the School of Optometry and Vision Science, UNSW, and the American Academy of Optometry (Student Travel Fellowship). This enabled me to present papers at the American Academy of Optometry meeting in San Francisco, USA (2010) and at the International Ergonomics Association Triennial Congress in Recife, Brazil (2012). In kind support was gratefully received from the Optometrists Association of Australia (National Office), the Schools of Optometry and Vision Science at the Queensland University of Technology, University of New South Wales, University of Auckland and the Australian College of Optometry, who agreed to distribute the questionnaires and surveys on my behalf. The Optometrists Association of Australia (Queensland) invited me to present at the Australian Vision Convention in 2011 and kindly provided my airfares, accommodation and conference registration.

This thesis could not have been written if it weren’t for the 500+ people who participated in the surveys, interviews and observations. I can only repay the generosity of the participants who shared their experience of work-related discomfort by publishing the data I have collected and by increasing awareness of this issue.

I did not anticipate that I would publish quite so many papers when I commenced this project. This certainly has been the “really steep hill” part of the marathon course. In much the same way a runner might look ahead and wonder “Can I actually run up this hill?” sometimes I read the reviewers comments and wondered “How on earth can I address this?” I am very grateful for the feedback from the many anonymous reviewers who commented on my manuscripts as these comments and observations have helped strengthen the arguments presented in this thesis.

What would a sporting event be without a cheer squad? Grace and Airdrie have been like spectators who run beside athletes cheering “Come on. Run faster.” Their frequent phone calls, emails and text messages asking “How are you going?” really did spur me to keep running. I have spent the past four months compiling this thesis in its final format – this has been the equivalent of entering the stadium for one last lap of the oval before reaching the finishing line. During this time the cheering from the crowd has been deafening. I cannot begin to name all the faces in the crowd – friends, family, colleagues – who have asked “How are you going?”, “When will you be submitting?” or congratulated me for “getting to the end”. The cheering was not in vain – it provided me with a much needed extra spurt of energy as I focussed on the finishing line.

What does an athlete do when they reach the end of a marathon? Champagne? Rest and relaxation? Yes, these things are on the agenda. However, what also lurks in the back of an athlete’s mind is the question “When is the next race?” I suppose this means I will be looking for the next project…

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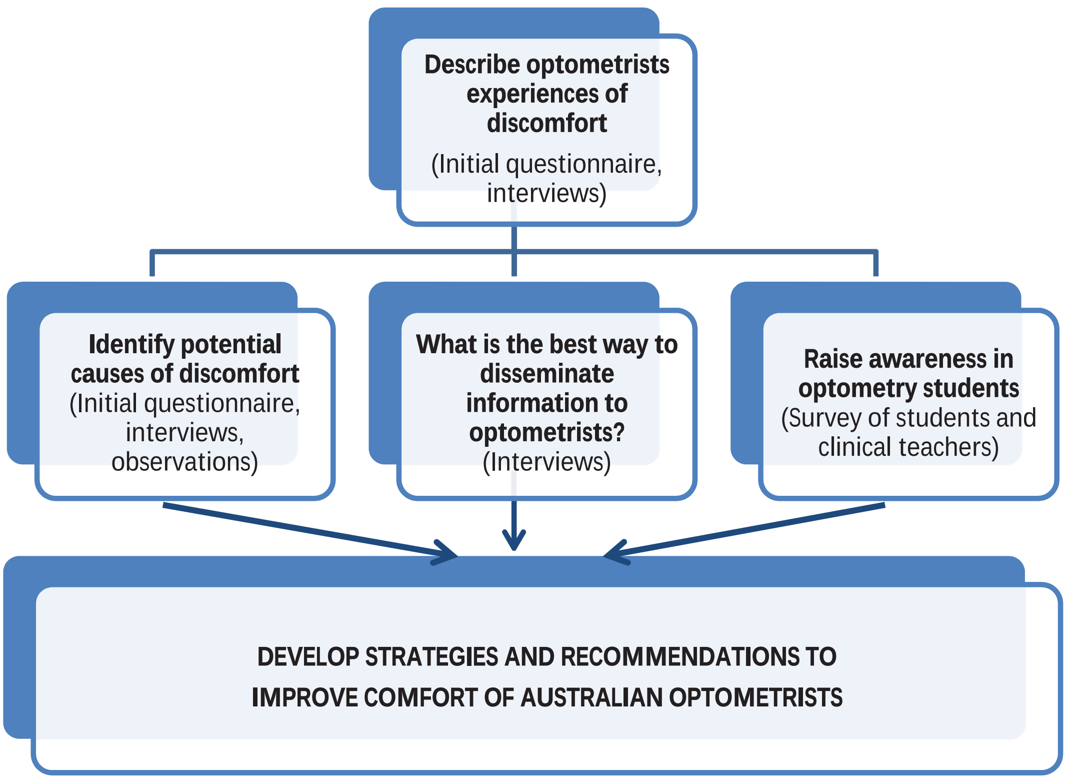
Thesis overview

This thesis is a multi-stage study. The objective was to develop strategies and recommendations to improve comfort of Australian optometrists. There were five phases of investigation:

1. A questionnaire issued to Australian optometrists (n=416 respondents)
2. Interviews with 60 optometrists
3. Observations of 10 optometrists conducting an eye examination
4. Survey of senior optometry students at the School of Optometry and Vision Science, UNSW (n=64)
5. Survey of clinical optometry teachers at optometry teaching institutions in Australia and New Zealand (n=46)

The structure of the investigation can be depicted as:



PART 1: Introduction – Chapters 1 and 2

Chapter 1 provides the context for the investigation and includes a description of the role of an optometrist in the Australian healthcare system, a brief description of the tasks performed by an optometrist during an eye examination and an overview of what is currently understood about work-related discomfort in optometrists. This chapter also provides an overview of strategies adopted by other healthcare professions when investigating work-related discomfort and a description of various approaches for initiating change to reduce work-related discomfort.

Chapter 2 provides an overview of the thesis methodology and how it developed over time. This was presented at the International Ergonomics Association Congress in Recife, Brazil in February 2012 and was published in the journal *WORK.*

PART 2: Description of discomfort – Chapter 3

Chapter 3 includes three publications describing Australian optometrist's experiences of work-related discomfort. The first publication (*Optometry and Vision Science*) describes independent risk factors for discomfort which were determined from the initial questionnaire to optometrists. The second (*Clinical and Experimental Optometry)* reports qualitative data from the initial questionnaire and describes how Australian optometrists manage work-related discomfort. The third publication (under review*)* reports qualitative data from interviews with optometrists and describes the consequences of work-related discomfort for optometrists' personal and working lives.

PART 3: Identify potential causes of discomfort – Chapters 4, 5 and 6

Chapter 4 discusses whether work-related discomfort is an issue which should be managed by optometrists (e.g. adjusting their posture) or an issue which should be addressed by employers, equipment designers and consultation room designers. The publication (*Ergonomics Australia)* included in this chapter identifies four contributing factors to discomfort: sustained postures, awkward postures, inability to adjust equipment and insufficient space. It also reports data related to optometrists' control over their physical work environment and their work pace.

Chapter 5 illustrates the four contributing factors to discomfort identified in the previous chapter with data collected during onsite observations of optometrists in their practices. Four clinical tasks are presented: using the phoropter, ophthalmoscope, slit lamp and computer.

These data were presented during the *Vaegan Seminar Series* at the School of Optometry and Vision Science in August 2012.

There is evidence in the scientific literature that psychosocial factors can also contribute to work-related discomfort. The interviews included questions about control of the work environment and job satisfaction. Data relating to control of the work environment are presented in chapter 4. Job satisfaction is reported in **Chapter 6** in the manuscript "What do clinical optometrist like about their job?". This has been accepted for publication in *Clinical and Experimental Optometry*.

PART 4: Disseminating information to clinical optometrists – Chapter 7

If strategies and recommendations are developed to reduce work-related discomfort, then it is important to first evaluate how to effectively communicate this information. **Chapter 7** contains two publications with data collected from the interviews. The first publication discusses whether participatory ergonomics approaches are likely to be accepted in optometry practices. This was presented as a poster at the Human Factors and Ergonomics Society of Australia conference in Queensland in November 2010 and the paper was published in the accompanying peer-reviewed conference proceedings. The second paper describes how optometrists prefer to obtain information to assist their physical comfort and the potential effectiveness of various communication methods which could be used to disseminate guidelines and recommendations to the profession. This was presented as an oral paper at the 13th Biennial Scientific Meeting and 7th Educators Meeting in Optometry (SEMO) in Sydney in August 2010 and published in *Ergonomics Australia* in 2011.

PART 5: Raising awareness in optometry students – Chapter 8

Although some interview participants recalled receiving instruction during their undergraduate training on the topic of work-related discomfort, there were others who wished that they were aware of this issue earlier in their professional careers – before they started to experience discomfort. **Chapter 7** reports data collected from two surveys which were issued concurrently in 2010:

- A survey of senior optometry students at the School of Optometry and Vision Science, UNSW, to determine their experience of discomfort and how they have obtained information to reduce discomfort when performing clinical procedures.
- A survey of clinical teachers at optometry teaching institutions in Australia and New Zealand to determine what instruction they give students to reduce work-related discomfort.

These data were presented at the Human Factors and Ergonomics Society of Australia conference in Sydney, November 2011 and published in a special conference edition of *Ergonomics Australia.*

PART 6: Strategies and Recommendations – Chapters 9 and 10

Chapter 9 presents the principle findings of this thesis within a risk management framework. This publication was commissioned by *Optometry in Practice.* Its aim is to provide practical guidance for optometrists to reduce the risk of discomfort for themselves and others in their practices.

Chapter 10 summarises the main findings reported in this thesis and suggests strategies which could be implemented to reduce work-related discomfort in the optometry profession.

References

This portfolio of work has been published in different journals. Consequently, the reference styles vary between the various publications (e.g. Vancouver, Author-date, SIAM, Clinical and Experimental Optometry own style).

References are included at the end of each chapter, in-press manuscript or publication to assist readability and to maintain consistency throughout this document.

The unpublished portions of this thesis and the in-press manuscripts have all been formatted with the style APA 5th.

What's in a name? Discomfort versus Injury

This project commenced as an investigation of work-related discomfort in the optometry profession. During the course of the investigation it became apparent that the discomfort reported by optometrists ranged from mild to severe. Some optometrist participants reported that they have received medical diagnoses for their discomfort and now work reduced hours or have ceased working as an optometrist altogether. For these optometrists, the term "injury" may be more appropriate. Therefore, in this thesis, the terms "discomfort" and "injury" are both used.

PART 1: Introduction

Chapter 1: Injured in the line of duty: How is this relevant to the optometry profession?

1.1 The optometry profession

The first spectacle lenses are reported to have been invented in about 1270 (Orr, 1985; Wright, 1988). Since then, the profession of optometry has evolved from being spectacle sellers where the "correct" spectacles were determined and sold by trial and error, through to its current status as a healthcare profession. The World Council of Optometry (World Council of Optometry, 2011) defines an optometrist as a person who is competent to dispense and prescribe optical appliances, refract (i.e. determine the correct spectacle lens prescription) and detect diseases and abnormalities of the eye and visual system. This is a minimum requirement. In the United States of America and in Australia, optometrists may also be licenced to prescribe therapeutic drugs e.g. for the treatment and management of eye disease. Optometrists are different to ophthalmologists who are medical doctors and who specialise in examining, diagnosing and treating diseases and injuries in and around the eye (RANZCO, 2012).

To practice optometry in Australia, an optometrist needs to demonstrate knowledge and competencies as defined in published competency standards (P Kiely, 2009) and be registered with the Optometrists Board of Australia. Competency can be demonstrated by either successfully completing an Australian university qualification (see table 1) or by sitting an examination administered by the Optometry Council of Australia and New Zealand. Once registered, an optometrist can apply for a Medicare provider number. This enables eligible patients seeking optometry services to claim a rebate from the Australian Government (Australian Government Department of Health and Ageing, 2011). Workforce estimates indicate that in 2011 there were 4429 optometrists registered to practice in Australia (Anonymous, 2011). Data reported for 2009 indicates that 55% of optometrists were male and 45% of optometrists were aged less than 40 years (P Kiely, Horton, & Chakman, 2010).

The content and length of time of an eye examination is not strictly defined, although the Medicare schedule assigns different item numbers and reimbursement for consultations less than 15 minutes and consultations longer than 15 minutes (Dutton, 2010). A general comprehensive optometry consultation usually comprises the following categories: talking with the patient (e.g. history and symptoms, summary of results and advice to patient), refraction (determining if the patient requires an optical correction) and ocular health examination. Examples of clinical tasks are illustrated in table 2.

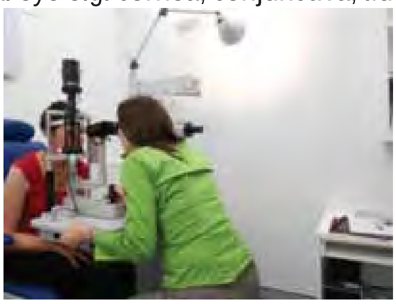
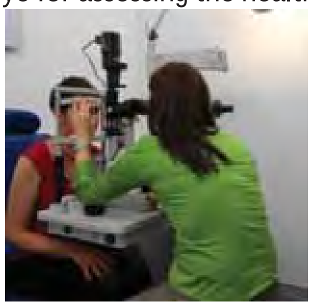
Research published in the United Kingdom indicates that optometrists require at least 30 minutes to provide a comprehensive eye examination (Dutton, 2010). Some optometrists provide eye examinations of shorter duration (e.g. 20 minutes) by utilising optometric assistants to administer automated testing procedures (Anonymous, 2009; Gailmard, 2007) e.g. digital retinal imaging, non-contact tonometry and auto-refraction. This means that an optometrist could perform up to 25 eye examinations per working day.

Clinical Australian optometrists primarily work in private practice. These practices may be independent (i.e. their practices are owned by optometrists) or non-independent (i.e. optometrists working in franchise arrangements or for dispensing companies). It is estimated that independent optical outlets account for 62% of all optical outlets in Australia but this represents only 38% of the total market share (Cushway, 2011). It is also estimated that 74% of optometry practices are located in the major cities of Australia (P Kiely & Chakman, 2011).

Table 1. Optometry courses within Australia

State	University	Degree
New South Wales	University of New South Wales	Bachelor of Optometry / Bachelor of Vision Science (5 years)
Queensland	Queensland University of Technology	Bachelor of Vision Science / Master of Optometry (5 years)
South Australia	Flinders University	Bachelor of Medical Science (Vision Science) / Master of Optometry (5 years)
Victoria	University of Melbourne	Doctor of Optometry (post-graduate, 4 years)
	Deakin University	Bachelor of Vision Science / Master of Optometry (3.5 years)

Table 2. Examples of tasks conducted during an eye examination

Clinical task	Description
Refraction – determining whether the patient needs an optical correction (e.g. spectacles or contact lenses)	Refraction can be performed in free-space by placing trial lenses in front of the patient's eyes:   It can also be performed using a phoropter (refractor head). This can be manual (the optometrist manually turns the dials) or electronic (where the lenses are controlled by a computer terminal):  
Slit lamp examination and associated techniques	A slit lamp examination provides the optometrist with a magnified view of the external eye e.g. cornea, conjunctiva, lids.  **Slit lamp fundoscopy** is a technique whereby a small lens is held in front of the patient's eye for assessing the health of the retina.  **A Goldman tonometer** may be attached to the slit lamp to measure intraocular pressure. **Gonioscopy** is a similar technique to slit lamp fundoscopy and allows examination of the drainage angle of the anterior eye, which is important for glaucoma assessments.

Clinical task	**Description**
Ophthalmoscopy	Ophthalmoscopy is used to assess the health of the posterior portion of the eye e.g. retina, vitreous humour, macula, optic disc. A direct ophthalmoscope is a small portable instrument.  Binocular indirect ophthalmoscopy requires the optometrist to wear a head-mounted light source and hold a condensing lens in front of the patient's eye. 
Tonometry	Tonometry is used to measure the eye's intraocular pressure. It can be performed using a Goldmann tonometer attached to the slit lamp (see above) or with hand held instruments, including Keeler Pulsair, iCare and Perkins tonometers:  

1.2 Work-related discomfort in ophthalmic practice

The impetus for this thesis was hearing anecdotal reports within the optometry profession of work-related discomfort. Despite many optometrists having a "story to tell", a literature review revealed very few publications on the topic. There are two categories of publications related to work-related discomfort in the ophthalmic professions: epidemiology of discomfort within ophthalmology and guidelines for optometrists and ophthalmologists in clinical practice. There are also two editorials: one in *Optometry* (Newman, 2005) and another in *Ophthalmology* (Marx, 2012).

1.2.1 Epidemiology studies

Estimates of the prevalence of work-related discomfort in the ophthalmic professions vary between 52% and 80% (see table 3). Explanations for discomfort include prolonged static postures within the operating theatre (Chatterjee, Ryan, & Rosen, 1994), high stress levels, high patient load and female gender (Dhimitri et al., 2005). This latter study attributes the gender risk to anthropometric differences (e.g. women are smaller and therefore may not be able to reach and manipulate equipment easily).

A 2012 survey of eye care physicians (ophthalmologists and optometrists) working in a United States teaching hospital showed that eye care physicians were more likely to report musculoskeletal discomfort compared to family medicine physicians (Kitzmann et al., 2012). Discomfort was associated with physical factors e.g. performing repetitive tasks, bending/twisting, awkward postures and sustained postures, and with psychosocial factors e.g. high job demands and low control. Unfortunately, the study design combined the responses of the ophthalmologists and optometrists so it is not possible to ascertain which group was more at risk. It is possible that there are differences between the two professions due to job tasks e.g. ophthalmologists perform surgery, optometrists are more likely to perform refractions.

Table 3. Work-related discomfort in the ophthalmic professions

Description of study	**Self-reported work-related discomfort**
Survey of 325 United Kingdom ophthalmologists (Chatterjee, et al., 1994)	54% experience back pain and of these, 68% had sought treatment e.g. medication, physiotherapy
Survey of 162 Iranian ophthalmologists (Chams, Mohammadi, & Moayyeri, 2004)	80% reported back pain, 69% reported neck pain
Survey of 697 United States ophthalmologists (Dhimitri, et al., 2005)	52% reported musculoskeletal disorder symptoms, 39% lower back pain, 33% upper extremity pain and 33% neck pain.
Case control study of 94 eye care physicians with 92 family medicine physicians at a US teaching hospital (Kitzmann, et al., 2012)	Optometrists and ophthalmologists combined results: neck pain 46%, hand/wrist pain (17%), lower back pain (26%)

1.2.2 Guidelines

Advice for reducing work-related discomfort in clinicians is the subject of 11 ophthalmic publications:

- Marx et al (Marx, Wertz, & Dhimitri, 2005), who also published an epidemiology study about ophthalmologists (Dhimitri, et al., 2005) review the common medical syndromes associated with work-related discomfort (e.g. carpal tunnel syndrome, ulnar neuropathy, rotator cuff tendonitis) and then describe how the risk can be reduced by implementing postural change and making adjustments to equipment. Three publications written by journalists reiterate this advice (K. Green, 2008; Roach, 2009a, 2009b).
- Three publications written by optometrists (Bruce & Snibson, 2007; Hutchins & Schneebeck, 2004) and ophthalmologists (Chiang, Baker, Milder, & Garg, 2010) use self-experienced discomfort and case-anecdotes as the platform for their advice which is mainly related to postural awareness. One publication written by a journalist uses this format as a model and provides specific advice for the purchase and use of equipment in optometry consultation rooms (Kirby, 2007).

- Two publications are written by ergonomists. One describes stretching exercises and provides "safety hints" for several different optometry tasks (Anonymous, 2007) while the other advises that comfort issues can be circumvented by considering ergonomics principles when purchasing equipment (Long, 2008).
- One publication written by a journalist focuses on the benefits of sport and exercise for reducing the risk of work-related discomfort (M. Green, 2009).

1.3 How have other healthcare professions investigated work-related discomfort?

Questionnaires and surveys are useful for establishing the presence of work-related discomfort within a profession as they can be easily and quickly distributed to large numbers of people. To gain a better understanding of the causes of work-related discomfort, its consequences and any barriers for implementing change, other investigative methods may also need to be used e.g., logbooks, interviews, focus groups, observation studies and objective measurements. A brief description of each tool and examples of its application within healthcare is given below.

1.3.1 Questionnaires

The Standardised Nordic Musculoskeletal Questionnaires (NMQ) was developed for screening musculoskeletal disorders within ergonomics and occupational settings (Kuorinka et al., 1987). All the questions are forced choice, which makes it easy to administer and use and reasonably reliable (Dickinson et al., 1992; Kuorinka, et al., 1987) although modifications have been suggested for using it in other languages (Dickinson, et al., 1992). The NMQ has become popular for assessing the prevalence of work-related discomfort within occupational groups. In healthcare this includes use with physical therapists (Bork et al., 1996; Cromie, Robertson, & Best, 2000), nurses (Smith, Wei, & Wang, 2004; Trinkoff, Brady, & Nielson, 2003), physicians (Smith, Wei, Zhang, & Wang, 2006), surgeons (Szeto et al., 2009) and veterinarian workers (Scuffham, Legg, Firth, & Stevenson, 2010). The NMQ can also be used to assess severity of discomfort since it contains questions related to the impact of symptoms on activities at work and home during the previous 12 months.

Most healthcare groups who have investigated work-related discomfort using the NMQ have included supplementary task-specific questions, while other healthcare groups have developed their own questionnaire tools with occupation specific questions e.g. dentists (Alexopoulos, Stathi, & Charizani, 2004), physiotherapists (West & Gardner, 2001) and surgeons (Sivak-

Calicott et al., 2011). Occupation-specific questions used in healthcare studies include asking respondents to rate on a scale the frequency of job risk factors (Alexopoulos, et al., 2004; Bork, et al., 1996; Cromie, et al., 2000; Scuffham, Legg, et al., 2010; Smith, et al., 2004; Szeto, et al., 2009; West & Gardner, 2001), rate on a scale the frequency with which self-protective behaviours are adopted (Cromie, et al., 2000; Trinkoff, et al., 2003), indicate with a yes/no response the presence of risk factors (Szeto, et al., 2009) or answer open-ended questions (Scuffham, Firth, Stevenson, & Legg, 2010; West & Gardner, 2001).

1.3.2 Logbooks

Questionnaires and surveys are retrospective. There is evidence that memory for pain can be inaccurate and that recall is influenced by factors such as current experience of pain (Miranda, Gold, Gore, & Punnett, 2006) and pain location (Jamison, Sbrocco, & Parris, 1989). Others have shown that recall for pain over the previous 7 days is similar to pain experiences recorded in daily logbooks (Bolton, Humphreys, & van Hedel, 2010). A pain diary (or logbook) is one method to document and rate actual pain experienced throughout the day, and thus overcome the risk of recall bias. Examples of the use of logbooks in a healthcare setting are given in table 4.

1.3.3 Interviews and focus groups

Interviews allow participants to describe their experiences and opinions in their own words. They may be structured (the interviewer strictly follows a pre-determined schedule of questions), semi-structured (the interviewer has a schedule of questions which are used as a prompt to guide the interview) or unstructured (there are no pre-determined questions or structure) (Stanton, Salmon, Wlaker, Baber, & Jenkins, 2005). While all strategies may include closed and open-ended questions, semi-structured and unstructured interviews also provide the opportunity for the interviewer to probe further with exploratory questions which might not be anticipated prior to the interview. Subsequently, interviews are a useful strategy which can return unexpected data (Silverman, 2010).

Data analysis is conducted by coding participant responses into themes or patterns (Barbour, 2001; Bowen, 2009; de Wet & Erasmus, 2005). Since participants share their own personal stories, there may be bias (Pepper & Wildy, 2009) but this can be offset by using standardised questions and large sample populations (Lewis, 2009) which include individuals who are exceptions, or outliers (Barbour, 2001; Morse, Barrett, Mayan, Olen, & Spiers, 2002).

Focus groups are a variation on interviews. This is a less time consuming option during the data collection phase as small groups of people discuss a set of questions, but bias can be introduced if there are dominant personalities within the group who sway the responses of other group members (Crawford, Gutierrez, & Harber, 2005).

Examples of the use of interviews and focus groups in a healthcare setting are given in table 4.

1.3.4 Observation

While interviews provide insight into perceptions and attitudes, participants might not provide accurate descriptions of their tasks or postures in the workplace. Observation overcomes this limitation (Paterson, Bottorff, & Hewat, 2003). At its simplest level, photographs and video can be used to document examples within the workplace (Corlett, 1995; Dempsey, McGorry, & Maynard, 2005). Photographs, video and real-time observation can also be used to conduct more objective assessments of postures which contribute to work-related discomfort.

Examples of semi-quantitative postural analysis tools include the Ovako Working Posture Analysing System (OWAS) (Karhu, Harkonen, Sorvali, & Vepsalsinen, 1981), Rapid Upper Limb Assessment (RULA) (McAtamney & Corlett, 1993), Rapid Entire Body Assessment (REBA) (Hignett & McAtamney, 2000), Quick Exposure Check (QEC) (David, Woods, Li, & Buckle, 2008) and Manual Task Risk Assessment (ManTRA) (Burgess-Limerick, 2008). There are strengths and weaknesses of each tool, for example, it has been reported that RULA is the best predictor for upper limb discomfort (Brodie & Wells, 1997) and is useful for assessing sedentary tasks (Li & Buckle, 1999) whereas OWAS is good for assessing strenuous tasks (Li & Buckle, 1999). The authors of each of these tools recommend that observers should be trained in the tool use as this will improve accuracy. However, compared to other more objective measures, there may be inaccuracies due to interpretation and scoring of the postures (Burdorf, Derksen, Naaktgeboren, & van Riel, 1992) or lack of precision in making a subjective observation (Burdorf, et al., 1992; Yen & Radwin, 2000).

Video is a useful tool for postural analysis as it is possible to replay footage when assessing more than one body region (Bao, Howard, Spielhoz, & Silverstein, 2007), review the footage multiple times or use multiple observers to increase accuracy while maintaining cost effectiveness (Mathiassen, Liv, & Wahlstrom, 2012). On the other hand, it may need to be supplemented by other tools (e.g. written notes, photographs) if the video recorder is unable to adequately capture the posture e.g. if the filming width of view is narrower than the actual task area (Paterson, et al., 2003). Video may be regarded as an intrusive method (Crichton & Childs, 2005) particularly in a healthcare setting where observations are made of clinician interaction with patients (Janowitz et al., 2006), although intrusiveness has also been reported as a barrier for recruiting dentist participants in a direct (non-video) observation study (Rabiei, Shakiba, Shahreza, & Talebzadeh, 2012).

Examples of the use of observation tools in a healthcare setting are given in table 4.

1.3.5 Objective measurement

The techniques described so far are subjective: they either require participants to report a memory or an opinion of discomfort (questionnaires, logbooks, interviews) or observers to make judgements of postures or postural angles (observations). Technology options, such as goniometers, surface electromyography (EMG) and biomechanical analysis provide a more objective measure of posture, muscle action, angles and forces.

Objective techniques used in the evaluation of healthcare professions are generally non-invasive, i.e. the device/sensor is applied to the external body. However, since the measurements are often made while the task is being performed in a clinical setting, the devices/sensors can inhibit movement and may limit the body locations which are able to be measured (Li & Buckle, 1999; Szeto et al., 2012). The literature cautions that although these techniques give an illusion of accuracy by providing numerical data, they do not provide information about the work context and so are best used in conjunction with other observation methods (as described above) or used for making comparisons between postures or tasks (Corlett, 1995; Tracy, 1995).

Goniometers and inclinometers use a similar principle to a protractor and measure the angle of the body relative to the vertical or between adjacent body parts e.g. the angle between the upper and lower arm. Mechanical devices manually measure body segment angles, but they only allow measurement in one plane of motion and are not suitable for measuring dynamic postures (Li & Buckle, 1999). Electrogoniometers can be attached to the body part under observation and are used to measure dynamic postures over time. Some also allow simultaneous measurements of multiple joints (Bao, et al., 2007) and multiple motion planes (Vieira & Kumar, 2004).

Surface Electromyography (EMG) is a technique where electrodes are placed on the muscle surface so that muscle activity and muscle force can be measured over time. Data collected from multiple participants or from participants conducting different tasks can be used to assess relative differences between postures (Corlett, 1995).

Biomechanical analysis calculates forces and accelerations at joints, within the spine or within trunk muscles. This can be achieved by using force gauges, spring scales and computer programs which allow assessment in 2 and 3 dimensions.

Examples of the use of objective measurement in a healthcare setting are given in table 4.

1.3.6 Triangulation of data

Although each tool can return valid data, combining several different tools will provide different perspectives (Barbour, 2001) and thus increase the credibility and validity of any findings (Bowen, 2009; Lewis, 2009). Examples of this triangulation approach in the evaluation of healthcare professions are given in table 4.

Table 4. Investigative techniques for evaluating work-related discomfort in healthcare settings

Investigative technique	Healthcare example
Logbook	- Logbooks were used to document diurnal variation in work-related discomfort, stress and time pressures in a study of 148 Danish hospital nurses (Warming, Precht, Suadicani, & Ebbehoj, 2009).
Interviews and focus groups	- 18 Australian physiotherapists who changed their career due to work-related discomfort were interviewed to understand their experiences of Workers Compensation (Cromie, Robertson, & Best, 2003) and their attitudes to work-related discomfort (Cromie, Robertson, & Best, 2002) - 51 United States dental hygienists participated in focus groups of 10 people to investigate their experience of work-related discomfort, job control and relationships with other office staff (Crawford, et al., 2005) - 26 British nurses were first interviewed and then later invited to participate in focus groups of 3-4 people (Hignett & Richardson, 1995) to understand factors contributing to patient handling techniques.
Observations	- 60 British dental students were photographed while working in a pre-clinical laboratory and seated on two different types of chairs. A RULA score was calculated for their posture on each chair and compared (Gandavadi, Ramsay, & Burke, 2007) - Six United States dermatology surgeons were videotaped performing Mohs surgery and their postures analysed using RULA (Esser, Koshy, & Randle, 2007) - 494 United States hospital workers were observed in real-time and their postures analysed using REBA (Janowitz, et al., 2006).
Objective measurements	- 12 Swedish dental hygienists participated in observational studies (electromyography, inclinometry and goniometry) to understand the biomechanical loads involved in their work (Akesson, Balogh, & Hansson, 2012) - Hand forces and forearm muscle loads were measured in 3 endoscopists each performing 3 colonoscopy procedures (Shergill et al., 2009) - Inclinometers and electrogoniometers were attached to the head and shoulders of 14 surgeons performing laparoscopic surgery (Szeto, et al., 2012)
Triangulation of data	- 536 Australian physiotherapists returned a Nordic Musculoskeletal Questionnaire. 18 of the participants were then interviewed (Cromie, et al., 2000, 2002, 2003). - 17 United States dermatology surgeons completed a questionnaire to determine the prevalence of musculoskeletal disorders within their group. Six of these participants were then videotaped and their postures analysed using RULA (Esser, et al., 2007) - 92 Iranian dentists completed a Nordic musculoskeletal questionnaire. An ergonomist then conducted real-time postural analysis of the 92 participants using RULA (Rabiei, et al., 2012) - 12 Swedish dental hygienists were interviewed and administered the Nordic Musculoskeletal Questionnaire to determine if they had a musculoskeletal disorder. They then underwent a physical examination to diagnose the reason for any reported discomfort. The physical workload when performing their work was measured with surface electromyography, inclinonometers and electrogoniometers (Akesson, et al., 2012).

1.4 Initiating change to reduce work-related discomfort

1.4.1 The personal approach

At its simplest level, work-related discomfort can be reduced by individuals taking personal responsibility and making changes to their own work environment or work practices. This is the approach generally taken within ophthalmic publications. For example:

- Anecdotes describe how individuals have managed their own discomfort (Bruce & Snibson, 2007; Chiang, et al., 2010; Hutchins & Schneebeck, 2004)
- Advice is given about working postures (Kirby, 2007; Marx, et al., 2005; Roach, 2009b)
- Instructions are given for exercises which can be performed throughout the working day (Anonymous, 2007; M. Green, 2009).

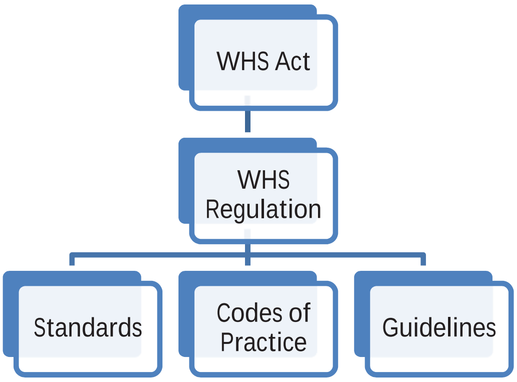
Except for a publication describing possible medical consequences of poor posture (Marx, et al., 2005), there is no experimental evidence within these publications to substantiate the advice given. For example, there is debate over which posture will lead to greater comfort when using the phoropter for refraction. Exponents of sitting argue that this posture is more comfortable but acknowledge there is the risk of discomfort if the optometrists arms are raised to reach the phoropter (Hutchins & Schneebeck, 2004). Others caution that standing is preferable so long as the optometrist maintains a good posture, is standing on carpet padding and is wearing comfortable shoes (Kirby, 2007). Some authors advocate alternating between sitting and standing as this provides postural variety (Anonymous, 2007).

1.4.2 The legislative approach

Work-related discomfort is an issue which falls under the jurisdiction of work health and safety (WHS) legislation. Therefore it can be argued that there is a legislative requirement for workplaces to manage the risk of work-related discomfort for themselves and for their employees.

Australian WHS legislation has a hierarchical structure with three tiers (see figure 1).

Figure 1. Hierarchical structure of Work Health Safety Legislation in Australia



Tier 1: The Work Health Safety Act (Safe Work Australia, 2011c) is enacted by the Federal Australian Parliament. It provides the structure and underlying principles for ensuring that workplaces are safe and stipulates:

- There is a duty of care to provide a safe work environment, equipment and systems of work. This also applies to self-employed people i.e. they must also ensure their own health and safety at work. (Part 2, Clause 19)
- Health and safety interventions should be reasonably practicable. This means that a person conducting a business does not have to ensure absolute safety. Instead, interventions should take into account factors such as the likelihood and consequences of harm, the availability of control measures and the cost associated with eliminating or minimising risk. (Part 2, Clause 18)
- Business owners and managers need to take reasonable steps to protect themselves, workers and visitors to workplaces. This is known as due diligence. (Part 2, Clause 27, 28 and 29)
- There should be consultation with workers before applying interventions. This is recommended because workers are more likely to understand the inherent risks within their work or the hazards associated with using items of equipment. (Part 2, Clause 47, 48 and 49)

Tier 2: The Work Health Safety Regulation (Safe Work Australia, 2011b) is also enacted by the Federal Parliament of Australia. Its purpose is to provide more guidance or clarification to workplaces how to implement the WHS Act. For example, chapter 3 of the Regulations describes the duty of people within workplaces to adopt a risk management approach when managing risks to health and safety. The WHS Act and Regulations are designed to be read together.

Tier 3: Specific guidance for acceptable practice is provided in the standards, model codes of practice and guidelines.

- Standards are developed by committees which consist of experts (e.g. academics) and industry, government and consumer representatives. They are guidelines for the quality and safety of products, services and systems. Australian standards usually undergo review every 7-10 years, which includes a process which allows for public comment (Standards Australia). Although Australian Standards are not legal documents, the contents are generally accepted as valid guidelines for use within workplaces (Standards Australia). An example of a standard relevant to the WHS legislation is Australian / New Zealand Standard AS/NZS ISO 31000:2009 Risk management – Principles and guidelines ("Australian / New Zealand Standards AS/NZS ISO 31000:2009 Risk management - Principles and guidelines,"). The process described in this standard includes establishing the organisational context, identifying, analysing and treating risks, while simultaneously monitoring and reviewing the process. It also recommends communication and consultation with stakeholders at each stage of the process.
- Model Codes of Practice are published by the government organisation, Safe Work Australia, and include a public comment phase during their development. They are designed to supplement the WHS legislation and may be considered in court proceeding as an acceptable minimum standard of practice (Safe Work Australia, 2012). An example of a Model Code of Practice is the "Hazardous Manual Tasks Code of Practice" (Safe Work Australia, 2011a) which addresses the issue of musculoskeletal disorders.
- Guidelines for the practice of optometry are published by the Optometrists Association Australia (OAA) and are available in the members' area of the OAA website. Some guidelines direct the reader to peer-reviewed publications, while others are written by the OAA. The Optometry Board of Australia also has policies, codes and guidelines (Optometry Board of Australia, 2011) which clarify expectations within the optometry profession. There are no guidelines published by the Optometrists Association Australia or by the Optometry Board of Australia on the topic of musculoskeletal discomfort in optometrists.

1.4.3 Embedding change within a business context

Interventions for reducing work-related discomfort are traditionally associated with prescribing a change to the system (e.g. instruction to alter a posture while performing a task) with the expectation that there will subsequently be a decrease in discomfort and injury. However, the recurrent theme within the ergonomics literature is that single interventions (e.g. conducting a workstation assessment, providing training or recommending exercises) are not as effective as multifaceted strategies (Culig, Dickinson, Lindstrom-Hazel, & Austin, 2008; Kennedy et al., 2010; Nelson et al., 2006; Szeto et al., 2010).

There are arguments that ergonomics should be embedded with general company strategies (Dul & Neumann, 2009; Hagg, 2003) and that ergonomists need to provide a business case for their recommendations, not simply focus on health and safety legislation. This could include documenting the financial, productivity and efficiency benefits of ergonomics interventions (Dul & Neumann, 2009; Hendrick, 1996; Lee, 2005), providing a combination of quantitative data (e.g. cost savings) and qualitative data (e.g. how the savings were achieved) (Kerr, Knott, Moss, Clegg, & Horton, 2008) and proposing ergonomic change in conjunction with other processes or engineering changes (Koningsveld, Dul, Van Rhijn, & Vink, 2005). There are models and cost-benefit calculators in the public domain to assist ergonomists with this process (HFES, 2012; Oxenburgh, Marlow, & Oxenburgh, 2004).

One way of embedding change within an organisation is by using participatory ergonomics. This is a consultative approach whereby training and information about ergonomics is given to the whole working group (managers, ancillary staff as well as the workers engaged in the actual work task) and, through facilitated meetings, the group devises their own strategies to improve comfort and performance. Participatory ergonomics has been shown to be effective in reducing injuries associated with manual tasks (Rivilis et al., 2006; Rivilis et al., 2008; Straker, Burgess-Limerick, Pollock, & Egeskov, 2004) and changes are more likely to gain acceptance in the workplace (Wilson, 1995) and be sustainable over time (Jensen, Alstrup, & Thoft, 2001).

The challenge for embedding change within optometry is that optometrists predominantly work in small business and small business environments are reported as having a higher risk of injury for individuals (Olsen, Legg, & Hasle, 2012; Sorensen, Hasle, & Bach, 2007). This is probably related to the size of the workplace and limited resources for controlling risks (Olsen, et al., 2012) but other barriers for implementing change include lack of knowledge e.g. small business operators don't actively seek safety information, promotional programs don't always reach their target audience or are not seen as beneficial (Olsen, et al., 2012).

In a project investigating the adoption of ergonomics interventions to reduce musculoskeletal discomfort in agricultural workers, it was found that the barriers for implementing change varied depending on the likelihood of a person adopting an intervention (Karsh, Newenhouse, & Chapman, 2013). For example, barriers typically cited by those likely to adopt an intervention include lack of information, inability to try the innovation and lack of knowledge how/where to purchase the product, whereas barriers typically cited by those unlikely to adopt an intervention include cost and inability to see the benefits of change. This has implications for implementing change within optometry: if information is provided to optometrists to reduce their risk of work-related discomfort, then perhaps there is a need to provide information in different formats, depending on the decision-making stage of the end user e.g. basic information, more technical information, conference presentations, hands-on trials.

1.4.4 Embedding change within education

Healthcare providers are charged with ensuring that their patients receive appropriate care. Therefore, a culture may develop within healthcare professions to place the needs of patients above one-self and to continue to work when ill or injured. This has been reported in nursing (Trossman, 2004), physiotherapy (Cromie, et al., 2002) and medicine (McKevitt & Morgan, 1997). There is also evidence that work-related discomfort can occur early within a healthcare practitioner's career, with reports of discomfort in populations of medical students (Smith & Leggat, 2007) and dental students (Rising, Bennett, Hursh, & Plesh, 2005).

Teaching students good working habits and exposing them to safe working practices *before* they are injured is the basis for the development of teaching curricula in the nursing (Waters, Nelson, Hughes, & Menzel, 2009) and dental hygiene (Beach & DeBiase, 1998) professions. It is postulated that this may have a positive effect on professional culture and create sustainable change for reducing work-related discomfort (Trossman, 2004).

1.4.5 A multifaceted approach

The risk management standard ("Australian / New Zealand Standards AS/NZS ISO 31000:2009 Risk management - Principles and guidelines,") recommends that commitment to change should be sought at all levels within an organisation (i.e. with all stakeholders) to ensure effective and sustained change. Misalignment of the interests of various stakeholders (e.g. business owners, workers, legislators, insurance companies) is described as a primary barrier to implementing preventative measures within organisations (Cherniak & Lahiri, 2010).

An example of a multifaceted approach is a project investigating work-related discomfort in nurses in the USA. For the past 20 years, the National Institute for Occupational Safety and Health (NIOSH) in the USA has coordinated a project with the aim of reducing injury associated with overexertion and slips, trips and falls in nurses (Collins & Bell, 2010). The stages of the process include:

1. Literature review
2. Epidemiological analysis of injury data
3. Consultation with stakeholders and others within the profession to determine their opinion on existing problems and potential solutions
4. Intervention trials to test the effectiveness of prevention programs
5. Laboratory and field research to quantify and evaluate interventions
6. Develop business cases illustrating economic advantage of implementing interventions
7. Demonstrate positive patient outcomes (i.e. the intervention does not improve nurse comfort at the expense of patient comfort)
8. Assess the sustainability of prevention programs
9. Develop evidence-based best practice
10. Implement evidence-based best practice principles e.g. incorporate in nursing curriculum and in legislation.

Although nursing and optometry are both healthcare professions, there are major differences between the two which potentially limits the use of this model for optometry. Compared to the 4429 registered optometrists in Australia (Anonymous, 2011) who primarily work in a small business environment (Cushway, 2011), Australian workforce estimates for nursing in 2009 indicates that there were approximately 320,982 enrolled and registered nurses, the majority of whom were employed in hospitals (62.2%) or residential aged care centres (10.9%) (AIWH, 2011). The numbers are even larger in the USA where the NIOSH project has been implemented: in 2008 there were 2.6 million licenced registered nurses employed in nursing in that country and 62.2% worked in hospitals (American Nurses Association, 2011).

Nevertheless, a multifaceted approach has been shown to be effective, albeit in a large profession (Collins & Bell, 2010; Collins, Wolf, Bell, & Evanoff, 2004; Nelson & Baptiste, 2004; Nelson, et al., 2006) The strength of this approach lies in the fact that it incorporates strategies which target the needs of various stakeholders (e.g. health and safety, business, education, legislation), it addresses many of the barriers outlined in section 1.4.3, and provides evidence for recommended change in practice (Nelson & Baptiste, 2004; Nelson et al., 2007).

1.5 Thesis aims

Little is understood about work-related discomfort in the optometry profession. The purpose of this thesis is to gain a better understanding of this issue, investigate options for implementing change and make recommendations which can improve the physical comfort of optometrists.

This is an exploratory study. The specific aims are to:

1. Describe Australian optometrists' experiences of work-related musculoskeletal discomfort and injuries.
2. Identify potential causes of work-related musculoskeletal discomfort and injuries experienced by Australian optometrists.
3. Assess methods of disseminating information to Australian optometrists to decrease their risk of developing work-related musculoskeletal discomfort and injuries.
4. Investigate how optometry students obtain ergonomics information and how it applies to their comfort in the consultation room.
5. Develop recommendations and strategies to improve the comfort of Australian optometrists at work.

Understanding the answers to these aims is important for the welfare of optometrists, the longevity of the optometric workforce and compliance with work health and safety legislation.

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Chapter 2: Methodology for exploring work-related discomfort in the optometry profession

This thesis has been a journey. It commenced by asking Australian optometrists “Do you experience work-related discomfort?” and expanded into a multistage study which included interviews, observations and surveys of clinical optometrists, students and teachers. More than 500 people participated in this investigation which spanned almost 5 years.

The following paper is an overview of the thesis. It discusses why methods were adopted, challenges for the project and challenges for developing guidelines for the optometry profession. It also proposes avenues for further investigation. Specific details of the methods and results are covered in later chapters.

The diagram presented as figure 1 in this paper is the one used to map the structure of this thesis (thesis overview, page 1) and corresponds to the thesis aims listed in chapter 1 (section 1.5, page 25).

This overview was presented as an oral presentation at the International Ergonomics Association Triennial Congress in Recife, Brazil, in February 2012. The accompanying conference paper was published in *WORK: A journal of prevention, assessment and rehabilitation.*

Long J, Burgess-Limerick R, Stapleton F (2012) Work-related musculoskeletal discomfort and injuries in Australian optometrists. *Work* 41: 1864 – 1868 is reproduced with the kind permission of IOS Press.

Work 41 (2012) 1864-1868
DOI: 10.3233/WOR-2012-0399-1864
IOS Press

Work-related musculoskeletal discomfort and injuries in Australian optometrists

Jennifer Long[a,*], Robin Burgess-Limerick[b] and Fiona Stapleton[a]
[a]*School of Optometry and Vision Science, University of New South Wales, Sydney NSW 2052, Australia*
[b]*Minerals Health and Safety Centre, Sustainable Minerals Institute, University of Queensland, Brisbane QLD 4072, Australia*

Abstract. Work-related musculoskeletal discomfort and injuries are reported by optometrists. The purpose of this paper is to describe the process used to investigate work-related discomfort in Australian optometrists. A multistage project was conducted which included questionnaires, interviews and onsite observations. Participants, with and without self-reported discomfort, included clinical optometrists, optometry students and clinical teachers. The various stages of the study developed over the course of the project, primarily in response to results collected at various stages. A multistage approach proved valuable for confirming results and testing hypotheses, and for investigating different groups of workers (clinicians, teachers and students). General guidelines to reduce the risk of work-related discomfort in optometrists can be developed from this project. Specific recommendations and teaching curricula have been identified in this project as areas of future research and development.

Keywords: education, guidelines, interview, observation, questionnaire

1. Introduction

Optometry is a primary healthcare profession with 4429 registered practitioners in Australia [1]. The role of an optometrist is to provide eye and vision care which includes determining an optical correction (e.g. spectacles, contact lenses), detecting / diagnosing/ managing eye diseases and assisting with the rehabilitation of eye conditions [2]. Optometrists often work with small teams of people which may include a practice manager, receptionist and optical dispenser. Larger practices may have multiple optometrists working from the same premises and ophthalmic assistants to administer automated testing procedures. Optometrists may work full-time in one practice, part-time between multiple practices or on a short-term (locum) basis. Workloads vary between practices but the typical duration of an eye examination is 20-30 minutes. Therefore, a busy optometrist may examine up to 25 patients per day.

Optometrists perform several different clinical procedures during a consultation. Although each individual procedure may take less than five minutes to complete, many procedures require sustained postures, awkward postures and fine motor control of the fingers. Subsequently, there have been reports of physical discomfort within the ophthalmic profession [5, 8, 7] and anecdotal reports of optometrists who experience work-related discomfort on a day-to-day basis, who have modified their work hours or work tasks and who have even left the profession.

The initial purpose of this investigation was to substantiate reports of work-related discomfort in Australian optometrists. This was achieved by issuing a questionnaire to obtain an estimate of the type, severity and independent risk factors for discomfort. However, the questionnaire results raised issues which warranted further investigation, leading to an expansion of the project scope.

The purpose of this paper is to:

- Describe the process used to investigate work-related musculoskeletal discomfort and injuries in Australian optometrists
- Discuss some of the issues associated with developing guidelines for clinical practice to reduce work-related discomfort and injuries.

*Corresponding author. Telephone +61 2 4782 3472 E-mail: j.long@unsw.edu.au

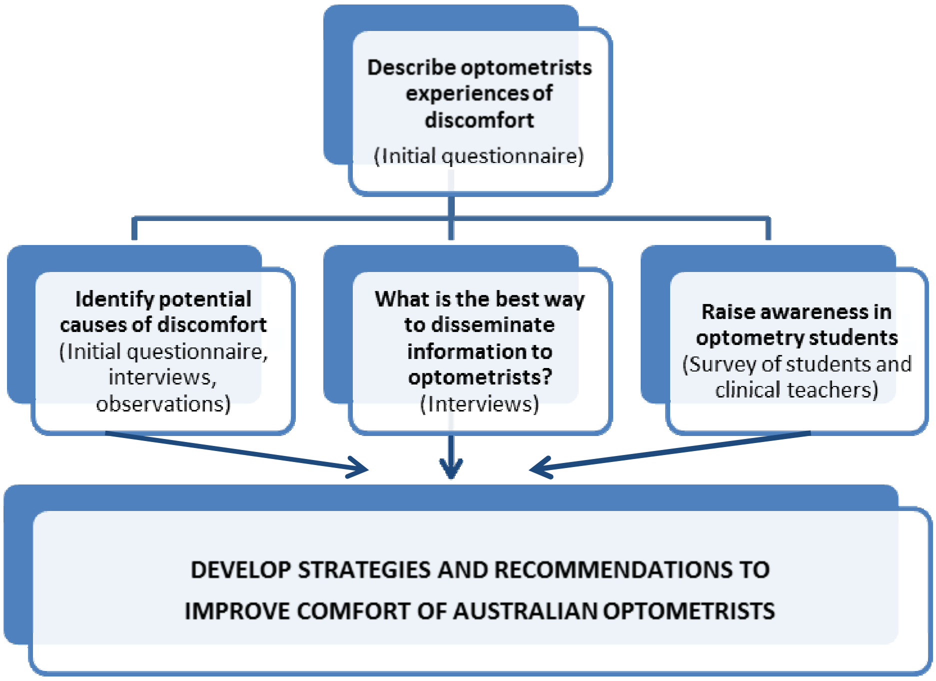

Figure 1. Project overview

2. Methods

This multi-stage study included:

- An initial questionnaire sent by email to members of the Optometrists Association of Australia (OAA) in August 2008, based on the Nordic Musculoskeletal Questionnaires [10] and job factors identified by Bork et al [4]. A more detailed description of the methodology is reported elsewhere [14]
- 30 minute telephone or face-to-face interviews with optometrists. These were semi-structured and included questions relating to demographics, job satisfaction, description of discomfort and ergonomics. A more detailed description of the methodology is reported elsewhere [12, 11]
- Onsite observations of 10 optometrists with video recording of the participant conducting an eye examination. Analysis of the video recordings were conducted with RULA (Rapid Upper Limb Assessment)[16] and ManTRA (Manual Tasks Risk Assessment) [6]
- A survey of optometry clinical teachers at three Australian teaching institutions (University of New South Wales, University of Queensland, Australian College of Optometry) and at one New Zealand teaching institution (University of Auckland) to determine what type of teaching is given to optometry students to reduce their risk of work-related discomfort.
- A survey of optometry students enrolled in the Bachelor of Optometry and Bachelor of Vision Science program at UNSW. The purpose was to determine if optometry students experience discomfort when performing clinical procedures and their preferences for receiving information how to reduce their risk of discomfort. A description of the methodology used in the surveys of clinical teachers and optometry students is reported elsewhere [13].

An overview of the approach is shown in figure 1. All stages of investigation were approved by the Human Research Ethics Advisory Panel of the University of New South Wales.

3. Results

3.1. Questionnaire

The project was developed by the first author following anecdotal reports of work-related discomfort by optometrists. The initial questionnaire was distributed to determine the type, severity and independent risk factors for discomfort in Australian optometrists.

There were 416 optometrists (n=233 females, 56%) who participated in the questionnaire, which represents approximately 25% of optometrists with active email addresses when the questionnaire was issued [14]. Of these respondents, 82% reported work-related discomfort, most commonly in the neck, shoulder and lower back. The results showed that the risk of reporting discomfort increased for female gender (OR 6.6 CI= 2.2-19.9) and those who conduct a greater number of eye examinations per day (OR 5.1 CI 2.1-12.7) and the risk of experiencing severe discomfort (i.e. discomfort present for greater than 30 days) increased for those who perform repetitive tasks (OR 1.9 CI=1.2-3.1) and who continue to work while injured (OR 2.9, CI=1.6-5.2).

While this confirmed initial suspicions that work-related discomfort exists in the optometry profession, it also raised many more questions. For example, population attributable risk analysis showed that eliminating repetitive tasks and ceasing to work while injured would reduce the disease load for severe discomfort by 28% - but this means that 72% of the risk is unaccounted for.

3.2. Interviews

Telephone interviews were conducted with 60 optometrists (n = 47 with self-reported discomfort) to further explore reasons for work-related discomfort and strategies used to reduce discomfort. All participants were asked about work satisfaction and their ability to control their working environment.

At this stage of project development, there were enquiries from members of the profession for practical advice to reduce work-related discomfort. It became clear that guidelines or recommendations would be a useful outcome of the project. With this in mind, the interview schedule of questions was expanded to include questions about ergonomics and how the participant would prefer to access information aimed at reducing work-related physical discomfort.

There were six participants who reported that they have modified their work hours as a result of work-related discomfort (n=2 medically retired, n=4 work reduced hours) and some participants reported spending several hundred Australian dollars per month simply to keep their pain under control. Two ophthalmic tasks were commonly described as contributing to discomfort (refraction and slit lamp). This suggested that another stage of investigation – onsite observation and postural analysis of clinical tasks – may provide useful information to assist with the development of guidelines and recommendations for the profession.

When asked their opinion on accessing ergonomics information to reduce the risk of work-related discomfort, participants reported that they would access information [12] and were open to implementing a participatory ergonomics approach in their practices [11]. There were no significant relationships between preference for obtaining information and personal experience of work-related physical discomfort. Although this cohort were generally interested in ergonomics, many felt that it is too late to educate optometrists already in practice about work-related discomfort as habits have already been formed and equipment purchased and installed. This prompted the development of an investigation of optometry students and clinical teachers.

3.3. Onsite observations

There were 10 optometrists who participated in the onsite observations (n=8 with self-reported discomfort). RULA analysis appears to be a more sensitive indicator of the risk of discomfort associated with individual ophthalmic tasks. This is consistent with the questionnaire results (section 3.1) showing that optometrists are more likely to report upper body discomfort.

These observations can be used as case studies illustrating examples of good and bad practice and techniques when guidelines for optometrists are developed.

3.4. Survey of optometry students and optometry clinical teachers

The feasibility of raising awareness of work-related discomfort in optometry students was investigated using two surveys. There were 64 optometry students (48% response rate, n=45 females) and 46 clinical teachers (30% response rate) who participated in this stage of the project [13].

Of the 64 optometry students who participated, 77% reported physical discomfort in the previous 12 months while performing clinical procedures, most commonly in the lower back, neck, shoulder and upper arm. This indicates that work-related discomfort can occur early in an optometrist's professional career. Although clinical teachers do not receive formal instruction to assist students reduce their risk of work-related discomfort, the majority of respondents reported that they do provide informal instruction, for example, correct a student when they are observed using a poor posture.

4. Discussion

Publications exist in the ophthalmic literature describing work-related discomfort and possible ways to reduce discomfort. These publications are primarily based on the author's experience of discomfort or their observations in the consultation room [9, 15, 3]. To our knowledge there has not been a systematic analysis of the extent of work-related discomfort within optometry, nor analyses of the risk factors, strategies adopted by clinicians, costs or consequences of injury. This project, which consisted of multiple stages of investigation, established that work-related discomfort exists in optometry and has attempted to systematically investigate this with a view to developing evidence-based recommendations and guidelines for clinical practice.

The multistage approach allowed flexibility in the development of ideas and the methodology over the course of the project. For example, comments by some of the interviewees that students should be given instruction led to the investigation of clinical teachers and students. The flexible approach also averted conducting large numbers of onsite observations once it became clear that it was impractical to make observations of all possible working environments and equipment.

The multistage approach was also important for substantiating and confirming information that was gathered, an important methodology within qualitative research [17]. For example, the initial questionnaire asked participants if they have been able to modify their work or workspace to decrease their discomfort. Although this was valuable for understanding the diversity of methods used by optometrists in the consultation room, the interviews gave the opportunity for participants to elaborate on their responses.

Except for the use of the Nordic Musculoskeletal Questionnaire, the methodology was essentially exploratory. This approach was necessary since there is little published in the scientific literature on work-related injuries in optometrists. There was also response bias in that optometrists who were interested in participating or who have experienced work-related discomfort elected to participate and these optometrists may not be representative of all optometrists in clinical practice. On the other hand, this project represents the first step in understanding the issues of discomfort in this professional group and is useful for the development of more formal investigation tools. For example, open ended questions were asked in the interviews to better understand how optometrists prefer to gain information about ergonomics to reduce the risk of work-related discomfort. This will assist in the construction of a participatory ergonomics program which has widespread acceptance by optometrists.

The principle difficulty encountered in this multistage project was becoming conversant with a wide range of methodologies and bodies of knowledge e.g. education, musculoskeletal assessment tools, psychosocial factors, professional development. Although a challenge, this holistic approach is a cornerstone of ergonomics and reflects the multifaceted nature of work-related discomfort.

4.1. To the future

The initial goal to develop guidelines has proved more elusive than first envisioned. This is due to the diversity of equipment, practice styles, work practices, room arrangements and individual body dimensions. While it is possible to develop some generic guidelines for clinical optometrists, specific advice may be better given on an individual as-needs basis.

This project has identified several potential areas for future research. For example:

- Questionnaire and interview participants identified equipment design and room design as contributing factors to their discomfort. There is scope for further investigation into these issues with a view to making specific recommendations about ophthalmic equipment and consultation room design.
- Participatory ergonomics programs may assist optometrists reduce work-related discomfort. The results of this project provide guidance for strategies which may be attractive to optometrists. However, the actual participatory programs need to be developed and tested for effectiveness.
- RULA appears to be a more sensitive indicator for risk of discomfort compared to ManTRA for individual ophthalmic tasks. However, to assess the total risk of discomfort in optometrists it may be necessary to undertake more detailed biomechanical analysis, particularly to evaluate and

document improvements in the use of alternative equipment.

- It is beyond the scope of this current study to develop and test appropriate curricula for optometry students. However, the results of this project indicate that a three-way strategy may be required to reduce the risk of discomfort in optometry students: educate the students, educate the educators and maximize student exposure to good practice.

The best outcome for reducing work-related discomfort in optometrists is to involve the whole profession – clinicians, academics, students, industry – in the problem solving process. By doing this, a holistic rather than a fragmented solution will be achieved.

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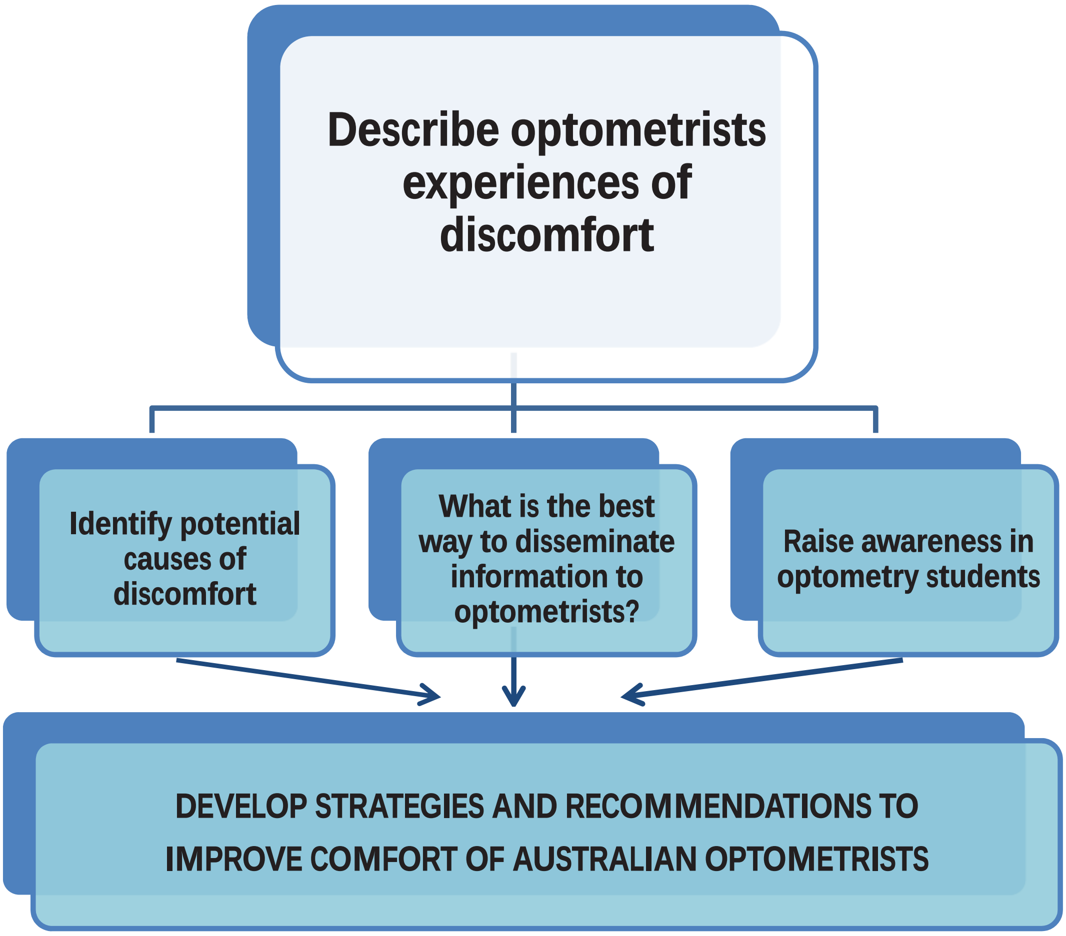
PART 2: Description of discomfort



Chapter 3: A description of discomfort in Australian optometrists

It is easy to underestimate the wealth of data generated by a questionnaire. When this project commenced in 2008, we hoped that we would receive enough data to write a small paper. Optimistically, we anticipated about 100 optometrists would participate. Instead, we received 120 responses within the first 24 hours of issuing the questionnaire, and 416 completed responses by the time the questionnaire closed 6 weeks later.

Consequently, writing up the results became a larger project than our initial estimate, which was to analyse the data over a weekend and then polish it up for a paper over the course of a couple of weeks. The actual time from issuing the questionnaire to publication was 4 years.

The first paper in this chapter "Risk factors for physical discomfort in Australian optometrists" was published in *Optometry and Vision Science* in 2011. This paper describes independent risk factors for any discomfort and for severe discomfort in Australian optometrists.

The second paper in this chapter "How do Australian optometrists manage work-related physical discomfort?" was published online (ahead of print) in April 2012 in *Clinical and Experimental Optometry.* This reports qualitative data collected in the questionnaire, including the tasks most cited as contributors to discomfort and strategies adopted by optometrists to reduce their discomfort.

The questionnaire raised many more questions than it answered. This led to the second stage of this project, interviewing 60 optometrists. The third paper in this chapter "Personal consequences of work-related physical discomfort: an exploratory study" reports data collected from interviews with 47 optometrists who experience work-related discomfort, including the impact this discomfort has had on their lives, medical diagnoses which have been given and medical treatment accessed. This paper was submitted to *Clinical and Experimental Optometry* in June 2012 and has undergone peer review.

An interesting theme emerges from the data in this chapter: although work-related discomfort is widespread within the optometry profession, it is generally viewed as a personal issue to be managed by an individual within their own time. This has implications for implementing change across the profession, a topic which is discussed later in this thesis.

Long et al (2011) Risk factors for physical discomfort in Australian optometrists. *Optometry and Vision Science* 88(2): 317-326, is reproduced with the kind permission of Wolters Kluwer Health.

Long et al (2012) How do Australian optometrists manage work-related physical discomfort? *Clinical and Experimental Optometry* 95(6): 606-614, is reproduced with the kind permission of Wiley publishers.

Personal consequences of work-related physical discomfort: an exploratory study has been submitted to *Clinical and Experimental Optometry* in June 2012 and is still under review. The manuscript in this thesis is the one submitted after the first round of reviewer's comments, and is reproduced with the kind permission of the editor of *Clinical and Experimental Optometry*.

1040-5488/11/8802-0317/0 VOL. 88, NO. 2, PP. 317–326
OPTOMETRY AND VISION SCIENCE

ORIGINAL ARTICLE

Risk Factors for Physical Discomfort in Australian Optometrists

Jennifer Long*, Thomas J. Naduvilath†, Ling (Eileen) Hao‡, Annie Li‡, Weixiang Ng‡, Wesley Yip‡, and Fiona Stapleton§

ABSTRACT
Purpose. There are anecdotal reports that optometrists suffer work-related physical discomfort but no published reports to support this.
Methods. An on-line questionnaire was sent by e-mail to ~1700 Australian optometrists. Participants were asked if they experienced work-related discomfort in any of eight nominated body regions, the type and severity of discomfort, self-reported work-related factors contributing to the discomfort, and demographic and work-related information.
Results. Four hundred sixteen optometrists participated in the questionnaire. Work-related physical discomfort was reported by 82% of respondents. The most common sites of discomfort were neck, shoulder, and lower back. Univariate analysis revealed that females are more likely to report discomfort than males (p = 0.001) and more likely to report a higher number of discomfort sites (p = 0.002). Multivariate analysis revealed that females have up to a 6.6× [confidence interval (CI) = 2.2–19.9] greater risk of reporting discomfort in individual body locations compared with males and a higher risk of experiencing severe discomfort (discomfort present for >30 days) [odds ratio (OR) = 3.0, CI = 1.7 to 5.5]. A greater number of eye examinations per day increased the risk of reporting work-related discomfort by up to 5.1× (CI = 2.1 to 12.7). Being self-employed and being older than 40 years both appear to be protective factors for work-related discomfort. The risk of experiencing severe discomfort is increased by performing repetitive tasks (OR = 1.9, CI = 1.2 to 3.1) and by continuing to work while injured (OR = 2.9, CI = 1.6 to 5.2). Eliminating both these factors would reduce the disease load for severe discomfort by 28%.
Conclusions. Females, young optometrists, and those conducting a high number of consultations daily have a higher risk of experiencing work-related physical discomfort. Performing repetitive tasks and continuing to work while injured increases the risk of severe discomfort. The results of this investigation have important implications for the longevity of the optometry workforce.
(Optom Vis Sci 2011;88:317–326)

Key Words: Australia, optometry, pain, questionnaires, work

Work-related musculoskeletal injuries have been reported for a variety of health professions including physiotherapists,[1] dentists,[2] and ophthalmologists.[3,4] In physiotherapy[1,5] and ophthalmology,[3,6] young women appear to be more at risk particularly if attending to a high-patient load. As a consequence, injured health professionals may be limited in the tasks they are able to perform at work or may have to adapt their techniques to compensate for their discomfort. This, in turn, can result in lower productivity and staffing issues as injured individuals reduce their patient contact or leave their professions.

There are anecdotal reports of similar issues within optometry,[7] but there are no published studies to support this. Of the reports detailing injuries in the ophthalmic professions, one[7] provides general unsubstantiated ergonomics advice for reducing the risk of injury when dealing with patients; the other[4] has photographs demonstrating correct and incorrect postures for a variety of ophthalmic procedures.

There are more than 3700 optometrists registered to practice optometry in Australia and of these, 76% are employed in private practice.[8] Although it is common for optometrists to be engaged in full-time work within one practice, it is also common for optometrists to

*BOptom(Hons), MSafetySc
†PhD
‡BOptom
§McOptom, PhD, FAAO
School of Optometry and Vision Science, University of New South Wales (JL, LH, AL, WN, WY, FS), and the Brian Holden Vision Institute (TJN), Sydney, New South Wales, Australia.
Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.optvissci.com).

work part-time at several different practices or work in short-term locum placements. Australian optometrists have a primary care role in the healthcare system and may be engaged in prescribing optical devices (such as spectacles and contact lenses), detecting and monitoring eye disease and in some states of Australia, prescribing therapeutic drugs for the treatment of eye disease. A busy optometrist may examine up to 20 patients per day, with many test procedures requiring sustained postures and fine motor control of the fingers.

Workforce estimates report that 41% of Australian optometrists are female and that there is a trend toward feminization of the workforce.[8] Recent changes to legislation controlling the structure of optometry practices have seen a shift away from independently owned practices toward corporatization where an optometrist may be employed by an ophthalmic company. Therefore, many new graduates may not have the opportunity to own their own practices, may not have full control over their work load and appointment scheduling, and may not be actively involved in purchasing equipment and furnishings in the practice in which they work. It is possible that this lack of control over the work environment can lead to an increased risk of work-related discomfort and injury, for example, if the equipment is too large, positioned too high for ease of use or too heavy to move easily, or if there are insufficient rest breaks scheduled throughout the day.

The aim of this article is to determine if Australian optometrists experience work-related physical discomfort and if so to establish the profile of optometrists who are more likely to report work-related discomfort and identify independent risk factors which lead to discomfort, and to explore the severity of work-related musculoskeletal discomfort reported by Australian optometrists and establish the independent risk factors associated with more severe discomfort.

METHODS

Overview

An on-line questionnaire (for an abridged version of the questionnaire, see the Appendix, available at http://links.lww.com/OPX/A38) was constructed with questions about work-related discomfort in eight different body regions. A link to this questionnaire was sent by e-mail to members of the Optometrists Association of Australia (OAA) in August 2008. The link to the questionnaire remained open for 6 weeks and participants were able to access the questionnaire on multiple occasions until all questions were answered. The results were saved with a unique identifying number related to the IP address of their computer. To prevent participants from submitting multiple responses to the questionnaire, further access was denied once they had hit the final "submit" button.

An article related to the study was also published in *Australian Optometry* in June and September 2008 inviting participation and advising those who were not on the e-mail database of the OAA of the availability of a word version of the questionnaire. A word version of the questionnaire was sent to one participant who received the e-mail invitation but was unable to access the on-line version, and these results were manually entered into the database.

The study was approved by the Human Research Ethics Advisory Panel of the University of New South Wales. There was implied consent if optometrists chose to complete and submit the questionnaire.

Construction of the Questionnaire

The questionnaire consisted of three parts:

Part 1 asked if the optometrist had experienced discomfort in any of eight body regions during the previous 12 months. The term "discomfort" was defined in this study as pain, ache, difficulty with movement, and numbness. If participants had experienced discomfort they were able to select as many regions as applicable, and the questionnaire took them to the relevant screen pages in part 2. Participants were also able to indicate if they had not experienced discomfort—if this was the case, the questionnaire took them directly to part 3.

Part 2 contained questions specifically related to the body parts neck, shoulder, upper back, lower back, elbow/arm, wrist/hand, knee/leg, and ankle/foot. A separate page for each body region was constructed with identical questions on each page and labeled sections A to H. If a participant indicated in part 1 that they experienced neck and ankle/foot pain, then section A (neck) and section H (ankle/foot) questions were displayed on the screen page. On answering the questions on the relevant screen pages, the questionnaire took the participant to part 3.

Part 3 asked questions about the age and gender of the optometrist and the type of work they were engaged in.

An on-line version of the questionnaire was designed because of the complexity of the questionnaire. It also allowed easy distribution to optometrists nationally. An abridged version of the questionnaire is available as supplementary material on-line.

Selection of Questions

The questions in part 2 were derived from two sources.

Questions 1 to 7 were based on the standardized Nordic questionnaires for the analysis of musculoskeletal symptoms in an occupational setting.[9] The Nordic questionnaire is a research tool frequently used in musculoskeletal research and its content validity and reliability has been established.[9] The original Nordic tool used the wording "trouble" and defined this as "ache, pain, or discomfort." The definition of discomfort was expanded in this study to include "pain, ache, difficulty with movement, and numbness" because this more accurately reflects the diversity of symptoms that may be experienced with work-related musculoskeletal disorders.[10,11] Nine body regions were described in the original Nordic tool. After feedback from participants in a pilot study, this questionnaire was modified by eliminating questions related to hips/thighs and by expanding "knees" to include knee/leg and "elbow" to include elbow/arm. Adaptations to the original definition[12] and to the use of the tool[13] have also been used in other published investigations of musculoskeletal discomfort.

Question 8 was derived from job factors identified by Bork et al.,[5] which contribute to work-related musculoskeletal disorders in physical therapists. It was adapted to make it relevant for tasks, which may be performed by optometrists. Questions 9 and 10 were open ended and were designed to elicit information that may not have been captured in questions 1 to 8.

The questions in part 3 (Personal Particulars) were included in the questionnaire to determine if there were any demographic- or practice-related risk factors for work-related discomfort.

Analysis of Data

The on-line questionnaire data were managed within a Microsoft excel spreadsheet. This information was then transferred to an SPSS 15.0 program for descriptive analysis and multivariate analysis.

Currency of discomfort was taken as discomfort experienced in the 7 days before the completing the questionnaire. Severity was dichotomized into the categories "severe" if the discomfort was present for >30 days and "not severe" if present for ≤30 days. In this way, chronic injuries would be classified as "severe."

Data on work-related injury were summarized as a percentage of all respondents and its 95% confidence interval (CI). For the purpose of establishing factors associated with injury, each type of reported injury was analyzed as a binary outcome variable, where 1 indicated the report of a specific type of injury and 0 was used for those reporting no discomfort or injury. For the analysis of the severity of discomfort, each body condition was analyzed as a binary outcome variable, where 1 indicated the report of severe discomfort and 0 was used for those reporting non-severe discomfort. Demographic- and work-related factors were categorical independent variables.

Initially, univariate analysis using a chi-squared test was performed to determine associations. Factors that were significant in the univariate analysis were entered in a logistic regression analysis to develop a multivariate model. The method of model building comprised initially of backward stepwise removal starting from the least significant factor until all variables in the model were significant. This was followed by entering back each excluded factor to determine any improved value to the model. Such a factor was retained in the final model if there was a significant improvement in overall χ^2 value or if it confounded other existing factors. Statistical significance was set at 5%. The strength of association for significant factors was summarized using the odds ratio (OR) and their 95% CI. Interaction of factors in the multivariate model was tested for significance using the likelihood ratio test and was retained if significant at $p < 0.05$. The goodness-of-fit of the final model was assessed using the Hosmer-Lemeshow test. The discriminatory ability of the model was assessed using the area under the receiver operating characteristic (ROC) curve based on predicted probabilities.

Population Attributable Risk (PAR) is defined as the reduction in incidence that would be observed if the population was entirely unexposed compared with its current exposure pattern. In this article, the PAR% was computed as the reduction in overall incidence because of exposure as a proportion of the overall incidence and represented as a percentage.

RESULTS

The OAA estimates that there were ~1700 members with active e-mail addresses on their e-mail database at the time the questionnaire was issued. The response rate to this questionnaire was ~25% (416 competed questionnaires; 183 male participants). Most participants were aged 21 to 50 years, half had >15 years experience, and almost half were self-employed (Table 1). The distribution of age, practice type, work experience, and hours per week was different between males and females (Table 1).

TABLE 1.
Study population

	N	Percentage of study population	Males (%)	Females (%)
Gender				
Male	183	44.5		
Female	228	55.5		
Age group				
21–30	109	26.5	16.6	34.6
31–40	135	32.8	28.7	35.5
41–50	104	25.2	33.7	18.4
51–60	54	13.1	16.6	10.5
>61	10	2.4	4.4	0.9
Experience (yr)				
<5	73	17.7	13.1	21.2
5–10	56	13.6	8.7	17.7
11–15	75	18.2	16.4	19.0
>16	208	50.5	61.7	42.0
Mode of practice				
Self-employed	203	49.2	68.7	33.8
Employee	173	41.9	25.8	54.8
Locum	37	9.0	5.5	11.4
Hours worked per week				
≤9	74	18.0	4.9	28.6
10–30	137	33.4	26.8	48.8
>40	199	48.5	68.3	32.6

Profile of Australian Optometrists Who Report Discomfort

Work-related physical discomfort was reported by 82% of respondents. The most common discomfort sites were neck, shoulder, and lower back (Table 2). Of the optometrists who responded to the questionnaire, 339 reported work-related physical discomfort in one or more body regions, most commonly in the neck and shoulder (Table 2). There were also significant relationships between sites of discomfort. Table 3 shows a strong likelihood of having combinations of neck, shoulder, and back pain and combinations of shoulder, arm, and wrist pain. Leg and foot pain were likely to be reported together but had no relationship with other sites of discomfort.

Univariate chi-squared analysis revealed that females were more likely to report discomfort for all body regions than males ($p = 0.001$). Multivariate analysis revealed that the odds of females reporting discomfort in each body region was more than double that of males (Table 4).

Overall, younger optometrists were more likely to report discomfort (defined as "any problem") than older optometrists ($p = 0.016$). Multivariate analysis indicates that being young is a predictor for upper back discomfort ($p = 0.033$) and that optometrists older than 40 have a lower risk of upper back discomfort than those aged younger than 40 [0.4×, CI 0.1 to 0.8].

A statistically significant relationship was not established between hours worked and discomfort. However, the number of eye examinations per day is positively associated with reported discom-

TABLE 2.
Site of discomfort and number of optometrists reporting severe discomfort[a]

Discomfort site	Number of optometrists reporting discomfort, n (%)	95% CI	Number of optometrists with severe discomfort[a]		
			Males	Females	Total
Neck	215 (51.7)	51.4–51.9	32	57	89
Shoulder	209 (50.2)	50.0–50.5	24	48	72
Upper back	154 (37.0)	36.8–37.2	25	31	56
Lower back	191 (45.9)	45.7–46.1	28	29	57
Elbow/arm	61 (14.7)	14.5–14.8	4	10	14
Wrist/hand	64 (15.4)	15.2–15.6	6	15	21
Knee/leg	23 (5.5)	5.4–5.6	3	5	8
Ankle/foot	27 (6.5)	6.4–6.6	5	8	13
No discomfort	77 (18.5)	18.3–18.7	N/A	N/A	N/A
Any problem	339 (81.5)	N/A	66	103	169

[a]Discomfort for more than 30 days.

TABLE 3.
Significant relationships between multiple sites of discomfort (χ^2, p values)

	Neck	Shoulder	Upper back	Lower back	Elbow/arm	Wrist/hand	Knee/leg	Ankle/foot
Neck	—	**<0.001**	**<0.001**	**<0.001**	0.096	0.077	0.398	0.116
Shoulder	**<0.001**	—	**<0.001**	0.117	**<0.001**	0.135	0.391	0.427
Upper back	**<0.001**	**<0.001**	—	**<0.001**	**0.044**	1.000	0.658	0.684
Lower back	**<0.001**	0.117	**<0.001**	—	0.126	**0.041**	0.196	1.000
Elbow/arm	0.096	**<0.001**	**0.044**	0.126	—	**<0.001**	0.358	0.781
Wrist/hand	0.077	0.112	1.000	**0.041**	**<0.001**	—	0.767	0.280
Knee/leg	0.398	0.391	0.658	0.196	0.358	0.767	—	**<0.001**
Ankle/foot	0.116	0.427	0.684	1.000	0.781	0.280	**<0.001**	—

Bold numbers are statistically significant, $p < 0.05$.

fort. Multivariate analysis revealed that conducting in excess of 11 eye examinations per day more than quadrupled the risk of reporting ankle/foot discomfort and more than doubled the risk of reporting neck, shoulder, upper back, lower back, and elbow/arm discomfort compared with conducting 6 to 10 consultations per day (Table 4). Compared with optometrists who conducted 0 to 5 consultations per day, optometrists who conducted 11 to 15 consultations per had a greater risk of neck discomfort (OR = 6.9, CI = 2.4 to 19.6), lower back discomfort (OR = 7.4, CI = 2.5 to 21.9), elbow/arm discomfort (OR = 15.1, CI = 1.7 to 131.1), and ankle/foot discomfort (OR = 9.2, CI = 1.0 to 87.8).

Univariate analysis showed a slight but significant relationship between mode of practice and reporting discomfort. Locum and employee optometrists are more likely to report discomfort than self-employed optometrists ($p = 0.047$). These workers appear to have more significant arm/elbow discomfort ($p = 0.008$), lower back discomfort ($p = 0.019$), and upper back discomfort ($p = 0.011$).

There were 77 optometrists who did not report any work-related discomfort. The univariate analysis showed that those who did not report any discomfort more likely to be male ($p = 0.001$), in the 41 to 50 age group ($p = 0.016$), self-employed ($p = 0.047$), having worked 16 years or more ($p = 0.033$), and who perform 6 to 10 consultations per day ($p = 0.001$).

All factors that were significant in the multivariate model were tested for interactions, but no significant interactions were detected. The model's goodness of fit test suggests that the logistic model was appropriate for the analyzed data. The area under the ROC curve ranged from 64 to 77%. The area under the ROC curve provides a measure of the model's ability to discriminate between those subjects who reported an injury vs. those who reported no injury. The reported area would be considered as acceptable discrimination.

Severity of Work-Related Discomfort Reported by Australian Optometrists

The impact of work-related discomfort was assessed by number of optometrists who have been hospitalized, number of optometrists who report changing jobs and duties, and number of optometrists who have consulted a healthcare practitioner about their work-related discomfort.

Hospitalization as a result of work-related discomfort was reported 35 times and changing jobs and duties as a result of work-related discomfort was reported 91 times (Table 5). Lower back discomfort was the most frequently cited body region for both these scenarios. Healthcare practitioners were primarily consulted for neck, shoulder, and back discomfort. Neck discomfort was the

TABLE 4.
Multivariate analysis of demographic factors contributing to work-related discomfort in optometrists

	Variable	Group	Total (N)	Percentage with discomfort	OR	p	95% CI
Neck discomfort	Gender	Male	128	63.3		Referent	
		Female	159	81.8	3.07	**<0.001**	1.72–5.50
	Eye examinations per day	0–5	21	42.9		Referent	
		6–10	112	68.8	3.08	**0.029**	1.13–8.42
		11–15	122	82.8	6.90	**<0.001**	2.43–19.60
		>16	34	73.5	5.84	**0.005**	1.69–20.16
Shoulder discomfort	Gender	Male	121			Referent	
		Female	162	82.1	3.43	**<0.001**	1.91–6.15
	Eye examinations per day	0–5	24			Referent	
		6–10	108	67.6	2.11	0.124	0.81–5.49
		11–15	117	82.1	4.88	**0.002**	1.81–13.16
		>16	34	73.5	4.56	**0.013**	1.38–15.08
Upper back discomfort	Gender	Male	105	55.2		Referent	
		Female	123	76.4	2.29	**0.012**	1.20–4.36
	Eye examinations per day	0–5	22	45.5		Referent	
		6–10	89	60.7	1.65	0.335	0.60–4.60
		11–15	88	76.1	3.93	**0.011**	1.37–11.32
		>16	29	69.0	3.90	**0.036**	1.09–13.92
	Age	21–30	64	78.1		Referent	
		31–40	73	74.0	0.69	0.383	0.30–1.58
		41–50	54	53.7	0.35	**0.019**	0.14–0.84
		>50	37	48.6	0.30	**0.013**	0.12–0.78
Lower back discomfort	Gender	Male	131	64.1		Referent	
		Female	132	78.0	2.35	**0.004**	1.30–4.23
	Eye examinations per day	0–5	19	36.8		Referent	
		6–10	93	62.4	2.53	0.085	0.88–7.30
		11–15	117	82.1	7.41	**<0.001**	2.51–21.93
		>16	36	75.0	6.17	**0.004**	1.76–21.57
Elbow/arm discomfort	Gender	Male	70	32.9		Referent	
		Female	66	56.1	3.06	**0.004**	1.43–6.55
	Eye examinations per day	0–5	13	7.7		Referent	
		6–10	59	40.7	7.91	0.058	0.93–67.19
		11–15	47	55.3	15.08	**0.014**	1.73–131.06
		>16	18	50.0	17.23	**0.016**	1.71–173.56
Wrist/hand discomfort	Gender	Male	68	30.9		Referent	
		Female	71	59.2	3.24	**0.001**	1.61–6.52
Knee/leg discomfort	Gender	Male	55	14.5		Referent	
		Female	44	34.1	3.04	**0.025**	1.15–8.06
Ankle/foot discomfort	Gender	Male	55	14.5		Referent	
		Female	48	39.6	6.55	**0.001**	2.16–19.87
	Eye examinations per day	0–5	13	7.7		Referent	
		6–10	42	16.7	2.14	0.508	0.22–20.53
		11–15	33	36.4	9.15	0.055	0.95–87.79
		>16	16	43.8	17.03	**0.022**	1.50–194.05
Any discomfort	Gender	Male	183	74.3		Referent	
		Female	228	87.3	2.67	**<0.001**	1.56–4.57
	Eye examinations per day	0–5	30	60.0		Referent	
		6–10	155	77.4	2.32	0.056	0.98–5.51
		11–15	177	88.1	5.13	**<0.001**	2.07–12.69
		>16	50	82.0	4.18	**0.010**	1.41–12.40

Bold numbers are statistically significant, $p < 0.05$.

TABLE 5.
Impact of discomfort

Body region	Number of respondents who have been hospitalized, n (%)	Number of respondents who have changed jobs or duties, n (%)	Percentage of respondents who have consulted a healthcare practitioner	Percentage of respondents who have experienced discomfort in the 7 d before completing the questionnaire
Neck	3 (1.4)	17 (7.9)	70.7	59.5
Shoulder	5 (2.4)	19 (9.1)	63.6	53.1
Upper back	4 (2.6)	13 (8.4)	64.9	58.4
Lower back	14 (7.3)	23 (12.0)	66.0	51.8
Elbow/arm	1 (1.6)	5 (8.2)	39.3	31.1
Wrist/hand	1 (1.6)	7 (10.9)	48.4	51.6
Knee/leg	3 (13.0)	3 (13.0)	47.8	60.9
Ankle/foot	4 (14.8)	4 (14.8)	63.0	63.0

most commonly reported discomfort experienced in the 7 days before completing the questionnaire.

Females were more likely to report severe discomfort than males (Table 2). Neck discomfort was the most commonly cited reason for severe discomfort for both genders. Female optometrists have a higher risk of experiencing severe discomfort in any body region (OR = 3.0, CI = 1.7 to 5.5) compared with males (Table 6). This is also true for neck, shoulder, elbow/arm, and wrist/hand discomfort. Performing 11 to 15 eye examinations per day also increased the risk of experiencing severe discomfort in any body region (OR = 4.5, CI = 1.6 to 12.4) and for neck, upper back, and lower back discomfort.

Multivariate analysis reveals that performing repetitive tasks ($p = 0.005$) and continuing to work while injured or hurt ($p = 0.001$) were associated with severe discomfort. The risk of experiencing severe discomfort in any body region is increased by performing repetitive tasks (OR = 1.9, CI = 1.2 – 3.1) and by continuing to work while injured (OR = 2.9, CI = 1.6 to 5.3) (Table 7). Continuing to work while injured is an individual risk factor for neck discomfort (OR = 3.1, CI = 1.7 to 5.6) and shoulder discomfort (OR = 3.2, CI = 1.7 to 6.2). Performing repetitive tasks is an individual risk factor for shoulder discomfort (OR = 2.6, CI = 1.4 to 5.0), upper back discomfort (OR = 2.8, CI = 1.4 to 6.0), and lower back discomfort (OR = 3.3, CI = 1.7 to 6.2).

Based on the PAR%, eliminating repetitive tasks would reduce the disease load for severe discomfort by 18%, whereas taking time off to recover from discomfort would reduce the disease load for severe discomfort by 12%. Implementing both strategies would reduce the disease load in optometrists by 28%.

DISCUSSION

This is the first study reporting the profile, type, and severity of work-related musculoskeletal discomfort in Australian optometrists. The term "discomfort" was defined in this study as pain, ache, difficulty with movement, and numbness. The severity of discomfort varied between respondents and for some, the term "injury" may be more appropriate.

The response rate to the questionnaire was 25% which compares favorably with published investigations of ophthalmologists (28%),[4] surgeons (27%),[14] and pediatricians (28%).[15] Published response rates for surveys of Australian optometrists are 9% (questionnaire included in postal mailout to OAA members),[16] 17.8% (questionnaire mailed to random sample of 1000 optometrists),[17] and 43% (questionnaire mailed to random sample of 400 optometrists).[18] A higher response rate might have been achieved with more aggressive follow-up of optometrists but because the invitation was sent to optometrists through the OAA mailing list and participants could choose to remain anonymous, it was not possible to identify who had not responded to the call for participation.

It could be argued that there was sampling bias in that there were only approximately half OAA members with an active e-mail address at the time the questionnaire was issued. To overcome this problem, a notice was placed in Australian Optometry alerting optometrists to the study and inviting them to participate. However, there were no requests for a hard copy of the questionnaire from optometrists without e-mail.

It could be argued that there was response bias in the sample, i.e., 82% of respondents reported discomfort and were therefore more likely to respond. Although optometrists were encouraged to participate even if they did not experience discomfort, there may have been less incentive to participate if they did not perceive that they were experiencing problems. However, it has also been shown that health employees with less control of their work are less likely to respond to a survey, particularly if they are not remunerated for their time,[19] and this can result in an underestimation of discomfort.

More females participated in the questionnaire (56%) than males. This is a greater proportion than the number of females in the Australian optometry population (41%) reported by Horton et al.[8] Only 12% of female participants did not report discomfort, compared with 25% male participants. The higher proportion of women respondents could indicate response bias, but it is not possible to generalize that women are more likely to respond to a survey because this is not always true[20] especially in healthcare. It could also indicate that females experience more work-related discomfort than males, whether this is due to physical limitations (e.g., mismatch between size/weight of equipment and physical capacity), job demands or job control,[21] or that they are simply more willing to report discomfort.[22] However, it has also been argued that the style of reporting symptoms is different between

TABLE 6.
Multivariate analysis of demographic factors associated with severe discomfort in optometrists

	Variable	Group	Total (N)	Percentage with discomfort	OR	p	95% CI
Neck discomfort	Gender	Male	79	40.5		Referent	
		Female	86	66.3	3.35	**0.001**	1.69–6.64
	Eye examinations per day	0–5	15	20.0		Referent	
		6–10	70	50.0	4.11	**0.048**	1.01–16.74
		11–15	63	66.7	8.45	**0.003**	2.02–35.32
		>16	18	50.0	6.28	**0.030**	1.19–33.04
Shoulder discomfort	Gender	Male	71	33.8		Referent	
		Female	77	62.3	3.24	**0.001**	1.65–6.36
Upper back discomfort	Eye examinations per day	0–5	16	25.0		Referent	
		6–10	52	32.7	1.39	0.633	0.36–5.28
		11–15	47	55.3	4.52	**0.027**	1.19–17.24
		>16	19	52.6	4.51	0.055	0.97–20.94
	Age	21–30	31	54.8		Referent	
		31–40	42	54.8	0.71	0.501	0.26–1.94
		41–50	33	24.2	0.19	**0.004**	0.06–0.59
		>50	27	29.6	0.24	**0.017**	0.07–0.78
Lower back discomfort	Eye examinations per day	0–5	14	14.3		Referent	
		6–10	47	25.5	2.06	0.387	0.40–10.54
		11–15	52	59.6	8.86	**0.007**	1.80–43.70
		>16	20	55.0	7.33	**0.025**	1.29–41.68
Elbow/arm discomfort	Gender	Male	51	7.8		Referent	
		Female	39	25.6	4.05	**0.028**	1.16–14.12
Wrist/hand discomfort	Gender	Male	53	11.3		Referent	
		Female	44	34.1	4.05	**0.009**	1.41–11.62
Any problem	Gender	Male	113	58.4		Referent	
		Female	132	78.0	3.01	**<0.001**	1.66–5.47
	Eye examinations per day	0–5	23	47.8		Referent	
		6–10	93	62.4	1.96	0.176	0.74–5.18
		11–15	98	78.6	4.51	**0.003**	1.64–12.38
		>16	31	71.0	4.15	**0.022**	1.23–13.95

Bold numbers are statistically significant, $p < 0.05$.

genders[22,23] and that males may be poor historians when it comes to perceiving and reporting somatic symptoms.[24]

It is debatable whether a higher response rate would change the findings of this study because it has been shown that there are often only small differences between respondents and non-respondents and in early and late respondents in studies involving physicians.[25,26] It has been speculated that this is due to the homogeneity of the population with respect to knowledge, training, attitudes, and behavior.[25] Although the prevalence of work-related discomfort in optometrists could not be estimated using this study design, this study has established the relative frequency of discomfort at different body sites and major independent risk factors for discomfort.

Profile of Optometrists Reporting Discomfort

The principal results of this questionnaire are consistent with reports from other professions. For example, female optometrists and young optometrists are more likely to report discomfort is similar to reports in ophthalmology[3,4,6] and physiotherapy.[1,5] The principal sites of discomfort (neck, upper extremity, and back) are also consistent with reports of musculoskeletal discomfort in ophthalmologists.[4,6,27] Younger optometrists are more likely to report upper back discomfort. It is possible that particular clinical techniques are associated with specific discomfort sites for example, lower back discomfort and direct ophthalmoscopy or shoulder discomfort and slitlamp biomicroscopy,[4] and it is conceivable that changes in the techniques used in optometry consultations contribute to the differences in discomfort sites with age. For example, slitlamp fundoscopy and binocular indirect ophthalmoscopy are the techniques of choice for examining diabetic patients[28] and are currently taught in Australian optometry schools, yet there are many optometrists currently in practice whose undergraduate education predates this change and who may not yet have adopted the use of these techniques. Further investigation needs to be made into whether different clinical techniques are contributing to the reported differences in discomfort sites between age categories.

A relationship was established between work-related discomfort and the number of consultations conducted per day. However, the

TABLE 7.
Multivariate analysis of work task factors associated with severe discomfort in optometrists

	Variable	Group	Total (N)	Percentage with severe discomfort	OR	p	95% CI
Neck discomfort	Reaching away from body	Not cited as a factor	125	34.4		Referent	
		Cited as a factor	90	52.2	1.80	**0.045**	1.01–3.21
	Continue working while injured	Not cited as a factor	145	32.4		Referent	
		Cited as a factor	70	61.4	3.05	**<0.001**	1.67–5.57
Shoulder discomfort	Perform repetitive tasks	Not cited as a factor	91	20.9		Referent	
		Cited as a factor	118	44.9	2.61	**0.003**	1.37–4.97
	Continue working while injured	Not cited as a factor	153	26.1		Referent	
		Cited as a factor	56	57.1	3.22	**0.001**	1.67–6.21
Upper back discomfort	Perform repetitive tasks	Not cited as a factor	73	24.7		Referent	
		Cited as a factor	80	48.8	2.84	**0.006**	1.35–5.95
	Work in awkward postures	Not cited as a factor	80	23.8		Referent	
		Cited as a factor	73	52.1	3.13	**0.002**	1.51–6.48
	Work near physical limits	Not cited as a factor	144	34.0		Referent	
		Cited as a factor	9	88.9	14.28	**0.020**	1.52–134.47
Lower back discomfort	Perform repetitive tasks	Not cited as a factor	110	20.0		Referent	
		Cited as a factor	78	44.9	3.26	**<0.001**	1.71–6.21
Elbow/arm discomfort	Lift heavy objects	Not cited as a factor	53	15.1		Referent	
		Cited as a factor	8	75.0	16.88	**0.002**	2.88–98.89
Wrist/hand discomfort	Lift heavy objects	Not cited as a factor	58	27.6		Referent	
		Cited as a factor	6	83.3	13.13	**0.023**	1.42–121.2
Knee/leg discomfort	Work in awkward positions	Not cited as a factor	16	18.8		Referent	
		Cited as a factor	7	71.4	10.83	**0.024**	1.37–85.44
Ankle/foot discomfort	Continue working while injured	Not cited as a factor	18	33.3		Referent	
		Cited as a factor	9	77.8	7.00	**0.039**	1.10–44.61
Any problems	Perform repetitive tasks	Not cited as a factor	185	41.1		Referent	
		Cited as a factor	154	61.0	1.92	**0.005**	1.21–3.05
	Continue working while injured	Not cited as a factor	268	44.0		Referent	
		Cited as a factor	71	73.2	2.88	**0.001**	1.58–5.24
	Lift dependant patients	Not cited as a factor	331	49.2		Referent	
		Cited as a factor	8	87.5	8.84	**0.046**	1.04–74.91

Bold numbers are statistically significant, $p < 0.05$.

number of working hours per week was not a predictor of discomfort. This difference could be explained by the type of tasks engaged in by optometrists. For example, a full-time working optometrist may work in a quiet practice and see <5 patients per day or engage in other activities such as administrative tasks. Being self-employed also appears to offer some protection for physical discomfort. Two possible explanations are that self-employed optometrists may have more control over their working environment (such as furniture and equipment purchases and pace of work) or that self-employed persons may engage in a wider variety of work tasks and activities.

It is well documented that psychosocial factors also contribute to work-related physical discomfort. Psychosocial factors include job demands such as mental workload and personal factors such as motivation and coping capacity.[29] Upper body discomfort appears to be more positively associated with psychosocial factors,[30] and it has been demonstrated that physiological changes in muscle activity can accompany stress.[11] In particular, neck discomfort has been reported to be associated with high job demands (e.g., the presence of deadlines) and lack of opportunity to make decisions[31] and more common in women,[30] however, Dhimitri et al.[3] also report a relationship between lower back and stress. Shoulder discomfort has been reported in computer users when there are combinations of high computer usage/low job satisfaction and high computer usage/high perceived work loads.[13] Psychosocial factors were not specifically explored in this study, but it is conceivable that they have a role in the rate or severity of work-related discomfort in this population, particularly with optometrists performing a larger number of consultations per day and with those not self-employed.

There appears to be a survivor effect[32] in that older optometrists are less likely to report discomfort but it is unclear whether this is because older optometrists are more likely to be engaged in management and administrative type activities, are more likely to be self-employed, are more physically resilient or are less inclined to report discomfort.[33]

Severity of Work-Related Discomfort Reported by Australian Optometrists

The results indicate that severe discomfort (i.e., discomfort present for >30 days) is increased by physical factors (performing repetitive tasks) and psychosocial factors (continuing to work while injured). Eliminating these two factors will decrease the risk of severe discomfort by 28%. This indicates that there are other factors which contribute to discomfort in optometrists which were not identified in this questionnaire. This issue requires further exploration.

Unlike other healthcare professions,[34] optometrists do not appear to be averse to acknowledging their discomfort and seeking medical help. However, optometrists appear to be similar to other healthcare professions in that they continue to work while injured.[34–36] It is unclear whether this is due to staffing issues, financial constraints, or cultural factors (e.g., will the individual be perceived as uncaring if they put their own health before their patient's welfare?). These issues may be better explored through interviews as demonstrated by Cromie et al.[36] and Alnaser.[35]

It is clear that there are personal costs associated with work-related discomfort as many optometrists admit to being hospitalized or changing jobs and duties as a result of their discomfort. It has been shown that work-related discomfort can also impact on productivity[37,38] and work quality.[39] These factors were not assessed in this study and in fact may be difficult to measure in a profession like optometry where cognitive components of tasks[39] (e.g., accuracy, ability to make correct clinical decisions) are important outcome measures of the job.

Limitations

There are several limitations of this questionnaire. The original Standardized Nordic Questionnaire for the analysis of musculoskeletal symptoms[9] contained a diagram of the human body illustrating what was meant by each of the body regions. A diagram was not used in this investigation of discomfort in optometrists because it was not possible to include it in the on-line version of the questionnaire. It is possible that some participants may have had difficulty identifying whether their discomfort was in their neck or shoulder (or both). Although some error may have been introduced by the absence of a diagram, the way the sites were grouped mitigated against this problem, and it does not change the overall results that a good proportion of optometrists suffer musculoskeletal discomfort at work and have multiple sites of discomfort.

Another limitation is that this questionnaire did not control for activities outside of work. For example, it is unclear whether hand and arm discomfort at work is a direct result of work-related tasks or is exacerbated by leisure activities such as sport, computer use, or playing a musical instrument. It is also possible that discomfort in one body region is related to discomfort or factors in other body regions. For example, female optometrists wearing high-heeled footwear could contribute to either foot discomfort or to lower back discomfort, depending on the individual. These are potentially complex issues and ones which were difficult to encapsulate in this already lengthy questionnaire. These issues will be the subject of further exploration through other research modalities such as interviews with optometrists.

The questionnaire distributed in this study was relatively long especially if an optometrist experienced multiple sites of discomfort. For example, if an optometrist experienced discomfort in six body regions, they would be required to complete six versions of part B, one for each discomfort site. The number and type of questions was therefore rationalized in an attempt to encourage participation.[20,25] It would have been useful for data analysis if information were obtained about the proportion of time engaged in various work and leisure activities but this will be the subject of further investigation into this topic.

CONCLUSIONS

The purpose of this article was to determine if Australian optometrists report work-related physical discomfort and if so, establish the profile of those experiencing discomfort, explore the severity of reported discomfort and determine the independent risk factors for discomfort.

Female optometrists and those conducting a higher number of eye examinations daily are at a higher risk of experiencing work-related physical discomfort than optometrists within other demographics. This study also showed that being young is a predictor for upper back discomfort. Age and gender have been shown as predictors for physical discomfort in other healthcare professions; the results of this study are consistent with other healthcare professions.

Many optometrists who participated in this study reported a history of hospitalization and a need to change jobs as a result of their work-related discomfort. There were also many who reported discomfort which lasted >30 days, and this was positively associated with performing repetitive tasks and continuing to work while injured or hurt. Although eliminating both these factors will reduce the disease load for severe discomfort, there are other contributing factors which were not identified in this study and which require further exploration.

The Australian optometric workforce has undergone a shift over the past decade toward female graduates and away from self-employment.[8] Work-related discomfort needs to be identified early and solutions implemented before it causes long-term health outcomes and impacts the longevity of the optometry workforce.

APPENDIX

An appendix (an abridged version of the on-line questionnaire) is available at http://links.lww.com/OPX/A38.

Received March 19, 2010; accepted August 31, 2010.

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Jennifer Long
School of Optometry and Vision Science
The University of New South Wales
Sydney, New South Wales 2052
Australia
e-mail: j.long@unsw.edu.au

CLINICAL AND EXPERIMENTAL
OPTOMETRY

RESEARCH PAPER

How do Australian optometrists manage work-related physical discomfort?

Clin Exp Optom 2012; 95: 606–614 DOI:10.1111/j.1444-0938.2012.00711.x

Jennifer Long BOptom (Hons) MSafetySc
Wesley Yip BOptom
Annie Li BOptom
Weixiang Ng BOptom
Ling Eileen Hao BOptom
Fiona Stapleton MCOptom PhD FAAO GradCertOcTher

School of Optometry and Vision Science, University of New South Wales, Sydney, Australia
E-mail: j.long@unsw.edu.au

Submitted: 28 September 2011
Revised: 15 December 2011
Accepted for publication: 23 December 2011

Background: Work-related physical discomfort exists within the optometric profession. It is not well understood how optometrists manage this issue in their workplaces.

Method: An online questionnaire was sent by e-mail to approximately 1,700 Australian optometrists. Participants were asked if they experienced work-related discomfort in any of eight nominated body regions. If so, they were asked to describe specific work tasks, which contribute to their work-related discomfort, and strategies they have adopted to minimise their discomfort. These data were subject to qualitative and quantitative analyses.

Results: There was a 25 per cent response rate and 416 optometrists participated in the questionnaire. Work-related physical discomfort was reported by 339 respondents (81 per cent), most commonly with the use of the phoropter (n = 144, 35 per cent) and slitlamp (n = 94, 23 per cent). Males were more likely to report lower back discomfort with phoropter use (Chi-squared, $p < 0.01$) and ophthalmoscopy (Chi-squared, $p < 0.01$). To minimise discomfort, optometrists 41 years and older were more likely to report that they adjust their posture (Chi-squared, $p < 0.03$) and females were more likely to report that they alter their work schedule (Chi-squared, $p < 0.05$). A recurrent theme expressed by participants was an inability to make changes to improve their comfort due to room and equipment design, poorly maintained equipment, non-supply of suitable equipment or furniture and inherent difficulties within optometric tasks.

Conclusion: There is a need for all optometrists to have skills to evaluate their own personal risk of discomfort in the consultation room. Owners and managers of optometric practices also need greater awareness of the importance of room and equipment design and maintenance on work-related discomfort. This has implications for the well-being of optometrists, for their productivity and for compliance with health and safety legislation.

Key words: Australia, discomfort, ergonomics, health, optometrists, safety, work

Optometrists strive to provide optimal vision care for patients and promote optimal visual conditions in workplaces. In short, optometrists care about the visual welfare of others but do we also look after our own health and well-being while at work?

Australian optometrists may examine up to 20 patients per day and during each eye examination perform clinical procedures, which require them to bend and twist their bodies, stand and sit in awkward postures or hold their arms outstretched while making fine movements with their hands and fingers. In an earlier paper, we reported a survey, which showed that Australian optometrists report physical discomfort at work (82 per cent of survey respondents and at least 20 per cent of all optometrists in Australia)[1] and established that work-related physical discomfort is more likely for females and for young optometrists.

Independent risk factors for severe discomfort (discomfort present for more than 30 days) include performing repetitive tasks and continuing to work while injured.[1] Other reasons postulated for ophthalmic work-related discomfort include static postures while working with patients,[2,3] awkward postures,[3] high patient loads[1,4] and high stress levels.[4] The consequences of work-related discomfort in ophthalmic practitioners includes hospitalisation,[1,2] reduced ability to perform tasks[4] and reduced work hours.[5,6]

Work-related discomfort among optometrists may be perceived as common and unavoidable,[7] but this does not diminish the legal obligations of employers to ensure the health and welfare of their employees[8,9] and indeed themselves, particularly when a risk has been identified. Understanding the reasons for work-related discomfort and potential strategies for effectively reducing discomfort is imperative to meeting these legal obligations and for compliance with the internationally accepted risk management approach[10] to identify, treat and manage risks.

Maintaining comfort in the consultation room is also important for the longevity of the optometric workforce. Australians born after 1 July 1964 must be 60 years-of-age before they can access superannuation savings[11] and eligibility for the Australian Government Age Pension has recently been increased to 67 years for men and women born after 1957.[12] This means that an Australian optometric student, who completes five years of tertiary study directly after leaving high school will be aged approximately 23 years upon graduation and therefore could expect to be working in the profession for more than 40 years. Subsequently, there are significant direct and indirect costs to individuals and to the community if practitioners are lost to the profession due to work-related injury.

There are publications that offer practical advice for reducing the risk of work-related discomfort in ophthalmic practitioners. These appear to be largely based on the respective authors' observations of practitioners and their own experiences in the consultation room[3,6,13–18] or predictions of possible causes of work-related discomfort by analysis of underlying injury mechanisms.[3]

This paper differs from these other publications in that it measures optometrists' experience of work-related discomfort by surveying the Australian optometric population and investigates discomfort associated with all work tasks, not just ophthalmic procedures. The purpose of this paper is to identify tasks associated with work-related physical discomfort in Australian optometrists and describe how Australian optometrists modify their workspace to decrease the impact of discomfort. This knowledge is important for implementing risk management processes in optometric practices and for providing direction for future investigations into this issue.

METHODS

An online questionnaire was constructed with questions about work-related discomfort in eight different body regions. A link to this questionnaire was sent by e-mail to members of Optometrists Association Australia (OAA) Australia-wide in August 2008. The study was approved by the Human Research Ethics Advisory Panel of the University of New South Wales. There was implied consent if optometrists chose to complete and submit the questionnaire.

The questionnaire consisted of three parts: Part 1 asked if the optometrist had experienced discomfort in any of eight body regions during the previous 12 months. The term 'discomfort' was defined in this study as pain, ache, difficulty with movement and numbness. Part 2 contained questions specifically related to the body parts: neck, shoulder, upper back, lower back, elbow/arm, wrist/hand, knee/leg and ankle/foot and was partially based on the standardised Nordic questionnaires for the analysis of musculoskeletal symptoms in an occupational setting[19] and job factors, which contribute to discomfort listed by Bork and colleagues.[20] A separate page for each body region was constructed with identical questions on each page and labelled Sections A to H. Part 3 included demographic questions. Table 1 gives a summary of the questions used in the questionnaire. A more detailed description of the construction of the questionnaire and its distribution are given elsewhere, together with the independent risk factors for any discomfort and for severe discomfort.[1]

The qualitative data collected from Part 2 of the questionnaire are presented in this current paper. These data were transferred to a Microsoft Excel file (Microsoft Corporation, Richmond, WA, USA) and manually coded into themes and subcategories for each body region. Tasks contributing to discomfort were coded into the categories: ocular health examination, refraction and recording information. Strategies for reducing discomfort were coded into the categories: adjust equipment, adjust posture, perform alternative clinical procedures, alter the work schedule and stretching and relaxation exercises. Some participants reported multiple tasks contributing to discomfort in one body region or multiple strategies for reducing discomfort. Therefore, the total number of reports may exceed the number of respondents.

Chi-squared analysis was conducted to establish whether there were any associations between demographic factors or reports of severe discomfort and the number of participants who reported specific tasks contributing to discomfort and strategies for reducing discomfort. Statistical significance was set at $p = 0.05$. To ensure sufficient numbers within categories, the demographic factors were divided into the categories: male and female, aged 21 to 40 years and age 41 years and over and self-employed/employee and locum. 'Severe discomfort' was defined as discomfort present for more than 30 days.

	Questions subject to quantitative analysis	Questions subject to qualitative analysis
Part 1	Have you experienced discomfort in any of eight body regions (neck, shoulder, upper back, lower back, arm/elbow, wrist/hand, knee/leg and ankle/foot) during the previous 12 months?	
Part 2	Questions based on the Nordic Musculoskeletal questionnaires[19] including:	Do any specific work tasks or ophthalmic techniques increase your discomfort?
	Need for consulting another healthcare practitioner or requiring hospitalisation for discomfort	Have you been able to modify your work or your work space to decrease your discomfort?
	Length of time experiencing discomfort in previous 12 months	
	Whether discomfort has resulted in an inability to perform work-related or leisure-related activities	
	A question asking participants to nominate factors that contribute to personal discomfort, based on Bork and colleagues[20] (e.g. performing repetitive tasks, examining a large number of patients per day)	
Part 3	Demographic questions including:	
	Gender	
	Age	
	Years working as an optometrist	
	Employment status	
	Hours working per week as an optometrist	
	Number of eye examinations conducted per day	

Table 1. Summary of content of the questionnaire

RESULTS

There were approximately 1,700 optometrists with active e-mail addresses on the OAA e-mail database at the time the questionnaire was issued. The response rate to this questionnaire was 25 per cent (416 competed questionnaires) with 339 respondents reporting work-related discomfort. The results presented in this paper are gathered from these 339 respondents. There were 183 males (44 per cent) and 165 optometrists aged 41 years or older (40 per cent), who participated in this questionnaire. This is slightly less than the number of males (55 per cent) and optometrists aged 40 years or more (50 per cent) reported in the Australian optometric population in July 2009.[21]

Tasks associated with ocular health examination (slitlamp examination and ophthalmoscopy) and refraction (phoropter and use of hand-held equipment) were the most frequently reported tasks associated with discomfort (Table 2) and with severe discomfort (Table 3). There were eighteen participants who reported severe discomfort associated with three or more clinical tasks (Table 3). Males were more likely to report lower back discomfort associated with the use of the phoropter ($p < 0.01$) and ophthalmoscopy ($p < 0.01$). Computer-related discomfort was cited by 60 participants. Explanations for this include 'twisting neck to see computer and then speak to the patient', 'working at the computer for long periods' and '(using the) computer at awkward angles'.

There were 156 participants who described strategies for reducing discomfort (90 females; 89 aged younger than 41 years; 81 self-employed). Adjusting the equipment and adjusting posture were the most common strategies reported by participants to decrease their discomfort (Table 4). Optometrists 41 years and older were more likely to report that they adjust their posture ($p < 0.03$) and females were more likely to report that they alter their work schedule ($p < 0.05$), for example, stop full-time work, decrease the number of patients they see or cease performing some tasks. Engaging the

			Participants reporting discomfort[†]	Neck discomfort		Shoulder discomfort		Upper back discomfort		Lower back discomfort		Elbow/arm discomfort		Wrist/hand discomfort		Knee/leg discomfort		Ankle/foot discomfort	
			N	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Phoropter	Total		144	46	32	71	49	26	18	34	24	15	10	16	11	1[‡]	<1	2[‡]	1
	Gender	Male	59	22	37	28	47	11	19	22[§]	37	7	12	6	10	—	—	—	—
		Female	85	24	28	43	51	15	18	12[§]	14	8	9	10	12	—	—	—	—
	Age (years)	21–40	84	36	43	44	52	17	20	19	23	11	13	9	11	—	—	—	—
		41+	60	29	48	27	45	9	15	15	25	4	7	7	12	—		—	—
Slitlamp/fundoscopy/ gonioscopy	Total		94	51	54	38	40	26	28	22	23	10	11	8	9	1[‡]	1	0	0
	Gender	Male	32	17	53	11	34	8	25	8	25	3	9	4	13	—	—	—	—
		Female	62	34	55	27	44	18	29	14	23	7	11	4	6	—	—	—	—
	Age (years)	21–40	68	34	50	29	43	21	31	15	22	9	13	7	10	—	—	—	—
		41+	26	17	65	9	35	5	19	7	27	1	4	1	4	—	—	—	—
Ophthalmoscopy	Total		62	43	69	10	16	21	34	26	42	0[‡]	0	3[‡]	5	0[‡]	0	1[‡]	2
	Gender	Male	17	11	65	4	24	8	47	14[§]	82	—	—	—	—	—	—	—	—
		Female	45	32	71	6	12	13	29	12[§]	27	—	—	—	—	—	—	—	—
	Age (years)	21–40	36	23	64	5	14	13	36	16	44	—	—	—	—	—	—	—	—
		41+	26	20	77	4	15	8	31	10	38	—	—	—	—	—	—	—	—
Computer and writing tasks	Total		60	19	32	14	23	8	13	5	8	8	13	23	38	0[‡]	0	0[‡]	0
	Gender	Male	24	5	21	5	21	2	8	5	21	2	8	7	29	—	—	—	—
		Female	36	14	39	9	25	6	17	—	—	6	17	16	44	—	—	—	—
	Age (years)	21–40	35	13	37	6	17	6	17	1	3	4	11	17	49	—	—	—	—
		41+	25	10	40	8	32	2	8	4	16	4	16	6	24	—	—	—	—
Trial frame / trial lenses / hand held equipment, for example, occluder, prism bars	Total		34	9	26	15	44	1[‡]	3	3[‡]	9	2[‡]	6	4[‡]	12	0[‡]	0	0[‡]	0
	Gender	Male	11	4	36	4	36	—	—	—	—	—	—	—	—	—	—	—	—
		Female	23	5	22	11	48	—	—	—	—	—	—	—	—	—	—	—	—
	Age (years)	21–40	21	5	24	10	48	—	—	—	—	—	—	—	—	—	—	—	—
		41+	13	4	31	5	38	—	—	—	—	—	—	—	—	—	—	—	—

[†] Participants may have reported discomfort with more than one body region.
[‡] To preserve anonymity, data with a total less than five is not subdivided into gender and age.
[§] Chi–squared, $p < 0.01$.
— means to preserve anonymity, data are not given.

Table 2. Body regions affected for the five most commonly reported tasks contributing to discomfort

	Any severe discomfort†		Neck discomfort		Shoulder discomfort		Upper back discomfort		Lower back discomfort		Arm/elbow discomfort		Wrist/hand discomfort		Leg/knee discomfort		Ankle/foot discomfort	
	N	%‡	N	%‡	N	%‡	N	%‡	N	%‡	N	%‡	N	%‡	N	%‡	N	%‡
Phoropter	67	46	21	46	29	41	10	38	17	50	3	20	6	38	1	100	1	50
Slitlamp/fundoscopy/gonioscopy	49	52	26	51	17	45	13	50	11	50	3	30	2	25	0	0	0	0
Ophthalmoscopy	40	65	26	61	6	60	13	62	8	31	0	0	2	67	0	0	1	100
Computer and writing tasks	19	32	8	42	4	29	3	38	1	20	1	13	9	39	0	0	0	0
Trial frame / trial lenses / hand held equipment, for example, occluder, prism bars	13	38	4	44	6	40	0	0	2	60	2	100	1	25	0	0	0	0
Severe discomfort reported (with or without nominating specific work tasks that contribute to discomfort)	169	—	89	—	72	—	56	—	57	—	14	—	21	—	8	—	3	—
Severe discomfort described for 1 or 2 specific work tasks	115	—	68	—	29	—	29	—	29	—	4	—	16	—	1	—	2	—
Severe discomfort described for 3 or more specific work tasks	18	—	5	—	3	—	2	—	7	—	1	—	2	—	0	—	0	—

† Participants may have reported severe discomfort with more than one body region.
‡ Percentage = number of participants reporting severe discomfort / number reporting discomfort for that task (as given in Table 2).

Table 3. Severe discomfort (discomfort present for more than 30 days) reported by participants

assistance of others, for example, 'get others to do frame adjustments' or 'I ask my kids and husband to lift equipment for me' indicates that work-related discomfort may also have ramifications for optometrists' families and work colleagues.

Twenty participants reported that they have adopted the use of technology (for example, computerised phoropter, digital retinal imaging) or relocated their practice to facilitate extra space as a means of reducing discomfort; however, simply replacing one technique or piece of equipment for another does not necessarily ensure that discomfort will be totally eliminated. For example, one participant who installed a computerised refractor head to alleviate elbow and arm pain had 'to sit, which aggravates back/neck problems', while two participants reported that changing their posture has since resulted in discomfort in other body regions.

A recurrent theme expressed by participants was that although they could identify the cause of their discomfort, they were unable to make the necessary changes. There were 18 participants who reported that their discomfort was not totally alleviated even after implementing strategies (10 females, 14 optometrists aged less than 41, 12 employee/locum optometrists), five of whom reported severe discomfort with three or more clinical tasks, for example, 'I now do refractions standing so that my arm is lower. This helps but it still hurts'. Other barriers to improving comfort included:

1. room and equipment design, for example, '(I) ensure (the) slitlamp and seat are the correct height but (this) does not prevent problem'
2. poorly maintained equipment, for example, 'the phoropter movement (is) not well maintained'
3. non-supply of suitable equipment or furniture, for example, 'practice refused to upgrade (the) slitlamp or chair'
4. inherent difficulties within optometric tasks themselves, for example, '(I) have tried (different strategies to reduce discomfort) but the task needs to be done'.

Table 4. Strategies adopted to reduce discomfort

Strategy	Demographics of participants who reported a strategy		N	%	Specific strategies‡	N	%
Adjust posture	TOTAL		93		Total citations for all body sites	134	
	Gender	Male	41	44	Adopt 'better' posture / change posture / adjust positions	59	44
		Female	52	56	Stand for procedures	25	19
	Employment	Self-employed	49	53	Work bilaterally / alternate sitting and standing / change hands	20	15
		Employee/locum	44	47	Sit whenever possible for procedures	18	13
	Age† (years)	21–40	46	49	Support hand/arm	12	9
		41+	47	51			
Adjust equipment	TOTAL		74		Total citations for all body sites	123	
	Gender	Male	29	39	Adjust height of patient chair / practitioner chair / equipment	65	53
		Female	45	61	Change chair/stool	28	23
	Employment	Self-employed	37	50	Adjust computer arrangement on desk / rearrange consultation room / move to a larger office / alternate between consultation rooms	25	20
		Employee/locum	37	50	Wear good shoes / wear trousers instead of skirt	5	4
	Age (years)	21–40	45	61			
		41+	29	39			
Perform alternative procedures	TOTAL		26		Total citations for all body sites	38	
	Gender	Male	11	42	Indirect ophthalmoscopy / slitlamp fundoscopy / digital imaging instead of direct ophthalmoscopy	19	50
		Female	15	58	Computerised phoropter / automated equipment	7	19
	Employment	Self-employed	15	58	Hand held tonometer / non-contact tonometer	6	16
		Employee/locum	11	42	Stop using trial frame / use more retinoscopy	4	10
	Age (years)	21–40	18	69	Less typing / alternative word processing program	2	5
		41+	8	31			
Alter work schedule	TOTAL		13		Total citations for all body sites	22	
	Gender†	Male	2	15	Stop full-time work / cease conducting home visits / change job tasks / decrease number of patients	10	45
		Female	11	85	Take rest break / lunch break	6	27
	Employment	Self-employed	5	38	Perform tasks faster	3	14
		Employee/locum	8	62	Delegate tasks and procedures to other staff / family members	3	14
	Age (years)	21–40	7	54			
		41+	6	46			
Stretching and relaxation exercises	TOTAL		16		Total citations for all body sites	20	
	Gender	Male	4	25			
		Female	12	75			
	Employment	Self-employed	7	44			
		Employee/locum	9	56			
	Age (years)	21–40	7	44			
		41+	9	56			

† Chi-squared, $p < 0.05$.
‡ Participants may have nominated a strategy for more than one body region.

This suggests that more holistic and strategic solutions might be required for managing work-related discomfort, rather than simply relying on a prescriptive approach, for example, recommending a specific item of equipment or advocating a particular posture for performing a clinical task.

DISCUSSION

This paper supports anecdotal reports within ophthalmic literature that work-related physical discomfort is related to specific ophthalmic tasks and techniques. The two most commonly cited ophthalmic tasks involved the phoropter and the slitlamp and were associated with neck, shoulder and back discomfort. Some of the contributing factors to discomfort (for example, inability to adjust equipment) and strategies to reduce discomfort (for example, adjust posture or equipment, reduce patient contact hours) reported in this questionnaire have also been reported in other professions, for example, veterinary science,[22,23] physical therapy,[24,25] nursing[26] and dentistry.[27,28] The results also identify non-ophthalmic factors contributing to discomfort that have not been described previously, for example, room and equipment design and equipment supply and maintenance.

Why do individuals continue to work in conditions that contribute to personal discomfort? Although the answer to this specific question requires further investigation, it is clear from the results that discomfort is not experienced by an isolated few. There may be response bias associated with the survey in that optometrists who experience work-related discomfort might have been more motivated to participate in this anonymous questionnaire. Nevertheless, the total number of participants who reported work-related discomfort (n = 339) is likely to be a lower estimate of the total number of Australian optometrists who actually experience discomfort.

It is possible that some optometrists experience discomfort because they have not recognised a link between their discomfort and specific work tasks or because they have been unable to determine a practical solution for their problem. This is not necessarily a poor reflection on the individual but might reflect the fact that solutions to problems are not always self-evident and might require a more strategic approach than trial and error or 'common sense'.[29,30]

Identifying the best solution for discomfort might also be complicated by variations in personal physical stature, design of equipment and room arrangement. This might explain apparent contradictions in the reported strategies (for example, some practitioners advocate sitting during an eye examination while others prefer standing) and the debate within the ophthalmic literature as to whether it is better to sit or to stand for refraction[18] or to alternate sitting and standing.[14]

Investigations within other healthcare professions[31–35] suggest that work-related discomfort is best addressed using a multifactorial approach and that there is unlikely to be a single solution that is suitable for all practitioners. This is consistent with previous findings[1] that removing the two independent risk factors for severe discomfort in optometrists (that is, performing repetitive tasks and continuing to work while injured) will not totally eliminate the risk of discomfort but only reduce the disease load in optometrists by 28 per cent. The variety of strategies described by participants in the present study supports the idea that work-related discomfort is multifactorial, while the barriers to improving comfort described by participants indicate that work-related discomfort might need to be addressed at different levels within the profession, for example, equipment design, consultation room design, practice management, as well as by individuals. The results presented in the present paper provide a useful starting point for implementing remedial action at these various levels.

It is alarming to discover that equipment supply and maintenance, and equipment and room design were reported as issues in some workplaces and that some participants were unable to make basic changes to improve their own comfort. Some participants reported that they manage their own discomfort by delegating tasks to staff or other family members. This raises the question whether there are inherent dangers performing some tasks and whether staff or family members are also at risk of sustaining a similar injury. In Australia, employers have an obligation to ensure the health and welfare of all people within the workplace. The risk management process[10] recommends effective communication and consultation with stakeholders (for example, the workers) and that any interventions to control risk should be monitored and reviewed to ensure that subsequent risks do not arise (including risks to other people). Further evaluation on a case-by-case basis (for example, interviews and observations) would be necessary to determine if individual practices comply with occupational health and safety legislation and to develop strategies to encourage compliance within these workplaces.[36]

The results also highlight the fact that new technology is not necessarily a panacea for work-related discomfort but needs to be monitored and reviewed on an ongoing basis, just as for any other intervention. For example, several participants report that since introducing alternative technology to reduce work-related discomfort, they now experience discomfort in other body regions. Desktop computers in the consultation room were reported as contributing factors to discomfort, indicating that some optometrists might not have set up their own computer workstations correctly for physical and visual comfort. Attending to this issue provides two opportunities for optometrists. First, workstation arrangements that allow neutral postures can reduce personal risk of work-related discomfort;[37] it also allows practitioners to demonstrate that they are able to apply basic ergonomic principles (which is a core competency for optometric practice in Australia[38]), particularly if these practitioners give advice to their patients on vision and visual ergonomics for computer use.

This questionnaire used an exploratory approach (open-ended questions) to identify factors contributing to discomfort and strategies adopted for managing discomfort. Subsequently, non-ophthalmic factors (for example, equipment maintenance issues) were described and these issues have not been reported previously in ophthalmic literature. The use of open-ended questions meant that some participants did not always provide comprehensive explanations, which hampered categorisation of the data. For example, it is unclear from the responses whether the response 'slitlamp' includes fundoscopy and gonioscopy or refers only to examination of the anterior eye. Despite this, the qualitative results indicate that use of the slitlamp, whether this includes fundoscopy and gonioscopy, is a contributing factor to neck, back and upper limb discomfort. This is consistent with predictions reported by Marx, Wertz and Dhimitri.[3]

It is possible that slitlamp examination and refraction were reported most frequently because they are the primary tasks performed by optometrists during a routine eye examination. Unlike other studies,[20] this questionnaire did not include quantitative measures to assess the relative contribution of factors to work-related discomfort (for example, asking participants to rate the contribution of individual tasks and procedures on a Likert scale), since including such questions would have increased the length of the questionnaire and might have discouraged participation.[39,40] Although quantitative information is useful for risk management (consequence-likelihood) matrices, these analyses are subjective and it has been argued that it might be a better use of resources to identify and control hazards rather than attempting to quantify and assess risks.[41]

Psychosocial factors (for example, workload, work satisfaction, job design) can contribute to work-related discomfort.[42] Some participants alluded to these issues, which have been identified previously as risk factors for discomfort (for example, performing more than 11 consultations per day, not being self-employed).[1] It is also possible that non-work-related injuries could be contributing to discomfort in some individuals. Other research methods, such as interviews with optometrists, are likely to be a better research method for exploring these issues[43] and therefore these topics will be the subject of further investigation.

CONCLUSION

The present study shows that physical discomfort and injury in optometrists is commonly associated with use of the slitlamp and phoropter and that these tasks contribute to upper body discomfort.

There is a need for greater awareness of the importance of room and equipment design and maintenance on work-related discomfort, particularly for owners and managers of optometric practices. There is also a need for all optometrists (including employees) to have skills to evaluate their personal risk of discomfort and be empowered to implement appropriate modifications (or suggest modifications to their employers) to minimise these risks. These skills could be taught to optometric students before they commence practice.[44] This is important for the effective management of work-related discomfort in optometric practices and thus for the well-being of optometrists, for their productivity and for compliance with health and safety legislation.

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Personal consequences of work-related physical discomfort: an exploratory study

Jennifer Long, Robin Burgess-Limerick, Fiona Stapleton

Submitted to *Clinical and Experimental Optometry* 21st June 2012

Background: Work-related physical discomfort has been reported in Australian optometrists. The purpose of this paper is to explore the personal consequences of work-related discomfort.

Methods: 47 optometrists with self-reported work-related discomfort participated in a 30 minute telephone or face-to-face interview related to ergonomics and physical comfort. Self-employed, employee, locum and retired optometrists participated. Four avenues were investigated: description of discomfort, non-work contributing factors, whether the participant has ever stopped work due to discomfort and the treatments accessed to alleviate discomfort. These data were subject to qualitative and quantitative analysis.

Results: Reported discomfort ranged from mild to severe. Eight participants (17%) ascribed their discomfort entirely to work and seven participants (15%) cited non-work factors as the cause. Many participants reported that non-work factors, e.g. sport and driving, aggravated existing work-related discomfort (n=32, 68%) and for some, their discomfort impacted on home and leisure activities. There were 15 participants (32%) who have stopped work because of discomfort, including 2 who have ceased working as an optometrist and 2 who now work reduced hours. The majority (n=32, 68%) continue to work despite discomfort. Many participants (n=31, 66%) seek treatment to alleviate discomfort, with 7 participants (15%) reporting that they receive multiple therapies per week. Work-related discomfort was generally viewed as a personal issue, with most participants accessing treatment in their own time (n=27, 57%) and funding it personally or with private health insurance. Only 4 participants have received funding through Workers Compensation or income protection insurance.

Conclusions: Work-related discomfort has significant financial and personal costs for some Australian optometrists. These qualitative data can be used to develop quantitative tools for assessing the impact of discomfort on quality of life for optometrists and their families. The results also highlight the need for preventative action to reduce work-related discomfort within the optometry profession.

Keywords: work-related discomfort, optometry, costs, consequences

Work-related physical discomfort is a complex entity. Superficially it appears straightforward: physical discomfort can occur if you perform repetitive tasks, adopt awkward postures, apply high forces or are exposed to vibration. Physical hazards such as these are well-documented in work health safety legislation (Safe Work Australia, 2011b) and guidelines(Safe Work Australia, 2011a). More recently, non-physical factors which contribute to work-related discomfort have also been acknowledged. These are often grouped together under the umbrella term "psychosocial" and include job demands (e.g. working hours), psychosocial factors (e.g. job satisfaction, control over the work environment, interpersonal relationships) and personal factors (e.g. stress and coping strategies, motivation) (Macdonald, 2004).

Adding to this complexity is exposure to risk factors. Is discomfort experienced at work a consequence of physical or psychosocial factors in the workplace? (Leka & Jain, 2010) Is discomfort the result of injuries sustained in leisure time, such as playing sport, lifting children, performing housework or using a computer? (Jensen, Ryholt, Burr, Villadsen, & Christensen, 2002; Sanders, 2006) Or does an individual have an underlying injury or condition which is aggravated by work-related factors? This complexity is encapsulated in a study of work-related discomfort in dentists where 34% of a sample of 421 dentists reported that their work-related discomfort was entirely due to clinical work, 54% only partially attributed their work-related discomfort to clinical work while 7% reported that their work-related discomfort was related to factors other than clinical work (Rucker & Sunell, 2002).

An individual experiencing work-related discomfort has three options:

1. Continue to work. Previous reports within optometry show that this is an independent risk factor for chronic discomfort (Long et al., 2011).
2. Apply an intervention (e.g. seek medical treatment, modify work or leisure activities) which enable the individual to continue to work despite their discomfort. Long et al (Long, et al., 2011) report 35 instances of hospitalisation related to work-related discomfort in a questionnaire completed by 416 Australian optometrists.
3. Reduce exposure (e.g. reduce work hours, perform alternative work tasks or leave the profession altogether). Long et al (Long et al., 2012) report that female Australian optometrists are more likely to manage work-related discomfort by altering their work schedule.

The option selected by an individual may be influenced by external factors e.g. personal finances or fear of job loss. It can also be influenced by internal factors e.g. a belief that work-related discomfort is inevitable (Holman, Ellison, Maghsoodloo, & Thomas, 2010; Rucker & Sunell, 2002) or a desire to place a patient's needs above their own (Alnaser, 2009; Crawford, Gutierrez, & Harber, 2005; Cromie, Robertson, & Best, 2002; Rucker & Sunell, 2002; Trossman, 2004).

An online questionnaire sent to Australian optometrists in 2008 established that work-related discomfort is an issue within the optometry profession. Although this questionnaire enabled the identification of independent risk factors for work-related discomfort (Long, et al., 2011) and provided a better understanding of the variety of ways optometrists manage work-related discomfort (Long, et al., 2012) it also raised many questions, e.g. why do optometrists continue to work while injured? Is discomfort experienced by optometrists purely related to work factors? If eliminating the primary risk factors for severe discomfort only reduces the disease load by 28% (Long, et al., 2011), then what are the other likely contributing factors? One of the recommendations of these reports was to further explore these issues through interviews with optometrists.

The purpose of this paper is to report qualitative data obtained through interviews with some of the optometrists who participated in the original online questionnaire. Specifically, this paper explores the personal consequences of work-related discomfort in Australian optometrists.

Methods

An online questionnaire on the topic of work-related discomfort was distributed to Australian optometrists in 2008 and achieved a participation rate of 25% (n=416 optometrists). Contact details for participation in future investigations were provided by 120 optometrists. They were contacted either by email or post and invited to participate in a telephone or face-to-face interview. There were 60 optometrists (n=47 reporting work-related physical discomfort) who agreed to be interviewed. All optometrists who positively responded to the invitation were interviewed during the period August 2009 – March 2010. The interviews covered a range of topics related to ergonomics and physical comfort. The data from the 47 participants who reported work-related discomfort are presented in this paper.

This study was approved by the Human Research Ethics Advisory Panel of the University of New South Wales and informed consent was given by all participants.

Subjects

There were 47 optometrists with self-reported work-related physical discomfort who participated in the interviews (n=23 self-employed, n=18 employee, n=6 locum). Three participants were retired (n=2 due to work-related physical injuries); they were classified according to their work-mode prior to retirement (n=2 self-employed, n=1 employee).

In this report, a locum is defined as an optometrist who works on a short-term contract basis. Participants who described themselves as “permanent locums” but who worked with one employer on a regular basis were categorised as “employees”. Participants who worked within a corporate or franchise structure were classified as non-independent. If a participant worked in more than one location, the practice structure and practice location were classified according to the participant’s primary work location. If participants worked equally between rural and urban practices then this was recorded as “both”.

Interview methods

The majority of interviews were conducted by telephone (45 interviews). Two participants requested a hard copy of the interview questions for completion within their own time.

Except for one participant who did not wish to be recorded, telephone and face-to-face interviews were digitally recorded and later transcribed for analysis. Each interview lasted approximately 30 minutes, although some interviews took up to 75 minutes when participants had many issues to discuss.

The interviews were semi-structured in that they followed a schedule of questions. These questions were divided into four sections: demographic information, job satisfaction, description of discomfort and ergonomics.

The “description of discomfort” questions included asking participants who reported discomfort to describe their discomfort, identify work tasks and non-work activities which contribute to their discomfort, discuss successful and unsuccessful strategies which they have attempted to reduce their discomfort and estimate the cost of their discomfort. If a participant reported discomfort in more than one body region, then the questions were repeated for each body region.

This paper reports the results of the interview questions related to the personal costs and impact of work-related discomfort (see table 1).

Analysis

Participants were categorised by demographics (gender, employment status, years in practice, practice location, practice mode) and self-reported discomfort versus no discomfort. The analysis methods used for each category are given in table 1. These were:

1. Coding of responses into themes and tabulation according to frequency.
2. Binary outcome measures assigned to participant responses. Chi-squared analysis was conducted to establish interactions between the demographic factors and the binary outcome measures. Statistical significance was set at $p = 0.05$.

Results

Work-related discomfort was reported by 47 interview participants. The demographics of this group are given in table 2. Eight participants (17%) reported that their discomfort is entirely work-related (i.e. when they are away from work on weekends or on holidays they do not experience discomfort).

Description of discomfort

Participants used a variety of descriptive terms for their discomfort (see table 3). Difficulty with movement was the most commonly reported descriptor for neck, shoulder and upper back discomfort. Pain was the most commonly reported descriptor for lower back discomfort. Specific diagnoses which participants report they have been given for their discomfort include arthritis, carpel tunnel syndrome, cervical spondylitis, degenerative spinal changes, disc prolapse and sciatica.

Non-work factors

There were 39 participants (83% of those with self-reported discomfort) who identified non-work factors which contributed to their discomfort. Of these:

- Seven participants (15% of those with work-related discomfort) reported a direct relationship between non-work activities and the discomfort they experience at work. This included sport (e.g. overtraining at the gym) (n=3) and playing a musical instrument (n=3). One participant linked their discomfort with pregnancy.

- The majority of participants (n= 32, 68%) reported that non-work factors aggravated their work-related discomfort. This included using the computer at home (n =16), driving long distances (n=11), sport (n=10), household chores (e.g. housework, gardening, sewing) (n=8), pregnancy and childcare (n=3). (N.B. Participants may have nominated more than one aggravating factor).

Work-related discomfort had an impact on home and leisure activities for 9 participants (19%). For example:

> *"Kayaking doesn't help but if (my shoulder) is playing up I don't get on the water."*

> *"It stops me doing things in my own time rather than things at work."*

Two participants report that they use their days off as recovery days so that they are able to attend work.

Stopping work

There were 15 participants (32%) who reported that they have stopped work due to work-related discomfort (see table 2). This included 2 participants (4%) who have ceased working as an optometrist altogether and 2 participants (4%) who had previously stopped work but who now work reduced hours. There were 2 participants (4%) who reported that they have not previously stopped work due to work-related discomfort but have experienced improved physical comfort since reducing their work hours (e.g. have one day off per week).

Of those who have taken time off due to work-related discomfort, 9 participants (19%) took minimal time off (e.g. *"I probably should have had 3 weeks off but 3 days is all I felt I could be away for"*) or occasional time off (e.g. *"Sometimes I leave work early", "I remember (once) taking 2 days off"*). At the other end of the spectrum, there were 2 participants who reported that they lose in excess of 10 working days per year due to work-related discomfort (e.g. *"Over the past 3 years quite a few days lost… (approximately) 10-15 days a year").*

The majority of participants (n=32, 68%) admit that they continued to work despite discomfort. Painkillers were used by 15 participants (32%) and 8 participants (17%) described that they "just soldier on", "grin and bear it" or "just push on". There were 2 self-employed participants who stated that they continue to work because they need the money and 1 self-employed participant who stated that they do not believe in taking time off for sickness. Chi-square analysis did not show any significant interactions between stopping work and the demographic factors.

Treatment

A wide variety of treatments for work-related discomfort were reported. The most common treatments reported were physiotherapy (n=22), massage (n=17) and chiropractic (n= 10), but treatments also included acupuncture, Bowen technique, botox injections, epidurals, hypnotism, kinesthesiology, myotherapies and surgery. Investigative procedures included arthroscopy, ultrasound, MRI and x-rays. Eleven participants (23%) admitted to trying multiple therapies in an attempt to identify an effective one (e.g. *"I saw two physiotherapists. The first one I felt didn't help that much so a friend recommended someone else."*). Three participants (6%) have undergone surgery to help alleviate their discomfort.

Almost half the participants (n=21, 45%) reported that they sought treatment at least once every 3 months (see table 4) with some (n=7) routinely receiving multiple therapies per week. There were six participants who supplemented treatment regimens with exercises in their own time. There were no significant interactions between demographic factors and frequency of seeking treatment.

The most common source of partial funding for treatment was private health insurance (n=22) although there were two participants who had received income protection insurance and two participants who had received workers compensation payments. Three participants with long-standing discomfort were self-employed and did not have workers compensation cover, while one employee participant reported that they had not claimed for their injury because "*it never occurred to me."* Two participants reported that financial cost has led them to cease treatment, despite the treatment being effective.

The majority of participants sought treatment in their own time (n=27). Of those who attended treatment within work time, this was achieved by forfeiting seeing a patient (n=6), rescheduling their appointments / work hours (n=6) or attending when there was a gap in the appointment book (n=3). Other methods for compensating time away from work included utilising sick leave (n=6) or annual leave (n=1). One participant viewed the treatment of their own health a professional responsibility (*"It is an expense I see as my professional requirement"*) while another has actively improved their health and fitness as a management strategy. Only four participants reported that they had employed another optometrist to perform their work in their absence.

Discussion

This paper illustrates that work-related discomfort has severe consequences for some Australian optometrists and can impact on personal lives (e.g. paying for medical treatment, accessing treatment in their own time, restricting leisure activities) and in workplaces (e.g. rescheduling appointments to access medical treatment, stopping work).

It has been argued that business and industry is unfairly blamed for work-related discomfort when individuals may be exposed to contributing factors in their leisure time.(Sanders, 2006) This might be true for the small percentage (15%) of participants in this study who admitted that leisure activities were directly responsible for their discomfort, but the fact that individuals may be exposed to factors outside of work does not limit the liability of employers to provide workplaces which are safe and comfortable (Safe Work Australia, 2011c). Nevertheless, the multifactorial nature of work-related discomfort does highlight the need for a better understanding of all the risk factors (Malchaire et al., 2001; Sanders, 2006) to ensure that discomfort is managed throughout the whole day, not just at work. This is particularly important considering that 39 participants in this study (83%) reported that non-work factors aggravated their discomfort at work.

The purpose of this paper was to gain a better understanding of the consequences of work-related discomfort in the optometry profession. This has been achieved through interviews with 47 optometrists who reported discomfort ranging from minimal impact (e.g. did not access medical treatment) through to extreme impact (e.g. are unable to work). Although this is a substantial number of interview subjects, there is response bias in that participants chose to participate and these participants may not be representative of the whole profession. A previous stage of this investigation showed that females were more likely to alter their work schedule as a strategy for reducing work-related discomfort (Long, et al., 2012) but an association between gender and behaviour (e.g. stopping work, accessing treatment) was not evident in these interview data. Similarly, there may be associations between behaviour and other demographic factors (e.g. employment status, practice mode) which approached but did not achieve statistical significance in this study.

Sample representativeness has implications for making generalisations about the study results. While it is disturbing to learn that 32% of participants in this study have stopped work as a result of work-related discomfort, this figure is similar to those reported for American dental hygienists (31% of 51 participants in a focus group) (Crawford, Gutierrez, and Harber 2005) and Australian physiotherapists (28% of 217 participants in a mailed questionnaire) (West & Gardner, 2001). A smaller proportion is reported for another group of Australian physiotherapists (21% of 824 participants in a mailed questionnaire) (Cromie, Robertson, & Best, 2000) and New Zealand veterinary workers (18% of 867 participants in an online questionnaire) (Scuffham, Legg, Firth, & Stevenson, 2010). It is unknown why there are differences between the two Australian physiotherapy studies, but the low proportion reported in the veterinary study can be explained by the choice of denominator used in the calculation method.

There are reports in the literature that healthcare professionals may avoid seeking treatment for their own illnesses and injuries, partially so that they are not “the patient” and partially because they place their patient’s welfare above their own (Cromie, et al., 2002; McKevitt & Morgan, 1997; Wachtel, Wilcox, Moulton, Tammaro, & Stein, 1995). It was therefore encouraging to discover that 66% of participants in this study do access healthcare services and that this is greater than that reported for physiotherapy (61%) (Cromie, et al., 2000) and dentistry (51%) (Alexopoulos, Stathi, & Charizani, 2004). Painkillers were used by 32% of participants in this study, which is less than that reported for ophthalmologists with back pain (56%) (Chatterjee, Ryan, & Rosen, 1994). Conversely, there were more participants in this study who accessed healthcare services (66%) than the number reported for ophthalmology (31%). These different proportions could be attributed to differences in job tasks and job demands or to the study design and sampling method. Chatterjee, Ryan et al (Chatterjee, et al., 1994) report only back pain and this data was gathered from a mail survey of 325 United Kingdom ophthalmologists).

Workers compensation is an option for maintaining an income for employees with work-related injury, but self-employed individuals are not covered by this program and so require personal income protection insurance (Business.gov.au). Workers compensation has a reputation for being difficult and unpleasant to access and this was described in a report of Australian physiotherapists (Cromie, Robertson, & Best, 2003). One participant in this study who has accessed workers compensation echoed these sentiments. There were four participants who have not accessed insurance or workers compensation because they did not think that it applied to them, which is consistent with the argument that injuries are under-reported to insurance companies and the Workers Compensation Commission (West & Gardner, 2001). The proportion of participants who have accessed workers compensation (4%) is the same as that reported by West and Gardner (West & Gardner, 2001) for physiotherapists. If the participants who have accessed workers compensation and income protection insurance are combined, then this proportion (8%) is similar to the proportion claiming workers compensation reported by Cromie et al (7.4%) (Cromie, et al., 2000) for physical therapists.

Placing the needs of patients or of the business before their own needs is exemplified in this paper by the number of participants who reported that they "just soldier on" or who have minimised their time away from work. This could be related to the high proportion of self-employed participants (49%) or the fact that most optometrists work in small business environments where there may not be the resources (staff, finances) to employ others to do the work while the optometrist is away. This latter conjecture is supported by the findings that only 4 participants employed someone else to perform their work while they were absent. It could also explain the high proportion of participants (57%) who sought treatment in their own time. This requires further investigation.

The qualitative data presented in this paper can be used to develop quantitative tools for economic cost modelling and for assessing the impact of discomfort on quality of life for optometrists and their families. If further projects are conducted, then it would be best to provide participants with a schedule of questions in advance to enable calculation of the actual, rather than approximate, costs to the profession.

Conclusion

The personal consequences of work-related physical discomfort are considerable for some Australian optometrists and their families. It is hoped that these findings will heighten awareness of work-related discomfort and that preventative strategies will be promoted and implemented within the optometry profession.

Table 1. Interview questions and how the results were analysed

Interview questions	**Analysis method**
1. Can you describe the discomfort you experience	Thematic analysis according to definition of discomfort used previously in investigation (Long, et al., 2011): pain, ache, difficulty with movement, numbness
2. Are there any activities that you do in your non-work time which you think contribute to the discomfort you experience at work? For example, playing a musical instrument, using the computer, playing sport	Thematic analysis, frequencies recorded for each category.
3. Have you ever had any medical treatment? o What sort of treatment? o How many treatments? Over what time period? o What was / is the cost of treatment? o Did you need to take off time for treatment? o If so, how much time? Did you employ another optometrist to do your work while you were away? o Have you claimed your treatment under Workers Compensation?	Thematic analysis, frequencies recorded for each category. Binary outcome measure, where "treatment less frequent than once every 3 months" = 0 and "at least one treatment every 3 months" = 1. Chi-squared analysis was conducted based on the breakdown of the results.
4. Have you had to stop work as a result of your discomfort? Or have you continued to work while uncomfortable?	Thematic analysis, frequencies recorded for each category. Binary outcome measure, where "have NOT stopped work" = 0 and "have stopped work" = 1. Chi-squared analysis was conducted based on the breakdown of the results.

Table 2. Participants who reported that they have stopped work as a result of work-related discomfort.

		TOTAL	Have you ever stopped work as a result of work-related discomfort?		Chi-square p-value
		N	Yes	No	
	TOTAL	47	15	32	
Gender	Male	21	6	15	<0.7
	Female	26	9	17	
Years practicing as optometrist	<15	16	4	12	<0.5
	15+	31	11	20	
Employment status	Self- employed	23	5	18	<0.2
	Not self employed	24	10	14	
Practice mode	Independent	32	8	24	<0.2
	Not independent	15	7	8	
Practice location	Rural	11	2	9	<0.3
	Urban	34	12	22	
	Both	2	1	1	

Table 3. Number of participants who reported discomfort for each body region and examples of descriptive terms used (participants may have used more than one descriptor)

Descriptors	Neck	Shoulder	Upper Back	Lower Back	Arm/Hand	Leg/Foot
PAIN: Dull, mild, sharp, deep, severe, burning, sore	15	16	9	17	5	5
ACHE	3	4	4	4	2	0
DIFFICULTY WITH MOVEMENT: Stiff, tight, constriction, tension, twinge, spasm, cramp, reduced mobility, frozen muscle	17	17	10	9	7	0
NUMBNESS: Pinch, tingling, pins and needles, numbness	0	1	0	0	5	0
OTHER: Nausea, headache	8	5	1	1	0	0

Table 4. Frequency with which treatment is accessed

Demographics		TOTAL	More than once every 3 months	Occasionally	Don't access	Chi-square p-value*
	TOTAL	47	21	10	16	
Gender	Male	21	8	6	7	<0.4
	Female	26	13	4	9	
Years practicing as optometrist	<15	16	6	4	6	<0.5
	15+	31	15	6	10	
Employment status	Self- employed	23	12	3	4	<0.3
	Not self employed	24	9	7	13	
Practice mode	Independent	32	15	8	11	<0.7
	Not independent	15	6	2	7	
Practice location	Rural	11	4	1	6	<0.6
	Urban	34	16	9	9	
	Both	2	1	0	1	

* More than once every 3 months versus occasionally/don't access

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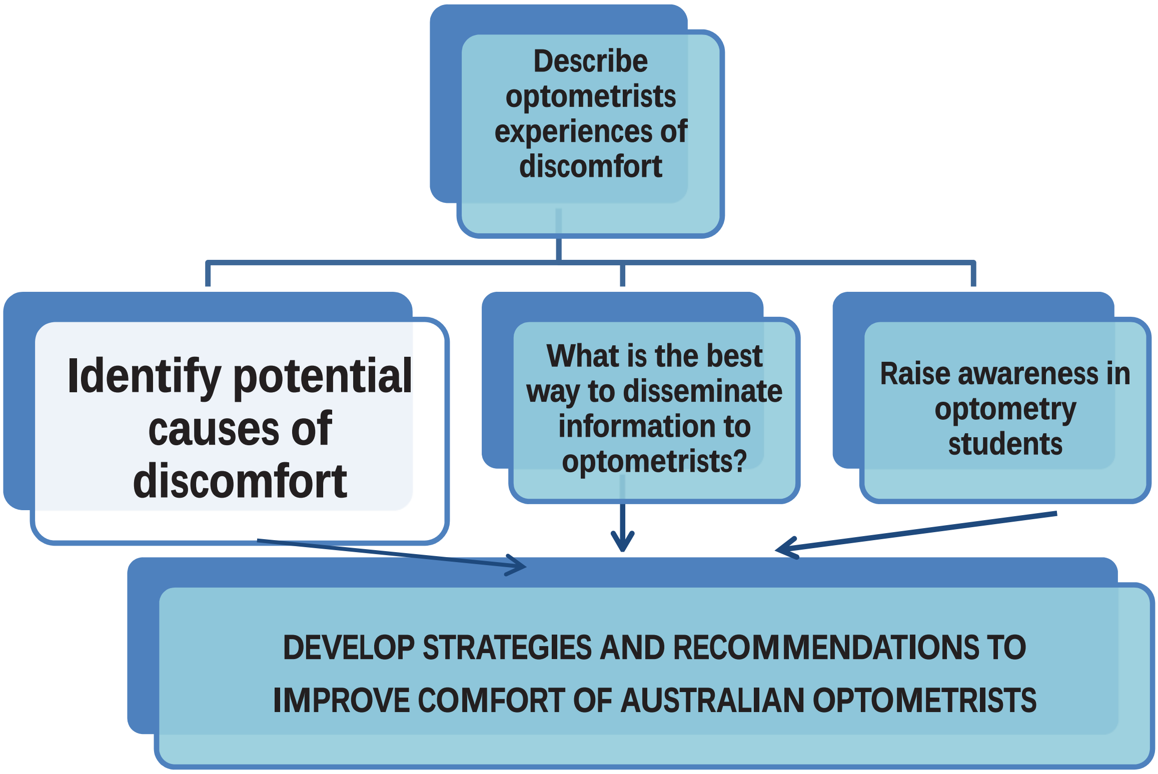
PART 3: Identify potential causes of discomfort



Chapter 4: Workplace factors contributing to discomfort

The previous chapter revealed an attitude within the optometry profession that work-related discomfort is a personal responsibility. However, after interviewing 47 optometrists with work-related discomfort and asking them “What tasks contribute to your discomfort?” and “Have you tried any strategies which work and which don’t work?” a further theme emerged requiring detailed exploration. This is the basis for this chapter which discusses whose responsibility is work-related discomfort.

Participants in the interviews included 47 optometrists with work-related discomfort and 13 optometrists who do not experience discomfort. Some of the optometrists without discomfort had purposefully designed their practices or structured their workload in an attempt to avoid discomfort, while others had no previous experience of discomfort and were puzzled how it could occur. All 60 participants (n=47 with discomfort and n= 13 without discomfort) were asked about their control of the work environment, including purchase of equipment and furnishings and control over pace of work. These data provide insight into the amount of responsibility which can be reasonably apportioned to optometrists in clinical practice.

The following paper “Work-related discomfort in the optometry profession – whose responsibility?” was invited as an oral presentation in the Healthcare Ergonomics Special Interest Group (SIG) stream at the Human Factors and Ergonomics Society of Australia conference in November 2012. The accompanying peer-reviewed paper, Long et al (2012), Work-related discomfort in the optometry profession – whose responsibility?” *Ergonomics Australia* 2012, 10:6, was accepted for publication on the 25th October 2012 and is reproduced with the kind permission of the Human Factors and Ergonomics Society of Australia Inc.

Research Article

Work-related discomfort in the optometry profession – whose responsibility?

Jennifer Long[1], Robin Burgess-Limerick[2], and Fiona Stapleton[1]

[1] *School of Optometry and Vision Science, University of New South Wales, Australia*

[2] *Minerals Industry Safety and Health Centre, Sustainable Minerals Institute, The University of Queensland, Australia*

Abstract

Background: Optometrists generally work in small business environments. Work-related discomfort is often viewed as a personal responsibility which can be managed by adjusting posture or equipment. **Aim:** The purpose of this paper is to explore the contributing factors for discomfort in optometrists and discuss whether the management of discomfort is the responsibility of individual optometrists or the employer. **Method:** Sixty optometrists (n=47 with work-related discomfort) were interviewed by telephone and asked questions about their control of the work environment and work factors contributing to discomfort. Data related to discomfort were collated and thematically analysed. Data related to control of the work environment were subject to qualitative and quantitative analysis. **Results:** Four factors contributing to discomfort were identified: sustained postures, awkward postures, inability to adjust equipment and inadequate space. Self-employed participants were more likely to report that they had input into the choice of equipment and furnishings in their primary work practice ($p<0.001$) while 18 participants (all not self-employed) reported no input. There were 27 participants (45%) who perceived they had full control over their pace of work. Control was achieved by good communication with other staff members and appointment book structure. Lack of control was related to expectations to perform unscheduled consultations. **Conclusion:** Individual optometrists can assume some personal responsibility for posture when performing clinical procedures. Since individuals may only have limited control over workload or equipment and consultation room design, there also needs to be a greater awareness amongst employers of the impact of these factors on work-related discomfort.

Background

Work-related discomfort falls under the auspices of Australian Work Health Safety (WHS) legislation. As such, responsibility for managing this risk could reasonably be apportioned to employers (provide a workplace which is safe and comfortable), equipment manufacturers and suppliers (provide equipment which is safe and comfortable) and to employees and the self-employed (take reasonable care for own health and safety)(1).

Ophthalmic publications discussing work-related discomfort largely reinforce the personal responsibility view e.g. advice is given about appropriate postures (2, 3) or exercises which can be performed throughout the working day (4, 5). In a questionnaire issued to Australian optometrists in 2008 (n=416, 25% response rate), adjusting posture was the strategy most commonly reported to minimise discomfort (6). Subsequent interviews with 47 of these optometrists revealed that work-related discomfort was frequently viewed as a personal issue e.g. treatment was accessed in non-work time and funded personally and/or with private health insurance (unpublished data).

Personal responsibility for managing discomfort assumes an individual has control of their work environment, but this may not always be the case. In Australia, clinical optometrists predominantly work in private practice and may work in independent practices (i.e. their practices are owned by optometrists) or non-independent practices (i.e. the practice is part of a franchise or is owned by a dispensing company). It is estimated that independent optical outlets account for 62% of all optical outlets in Australia (7). Optometry workforce estimates in 2005 showed a 5% decrease in self-employment over the period 1995-2005 and estimated that that there were 54% optometrists who were self-employed in 2005 (8). Non-self-employed optometrists may work as employees or as locums (i.e. work on short term contracts).

In the 2008 questionnaire to Australian optometrists, univariate analysis showed that employee and locum optometrists were more likely to report work-related discomfort (9) and multivariate analysis showed that any discomfort was associated with performing more than 11 consultations per day. Barriers to improving comfort included room and equipment design, poor maintenance of equipment and non-supply of suitable equipment or furniture (6).

The purpose of this paper is to report data collected from interviews with optometrists exploring how much control optometrists have over their work environment and why optometrists experience discomfort with common clinical tasks. This will help answer the question: whose responsibility is work-related discomfort?

Corresponding author: Jennifer Long. Email – j.long@unsw.edu.au

Method

An online questionnaire about work-related discomfort was sent to Australian optometrists in 2008 and achieved a 25% response rate (n= 416). Contact details were provided by 120 optometrists to participate in future stages of the study. They were contacted by email or post and invited to participate in a 30 minute telephone or face-to-face interview, of which 60 optometrists agreed to participate. Telephone and face-to-face interviews were conducted with these optometrists between August 2009 and March 2010 and covered a range of topics including experience of work-related discomfort, job satisfaction and ergonomics. Participants practiced optometry in all states and territories of Australia except for the Northern Territory. All optometrists who positively responded to these invitations were interviewed.

All 60 interview participants were asked questions about their control of the work environment. Only those with self-reported discomfort (n=47) were asked questions about their discomfort. The interview questions and analysis methods used within this paper are shown in Table 1.

Results

The demographics of the 60 interview participants are given in Table 2. Of these, 47 participants reported work-related discomfort and this was associated with using the phoropter (n=25) (Figure 1), slit lamp (n=18) (Figure 2), ophthalmoscope (n=10) (Figure 3) and computer (n=8).

Table 1. Interview questions and analysis methods

Participants	Interview questions	Analysis
Participants with self-reported discomfort (n=47)	**Experience of discomfort** Over the past 12 months have you experienced work-related discomfort in any of the following body regions? Neck, shoulder, upper back, lower back, elbow/arm, wrist/hand, knee/leg, ankle/foot Participants were then asked the following questions for each body region experiencing discomfort: • Are there any particular optometry tasks that make this discomfort worse? Please describe • Are there any strategies that you adopt to minimise or reduce this discomfort? Please describe. • Have you tried any strategies that don't work? Please describe	Previous results indicate that the 4 principle tasks associated with discomfort are using the phoropter, slit lamp, ophthalmoscope and computer (6). The data relating to these tasks were collated and thematically analysed.
All participants (n=60)	**Control over work environment** How much input did you have into the choice of equipment and furnishing in the practice where you work? How much control do you have over your pace of work e.g., length of appointments, appointment scheduling, lunch and other comfort breaks?	Coding of responses into themes and tabulation according to frequency Binary outcome measure, where: • "no input" = 0 and "any input" = 1 • "no control" = 0 and "any control" = 1 Chi-squared analysis was conducted to establish interactions between the demographic factors and the binary outcome measures. Statistical significance was set at p = 0.05.

Table 2. Demographic factors and control of work environment

Demographic factors		All participants					With self-reported discomfort
		Total	Did you have input into choice of equipment and furnishings?		Do you have control over your pace of work?		Total
		N	No	Yes	No	Yes	N
	TOTAL	60	18	42	33	27	47
Gender	Male	26	5	21	14	12	21
	Female	34	13	21	19	15	26
Report Discomfort	Yes	47	13	34	25	22	47
	No	13	5	8	8	5	0
Years practicing as optometrist	<15	19	7	12	9	10	16
	15+	41	11	30	24	17	31
Employment status	Self- employed	30	0	30#	18	12	23
	Not self employed	30	18	12	15	15	24
Practice mode	Independent	40	9	31	22	18	32
	Not-independent	20	9	11	11	9	15
Practice location	Rural	14	4	10	8	6	11
	Urban	44	13	31	24	20	34
	Both	2	1	1	1	1	2

 # p < 0.001

Figure 1. Using the phoropter

Figure 2. Slit lamp fundoscopy

Figure 3. Ophthalmoscopy

Experience of discomfort

Four themes emerged as contributing factors to discomfort: sustained postures, awkward postures, inability to adjust equipment and insufficient space. Sustained postures and to a certain extent, awkward postures, were associated with clinical tasks and the interaction between the optometrist and the patient. These were factors which participants reported they had some control over and are described in this paper as "task factors". Inability to adjust equipment and insufficient space within the consultation room were reported as contributing factors to awkward postures. These were factors over which participants did not always have control, and are described in this paper as "equipment design" and "consultation room design".

There were mixed reports about the benefits of personal strategies to reduce discomfort e.g., sport and exercise were cited as beneficial 23 times and non-beneficial (or increased discomfort) 4 times. Medication was not viewed favourably as a strategy for reducing discomfort associated with using the slit lamp (n=4), ophthalmoscope (n=2) or phoropter (n=3) as it was reported as ineffective or had adverse side effects e.g. increased blood pressure.

Task factors

Sustained postures were associated with using the phoropter and the slit lamp. For example:

- Having an elevated arm to reach the dials on the phoropter (n=5) especially if patients were slow decision makers when reading from the letter chart (n=2).
- Extending one arm to hold a fundoscopy lens (n=9) (Figure 2), epilate eyelashes or perform foreign body removal (n=4) when using the slit lamp.

Postural strategies adopted by interview participants to reduce discomfort when using the phoropter include standing so the arms are not elevated (n=3), sitting on a chair with back support (n=3), adjusting the patient position so the arms are not extended (n=3), facing the patient so the arms are not abducted (n=2), alternating sitting and standing (n=1) and sitting on a higher chair (n=1). Alternating between standing on the right and left side of the patient was cited as a strategy by 3 interview participants, while others reported that this strategy introduced more discomfort or became less efficient. Other strategies cited include minimising the time spent using the phoropter (n=1), working less hours (n=1) and taking rest breaks between patients (n=3).

Although commercial products are available to improve comfort when performing slit lamp fundoscopy, only one participant reported that they use a metal clip which holds the fundoscopy lens in place, and one participant reported that they have considered using an elbow support but has not pursued it further.

Awkward postures were reported when performing slit lamp examination (e.g. *"when there is a larger person in the chair, you can't sit facing them, you need to turn your legs to the side a little bit"*). One participant who reported back discomfort purposefully sat with his legs to the side out of modesty, while three participants described improved comfort since they stopped sitting in a "modesty pose". One participant reported that her comfort is better now that she wears trousers instead of a skirt.

Equipment design

The chair and stand is a key item of equipment in an optometry consultation room. The patient chair height is adjustable and the stand has items of equipment mounted on it for ease of use. Inadequate space next to the chair and stand was cited as a contributing factor for discomfort when using the phoropter and ophthalmoscope (e.g., compare the limited space for the optometrist to stand in Figure 1 with that in Figure 3). The consequences of inadequate space include awkward postures, e.g. can only work from one side of the patient (n=7), need to reach across the patient (n=7) or twist to the right for clinical tasks (n=4).

Inability to sufficiently adjust the height of the patient chair or their own chair was cited as a contributing factor for using the:

- phoropter (n=3) e.g. *"I don't stand because I am too tall, so I sit and reach up"*
- slit lamp (n=6) e.g. *"I can't sit on the chair because the slit lamp is too high…but I can't stand up properly either"*
- ophthalmoscope e.g. when examining smaller patients and children (n=4) or when working at external clinics where the patient sits on a conventional (non-adjustable) chair (n=3).

Six participants described how they attempt to adjust their own chair or use cushions to improve their comfort while using the slit lamp. Unsuccessful strategies reported include squatting and sitting on one leg. Three participants reported that they keep the patient as high as possible for ophthalmoscopy. One participant has purchased a bar stool for patients to sit on at external clinics, while another participant has ceased performing domiciliary visits *"because it was too hard on my back"*.

Consultation room design

The location of the projector letter chart relative to the patient chair was an issue for 2 participants when using the phoropter (*"My head gets in the way of the patient seeing the (letter) chart so I always duck over to the right hand side"*). Participants also described how the computer for recording examination data is oriented away from the patient (*"I have to turn my head to look over my right shoulder to talk to the patients."*) (n=3) or is installed on a workstation too low to use while standing (n=1). Many participants reported space limitations within the consultation room which prevented them rearranging their workstation or replacing furniture (n=2). One participant did not consider purchasing new furniture a priority even though it caused discomfort, while another participant perceived recording information as a transient activity and therefore not essential to be seated correctly. One participant used predictive software which minimises typing by recognising commonly used words and phrases (n=1) while another who was unable to implement change within the consultation room described how she handwrites information during the consultation and then enters the data into the computer later in the day.

Control over the work environment

Choice of equipment and furnishings

There were 42 participants (70%) who reported that they have had input into the choice of equipment and furnishings in their primary work practice (Table 2). Self-employed optometrists were more likely to report that they had input ($\chi^2 = 25.7$, df=1 $p<0.001$). The amount of input into choice of equipment and furnishings varied from 100% (n = 19 self-employed, n = 2 employees) to minimal e.g. small items of equipment and furniture. There were 18 participants who reported no input into the choice of equipment and furnishings where they work (n = 14 employees, n = 4 locums) although one participant said that they were asked their opinion *after* equipment was installed. Two locum optometrists reported that they take bags with small items of equipment to their workplaces (e.g. reading cards, patient literature) in the event that these items are not supplied.

Control over pace of work

There were 45% participants (n=27) who perceived that they had full control over their pace of work. This was achieved by specifying and enforcing appointment length and break times (n=19, 32%) or structuring the appointment book to allow time to "catch up" after complex patient presentations (n=4), to see emergency patients (n=3) or complete administrative tasks (n=2). There were 4 locums who reported that they stipulate appointment length and break times in their employment contracts; one reported that they have refused to work when conditions were not met.

Of those who perceived that they did not have full control, 12 participants (20%) reported that they could restructure the appointment book but chose not to do so. Reasons given for lack of control over pace of work include expectations of management to consult with a set number of patients per day irrespective of the complexity of clinical presentation (n=16), expectations of patients to be seen immediately (n=6) and emergency referrals from general practitioners and pharmacists (n=5). Lack of control was particularly an issue for 5 of the 7 optometrists who work at external clinics (e.g. *"One nursing home tricked me. They said they had 3 or 4 lined up but I ended up with 17 in one afternoon. By the end of that my back was so sore I could hardly walk."*). There were 6 participants (10%) who reported that sometimes they cannot take breaks, even if breaks are rostered into the appointment book and 5 participants who chose to forgo structured breaks in favour of completing paperwork or seeing additional patients. One participant reported insufficient time to complete their work within the allocated appointment times. Chi-square analysis did not show any significant interactions between the demographic factors and perceived control over pace of work (Table 2).

Discussion and conclusions

These results show that optometrists take personal responsibility for discomfort by making postural adjustments, performing exercises, using medication and adjusting their work hours or work tasks. Some contributing factors to discomfort e.g. sustained postures, may be amenable to modification by individuals, so it is appropriate that ophthalmic publications provide advice to optometrists on these matters.

Equipment and consultation room design are also contributing factors to discomfort, but control of these aspects by optometrists may be limited, especially by employee and locum optometrists. Since there is a trend away from self-employment within the optometry profession, there needs to be a greater awareness among employers, purchasers and designers of how these factors affect the comfort and efficiency of optometrists.

The WHS legislation stipulates that the self-employed have a responsibility to ensure personal health and safety, but this was not fully embraced by all participants. The view that personal comfort is a low priority is similar to the findings from other parts of this investigation e.g. continuing to work while injured is a risk factor for severe discomfort (9) and there may be personal incentives to continue to work if one is self-employed (unpublished data). Although it is reasonable to legislate in this way, optometry is a service industry operating in a small business environment. This means that self-employed optometrists may not have total control over their work, especially if there are expectations from external sources to provide additional consultations. This is an issue which requires more open discussion within the profession.

Some participants enjoyed the challenge of seeing a large number of patients per day and did not experience work-related discomfort. It is possible that combinations of factors may contribute to discomfort e.g. performing more than 11 consultations per day (9) AND adopting awkward postures. This requires further investigation.

There were two limitations of this study. Firstly, there was response bias in that the participants in this study chose to participate and they might not represent the experience of all optometrists in Australia. There was a higher proportion of females (57%) and participants older than 41 years (58%) in this study compared to estimates for the optometric workforce in 2009 (45% female and 50% aged at least 40 years (10)). The proportion of self-employed (50%) is comparable to projections based on past trends (5% decrease in self-employment per decade, most recent estimate of self-employment is 54% in 2005) (8).

The second limitation is that the interviews adopted an exploratory approach and only those with discomfort were asked to name strategies which they have used to reduce discomfort. Now that the factors contributing to discomfort in optometrists are better understood, it is possible to investigate how those without discomfort remain pain-free. This could be achieved by surveying a broader sample of optometrists and using targeted questions related to specific tasks, equipment or postures.

There are many contributing factors to work-related discomfort in optometrists. Consistent with Australian WHS legislation, the responsibility for this issue cannot be assigned solely to individuals, but needs to be addressed by all stakeholders, including employers, suppliers and designers.

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Cite this article as: *Long et al*. Work-related discomfort in the optometry profession – whose responsibility? *Ergonomics Australia*. 2012, 10:6.

Chapter 5: Observations of optometrists at work

Interviewing my colleagues was a very interesting and enjoyable experience. Most were candid with their responses and were keen to participate if it meant that others could avoid the discomfort and pain that they experience. The telephone interviews also provided an opportunity for participants to discuss their discomfort issues. Some of these participants have subsequently implemented change within their practices.

At the conclusion of the interviews, participants were asked if they were interested in participating in the next stage: an observation of them conducting an eye examination. Some participants declined straight away while others politely said it "sounds interesting" but were not very convincing with their enthusiasm. Then there was another group of participants who wanted to know when I would be coming out to see them.

I can only admire the bravery and trust in this latter group of optometrists, 10 of whom consented to having a video recorder set up in their consultation room while they conducted an eye examination. To address ethics considerations, I was the one filmed having my eyes examined, not a real patient.

This chapter illustrates some of the reasons for discomfort described in chapter 4 and presents a table of postural recommendations which could be developed for distribution within the optometry profession.

The results in this chapter were presented in August 2012 as part of the Vaegan Seminar Series within the School of Optometry and Vision Science, UNSW, at which there were 15 clinical teachers present.

Observations of optometrists at work

1. Introduction

A hazardous manual task is defined in the Hazardous Manual Tasks Code of Practice (Safe Work Australia, 2011) as one which involves repetitive or sustained force, high or sudden force, repetitive movement, sustained or awkward postures or exposure to vibration. Compared to other occupations which involve many or all of these factors, optometry appears to be a low risk profession. Although optometrists might adopt sustained or awkward postures or use repetitive movements, clinical procedures are of short duration and are varied throughout the day, handheld equipment is light-weight and large-size equipment is usually mounted on moveable tables.

Despite this, optometrists do report work-related discomfort (Long et al., 2011). It has been established earlier in this thesis that the four most commonly reported tasks contributing to discomfort in Australian optometrists are using the phoropter, slit lamp, direct ophthalmoscope and computer (Long et al., 2012) and this is associated with sustained postures, awkward postures, inability to adjust equipment and insufficient space (Long, Burgess-Limerick, & Stapleton, 2012). Advice given in ophthalmic publications to reduce discomfort includes: use height adjustable equipment (Anonymous, 2007; Kirby, 2007; Roach, 2009), sit or stand in neutral postures (Anonymous, 2007; Kirby, 2007), ensure that computers are set up correctly before use (Anonymous, 2007; Roach, 2009) use an elbow support for slit lamp fundoscopy (Marx, Wertz, & Dhimitri, 2005), spend less time and avoid leaning sideways for direct ophthalmoscopy (Anonymous, 2007; Hutchins & Schneebeck, 2004) and ensure personal comfort for short duration tasks since these tasks are performed many times every day (Chiang, Baker, Milder, & Garg, 2010). There is also debate about appropriate postures for clinical procedures, for example, whether it is better to sit (Hutchins & Schneebeck, 2004), stand (Kirby, 2007) or alternate between sitting and standing (Anonymous, 2007) for refraction (using the phoropter).

The purpose of this chapter is to explore in greater depth why using the phoropter, slit lamp, direct ophthalmoscope and computer are associated with discomfort in Australian optometrists. This will be achieved by reporting data from observations of optometrists conducting an eye examination.

2. Methods

2.1 Overview

An online questionnaire was sent to Australian optometrists in 2008. Of the 416 questionnaire participants (25% response rate) 120 provided contact details to participate in future stages of the study. These optometrists were contacted by email or post and invited to participate in a 30 minute telephone or face-to-face interview, of which 60 agreed to participate.

At the conclusion of these interviews, participants were asked if they would be interested in participating in an observational stage of the project. Based on these responses and travel logistics, email invitations were sent to 19 optometrists in Sydney, Canberra, Melbourne, Adelaide and rural NSW, and 11 agreed to participate. Only 10 optometrists were observed as a mutually convenient time could not be scheduled with one optometrist.

2.2 Observations

Observation visits were conducted between March 2010 and September 2010 in the optometry practice where the participant regularly worked. Each visit took approximately one hour, during which the participant was asked to conduct an eye examination on the investigator (JL) in the manner they would for a routine patient, including recording information. The investigator's spectacle lens prescription was not disclosed to the participant before refraction.

Each eye examination was recorded with a video camera mounted on a tripod within the room. When necessary the camera was moved part way through the eye examination to enable better capture of postures. When room dimensions prevented video recording of both the eye examination and recording information, preference was given to filming the eye examination.

To facilitate filming, eye examinations were conducted with some room illumination, even if the participant usually worked in darkness. Photographs of the equipment, consultation room and some clinical tasks were photographed with a digital camera. Measurements of room dimensions and equipment range of adjustability were measured with a 6 metre metal tape measure. Weight of hand held equipment was determined from published equipment specifications or by weighing similar items owned by JL with a digital scale.

The video data was used to calculate how long participants used the phoropter, slit lamp and direct ophthalmoscope. It was also used to conduct postural analysis for all four tasks. Two observational tools were used for the analysis: Rapid Upper Limb Assessment Tool (RULA) and Rapid Entire Body Assessment Tool (REBA).

2.3.1 Observation tools

Rapid Upper Limb Assessment (RULA) (McAtamney & Corlett, 1993) and Rapid Entire Body Assessment (REBA) (Hignett & McAtamney, 2000) are observational tools which allow a quick screening of posture. Individual scores are determined for a range of parameters (see table 1) and then combined to give a final score. The final score indicates the relative risk of discomfort or injury; the greater the risk score, the more urgently action is required to minimise risk. Since a score is given for individual parameters (e.g. upper arm position) it is possible to identify which aspect of the posture is the greatest contributor to risk and then change this postural aspect to reduce the overall risk.

RULA was designed for investigating risk associated with upper limb postures (McAtamney & Corlett, 1993) and has been reported as predictive of physical discomfort in dentists (Rabiei, Shakiba, Shahreza, & Talebzadeh, 2012), computer users (McAtamney & Corlett, 1993), drivers (Massaccesi et al., 2003; Stedmon, 2007) and in manufacturing (Brodie & Wells, 1997). REBA is useful for analysing larger and more dynamic postural changes (Li & Buckle, 1999) and has been reported for assessing the postures of hospital workers (Janowitz et al., 2006). RULA was used for postural analysis of participants for all tasks analysed in this chapter. REBA was also used to assess the risk associated with direct ophthalmoscopy (see table 1).

Table 1. Comparison of RULA and REBA scoring

Tool	Parameters assessed	Score interpretation	Technique assessed
RULA	Upper and lower arm position Wrist position and twist Neck and trunk position Leg support and balance Muscle use Force/load	1 or 2 = acceptable 3 or 4 = investigate further 5 or 6 = investigate further and change soon 7 = investigate and change immediately	Phoropter Slit lamp Ophthalmoscopy Some aspects of computer use
REBA	Upper and lower arm position Wrist position and twist Neck and trunk position Leg support and balance Muscle use Force/load Grip position	1 = no action necessary 2-3 = action may be necessary 4 -7 = action necessary 8 - 10 = action necessary soon 11 - 15 = action necessary NOW	Ophthalmoscopy

3. Results

There were 10 participants in the on-site observations and they were located in Sydney (n=1), Canberra (n=1), rural NSW (n=1), Melbourne (n=4) and Adelaide (n=3). Discomfort was reported by 8 participants but due to privacy considerations this parameter is not categorised in the demographic data shown in table 2.

Table 2. Demographics of participants in onsite observations

Demographics		**TOTAL**
	TOTAL	10
Gender	Male	5
	Female	5
Years practicing as optometrist	<15	3
	15+	7
Employment status	Self- employed	7
	Not self employed	3
Practice mode	Independent	9
	Not independent	1
Practice location	Rural	1
	Urban	9

3.1 Optometry practices and equipment

Consultation room sizes varied between 2.4m x 3.0m (smallest) and 3.6m x 3.9m (largest). All practices had a chair and stand for the patient to sit during the consultation and on which equipment is mounted to facilitate ease of use e.g. the phoropter is attached to an arm which swings into place in front of the patient's face, the slit lamp is mounted on a table which can be moved into position when required (see figures 1 and 2).

There were variations in the adjustability between different brands and models of chairs and stands observed in this study (see table 3). Although one participant reported that she had specifically chosen a chair and stand which was small to match her small stature, others, particularly employee participants, were required to work with the equipment supplied in their room.

There were also variations in the amount of space around the patient chair. Three chair and stand models were an open-design and allowed the participant sufficient room to sit or stand on either side of the patient (and example is shown in figure 1). The other 7 models observed had limited space for the participant to sit or stand (an example is shown in figure 2).

Table 3. Range of adjustability of equipment observed in this study

Equipment	Parameter	
Patient chair – height of seat above floor	Minimum height observed	45cm
	Maximum height observed	94cm
	Smallest range of height observed	55-69cm
	Largest range of height observed	52-92cm
Slit lamp – height of oculars (eyepieces) above floor	Minimum height observed	116cm
	Maximum height observed	165cm
	Smallest range of height observed*	129-131cm
	Largest range of height observed	116-165cm
	Number of slit lamps mounted on fixed height tables	8

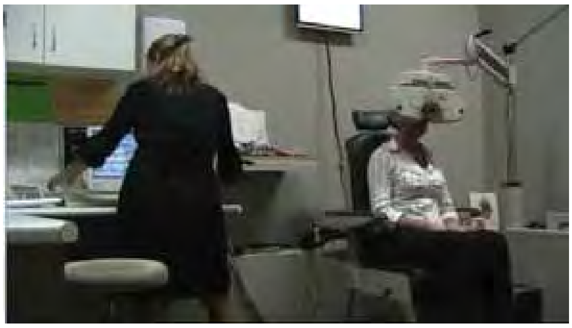
* This slit lamp was mounted on a fixed height table. The height range was achieved by adjusting the height of the oculars

Figure 1. Open design chair. There is adequate standing space for the optometrist as the equipment table is on a movable arm.

Figure 2. Chair and stand with limited standing space on the left hand side of the patient due to the location and design of the equipment table

One practice had fully computerised testing equipment and record keeping software while another did not have any computers or computerised equipment in the consultation room. The other 8 practices had integrated computers in the consultation room to various degrees e.g. computers for specific clinical tasks (e.g. digital retinal imaging), for recording patient contact details and final spectacle lens prescription, or for recording all examination results. The majority of practitioners used a manual phoropter (n=9). One participant used an electronic phoropter which was operated by a computerised control panel located on a workstation parallel to the patient chair (see figure 3).

Figure 3. Electronic phoropter



3.2 Using the phoropter

There were 10 observation participants (n=8 with self-reported discomfort, n=4 with discomfort associated with phoropter use). Since operating an electronic phoropter is essentially using a computer, only the data from the 9 participants who used a mechanical phoropter are presented here.

The time spent using the phoropter ranged from 150 seconds to 571 seconds (mean time = 316 seconds). This variation can be attributed to the variety of techniques used to determine a final prescription, e.g., some participants only used the phoropter for distance refraction and then refined the prescription and conducted binocular tests in free space, while other participants used the phoropter for all distance, near and binocular tests.

There were five different combinations of postures comprising the following variables:

- Sit or stand
- Torso facing patient or torso parallel with patient
- Work bilaterally (i.e. stand on the patients right side when refracting the right eye and the left side when refracting the left eye) or unilaterally (i.e. always stand on the right hand side of the patient)

The three participants who worked bilaterally had open-design chair and stands. Five participants who worked unilaterally on the right hand side of the patient did so because of limited standing room on the left hand side where equipment was mounted. One participant who worked unilaterally on the right hand side of the patient did so because of poor vision in her left eye (this enabled her to see the patient and the equipment without an excessive head turn).

RULA scores were calculated for each participant for each of three conditions: refracting right eye, refracting left eye and binocular refraction (see table 4). Calculations were only completed for distance refraction as not all participants conducted near tests with the phoropter.

The scores were lowest (and the inherent risk least) when the participant:

- Stood with their torso facing the patient
- Worked bilaterally.

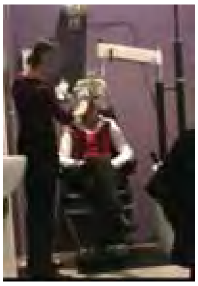
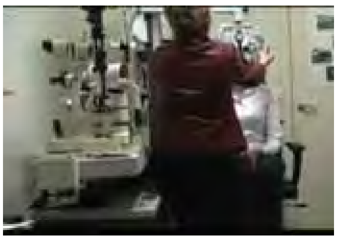
The scores were larger and the inherent risk greater when the participant:

- Stood or sat with their torso parallel to the patient and twisted their neck and torso
- Worked unilaterally and had their arm abducted for longer periods.

In general, participants reported discomfort with refraction when the RULA score exceeded 5. There were two exceptions:

- One participant stood with their torso facing the patient and worked bilaterally (RULA = 3-4). She reported arm discomfort with refraction but said the discomfort was caused by other clinical procedures.
- One participant who worked unilaterally sat with torso parallel to patient for distance refraction (RULA = 6-7) but stood with torso facing patient for near refraction. He did not report any discomfort with refraction.

Table 4. Using the phoropter: posture, reported discomfort and RULA score

Posture	Participant, reported discomfort	RULA score		
		Right eye refraction	Left eye refraction	Binocular refraction
Stand with torso facing patient, work bilaterally	 Arm discomfort	3	3	4
	 No discomfort	3	3	4
	 No discomfort	3	3	4
Stand with torso facing patient, work unilaterally	 No discomfort	3	4	4
Stand with torso parallel to patient, work unilaterally	 Neck and shoulder discomfort	4	5	5

Posture	Participant, reported discomfort	RULA score		
		Right eye refraction	Left eye refraction	Binocular refraction
Sit with torso facing patient, work unilaterally	 No discomfort	4	4	4
Sit with torso parallel to patient, work unilaterally	 Neck, shoulder and upper back discomfort	6	6	7
	 Lower back discomfort	6	6	7
	 No discomfort (sat for distance tests, stood for near tests)	6	6	7

3.3 Slit Lamp

Most participants sat on a chair while using the slit lamp (n=8). Of those who stood, one participant used a slit lamp mounted on a fixed height table and their eye height was approximately level with the height of the oculars (eye pieces). The other participant adjusted the height of the slit lamp table so that the oculars were level with their eye height. Of the seated participants, 2 had back support on their chair but did not use it. Instead, they leant forward to view through the oculars.

All participants completed a general slit lamp examination (i.e. examination of the external eye) and spent between 40 seconds and 93 seconds (mean = 68 seconds) on this task. Five participants completed slit lamp fundoscopy (i.e. examination of the retina with a fundoscopy lens weighing approximately 14g). The mean time for this procedure was 40 seconds (right eye) and 43 seconds (left eye).

Subjects who conducted both a general slit lamp examination and slit lamp fundoscopy adopted a similar head, neck and torso posture for both procedures. Upper arm posture for slit lamp fundoscopy varied between subjects (see table 5):

- Elbow support on the slit lamp table (n=3)[1]
- Weight of the arm supported by holding onto the patient headrest with fingers (n=3)
- Lens held in free space without arm support (n=1).

One participant used an elbow support when examining the patient's left eye and held onto the patient headrest with his fingers when examining the patient's right eye.

Table 5 shows that the risk of discomfort with slit lamp fundoscopy is increased by leaning the trunk forward and having the neck in extension (RULA score =5). There was no difference in RULA scores between elbow support and hand supported postures (RULA = 3) even though the participant using the hand support posture had a flexed wrist.

The participant who reported neck, shoulder and upper back discomfort, despite a low RULA score of 3, also reported discomfort when using the phoropter and ophthalmoscope.

[1] Only 2 observations and calculations are shown in Table 5 as the angle of the video camera for one subject did not enable analysis of the posture.

Table 5. Slit lamp fundoscopy: posture, reported discomfort and RULA score

Posture	Participant, reported discomfort	RULA score
Sitting Elbow support	 Neck, shoulder and upper back discomfort	3
Sitting Elbow support	 No discomfort	3
Sitting Hand support	 No discomfort	3
Sitting Hand support	 No discomfort	5

Posture	Participant, reported discomfort	RULA score
Standing Hand support	 No discomfort	5
Sitting No support	 Lower back discomfort	5

3.4 Ophthalmoscopy

Optometrists need to bend and twist their torso when conducting ophthalmoscopy to obtain a view inside the patient's eye. One participant commented:

> *"When I see students, I always say to them 'Don't worry if you find direct ophthalmoscopy uncomfortable. It is not necessarily meant to be nice for you to do. (You put up with discomfort to) get a good view'."*

A good view and personal comfort can be hindered by the chair and stand. For example, one participant demonstrated (see table 6) how he needed to support his weight on the chair and stand while he leaned over the patient:

> *"I can spin them. I get them to turn their body a little bit but mostly I just find it easier to hold on…it actually works fine when I hold onto the post. (The discomfort was worse) when I didn't think of that in the beginning. It is not the best, this room."*

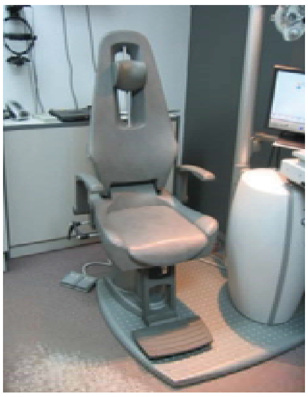
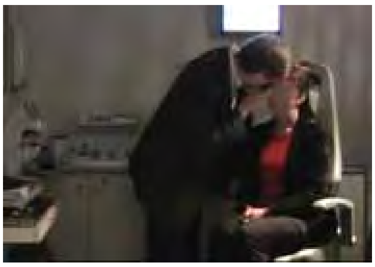
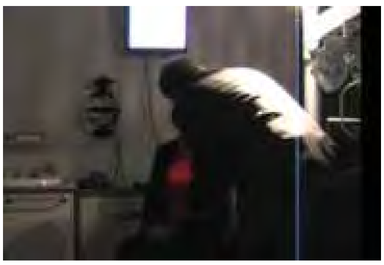
Two participants rotated the patient chair to examine the patient's left eye (an example is given in table 6). However, rotating the chair while the patient is sitting in the chair introduces other risks, particularly if the patient is heavy.

Of the 7 participants who conducted opthalmoscopy, 5 used a direct ophthalmoscope (approximate weight = 350g), one used a pan-optic ophthalmoscope (approximate weight = 520g) and one used a Riechart monocular indirect ophthalmoscope (approximate weight = 440g). The mean time spent examining the right eye was 34 seconds and the left eye 25 seconds.

Risk scores calculated with the observational tools RULA and REBA indicate that change is required to lessen the risk of injury and discomfort (score of 6 and 8 respectively). This high score can be attributed to the twisting and side bending postures of the neck and trunk.

Strategies which observation participants have implemented to decrease the risk associated with ophthalmoscopy include performing alternative techniques such as slit lamp fundoscopy (n=3) and digital retinal imaging (n=1).

Table 6. Ophthalmoscopy

Chair and Stand	Ophthalmoscopy technique	Comments
		The chair and stand design provides adequate space for the participant to stand on either side of the patient.
	 	Inadequate space on the left hand side of the patient means the participant needs to support himself on the chair and stand post while examining the patients left eye.
	 	The participant has rotated the patient chair so that he has sufficient space to stand when examining the patients left eye.

3.5 Using the computer

There were 9 practices with computerised technology in the consultation room. Two participants who did not report work-related discomfort described how they specifically designed their practices to accommodate computers. One practice which uses a computer for record keeping and for operating an electronic phoropter, has the computer terminal located parallel to the patient chair (see figure 4). The other practice which only uses a computer for record keeping has the patient seated next to the optometrist's desk during the patient history phase of the consultation (see figure 5).

Figure 4. The computer workstation is parallel to the patient chair

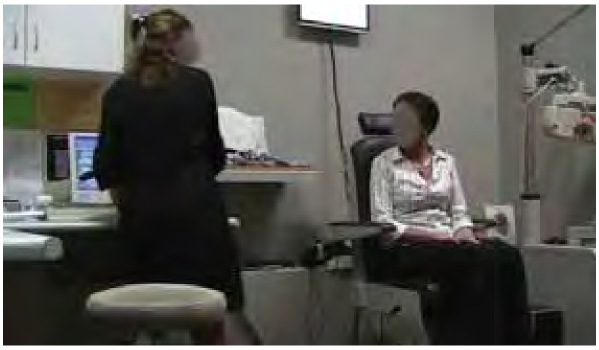


Figure 5. The patient is seated next to the computer workstation

Many practices had computerised technology installed onto furniture not originally designed for computer use. The most extreme example was an overcrowded consultation room where the optometrist stood on the patient chair to access the printer and reached behind the patient chair to use the keyboard and mouse (see figure 6). There were also manual handling issues as the optometrist was required to wheel computerised equipment mounted on tables into place in front of the patient as required. Although this participant did not report discomfort, working in this manner can affect safety, comfort and efficiency.

One participant tried to minimise twisting by positioning his computer at an oblique angle on the workstation (see figure 7). In another practice the participant adopted a flexed posture to the right when using the computer mouse and keyboard. Raising the table by placing it on top of a 16cm high platform enabled the participant to adopt a more neutral posture (see figure 8). This reduced the RULA score from 6 to 4.

Figure 6. Space was at a premium in this practice.

The computer keyboard and monitor was located behind the patient chair. The printer could only be accessed by standing on the patient chair.

A digital retinal camera and a visual field machine were mounted on tables which were wheeled into position in front of the patient when required.

Figure 7. A computer set up on a desk originally used for handwriting on record cards

Figure 8. Raising the table height reduced a sideways bend to use the computer mouse

4. Discussion

Sustained and awkward postures were observed in this study when participants used the phoropter, slit lamp, ophthalmoscope and computer. Although awkward and sustained postures are intrinsic to some clinical tasks e.g. holding the slit lamp fundoscopy lens, bending and twisting for ophthalmoscopy, awkward postures were sometimes exacerbated by inadequate space and inability to adjust equipment. This indicates that equipment design may play a role in solving work-related discomfort issues.

Technology and computerised equipment were used to various degrees within the observed consultation rooms. New technology is embraced by the optometry profession, as evidenced by the publication "Ophthalmic Equipment" published annually by the Optometrists Association Australia (Optometrists Association Australia). Technology can potentially eliminate some forms of discomfort. For example, digital retinal imaging and slit lamp fundoscopy are used by some optometrists as an alternative to direct ophthalmoscopy. On the other hand, technology may introduce different risks for users e.g. back discomfort with ophthalmoscopy might be replaced with shoulder discomfort associated with slit lamp fundoscopy. There is a need for heightened awareness within the optometry profession of the implications for installing new technology for comfort, safety and efficiency.

Optometry tasks are relatively low risk compared to other industries such as manufacturing and construction. This is highlighted when a different observation tool, Manual Task Risk Assessment (ManTRA) (Burgess-Limerick, 2008) is used to assess the tasks described in this paper. Like RULA and REBA, ManTRA assigns a risk score whereby the higher the score the more urgent a required intervention. Unlike RULA and REBA, ManTRa considers all risk components itemised in the Hazardous Manual Tasks Code of Practice (Safe Work Australia, 2011), not just posture. Optometry clinical tasks assessed with ManTRA returned very low scores with small differences in scores between postures. These low scores can be explained by the fact that optometrists are generally not exposed to vibration, high forces or high levels of exertion within the optometry consultation room, which are all scoring components of the ManTRA tool.

RULA and REBA were chosen as tools in this study because optometrists predominantly report upper body discomfort in the consultation room. RULA has been criticised as only useful for identifying high risk postures (Fountain, 2003). It is not known whether this is the reason for negligible differences in the scores for various slit lamp fundoscopy and refraction postures. For example, there are two postures demonstrated in table 5 for slit lamp fundoscopy which return the same RULA score of 3: sitting with elbow support and sitting with hand support. In the photo demonstrating hand support the participant's wrist is flexed backwards when holding the lens, whereas in the photo demonstrating elbow support the participant's wrist is in a neutral posture: one would expect the flexed wrist posture to return a higher score but it is the same as the score as that for the neutral posture. Therefore, the question "which posture is better?" might be better answered by using more sensitive test methods such as biomechanical analysis or electromyography.

There was a perception among some participants that risks in the consultation room are small because they are only performed for short durations. This perception is substantiated to a certain extent by RULA which assigns a higher score for postures with durations greater than one minute. It is possible that occupations like optometry require a new or different tool which combines the scores of multiple tasks and provides a global job score. This requires further investigation.

4.1 Limitations

There was response bias in that participants chose to participate: the participants might not represent all optometrists and their practices might not represent the diversity of equipment and room arrangements within Australia.

Although the video data were useful, sometimes analysis was hampered by participants obscuring their posture with their own body or moving chairs and equipment during the consultation. These types of errors are well documented (Bao, Howard, Spielhoz, & Silverstein, 2007; Corlett, 1995; Li & Buckle, 1999) and could have been minimised by using multiple video cameras or having another person in the room operating the video camera. The postural analysis could have been further improved by attaching body surface markers to the participants or using 3-dimensional motion analysis. The minimally invasive approach used in this project was adopted so that the participants were more likely to ignore the video camera and conduct the eye examination with their usual postures and techniques.

Standardisation was attempted by asking each of the participants to conduct an eye examination on one person (the investigator) who has healthy eyes and a simple spectacle prescription. Standardisation was not wholly achieved because each participant conducted the eye examination in a different way. It is also likely that RULA scores calculated in this project will vary between different eye examinations as the length of time performing procedures and the postures adopted will depend on patient complexity and patient physique. If future observation projects are conducted then it would be best to:

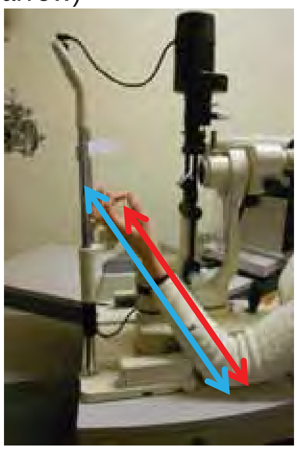
- nominate clinical tasks to enable comparison of postures between participants and
- ask participants to examine multiple patients who have different physiques and clinical complexity.

5. Conclusion / Recommendations

Specific postural advice can be given to optometrists to reduce their risk of work-related discomfort (see table 7). There is a need for greater awareness among optometrists about the impact of equipment design on comfort. For example, the findings of this study indicate that it is best to use a chair and stand which allows the patient chair to be adjusted over a large height range and which has an open design that allows the optometrist to work bilaterally.

Guidance (e.g. illustrations of good and bad practice design and equipment placement) should also be given to the optometry profession, shop fitters, practice designers and equipment suppliers to ensure that consultation rooms are designed to accommodate new technology.

Table 7. Postural recommendations for reducing discomfort

Task	Recommendation
Using the phoropter	• Face the patient so that your torso and neck are not twisted. • Sit or stand close to the patient so that your arms are not extended. • Lower the height of the phoropter so that your arms are not raised. • Work bilaterally.
Using the slit lamp	• Adjust the table or chair height so that your torso is upright and your neck is not in extension (i.e. don't lean forward). • Use an elbow support. For example, Alimed ulnar gel pad http://www.alimed.com/alimed-ulnar-gel-pads-and-hand-rest-gel-sleeves.html  Photograph used with permission, Alimed® This product is stackable. The correct height would need to be determined by calculating the difference in distance of o the length from your elbow to your finger/thumb grip (red arrow) and o the distance from the table to the canthus mark on the slit lamp headrest (blue arrow)  • Use a steady mount clip for holding the fundoscopy lens in place. For example, http://volk.com/catalog/index.php?cPath=34
Using the ophthalmoscope	• Raise the patient chair height. • Ensure adequate space to work bilaterally e.g. rotate the patient chair.

Task	Recommendation
Using computerised equipment	• Arrange the consultation room to minimise twisting between the computer and the patient • Use furniture which allows a neutral working posture e.g. o If the keyboard and mouse are used while standing then install a desk which is higher. o Ensure that there is sufficient space on the desk surface to work comfortably. • Consider the use of alternative technology e.g. tablet devices, which allow data entry while standing/sitting next to the patient during the examination. • Minimise pushing/pulling heavy equipment mounted on tables with wheels. Where possible, install computerised testing equipment such as visual field machines and digital retinal cameras on fixed tables (i.e. the patient needs to walk to the device) or on equipment tables attached to the chair and stand.

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Chapter 6: It's not just physical: Psychosocial factors contributing to work-related discomfort

Work-related discomfort is a physical experience: muscles hurt, joints ache and movement may be limited. It is therefore logical to associate work-related discomfort with physical factors such as lifting, bending and abnormal postures during the working day. These associations are supported in the scientific literature and documented as known hazards in work health safety legislation and in guidelines.

Physical factors in the work environment only tell part of the story. Other contributing factors to work-related discomfort include job demands (e.g. working hours), psychosocial factors (e.g. job satisfaction, control over the work environment, interpersonal relationships) and personal factors (e.g. stress and coping strategies, motivation).

There were 2 psychosocial aspects investigated in this project: control of the work environment and job satisfaction. Data related to control of the work environment were included in the discussion about responsibility for discomfort (chapter 4). This current chapter presents the interview data related to job satisfaction.

Optometry can be a very insular career. Optometrists are typically confined to their consultation room for long hours and may only have limited interaction with colleagues, particularly if they are self-employed. The job satisfaction questions which were asked in the interviews took many participants by surprise, but once recovered, the participants were generally very keen to share and discuss their opinions.

Unfortunately, it was not possible to establish a relationship between work-related discomfort and job satisfaction with the results of these open ended interview questions. Nevertheless the results do provide a basis for developing tools for investigating job satisfaction in the optometry profession.

"What do clinical optometrists like about their job?" was accepted for publication in *Clinical and Experimental Optometry* on the 11th October 2012 and is reproduced with the kind permission of Wiley publishers.

What do clinical optometrists like about their job?

Jennifer Long, Robin Burgess-Limerick, Fiona Stapleton

Submitted to Clinical and Experimental Optometry 21st June 2012

Accepted for publication: 11th October 2012

Background: There are few publications describing what optometrists like about clinical work. The purpose of this paper is to explore what clinical optometrists find satisfying with their work and what they find stressful.

Methods: 60 Australian optometrists participated in a 30 minute semi-structured telephone or face-to-face interview during the period August 2009 – March 2010. The interviews covered a range of topics related to ergonomics and physical comfort, including three questions related to satisfaction with clinical optometry, job satisfaction and self-perceived work-stress. These data were subject to qualitative and quantitative analysis.

Results: Participants reported that they liked clinical optometry because of work-related factors (e.g. clinical challenge) (n=47, 78%), people-related factors (e.g. helping people) (n=29, 48%) and relationships with patients (n=28, 47%). Clinical freedom was the most frequently cited reason for participants liking their current job (n=18, 30%). Self-employed participants were more likely to value relationships with their patients (Chi-square, $p<0.01$). Employee and locum participants were more likely to value relationships with staff (Chi-square, $p<0.05$) and colleagues (Chi-square, $p<0.05$). There were 32 participants (53%) who perceived their work as stressful, most commonly related to clinical issues (n=25, 42%), workload demands (n=20, 33%) and management tasks (n=15, 25%). Clinical issues were a stressor for employee and locum participants (Chi-square, $p<0.01$) and urban practitioners (Chi-square, $p<0.05$). Management tasks were a stressor for independently practicing participants (Chi-square, $p<0.01$).

Conclusion: Understanding what clinical optometrists like and find stressful about their work is important for employers, industry and the profession as these are key elements of employment satisfaction. The information presented in this paper can be used as a basis for developing quantitative tools for assessing job satisfaction and job stress more extensively in the optometry profession.

Keywords: Job satisfaction, stress, clinical optometry, business

Creating a working environment in which employees are happy is important for staff retention and productivity (Brown et al., 2001; Chakman, 2008; Moss, 2000, 2001; Woodruff, 2002). Satisfying work is also important for attracting and retaining individuals within careers and professions (Joyce & McNeil, 2006; van Saane, Sluiter, Verbeek, & Frings-Dresen, 2003; Williams et al., 2001).

A common definition of job satisfaction is a match between existing job conditions, individual values and expectations or professional norms, e.g. an expectation of working conditions based on prior experience or an expectation of conditions which are deemed necessary for good professional practice (Brown, et al., 2001; Faragher, Cass, & Cooper, 2005; Lichtenstein, 1984; Lu, While, & Barriball, 2005). Variations on this definition include the concept that job satisfaction is a positive reaction to a job or to elements of a job (Brown, et al., 2001; Faragher, et al., 2005) or a match between personal needs and job rewards (Scarpello & Campbell, 1983). Others propose that job satisfaction occurs when there is a match between work elements (e.g. autonomy, recognition for contribution) and the importance of these elements to the individual (Dul & Ceylan, 2011). Job satisfaction is not necessarily the opposite to job dissatisfaction (Lu, et al., 2005) yet it may be inversely related to job stress (Williams, et al., 2001).

Measurement tools to assess job satisfaction are usually developed for use within specific occupational groups (e.g. manufacturing industry workers (Warr, Cook, & Wall, 1979), physicians (Konrad et al., 1999; Lichtenstein, 1984)) which may limit the validity of their use within other occupations (Lichtenstein, 1984). The multifaceted nature of job satisfaction also means that a combination of tools may be required, as demonstrated in investigations of job satisfaction and job stress in general practitioners (Cooper, Rout, & Faragher, 1989) and physical and mental health in Swedish healthcare workers (Peterson et al., 2008). There is also conjecture whether a tool which measures satisfaction with individual aspects of a job will also predict overall satisfaction with a job (Roelen, Koopmans, & Groothoff, 2008; Wanous, Reichers, & Hudy, 1997).

The first step in attempting to understand job satisfaction within an occupational group is to generate an inventory of potential factors important and relevant to the group. This can be achieved by retrospective means, such as reviewing the scientific literature, or by active means, such as running focus groups and interviews. Once these factors are established, then it is possible to construct and trial tools, such as questionnaires, which can be widely distributed within the occupational group (Cooper, et al., 1989; Eker, Tuzun, Daskapan, & Surenkok, 2004; Konrad, et al., 1999).

Although there are publications discussing job satisfaction within optometry (Chakman, 2008; Keane, Smith, Lincoln, & Fisher, 2011; Moss, 2000, 2001; Voorhees et al., 1997) there does not appear to be any systematic analysis of the issue nor any published measurement tools specifically for the optometry profession. It is possible to infer what are the potential factors by reviewing reports written for other healthcare professions such as nursing (Finn, 2001; Lu, et al., 2005), medicine (Cooper, et al., 1989; Konrad, et al., 1999; Lichtenstein, 1984; Ulmer & Harris, 2002; Walker & Pirotta, 2007), physiotherapy (Eker, et al., 2004) or veterinary science (Scuffham, Legg, Firth, & Stevenson, 2010) but these factors might not be directly applicable to optometry due to differences in job tasks and working environments or differences in the personalities and motivations of those working in other vocations.

The purpose of this paper is to report qualitative data generated from interviews with Australian optometrists. The data identifies factors contributing to job satisfaction and job stress in clinical optometrists. The data were collected during interviews investigating work-related discomfort within the optometry profession. Job satisfaction and job stress were explored in these interviews because there are established associations between these factors and physical discomfort (Leka & Jain, 2010; Macdonald, 2004).

Methods

An online questionnaire on the topic of work-related discomfort was distributed to Australian optometrists in 2008 and achieved a participation rate of 25% (n=416 optometrists)(J. Long et al., 2011; J. Long et al., 2012). Of these participants, 120 provided contact details for participation in future investigations. These participants were contacted either by email or post and invited to participate in a telephone or face-to-face interview.

There were 60 optometrists who positively responded to an invitation to participate. All were interviewed. Participants included self-employed, employee, locum and retired optometrists. Participants were located in every state and territory of Australia except for the Northern Territory. This study was approved by the Human Research Ethics Advisory Panel of the University of New South Wales and informed consent was given by all participants.

The interviews were conducted in a conversational style and followed a schedule of questions. Except when clarification of a response was required, the questions were read to the participants without any further prompts. The questions covered a range of topics related to ergonomics and physical comfort and were divided into four sections: demographic information, job satisfaction, description of discomfort and ergonomics. Each interview generally took 30 minutes to complete, was digitally recorded and later transcribed for analysis. Two participants requested a hard copy of the questions to complete in their own time and one participant requested that the interview not be recorded. This paper reports the results of a subset of the interviews: three open-ended questions related to job satisfaction and perceived job stress (see table 1).

Analysis

Participants were categorised by demographics (gender, employment status, years in practice, practice location and practice mode) and self-reported discomfort versus no discomfort. The analysis methods used for each question are given in table 1. Responses to the interview questions were initially coded into themes by JL. The themes generated were similar to those reported for other health care practitioners e.g. dentists (Palliser, Firth, Feyer, & Paulin, 2005) and general practitioners (McGrail, Humphreys, Scott, Joyce, & Kalb, 2010; Ulmer & Harris, 2002; Walker & Pirotta, 2007) but showed the greatest similarity to the job satisfaction factors nominated by Konrad et al for physicians (Konrad, et al., 1999) (see table 2). The data was then re-coded by JL using Konrad's categorisation 6 months after the initial coding and the two sets of data were checked for consistency. A random audit of the coding was also conducted.

Table 1. Interview questions and how the results were analysed

Interview questions	Analysis method
Job satisfaction	
1. What do you like about working as an optometrist in clinical practice?	Thematic analysis based on categories nominated by Konrad et al for physicians.(Konrad, et al., 1999) Frequencies recorded for each category.
2. What do you like about your job where you currently work?	Thematic analysis based on categories nominated by Konrad et al for physicians.(Konrad, et al., 1999) Frequencies recorded for each category.
Perceived job stress	
3. In general, how stressful do you find your work as an optometrist? Why? Why not?	Binary outcome measure, where "not stressful" = 0 and "any stress" = 1. Chi-squared analysis of the results. Statistical significance was set at p = 0.05. Thematic analysis. Frequencies recorded for each category.

Table 2. Thematic categories used in pilot survey of job satisfaction in physicians (Konrad, et al., 1999)

Category	**Examples**	**Relevance to optometry**
Autonomy	Ability to set pace of own work Able to exercise clinical judgement	Yes
Relationships with colleagues	Respect by others in the medical community Opportunities to communicate with colleagues	Yes
Relationships with patients	Patient demands Ability to develop good patient relationships	Yes
Relationships with staff	Support and teamwork within the workplace Get along with other staff members	Yes
Personal time	Ability to take time off from work Work-life balance	Yes
Intrinsic	Clinical work is personally rewarding / provides intellectual stimulation Ability to make a difference in patient's lives	Divide into two categories: intrinsic (work) and intrinsic (people)
Community	Sense of belonging in the community where practices Opportunities within the community	Yes
Pay	Financial remuneration is adequate Financial security	Yes
Administration	Managing business aspects of the practice Supervising other staff	Yes
Resources	Adequate office space / equipment Support staff within the practice	Yes
Global job	Overall satisfaction with job Job meets expectations	Yes
Global Speciality	Chosen speciality has met personal expectations Would recommend this speciality to others	No
Global Career	Career has measured up to expectations Would recommend this career to others	Yes

Results

The demographics of the 60 optometrists who participated in the interviews are given in table 3. The proportion of participants who were female (57%) and aged at least 41 years (58%) is greater than that estimated for the Australian optometric workforce in 2009 (45% female (Kiely, Horton, & Chakman, 2010), 50% aged at least 40 years (Kiely, et al., 2010)). The number of self-employed participants (50%) is less than that estimated for the Australian optometric workforce in 2005(Horton, Kiely, & Chakman, 2006) (54%). However, Horton et al noted that there was a 5% decrease in self-employment over the period 1995-2005, so the proportion of self-employed participants in this study population is consistent with this trend.

Job satisfaction

What optometrists like about working as an optometrist in clinical practice

The most frequently cited reasons for liking work as a clinical optometrist were "I like talking to patients", "I like solving problems" and "I like helping people" (see table 3). Konrad et al (Konrad, et al., 1999) use one category, "intrinsic", to encompass factors related to solving clinical problems and helping people. However, these emerged as strong themes in these interviews so were subdivided into "intrinsic (job)" and "intrinsic (people)". When divided in this way, the dominant theme for liking clinical optometry work was intrinsic job factors such as "the work is challenging" and "I like solving problems". Conversely, pay and working conditions (e.g. ability to take time off work) were not mentioned as frequently so these were combined into one category "job conditions".

Chi-square analysis did not show any significant interactions between demographic factors and whether a factor was cited by a participant. Three participants (5%, n = 2 female, n = 3 in practice more than 15 years, 3 with self-reported discomfort) reported that they do not like their work as an optometrist.

What optometrists like about the job where they currently work

The most frequently cited reasons for liking the job where they currently work were "clinical freedom", "liking the patients" and the practice structure (i.e. whether the practice was consulting only or a consulting and dispensing practice) (see table 4). The predominant theme for liking the job where they currently work was global job factors (e.g. practice structure, practice philosophy). Self-employed participants were more likely to cite factors associated with relationships with patients (Chi-square, $p < 0.01$), whereas employee and locum participants (combined) were more likely to cite relationships with staff (Chi-square, $p < 0.05$) and relationships with colleagues (Chi-square, $p < 0.05$) as important factors for liking their current job. Non-independent practitioners were more likely to cite relationships with colleagues as an important factor for liking their current job (Fisher exact test, $p < 0.05$).

Perceived job stress

Do you find your work stressful as an optometrist? Why / why not?

There were 32 participants (53%) who perceived their work as an optometrist as stressful. Chi-square analysis did not reveal any associations between perception of stress and demographic factors (see table 5).

The most frequently cited factors associated with stress were clinical issues (e.g. complex patients), workload demands and management tasks (see table 5). Keeping to the appointment schedule was the most frequently cited stressor (n=20, 33%). Clinical issues were cited more frequently as stressors for employee and locum participants (Chi-square, $p < 0.01$) and participants practicing in urban areas (Chi-square, $p < 0.05$). Management tasks were more likely to be cited as stressors by independently practicing participants (Chi-square, $p < 0.01$). Other reasons cited for stress include unsuitability or unavailability of equipment and furniture (n=5), relationships with colleagues (e.g. don't like other staff members) (n=3) and dealing with customer enquiries and complaints (n=2).

Table 3. Number of optometrists who cited reasons for liking clinical optometry work (participants may have cited more than one factor)

			Number of optometrists who cited reasons for liking clinical optometry work							
			Intrinsic (job)		Intrinsic (people)		Relationships with patients		Job conditions	
Demographics		**N**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
	TOTAL	60	47	13	29	31	28	32	11	49
Gender	Male	26	21	5	13	13	10	16	5	21
	Female	34	26	8	16	18	18	16	6	28
Report Discomfort	Yes	47	38	9	23	24	20	27	9	38
	No	13	9	4	6	7	8	5	2	11
Years practicing as optometrist	<15	19	15	4	12	4	10	9	5	14
	15+	41	32	9	17	9	18	23	6	35
Employment status	Self- employed	30	21	9	13	17	13	17	6	24
	Not self employed	30	26	4	16	14	15	15	5	25
Practice mode	Independent	40	33	7	18	22	16	24	6	34
	Non-independent	20	14	6	11	9	12	8	5	15
Practice location	Rural	14	33	11	23	21	19	25	6	38
	Urban	44	12	2	6	8	7	7	5	9
	Both	2	0	2	0	2	0	2	0	2
Examples of reasons			I like solving problems (n= 23) The job is challenge/interesting (n= 19) I like the medical aspects (n= 16) There is variety within the job (n= 14) I don't often have to deliver bad news (n =2)		I like helping people (n =20) I feel that I make a difference (n = 17)		I like talking with patients (n= 23) I like / know my patients (n = 9)		Working conditions (n = 8) Pay (n = 5)	

Table 4. Demographic factors and factors cited for liking the job where the participant currently works (participants may have cited more than one factor)

Demographics		Total	Global Job		Intrinsic Job		Autonomy		Relationships with patients		Relationship with staff		Job conditions		Relationship with colleagues	
		N	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	TOTAL	60	29	31	24	36	22	38	17	43	14	46	13	47	11	49
Gender	Male	26	12	14	8	18	11	15	9	17	4	22	6	20	4	22
	Female	34	17	17	16	18	11	23	8	26	10	24	7	27	7	27
Report Discomfort	Yes	47	21	26	19	28	15	32	16	31	12	35	10	37	8	39
	No	13	8	5	5	8	7	6	1	12	2	11	3	10	3	10
Years practicing as optometrist	<15	19	11	8	6	13	8	11	3	16	6	13	7	12	5	14
	15+	41	18	23	18	23	14	27	14	27	8	33	6	35	6	35
Employment status	Self- employed	30	12	18	11	19	13	17	13**	17	3*	27	5	25	2*	28
	Not self employed	30	17	13	13	17	9	21	4	26	11	19	8	22	9	21
Practice mode	Independent	40	19	21	17	23	17	23	13	27	9	31	8	32	4*	36
	Not independent	20	10	10	7	13	5	15	4	16	5	15	5	15	7	13
Practice location	Rural	14	6	8	3	11	8	6	3	11	2	12	1	13	4	10
	Urban	44	23	21	19	25	14	30	14	30	12	32	11	33	23	21
	Both	2	0	2	1	0	0	2	0	2	0	2	0	2	0	2
Examples of reasons			Practice structure (n= 13) Work support structures (n = 7) Quiet / not stressful (n = 7) Practice philosophy (n= 4) Fun to go to work (n = 3) Service given at practice (n = 2)		Variety within job (n = 11) Clinical challenge (n = 8) Help patients, solve problems, make a difference (n = 7) Can follow up patients (n = 2) Work with people (n = 1) Likes business aspects (n = 1)		Clinical freedom (n = 18) Autonomy (n = 8)		Likes the patients, interested in the patients (n = 15) Likes the community (n = 4)		Likes the staff who work there (n = 10) Likes the employer (n = 3) Friendliness within the practice (n = 2) The staff understand how I work (n = 1)		Flexibility of work hours (n = 9) Close to home (n = 4) Pay (n = 2)		Respect from the colleagues I work with (n = 6) Learn from others in the practice (n = 5) Work with other people (n = 3) Respect from doctors and ophthalmologists (n = 2)	

* $p < 0.05$ ** $p < 0.01$

Table 5. Demographic factors and factors cited for stress (participants may have cited more than one factor)

Demographics		**Total**	**Do you find your work as an optometrist stressful?**		**Factors cited for stress**					
					Clinical issues		**Workload issues**		**Management**	
		N	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
	TOTAL	60	32	28	25	35	20	40	15	45
Gender	Male	26	12	14	11	15	6	20	6	20
	Female	34	20	14	14	20	14	20	9	25
Report Discomfort	Yes	47	24	23	21	26	17	30	12	35
	No	13	8	5	4	9	3	10	3	10
Years practicing as optometrist	<15	19	7	12	7	12	6	13	3	16
	15+	41	25	16	18	23	14	27	12	29
Employment status	Self- employed	30	13	17	7**	23	7	23	10	20
	Not self employed	30	19	11	18	12	13	17	5	25
Practice mode	Independent	40	21	19	15	25	14	26	15**	25
	Not independent	20	11	9	10	10	6	14	0	20
Practice location	Rural	14	7	7	2*	12	2	12	6	8
	Urban	44	24	20	22	22	18	26	8	26
	Both	2	1	1	1	1	0	2	1	1
Examples of reasons					Complexity of patient problems (n= 11) Patient expectations (n= 6) Patient anxiety/personality (n = 5) Accuracy of diagnosis (n = 4) Job isn't fun anymore (n = 3)		Meeting deadlines / running to time (n = 20)		Administrative tasks (n = 9) Management of staff (n = 4)	

*p < 0.05 **p < 0.01

Discussion

The principle reasons given by participants for liking clinical optometry work are the opportunity for clinical challenges and the opportunity to interact with and help people. The principle reasons given by participants for liking their current job appears to be contingent on employment status – self-employed participants rated their relationships with patients highly, whereas employees rated their working relationships with staff and colleagues highly. Although factors related to job conditions, such as pay, were cited by participants, these factors were not mentioned as frequently. This does not necessarily mean that job conditions and remuneration were unimportant to the participants (Woodruff, 2002). Extrinsic factors such as these can be viewed as "dissatisfiers", that is, if working conditions are poor then this can lead to dissatisfaction but the factor itself does not make the job satisfying (Lu, et al., 2005; Moss, 2001).

Keeping to an appointment schedule was cited as a stressor by participants across all demographics. Participants were not asked how long they had allocated for each patient, but some indicated that they had structured their day with blank appointment slots for seeing emergency patients or to allow catch-up time after attending to complex patient presentations. One participant mentioned that the number of clinical techniques to be performed during each appointment had increased but there was no extra time allocated for these additional tasks. These findings are similar to findings reported about optometry examination times in the United Kingdom (Dutton, 2010).

Administrative tasks were reported as a stressor for independently practicing participants, the majority of whom were self-employed. Many described this aspect of their work as a burden which encroached on their personal time or clinical time. This is consistent with other reports that job stress is not always related to technical skills but can include practice administration (Cooper, et al., 1989). Despite this, there were several participants who reported that they enjoyed this aspect of their job, one for whom administrative tasks were structured into their paid work time. It is possible that the difference in attitude toward administrative tasks is related to whether it is completed within or outside work hours, but this potential association was not evident until after the interview data were collated and analysed. This is an area which could be further explored.

One of the reasons for exploring job satisfaction and job stress was to determine any potential associations between psychosocial factors and work-related physical discomfort in optometrists, as have been reported for other health professions such as veterinary science (Scuffham, et al., 2010), nursing (Gunnarsdottir, Rafnsdottir, Helgadottir, & Tomasson, 2003; M. Long, Johnston, & Bogossian, 2012) and dentistry (Palliser, et al., 2005). Physical comfort issues, such as lack of suitable equipment and furniture, were cited as stressors by a small number of participants in these interviews but no statistical associations were determined. It is unknown whether this is because there are no associations, whether the interview methodology was not sensitive enough to determine differences, or if there are other contributing variables, such as personality (Allread & Marras, 2006; Glassock, Turville, Joines, & Mirka, 1999; Ilies & Judge, 2003) or role perception (Lu, et al., 2005), confounding the results. If tools are developed to assess job satisfaction and stress in optometrists then it may be important to also include questions about work-related physical discomfort and personality.

The sample of participants who were interviewed does not constitute a random sample and the opinions generated from this group might not be representative of all optometrists. However the sample included participants across a range of demographics, including three who do not like their work as optometrists but who still work in the profession.

This study has identified factors which contribute to job satisfaction and job stress in a small sample of clinical optometrists in 2009-2010. This is not a definitive list of factors, but does provide a basis for constructing tools such as questionnaires which can be more widely distributed within the optometry profession. This study has also identified avenues of further exploration e.g., why do employee and employer optometrists cite different reasons for liking the job where they currently work? How do clinical optometrists successfully manage stressors such as administrative tasks and time pressures? The answers to questions such as these are important for employers, industry and the profession as they are keys to understanding employment satisfaction, and this can impact on staff retention and productivity.

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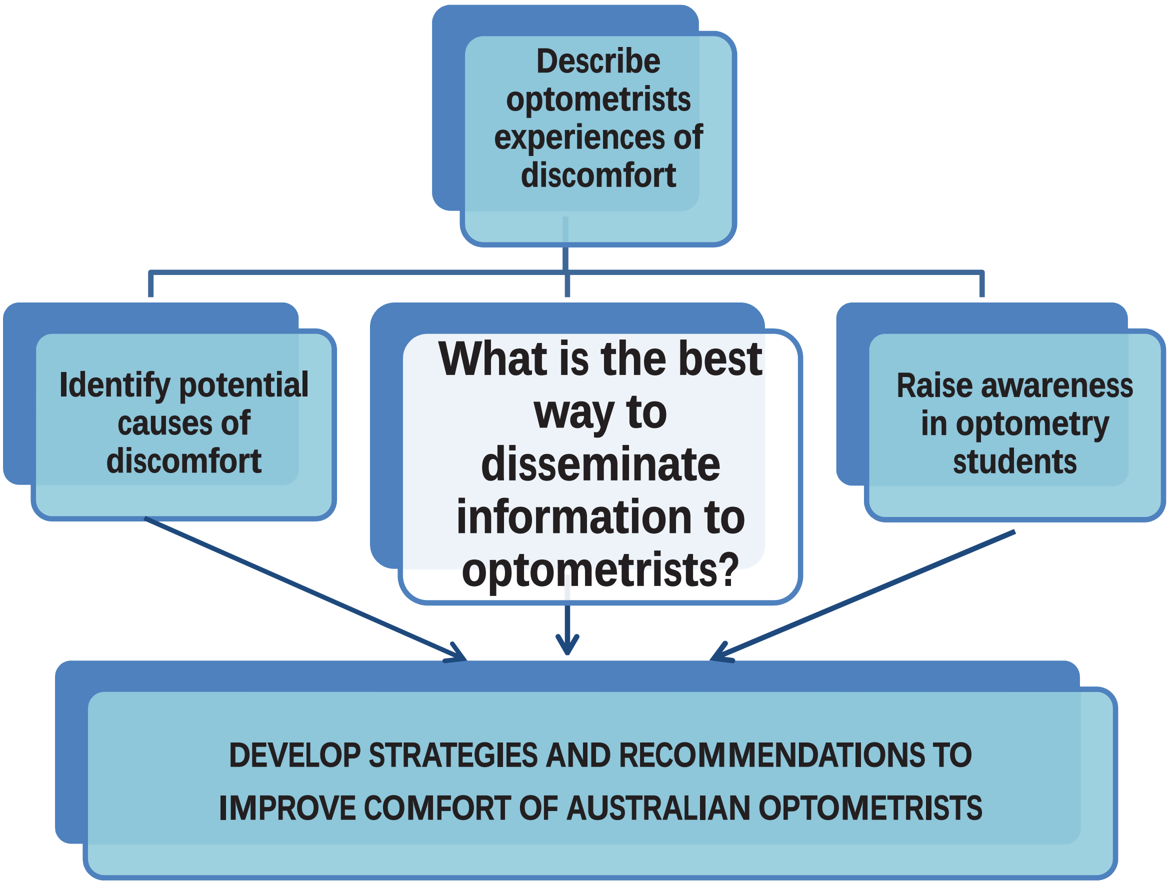
PART 4: Disseminating information to clinical optometrists



Chapter 7: Disseminating information to the optometry profession

It is all very well to collect data, write scientific journal articles and plan to write guidelines – but what is the best way to disseminate information to the profession to reduce the risk of work-related discomfort?

The Australian Work Health Safety legislation and the ergonomics literature both advocate consultation and communication with an organisation's stakeholders to better understand risks and possible solutions. There are many descriptions in the scientific literature of successful participatory ergonomics interventions in large business environments. It is unknown whether a participatory approach would be accepted by optometrists, some of whom work in small business environments with only one or two other people. The first paper in this chapter establishes that participatory ergonomics is feasible in a small business healthcare setting, but needs modification compared to models described for large business. These data were presented as a poster at the Human Factors and Ergonomics Society of Australia Annual Conference in Queensland in 2010. The paper included in this thesis, Long et al (2010) Acceptance of participatory ergonomics in a healthcare setting. Burgess-Limerick, R (Ed.) *Safer and more productive workplaces: Proceedings of the 46th Annual Conference of the Human Factors and Ergonomics Society of Australia.* Sydney, HFESA Inc., has been peer-reviewed and was published in the accompanying conference proceedings.

The second paper, Long et al (2011) Toward a more comfortable profession – disseminating ergonomics information to Australian optometrists. *Ergonomics Australia* 2011 7:1 (6 pages), explores methods of disseminating information, such as guidelines, to optometrists in clinical practice. Although we live in a digital age, written guidelines posted to optometrists was the preferred mode of communication. Most participants reported a potential interest in attending a conference presentation on the topic.

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Oops: There is a typographical error in the 2nd paragraph of the methods section of the first paper (page 132): "Of the 412 optometrists who participated in the questionnaire…" should read "Of the 416 optometrists…". This paper was used as a template for writing the 2nd paper, and the error has been duplicated (1st paragraph methods, page 141). Fortunately, this error does not impact on the findings reported in these papers.

Burgess-Limerick, R. (Ed.). (2010). *Safer and more productive workplaces: Proceedings of the 46th Annual Conference of the Human Factors and Ergonomics Society of Australia*. Sydney: HFESA Inc.

Acceptance of Participatory Ergonomics in a Healthcare Setting

Jennifer LONG
School of Optometry and Vision Science, UNSW, Sydney, NSW, Australia
Robin BURGESS- LIMERICK
School of Human Movement Studies, University of Queensland, Brisbane, QLD, Australia
Fiona STAPLETON
School of Optometry and Vision Science, UNSW, Sydney, NSW, Australia

Abstract

Background: Participatory ergonomics has been shown to be effective in large organisations. It is unknown whether a participatory ergonomics approach would be accepted in small business, particularly healthcare. ***Method:*** 60 Australian optometrists were interviewed by telephone as part of a larger study investigating work-related discomfort. Interviewees were given a participatory ergonomics scenario and asked if it could be implemented in their workplace. Optometrists with and without self-reported physical discomfort participated in the study. ***Results:*** 58% of optometrists interviewed were open to a participatory ergonomics approach and could see the value of ownership of problem solving. Barriers to implementing a participatory ergonomics approach include lack of time, financial constraints and difficulty in scheduling staff meetings. Many optometrists preferred a direct solution from an expert, in much the same way that their patients consulted them for direct solutions to their optometric problems. ***Conclusion:*** Optometrists appear to be open to a participatory ergonomics approach for solving work-related physical discomfort issues. However, modifications may need to be made to the approach used to ensure acceptance in small business healthcare settings.

Keywords

Participatory ergonomics, optometry, musculoskeletal discomfort, small business

1. Introduction

Ergonomics interventions are traditionally associated with prescribing a change to a system (e.g. a workstation alteration) with the expectation that there will be a subsequent decrease in discomfort and injury. This prescriptive approach does not always take into account that there may be other psychosocial and organizational factors, such as pace of work and work flow, which ultimately affect comfort and performance. Participatory ergonomics (PE) is an approach whereby training and information about ergonomics is given to the whole working group (managers, ancillary staff as well as the workers engaged in the actual work task) and, through facilitated meetings, the group devises their own strategies to improve comfort and performance (IWH, 2008). As these strategies may include physical changes to the way a task is performed plus psychosocial and organizational changes, it has been shown that this approach is more effective at reducing injuries associated with manual tasks (Rivilis et al., 2006; Rivilis et al., 2008; Straker, Burgess-Limerick, Pollock, & Egeskov, 2004) and leads to a greater acceptance of interventions within the workplace (Wilson, 1995a). The PE process typically occurs over a period of months and working groups are often involved in multiple workshops or training sessions lasting several hours (Burgess-Limerick et al., 2007; Kim & Lee, 2010; Rivilis et al., 2006). One of the rationales for a PE approach is to allow workers to "be their own ergonomist" which will in turn lead to ergonomics becoming a mainstream philosophy rather than an extra (and onerous) safety or design activity (Wilson, 1995a).

With the exception of one report on a small group of crane drivers (Wilson, 1995b), the majority of PE studies report the results of a PE approach in larger scale businesses. It is unclear whether a PE approach would be met with acceptance in small business, particularly healthcare, as it has been reported that doctors (McKevitt & Morgan, 1997) and physiotherapists (Cromie, Robertson, & Best, 2002) have a tendency to self-treat, partially out of reluctance to taking on the role of the "the patient", partially through work and cultural pressure to put their patients health before their own. Further, there may be reluctance on the part of health practitioners to disclose to ancillary staff their own health difficulties, even if their injury or discomfort has financial ramifications for their businesses.

Optometry is a health profession. In July 2009 there were 4255 optometrists registered to practice in Australia, of these 3719 work in clinical practice (Kiely, Horton, & Chakman, 2010). The primary task of an optometrist in clinical practice is to conduct eye examinations which, depending on the complexity of the presenting issues, can take between 10 minutes and 1 hour to complete. An optometrist's income is generated through consultation fees and in some business structures, through the sale of optical appliances such as spectacles and contact lenses. Subsequently, there are considerable time-pressures for optometrists working in clinical practice. Optometrists in Australia typically work with a small team of people which may include a practice manager, receptionist and optical dispenser. Larger practices may have multiple optometrists working from the same premises and ophthalmic assistants to administer automated testing procedures.

There are several modes of practice in Australia: independent practice whereby the optometrist is the owner of the business, corporate practice whereby the optometrist is employed by or affiliated with an ophthalmic company and franchise where the optometrist "owns" the business which is part of a larger ophthalmic company. Optometrists may be self-employed, employees or work in short-term locum placements (either in blocks of time e.g. when the principle optometrist of a practice takes annual leave or on a day-to-day basis to fill emergencies e.g. when the principle optometrist needs to take shorter periods of time off such as for sickness).
It is estimated that 87% of Australian optometrists are employed in private practice and that 45% of optometrists are female (Kiely, Horton, & Chakman, 2010). Recent trends within the ophthalmic industry have seen a shift away from independently owned practices and toward corporatisation (Horton, Kiely, & Chakman, 2006).

It has been shown that optometrists do suffer work-related physical discomfort, most commonly in the neck, shoulder and upper back and that the risk factors for discomfort include female gender, performing repetitive tasks and continuing to work while injured (Long et al., in press). Since an optometry practice usually involves small working groups and there is very little down-time throughout the working day, it is unknown whether a participatory ergonomics approach to solve work-related physical discomfort would be accepted by optometrists in private practice.

This project is part of a larger study investigating work-related physical discomfort in Australian optometrists, which aims to develop guidelines for optometrists in clinical practice. The current paper reports on a portion of the project which involved interviewing optometrists on a range of issues related to ergonomics and physical discomfort. This aims of this paper are to:

-Determine the perceived benefits and barriers of a participatory ergonomics approach in optometry practice and

-Identify how participatory ergonomics interventions might achieve greater acceptance in optometry practices.

2. Methods

2.1 Project overview

In August 2008 a questionnaire was sent to members of the Optometrists Association of Australia (OAA) who had active email addresses (approximately 1700 optometrists). The purpose was to discover if Australian optometrists experience work-related physical discomfort and if so, what are the risk factors for discomfort (Long et al., In press).

Of the 412 optometrists who participated in the questionnaire (25% response rate), 120 provided contact details for participation in future investigations. These participants were contacted either by email or post and invited to participate in a telephone or face-to-face interview. All optometrists who positively responded to the invitation were interviewed.

This study was approved by the Human Research Ethics Advisory Panel of the University of New South Wales.

2.2 Subjects

Sixty optometrists, with and without work-related physical discomfort, were interviewed during the period August 2009 – March 2010. Self-employed, employee, locum and retired optometrists participated. Of the three optometrists who were retired, two were retired due to work-related physical injuries.

2.2 Interview methods

The majority of interviews were conducted by telephone (56 interviews). Two interviews were conducted face-to-face and two participants requested a hard copy of the interview questions so that they could complete it within their own time.

With the exception of one participant who did not wish to be recorded, telephone and face-to-face interviews were recorded on a Sony digital recorder and later transcribed for analysis. Each interview lasted approximately 30 minutes, although some interviews took up to 1.25 hours as the participant had many issues that they wished to discuss.

The interviews followed a schedule of questions. These questions were divided into four sections: demographic information, job satisfaction, description of discomfort and ergonomics. The section on ergonomics was divided into two sections:

- How optometrists prefer to obtain information about ergonomics as it relates to their physical comfort at work

•Preferences for a participatory or prescriptive approach when implementing ergonomics in the workplace.

This paper reports on the findings of preferences for implementing ergonomics in the workplace.

2.3 Interview questions

Participants were given the following scenario:

"I am going to describe an ergonomics intervention and I would like you to tell me if this is something which could be implemented in the practice where you work.
You or a staff member has an injury. An ergonomist comes out to your practice and looks at what you are doing. But instead of telling you what to do to fix the problem, they give you and your staff information about ergonomics and how to reduce injuries. With the other staff members, you discuss this information and come up with ideas for how it could be implemented in your practice, for example, changing how work is scheduled or how the work space is arranged. The ergonomist has monthly chats with you and your staff to see how you are going and gives you guidance in the process.

So instead of someone coming out and telling you what to do, you are given the resources to come up with your own solutions."

Would it work?
If not, why not?
Could any adaptations be made to make such a plan work?"

For those participants who worked primarily as locums, they were asked to consider their locum business as "their practice" and if this scenario would work in their business as a locum. Some participants who worked in multiple practices also took the liberty of comparing and contrasting the various practices and whether they perceived such an intervention would work. Retired participants were asked to apply the scenario to the practice in which they worked pre-retirement.

2.3 Analysis of results

Interviews were transcribed and participants comments were manually coded into the following themes:

-Perceived benefits of a participatory ergonomics approach
-Perceived barriers of implementing a participatory ergonomics approach
-Suggestions for how participatory ergonomics interventions might be implemented in optometry practices.

Discomfort was classified "yes" if the participant currently experienced work-related discomfort. This included discomfort which was minimized or controlled by medical treatment or work modification (e.g. reduced working hours, modified clinical techniques).
Participants were categorised according whether or not they thought a participatory ergonomics intervention would work in their practice, also by gender, discomfort versus no discomfort, employment status, years in practice, work location and business structure. This information was tabulated in a Microsoft Excel file. Interactions were manually calculated using chi-square analysis.

A participant was classified as a locum in this study if they performed optometry work on a short-term contract basis, either working in optometry practices on a "one-day" basis or for pre-determined blocks of time (e.g. one month). Some participants described themselves as "permanent locums" due to the financial arrangement (e.g. they furnished a tax invoice to their employer rather than being on a salary) but they worked with just one employer on a regular and prolonged basis. These participants were categorised in this analysis as "employees".

The practice structure was classified according to the participant's primary work location. Some locums worked primarily for one ophthalmic company but in multiple locations, and so their practice structure was classified as "corporate" or "franchise". Locums who worked for a variety of independent, corporate and franchise practices were classified as "various".

The work location was taken as the primary work practice. For example, if a participant worked in urban and rural practices, then their work location was analysed according to that with the greatest number of working days per week. If participants worked equally between rural and urban practices then this was recorded as "both".

Retired participants were classified according to their work-mode prior to retirement.

3. Results

Sixty optometrists participated in the interviews. Participants were located in every state and territory of Australia except for the Northern Territory. Of these, 35 (58%) thought that a participatory ergonomics approach would work in the practice in which they primarily worked and six participants reported that their practice already has staff meetings where they discuss and attempt to resolve issues as a group. One participant had a family member in the health and safety industry who already assisted the practice using a participatory ergonomics approach.

Table 1 shows the demographics of the participants and whether or not they thought a participatory ergonomics approach would work in their practice. Chi-square analysis did not show any significant interactions between acceptance of a participatory approach and any of these demographic factors.

Table 1. Demographics of interview participants and whether a participatory approach would work in their practice

		Participatory approach would work	Participatory approach would not work	No preference	Total
Discomfort	No	9	3	1	13
	Yes	26	20	1	47
Gender	Male	15	11	0	26
	Female	20	12	2	34
Employment	Self employed	18	11	1	30
	Employee	13	9	1	23
	Locum	4	3	0	7
Years in practice	< 5 years	2	2	0	4
	5-9 years	4	2	0	6
	10-14 years	6	2	0	8
	15+ years	23	17	2	42
Work location	Urban	26	17	1	44
	Rural	8	5	1	14
	Both	1	1	0	2
Practice structure	Independent	23	15	2	40
	Corporate	5	5	0	10
	Franchise	5	1	0	6
	Various	2	2	0	4

3.1 Perceived benefits of a participatory ergonomics approach

The principle perceived benefits of a participatory ergonomics approach were related to ownership of problem solving and autonomy. For example:

> *"We would be more inclined to do it if it were our own ideas rather than someone else telling us"*
>
> *"If guidance was given rather than absolute direction it would allow the people in that area to better tailor the fix to suit different workflow demands at different times of day."*

Some participants also felt that such an approach would be good for their working team:

> *"I think the staff would probably get a lot out of being involved, having to come up with recommendations. As a group that would add to their job satisfaction as well."*

Five participants liked the idea of a participatory ergonomics approach as it would make them *"think outside the box"*, increase awareness of issues that otherwise would not be raised and allow discussion of these ideas. The novelty value of *"something different for the staff meeting"* was also cited as a benefit.

3.2 Perceived barriers to a participatory ergonomics approach

There were 23 participants who did not believe that a participatory ergonomics approach would work in their practice and given the choice, would prefer to be told how to solve a problem. Nine participants were specific that they preferred to engage an expert. For example:

"If I have a patient and I tell them what to do, they take my advice because I am the expert… they are the ones who could tell me straight away what we are doing wrong."

"I would appreciate the expertise of the person, they know what is best… if I had to put in too much time and effort… that would be put on the backburner and something else would take priority"

"I can make up my own mind from reading but that doesn't mean that I have the right solution. I would expect the person to have the knowledge to give me the advice to follow."

Three participants were concerned that the expert advice might be too generic; they specified that they would prefer the expert to have an understanding of optometry practices.

Other barriers were related to:

- A lack of perceived ability to make a meaningful change. For example:
  "It's really hard to change your behavior"
  "There (are limitations with) what you can do with the existing office layout"
  "I don't think it would achieve the outcome necessary… the people who have control over the fit-out of consulting rooms or the way the computers are set up are generally dictated by the status quo or the cheapest outcome … rather than seeking to invest time, effort and money into prevention"
- Resources. For example:
  "There are not many people (staff)"
  "Optometrists are time poor people"
  "I don't think people don't want to change, there are just no funds to do the change"
- The structure of the workplace. For example, if other staff are employed by another entity
- Personalities within the work setting. For example:
  "Some staff members may be very opinionated and may not always provide the right solution"
  "It is probably one of those things that is quite useful but some of the others would tend to think it is a bit wanky"
  "If it were one of the girls who got it, that might get a bit of attention paid to it, but if it is something that specifically related to me then I would have to be the one who made it happen"

Six participants could not see the benefit of implementing such strategies unless there was a pre-existing issue at work which needed to be solved.

3.3 Strategies for implementing a participatory ergonomics approach

Nine participants embraced the idea of having assistance, feedback and guidance from an external person such as an ergonomist. For example:

"There are a few issues around here and I don't know who to ask about them"

However, there still appears to be a role for a prescriptive approach. For example:

> *"I still would probably be asking for suggestions to point me in the right direction... what has worked for other people that I can try"*

Three participants were concerned that a participatory ergonomics approach would be a *"bunch of motherhood statements"* and that it would be difficult to implement extensive lists of remedies within the confines of a busy practice. They would prefer if the ergonomist could assist prioritizing issues to be attended to.

One participant reported that she would prefer follow up consultations with an ergonomist by email or internet *"So that I can do it out of hours"* and another suggested that it would only work if staff had an incentive:

> *"If they go to a website and win a prize they will do that. Then you (could) discuss it at the meeting."*

4. Discussion and Conclusion

The results of this study show that some optometrists in private practice are open to the prospect of a participatory ergonomics approach for solving work-related physical discomfort issues in their workplaces. However, only 58% of those interviewed believed that the scenario, as read, could be effectively implemented in the practice where they work.

Of the 60 optometrists interviewed, 12% already use a consultative approach for problem solving in their workplaces. There was no relationship between acceptance of a PE approach and demographic or other workplace factors, nor with current work-related physical discomfort. Therefore, acceptance of a PE approach cannot be used to predict likelihood of injury and does not appear to be protective of injury.

The perceived benefits cited by optometrists are consistent with that reported in the scientific literature, for example, that work may be perceived as more meaningful (Burgess-Limerick et al., 2007), that there will be improved ownership of problem solving (Burgess-Limerick et al., 2007; Rivilis et al., 2006; Wilson, 1995b) and it will increase awareness of ergonomics issues and confidence in addressing these issues (Wilson, 1995a; Wilson, 1995b). Similarly, some of the perceived barriers to a PE approach, in particular, a lack of time to implement such a program, which was cited by 11 participants, has also been reported elsewhere (Burgess-Limerick et al., 2007).

The principal barrier to a PE approach was that participants would prefer to engage an expert to tell them how to solve work-related ergonomics problems. This is contrary to the consultative approach encouraged in Australian occupational health and safety legislation ("Occupational Health and Safety Regulation 2001", 2001) and in the Australian and International Risk Management Standard ("AS/NZS ISO 31000:2009 Risk management - Principles and guidelines"). Some participants explained that financial difficulties and small staff numbers mitigated against a consultative approach and that many issues within optometry practices are *"fairly small type issues that should be able to be rectified very quickly and easily and don't require a lot of discussion"*. However, a PE approach has been described as a solution to these barriers because if workers have the training and knowledge to solve work-related issues then they may not need to engage an external consultant and are likely to pre-empt problems before they manifest (Wilson, 1995a). A PE approach may also be a solution to issues such as poor office and equipment design once it becomes an embedded perspective within the organisation and practiced by people other than ergonomists (Wilson, 1995a). This would address the frustration articulated by three participants about the constraints of the existing layout of their consultation rooms.

There was response bias in that participants in this project elected to participate. The gender (56% female) and proportion of optometrists who experience work-related physical discomfort (78%) is similar to the participation rate in the original email questionnaire. However, there were more self-employed participants in the interviews (50%) compared to those who participated in the original questionnaire (34%). Similarly, the number of optometrists working in independent optometry practices who participated in the interviews (67%) is greater than that which would have been predicted by optometrist demographics (54% in 2005) (Horton, Kiely, & Chakman, 2006). It is unknown why a higher number of self-employed optometrists working in independent practices participated, although it may be that these optometrists are able to make changes within their practices and were actively seeking strategies to implement.

More than half the participants experience work-related physical discomfort and many were generally interested in ergonomics and in the study. Despite this, the acceptance of a PE approach amongst this cohort was only 58%. The scenario given to optometrists in the interviews was hypothetical and some participants had difficulty understanding the how PE could be applied to an optometry practice, particularly if there were no existing issues. For example *"If there was someone with an injury then it may well work, but if no problem then probably not"*. Although some participants were familiar and comfortable with a consultative approach, some could only comprehend a prescriptive approach. If there were a greater understanding by participants as to what PE actually is and if some of the suggestions made by participants were incorporated into the hypothetical example, then there may have been greater acceptance of the PE approach.

Potential difficulties with implementing a PE approach in optometry include small staff numbers within practices (often less than 5 people), business structures where some staff members are employed by another entity (e.g. dispensing group) and the fact that decision makers (e.g. people who design the practice and purchase equipment) may be external to the working environment. Further investigations need to be made into these issues if PE is to be encouraged in the optometry profession.

4.1 Conclusions

A participatory ergonomics approach is one way to reduce work-related physical injuries and discomfort in optometrists. However, for it to be accepted within optometry private practices, the following issues should be addressed:

- -The PE approach needs to be specific to optometrists and preferably facilitated by someone who understands the industry (in particular, understands what the work demands are for optometrists)
- -The facilitator should be available to assist optometrists prioritizing issues which are identified

-It is preferable if there is also a prescriptive element, for example "here are some ideas for what you can do and what others have found useful" while allowing the individual practice to work out what will work in their environment

-The process should not be time intensive.

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Research Article

Toward a more comfortable profession – disseminating ergonomics information to Australian optometrists

Jennifer Long[1], Robin Burgess-Limerick[2] and Fiona Stapleton[1]

[1] *School of Optometry and Vision Science, The University of New South Wales, Australia*

[2] *Minerals Industry Safety and Health Centre, Sustainable Minerals Institute, University of Queensland, Australia*

Abstract

Background and aim: Work-related physical discomfort occurs in optometrists. The purpose of this paper is to explore how optometrists prefer to obtain information to assist their physical comfort at work. **Methods:** Sixty Australian optometrists working in clinical practice were interviewed as part of a larger study investigating work-related discomfort in the profession. Optometrists with (n=47) and without (n=13) self-reported physical discomfort participated. The results were subject to thematic (qualitative) and chi-square analysis. **Results:** Sixty percent of interviewees obtained information to assist their comfort at work. There was no relationship between self-reported discomfort and accessing information to assist comfort (chi-squared analysis). The majority of participants reported they would read unsolicited written material (92%), access an internet link (81%), attend a single stream (90%) or multi-stream (31%) conference presentation on this topic. Those in favour of this as a conference presentation were either searching for a solution to their own discomfort or wished to see more diverse topics offered at conferences. **Conclusions:** Optometrists in clinical practice acquire information to assist their physical comfort at work by both passive and active methods. Guidelines for reducing work-related discomfort should be first reviewed by optometrists to ensure their relevance and disseminated via multiple communication channels to cater for different learning styles. Guidelines should also be introduced during the optometry training program to ensure that future members of the profession develop good working habits.

Keywords: continuing professional education, ergonomics, optometry, work related discomfort

Received June 2011 Revised July 2011 Accepted July 2011

Background

Work-related injuries and discomfort have been reported in Australian optometrists (1) and this has a potential impact on participation in the workforce. Possible reasons for discomfort and injury include clinical techniques (2), performing repetitive tasks (1) and occupational health and safety issues. There have been articles (3, 4), recommendations (5) and guidelines (6, 7) published but it is unclear how effective these documents are for educating and informing optometrists.

There are many options for communicating with optometrists in clinical practice: conferences and lectures, direct mail outs (print media and digital media e.g. DVD) and electronic sources (e.g. email, web resources). Depending on the content of the communication, it is possible to assign credit points for continuing professional education which may increase the likelihood of optometrists accessing the information (8). Other than accruing continuing education points, other motivators for learning include perceived relevance to personal and career goals (9), "current-ness" of content (8, 10), interacting with colleagues and enhancing personal and professional position (10). On one level, the purpose of continuing profession education is to provide information which is applicable to optometrists immediate work setting (11). However, obtaining knowledge which may not be directly useful but which contributes to general professional knowledge and depth of understanding is also important for optometrists (12, 13). Risk management is a professional issue which has relevance for maintaining health and safety in the consultation room but may appear to have no immediate clinical relevance. It has been reported that the topic "risk management" is of only "average interest" to optometrists compared to say, presentations on other professional topics such as legal issues and ethics (8).

This project is part of a larger study investigating work-related physical discomfort in Australian optometrists, the goal of which is to develop guidelines for optometrists in clinical practice. However, if guidelines and recommendations are developed, then it is important to understand how to effectively communicate this information. The aims of this paper are to: (i) discover how optometrists in clinical practice currently obtain information about ergonomics to assist their physical comfort at work; and (ii) determine the most appropriate method for disseminating information to optometrists which will assist their physical comfort at work.

Corresponding author: Jennifer Long. Email – j.long@unsw.edu.au

Methods

Project overview

A questionnaire was sent to members of the Optometrists Association of Australia (OAA) in 2008; the purpose was to discover if Australian optometrists experience work-related physical discomfort and the risk factors for discomfort (1). Of the 412 optometrists who participated in the questionnaire, 120 provided contact details for participation in future investigations on this topic. These participants were contacted either by email or post and invited to participate in a telephone or face-to-face interview. All optometrists who positively responded to the invitation were interviewed. The interviews were approved by the Human Research Ethics Advisory Panel of the University of New South Wales (HREA 09033).

Subjects

Sixty optometrists, with and without work-related physical discomfort, were interviewed during the period August 2009 – March 2010. Self-employed, employee, locum and retired optometrists participated. Two retired optometrists had ceased working due to work-related physical injuries. One self-employed and two employee optometrists were working reduced hours due to work-related physical discomfort.

Interview methods

The majority of interviews were conducted by telephone (56 interviews). Two interviews were conducted face-to-face and two participants requested a hard copy of the interview questions so that they could complete the questionnaire in their own time. All interviews were conducted by the first author (JL).

With the exception of one participant who did not wish to be recorded, telephone and face-to-face interviews were recorded on a Sony digital recorder and later transcribed for analysis. Each interview lasted approximately 30 minutes, although one interview took 75 minutes.

The interviews were semi-structured in that they followed a schedule of questions. These questions were divided into four sections: demographic information, job satisfaction, description of discomfort and ergonomics. To maintain a conversational style during the interviews, questions were not always asked in the same order, for example, some subjects began the interviews by describing their experience of discomfort.

Analysis of results

Interviews were transcribed and responses coded into themes. Participants were categorised by demographics (gender, employment status, years in practice, work location, business structure), discomfort versus no discomfort and whether they had obtained ergonomics information in the past. Chi-squared analysis was conducted to establish interactions between any of these variables and statistical significance was set at p = 0.05. Responses to preferences for accessing information and attending conference presentations were tabulated according to frequency. Categorisation of demographic factors are described in more detail elsewhere (14).

Results

Sixty optometrists participated in the interviews. Participants were located in every state and territory of Australia except for the Northern Territory.

Have you obtained information about ergonomics in the past?

Sixty percent of participants (n=36) had previously obtained information about ergonomics to assist their physical comfort at work (Table 1). Chi-square analysis did not show any significant associations between obtaining information and presence of discomfort, gender, employment status, practice structure, work location or experience.

Table 1. *Demographics of interview participants and whether they have obtained information about ergonomics in the past*

		Number who have obtained information in the past (n = 36)	Number who have not obtained information in the past (n = 24)	Total (n = 60)
Discomfort	No	8	5	13
	Yes	28	19	47
Gender	Male	14	12	26
	Female	22	12	34
Employment	Self employed	17	13	30
	Employee	17	6	23
	Locum	2	5	7
Years in practice	< 5 years	1	3	4
	5-9 years	4	2	6
	10-14 years	5	4	9
	15+ years	26	15	41
Work location	Urban	8	6	14
	Rural	28	16	44
	Both	0	2	2
Practice structure	Independent	27	13	40
	Corporate	6	4	10
	Franchise	3	3	6
	Various	0	4	4

Four participants had family members (cousin, son, father, brother) who had provided them with ergonomics information and 11 (18%) had received advice from physiotherapists, chiropractors and occupational therapists. One participant, who did not report discomfort, received advice from another optometrist about purchasing equipment.

Thirteen participants had actively sought information from the internet, primarily for information about workstations, furniture and chairs, either for their own use or for staff members (e.g. receptionist chair). Two participants reported that they have discussed their needs with furniture manufacturers.

Only one participant recalled receiving instruction about ergonomics during their undergraduate optometry degree, while another who trained at the same university did not recall receiving ergonomics instruction at all. Six participants felt that the knowledge they had gained through professional optometry channels was sufficient, for example, during vision training courses, although one participant admitted that this information was related more to setting up a computer correctly than arranging an optometry room for comfort and efficiency.

There were seven participants who perceived the application of ergonomics within an optometry practice as "common sense" and who based the set-up of their consultation rooms on trial and error or on what had worked in other practices.

Would you access unsolicited information sent to you?

The majority of participants reported that they would read written material to assist comfort and prevent injury at work (92%) and would prefer this medium (62%), as it can be easily

Table 2. *Preferences for accessing information about ergonomics and physical comfort at work*

	Reasons given for accessing information	Barriers to accessing information	Strategies to improve likelihood of accessing information via this medium
Written material	**Actively seeking information** *"I am always interested in finding out if there are better ways to do things, new ways, or things that are better for my back."* **Business responsibility** *"…you have to be more responsible for the people who are employed by you… I take my responsibilities as an employer fairly seriously."*	**Time** *"(the reading material I am sent) is all in a pile."* **No interest in the topic** *"The topic doesn't interest me. I think that I know enough about ergonomics or the theory of it."* **Unable to apply the information** *"Reading about what should be done is not going to be very helpful if I don't have control over it".* *"…it is not my consulting room (so) I am kind of limited."*	**Easy to read** *"If it were … a pamphlet in easy English I would read it and probably keep it."* **Include clear subheadings** *"(I would) skim over it, read the headlines or the boxes '10 main points to consider' but probably not the whole article"* **Reputable source** *"I would look at the qualifications of the person who wrote it"* *"If it comes from the OAA I assume that it has been vetted correctly"* *"If it was scientific I would be more likely to read it."*
DVD	No specific reasons given – for most participants, this was not their preferred media	**Time** *"I have such a backlog of things that I ought to do that I would put it there carefully, it would stay in the pile, I wouldn't throw it out, but then after some time it would probably gather dust and move further down the pile".* *"…as soon as you start to watch it you have to watch even the stuff which is irrelevant."* **Access difficulties** Computer at work doesn't have a DVD attachment/sound *"That would mean that I would need to fight my children off the television – that is not going to happen…"* **Don't watch/like television** *"I am a print person, not a TV person"* **Inappropriate to watch DVD at work** *"Probably I could watch it at work, but with an article I can start it and stop it pretty easy. I know you can pause a DVD but it doesn't seem quite right."*	**Keep it short** *"up to 15-20 minutes"* *"no longer than 5-10 minutes"* **Attractive title** *"(make it relevant) to optometrists, such as 'exercises you can do inside your consultation room to prevent work injury'."* **Attention grabbing** *"…if it didn't catch my attention I might not finish watching it."* **Include Continuing Education credits** *"Unless I can get CPD (continuing education) points, I am not interested."* **Reputable source** *"If it arrived from … a professional society … I would definitely watch it, if it came from someone I had no knowledge of it would be taken with a large grain of salt."* **Make other staff watch it** *"Probably wouldn't watch it myself but I would make the staff optometrists watch it (and) ask him what he learnt."*
Internet or email attachment	**Ease of access** *"…that is automatic at the click of a button ...we are all lazy so you need to make it easy for us."*	**Time** *"By the end of the day I am usually over it, so (emails) tend to sit there until I can be bothered which tends to be Monday, my catch up day."* **Access difficulties** *"… (I have to send) it to my home computer so that I could watch it."* **Too many emails** *"…once it is in there for more than a day I think it would just get lost because I have so many emails."* **Don't use the Internet** *"I am not a big website user so I won't."*	

read at work or at home. Written material also facilitated skim reading which was viewed as a time-saving strategy (Table 2).

Accessing an internet web-link or an email attachment was also embraced as a communication medium (81% of participants in favour). The primary reason for liking this medium was ease of access. Only 55% of participants reported that they would watch a DVD and given the choice of print, digital or DVD information, DVD was the least attractive communication medium.

The primary reasons given for accessing information was because the participant was actively seeking solutions for their own physical discomfort or because they saw it as a business responsibility (Table 2). Lack of time was a common barrier to accessing information for all three communication media. Technology issues (e.g. access difficulties, information overload, aversion to television/internet) were cited as barriers for DVD and internet/email formats. One participant believed that it was inappropriate to watch a DVD or online video while at work, even if it was work-related.

Three participants admitted that they were uninterested in the topic, so would be unlikely to access information, irrespective of the media. Two participants reported that they were interested in the topic, but were discouraged from accessing information because they could not control their work environment, nor make meaningful changes to assist their comfort. Strategies that would improve the likelihood of optometrists accessing information on this topic included making the format attractive (e.g. easy to read, clear subheadings, attractive title, short length), providing material which has been developed by a suitably qualified author, and assigning continuing education credit points to the activity (Table 2).

Would you attend a presentation about ergonomics at a conference?

The majority of participants (90%) reported a potential interest in attending a conference presentation about how to prevent work-related discomfort and 19 participants (31%) would specifically attend this topic, choosing to attend either at a single stream or multi-stream conference. The two primary reasons participants gave for choosing to attend a presentation on this topic were that they are looking for a solution to their own discomfort (14 participants) or that they would like to see more variety of topics presented at conferences (7 participants) (Table 3). Non-relevance (e.g. do not currently experience work-related discomfort) and an inability to apply the knowledge to their work environment were commonly cited as factors for non-attendance.

Given the choice, 11 participants (18%) preferred to attend a clinical topic at a conference rather than an ergonomics topic. One participant felt that clinical continuing education should be separated from other topics, not presented in competition with each other at a conference, while two participants preferred written information or an internet link, which could be accessed in their own time. Three participants would "skip" the lecture altogether, even if presented during a single stream conference.

Table 3. *Reasons given for and against attending a conference presentation about ergonomics and physical comfort at work*

Reasons for attending an ergonomics presentation	Reasons for not attending an ergonomics presentation
Novelty *"anything that is a bit different or unusual is likely to be attractive than the diseases stuff or something that gets so well covered."* *"I would go to the ergonomics one, after 35 years I have heard the rest. There are not enough topics like that."*	**Not relevant** *"I am not terribly interested because I have figured it out."* **Cannot apply it at work** *"I would gain more out of a pathology workshop than I would gain out of an ergonomics workshop because … I am not in a position to control my own ergonomics that well."*
Searching for a solution to own discomfort *"I would be very interested in the ergonomics one…because I do have a problem."*	**Clinical and business education should be separated** *"I would probably attend the (diseases). I think it should be separated personally"* **The information would be too generic** *"I would be surprised if someone actually new more than me about what to change and what to do to help"*

Table 4. *Strategies suggested by participants to increase the attractiveness of a conference presentation about "ergonomics and physical comfort at work"*

Strategies suggested by participants to increase the attractiveness of a conference presentation about ergonomics and physical comfort at work
Make it practical *"if you could predict the ways to help your comfort at work, yes, I would go"*
Make it relevant to employee optometrists *"..if there is more things in terms of (what)I can do rather than changing the furniture…things I can do to relax the muscles…so I can apply it immediately."*
Keep it short *"20 minutes would keep my attention"*
Use an attractive title
Use a lecture format rather than workshop
Use an engaging speaker *"If I knew it had a good person talking…I wouldn't want a waffler"*
Use a speaker who is an expert *"if a physio giving lecture or (occupational therapist), more likely to attend, ergonomist OK, not if another optometrist because getting specialist advice already"*
Pitch it to employers and managers *"…title these sessions along the line "what optometrist employers or managers need to reduce work-related injuries"*
Pitch it as an insurance policy *"You need to put across the idea that it is like an insurance policy for them, that they learn about what they need to do and can structure their business so that it is sustainable for their body… the ability to work comfortably as an optometrist with less break-downs. This is a maintenance program for life."*
Present it at another forum *"I am more likely to attend at ODMA fair where I am also looking at equipment at the same time.", "What would work for me (is)…if there were a stand where I could talk to somebody…and answer a specific question."*

Two participants suggested that it might be more effective to educate optometry students in good working habits, rather than only providing information to optometrists already in clinical practice.

Participants volunteered ideas for how such a topic might garner more interest amongst optometrists. This included making it relevant and practical to optometrists and optometry managers, using an attractive format (e.g. short length, attractive title, competent speaker), and using other forums, such as trade fairs, to present the information (Table 4).

Discussion

The results of this study show that 60% of participants have previously obtained information about ergonomics to assist their physical comfort at work, either by passive or active means. If sent unsolicited information from a professional organisation, participants would prefer to receive this as written information or as an internet link. Although some participants would attend a conference presentation on the topic of ergonomics and how it relates to comfort at work, many reported that they would prefer to attend clinical topics at a conference.

It is possible that there was response bias present in this study, as participants in this project elected to participate and that all who responded positively to the interview invitation were interviewed. The gender (56% female) and proportion of optometrists who experienced work-related physical discomfort (78%) was similar to the participation rate in the original email questionnaire. However, there were more self-employed participants in the interviews (50%) compared to those who participated in the original questionnaire (34%). Similarly, the number of optometrists working in independent optometry practices who participated in the interviews (67%) is greater than that which would have been predicted by optometrist demographics (54% in 2005)(15). It is unknown why a higher number of self-employed optometrists working in independent practices participated, although it may be that these optometrists are able to make changes within their practices and were actively seeking strategies.

Many of the participants were generally interested in the study and in the topic of ergonomics, so it might be expected that this group of optometrists would be keen to attend conference presentations on this topic. This was not the case. Participants showed a preference for attending clinical topics at conferences, which is consistent with the skew toward ocular health topics currently presented at Australian conferences (16). On the other hand, there were participants who welcomed different topics at professional development meetings and who reported that they would actively seek to attend a presentation on ergonomics as it relates to their comfort in the consultation room simply because it is different. The novelty factor has been reported elsewhere as an attraction for attending optometry professional development sessions (17) and demonstrates that there are many reasons for attendance at professional development events besides obtaining direct clinical knowledge (10).

Some participants recognised that work-related discomfort is an occupational health issue, and one of their business responsibilities, and cited this as a reason for accessing information on this topic. There were others who viewed ergonomics as "common sense". While it might be possible for some optometrists to identify the source of their discomfort and then implement necessary changes to eliminate their discomfort, some participants reported that they were unable to implement change because they did not have sufficient control over their work environment. This sentiment has also been reported in nursing (18) and physical therapy (19) and poses a challenge for overcoming beliefs that work-related discomfort is an inherent part of the job (20).

One of the limitations of preparing guidelines for optometrists is that the advice needs to be generic, so that it can be applied to a range of working situations and consultation rooms. Lack of specificity of content was cited by some participants as a reason they would not attend a conference presentation on this topic. One solution might be to use written or oral communication media as a platform for raising awareness of work-related discomfort and then supplement this with individual advice to help optometrists solve their own problems e.g. someone available to give advice on a stand at a trade show or conference (as suggested by one participant) or providing a telephone hotline.

Written information was one of the preferred media for accessing information on this topic as it could be accessed and read easily. However, it may be necessary to pitch the information at different levels to cater for different reading preferences, for example, some participants preferred to read a pamphlet while others preferred to read a scientific article. It is unlikely that participants preferred written media because of an aversion to digital media and computers, as the participants had previously participated in an online questionnaire, had responded to an email invitation to be interviewed and some were interviewed using Skype. Other authors have also demonstrated learner preferences for written material (21), especially for business-related communication (22, 23). Providing information in a variety of formats would cater to different needs and learning styles (21).

Instructing students about good working habits rather than only providing information to those already in clinical practice has been explored in other professions (18, 24, 25). However, a three-pronged strategy may be necessary: education and guidelines to those already in practice, teaching guidelines for educators, as well as training for future professionals (18, 24, 26, 27). An investigation is currently being conducted by the authors into effective education and teaching strategies for optometry students.

The interview format was selected for this investigation to enable a more in-depth exploration of opinions (28) and has previously been demonstrated as a useful technique for canvassing the opinion of optometrists (29). The exploratory strategy also allowed participants to expand on their responses and offer suggestions for how information on this topic might be made more palatable to their colleagues. Although these suggestions were unsolicited and therefore unlikely to be comprehensive, the responses may offer guidance for future researchers investigating the continuing education preferences of optometrists and provide the basis for development of quantitative tools such as questionnaires on this topic.

Conclusion

Optometrists currently access information to assist their comfort at work from a variety of sources. If generic guidelines are developed to help reduce the incidence of work-related discomfort in optometrists, then optometrists should be included as a part of the review process to ensure that materials are relevant and are distributed through the channels they prefer. To cater for different learning preferences, guidelines should be disseminated via multiple channels e.g. academic and non-academic written material, internet and web-links and conference presentations. Options for providing more specific advice to individual optometrists include having a stand at a trade fair and providing a telephone hotline service. There is also a role for raising awareness of physical comfort issues among student optometrists, so that future members of the profession develop good working habits.

Declaration

The authors declare that they have no competing interests.

Acknowledgements

This work was presented at the 13th Scientific Meeting in Optometry and 7th Optometric Educators Meeting, the University of New South Wales, Australia, 10-12 September 2010.

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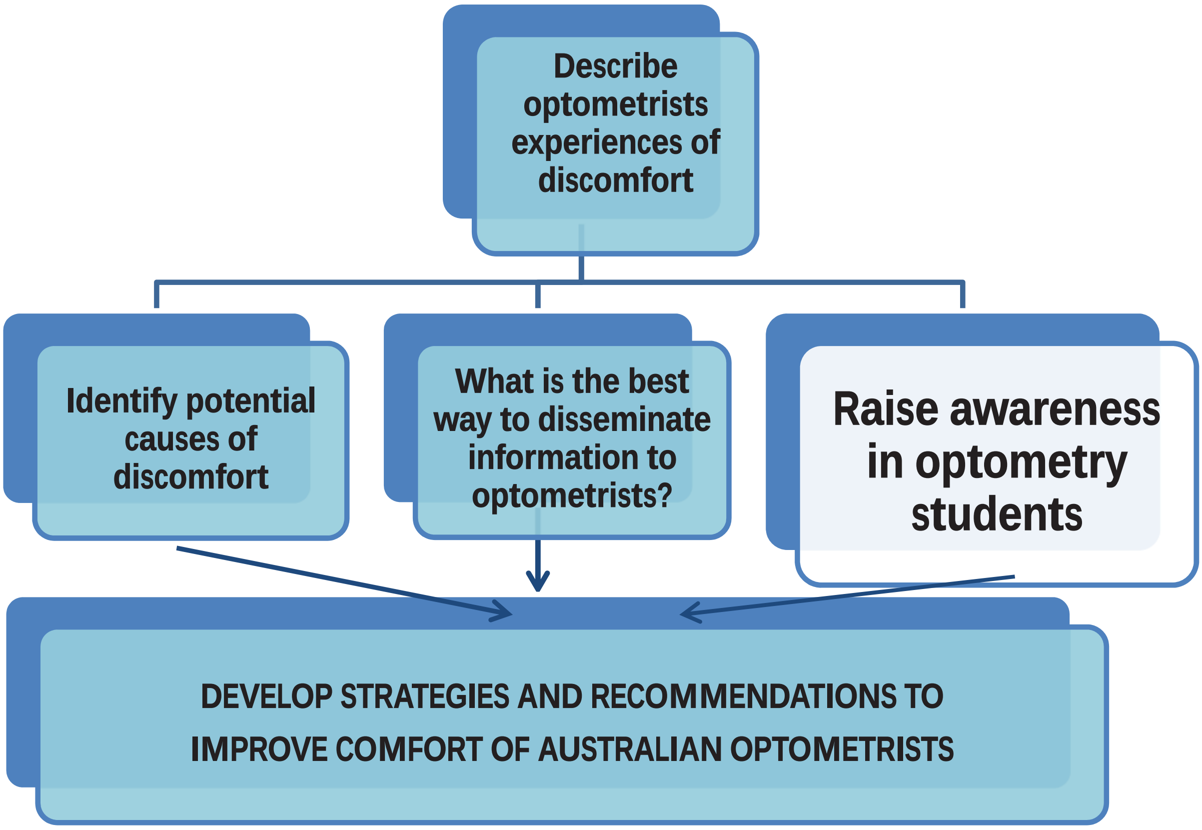
Cite this article as: *Long et al*. Toward a more comfortable profession – disseminating ergonomics information to Australian optometrists. *Ergonomics Australia* 2011 7:1.

PART 5: Raising awareness in optometry students



Chapter 8: The next generation of optometrists

It is remarkable the number of interview participants who said that they experienced discomfort for many years before someone was able to provide an explanation. Several of these participants now harbour severe injuries and work reduced hours or no longer work as an optometrist.

When asked how they would like to receive information on the topic of work-related discomfort (chapter 7), two interview participants suggested it might be more effective to educate optometry students rather than only providing information to optometrists in clinical practice. This led to the investigation reported in this chapter.

A survey of optometry students at the School of Optometry and Vision Science, UNSW, was conducted to determine their experience of discomfort, find out what instruction they have received and discover how they would prefer to receive information about work-related discomfort. Since I also teach at this institution, it was an ethics requirement that I did not directly approach the students to encourage participation. Therefore, this study was conducted as a student project in which I supervised two final year optometry students who were the "public face" of the survey. This proved to be an excellent strategy as these students provided valuable insight into the phrasing and the inclusion of questions in the survey. They are co-authors on this paper.

It is possible that students might not recall being taught about a topic – but the topic may actually have been taught. This was the rationale for running a concurrent study: a survey of clinical teachers at 4 teaching institutions in Australia and New Zealand to determine whether they provided instruction to students to reduce their risk of work-related discomfort. (This was not a part of the supervised student project.) It was encouraging to learn that students do recall receiving instruction and that there was synergy in the teaching methods provided and the preferred learning methods of the students.

The data in this chapter were presented as an oral presentation at the Human Factors and Ergonomics Society of Australia Annual Conference in Sydney in 2011. The accompanying peer-reviewed paper, Long et al (2011) Developing strategies for reducing work-related discomfort in optometry students, *Ergonomics Australia – HFESA 2011 Conference Edition* 2011 11:6 (6 pages), is reproduced with kind permission of the Human Factors and Ergonomics Society of Australia Inc.

Research article

Developing strategies for reducing work-related discomfort in optometry students

Jennifer Long[1], Yean Loe (Chloe) Ko[1], Christopher Lau[1], Robin Burgess-Limerick[2], Fiona Stapleton[1]

[1] *School of Optometry and Vision Science, University of New South Wales, Australia*
[2] *Minerals Industry Safety and Health Centre, Sustainable Minerals Institute, University of Queensland, Australia*

Abstract

Background: Work-related physical discomfort occurs in Australian optometrists. The purpose of this paper is to explore appropriate methods for educating optometry students about work-related discomfort before they commence clinical practice. **Methods:** Two surveys were distributed: one to students at the School of Optometry and Vision Science, University of New South Wales; the second to clinical teachers at four Australian and New Zealand optometry teaching institutions. The surveys were subject to descriptive analysis. **Results:** Sixty-four optometry students (48% response rate) and 46 academic and clinical teachers (30% response rate) participated. Students reported discomfort in the previous 7 days (56% respondents) and previous 12 months (77% respondents), most commonly in the lower back, neck, shoulder and elbow/arm. Informal instruction by clinical supervisors was the first preference for students learning how to reduce work-related discomfort (28% respondents). Advice from seniors/friends who have experienced discomfort and formal instruction in practical classes were also accepted learning methods. Patient comfort was rated more important than personal comfort when performing clinical procedures (Wilcoxon Signed Rank Test, $p<0.01$). Informal instruction and comments during clinic supervision was the most common form of instruction (89%) reported by optometry teachers. **Conclusion:** Work-related discomfort is experienced by optometry students and should be raised as an issue during training. Clinical teachers, both within optometry clinics and at external placements, should also receive training so that appropriate advice is given to students. Further investigation is required to identify tasks and environments which demonstrate a reduced risk of work-related discomfort and then maximise student exposure to these positive examples.

Background

Optometry is a primary healthcare profession with 4,429 registered practitioners in Australia (1). Work-related physical discomfort occurs in Australian optometrists (2), with the greatest risk for females and those who perform more than 11 consultations per day. The risk of severe discomfort is increased by performing repetitive tasks and continuing to work while injured.

It is unknown whether optometry students also experience work-related discomfort, although work-related discomfort has been reported in other healthcare students (3-6) with patterns of injury similar to that in clinicians (5). Explanations for discomfort include naivety to the possibility of injury (7), attitudes (e.g. patient comfort is more important than self-comfort) (7-8), and exposure to incorrect techniques (9). Teaching techniques employed to reduce work-related discomfort include feedback during clinical exercises (10) and theoretical and practical instruction (4, 6), but there are risks that good techniques will be undermined by outmoded practice (7, 9), poor workplace and equipment design, and inconsistencies between formal teaching content and practical observation of clinicians (11).

This paper forms part of a multistage project investigating work-related discomfort in Australian optometrists, the goal of which is to develop guidelines for clinical practice. The purpose of this paper is to: (i) describe optometry students experience of work-related physical discomfort; (ii) determine how students rate the importance of their own physical comfort; (iii) compare student preferences for learning how to reduce the risk of work-related physical discomfort with methods currently employed by clinical educators; and (iv) explore education strategies to reduce work-related discomfort in students.

Methods

Two online surveys were developed, one for undergraduate optometry students and one for optometric clinical teachers. Questions relating to students' experience of work-related discomfort were based on the Nordic Musculoskeletal Questionnaires (12) and a previous questionnaire developed for Australian optometrists (2). For consistency with other stages of the study (2) physical discomfort was defined as pain, ache, difficulty with movement and numbness. Other questions were developed by analysing student and teacher clinical timetables and informal interviews with students and teachers. Both surveys were pilot tested and then edited for clarity and relevance.

Potential participants were sent an email invitation containing a link to the survey and a follow up reminder email two weeks

Corresponding author: Jennifer Long. Email – j.long@unsw.edu.au

later. Results were saved with a unique identifying number related to the IP address of participant's computer which prevented participants submitting multiple responses. A word version of the teachers' survey was also distributed to casual clinical teachers at the University of New South Wales (UNSW) with a return addressed envelope and responses were manually entered into the database by the first author. A summary of the distribution, duration and construction of the two surveys is given in Table 1.

Table 1. *Methodology summary of student and teacher surveys*

	Student Survey	**Teachers Survey**
Participants	Stage 3,4 and 5 undergraduate optometry students UNSW[1]	Academic and clinical teachers Australia: • Queensland University of Technology • UNSW[1] • Australian College of Optometry New Zealand: • University of Auckland
Pilot Study	11 students	7 clinical teachers
Main study	64 students	46 clinical teachers
Content	• Demographic questions • Experience of optometry work-related discomfort • Experience of learning how to improve physical comfort while performing clinical procedures • Preferences for learning how to reduce optometry work-related discomfort • Attitudes to patient-comfort and self-comfort	• Demographic questions • Experience of optometry work-related discomfort • Type of teaching given related to optometry work-related discomfort
Distribution method	Internet link to online survey sent to student email account	Internet link to online survey sent to email accounts of clinical teachers at each of the 4 teaching institutions. A hardcopy of the survey was placed in the pigeon holes of casual clinical teachers at UNSW[1].
Duration	The survey was open from the 26th August 2010 to the 19th September 2010.	The online survey was open from 25th June 2010 to 1st October 2010 Hardcopy versions were received up until the 15th October 2010.

[1] University of New South Wales

Both studies were approved by the Human Research Ethics Advisory Panel of the UNSW (reference numbers 10038 and 10040). There was implied consent, if participants chose to complete and submit the survey. Data was managed within a Microsoft excel spread sheet and SPSS (13) and analysed using descriptive statistics.

Results

Students

There was a 48% response rate for the student survey (64 full-time optometry students n=45 female). The gender response rate (70% female) is similar to the gender distribution of senior students enrolled in the optometry program at UNSW (58% - 64% in years 3, 4 and 5).

Clinical exposure over the previous 7 days ranged from less than 3 hours (n=13) to 10+ hours (n= 31) (Table 2). The variation in clinical exposure is attributable to clinical rosters for internal and external clinics and pre-clinical laboratory classes. Clinical exposure over the previous 12 months is difficult to estimate because of the varied experience of students within the clinical program and is therefore not reported in this paper.

Table 2. *Profile of students and experience of discomfort in the last 7 days and in the past 12 months*

		Number of students reporting discomfort in past 7 days		**Number of students reporting discomfort in the past 12 months**	
		Yes	No	Yes	No
Gender	Male	10	9	12	7
	Female	26	19	36	9
Stage of study	Year 3	9	5	9	5
	Year 4	12	14	18	8
	Year 5	15	9	21	3
Clinical exposure during past 7 days	< 3hours	5	8	-	-
	4-6 hours	8	1	-	-
	7-9 hours	5	6	-	-
	10+ hours	18	13	-	-
Actively seek information to improve physical comfort	Yes	8	4	8	4
	No	28	24	40	12

Discomfort was reported when performing clinical techniques in the previous 7 days (n=36, 56%) and in the previous 12 months (n=49, 77%). There were no significant relationships between demographic factors and experience of discomfort although gender and experience of discomfort in the previous 12 months approached statistical significance (chi-square p = 0.06). Lower back, neck, shoulders and elbows/arm were the most frequently reported discomfort sites (Table 3) and were primarily related to performing specific ophthalmic tasks such as direct ophthalmoscopy, retinoscopy and slit lamp fundoscopy.

A small number of respondents (n=12) reported that they have actively sought information from other optometrists or classmates to improve their physical comfort. Only one reported that they had consulted textbooks and the Internet.

The majority of respondents (n=47, 73%) recalled receiving instruction or advice on how to improve their physical comfort while performing clinical procedures. This included

Table 3. *Discomfort associated with clinical techniques according to body site reported by students in the previous 7 days and the previous 12 months*

	% of students reporting discomfort in previous 7 days	% of students reporting discomfort in previous 12 months
Lower back	31	42
Neck	25	39
Elbows/arms	17	33
Shoulder	17	31
Upper back	14	22
Wrist/hands	13	17
Knees/legs	11	22
Ankles/feet	3	8

informal advice from supervisors during practical classes and clinics (n= 36), instruction in lectures (n=21), formal instruction in practical classes (n=9), and advice from seniors/friends who had experienced discomfort (n=6).

Respondents nominated informal instruction or comments from supervisors while performing clinical procedures (28%), formal instruction in practical classes (27%), and one-on-one supervision (14%) as their first preference for learning how to reduce discomfort (Table 4). Other learning methods which were also accepted (but not rated as the first preference) included advice from seniors/friends who had experienced work-related discomfort, trial and error, and watching other colleagues.

When asked to rate the following statements on a Likert scale from 1 (strongly disagree) to 5 (strongly agree):

- "When I set up the consultation room/equipment, I ensure that I am physically comfortable" and
- "When I set up the consultation room/equipment, I ensure that my "patient" is physically comfortable"

Patient comfort was rated more important than personal comfort (Wilcoxon Signed Rank Test, p<0.01).

Clinical Teachers

There were 46 clinical teachers (30% response rate) who participated in the survey, 89% of whom perform clinic supervision. The majority of respondents' work as an optometrist at least one day per month (78%) and make adaptations to clinical techniques to enhance their own physical comfort (93%). Despite this, 48% report that they experience physical discomfort when performing clinical tasks (Table 5).

Providing informal feedback to students (e.g. instruct student to raise the height of the patient chair) and formal instruction in practical classes were the most common teaching methods employed by respondents to assist student comfort (Table 4).

Table 5. *Profile of clinical teachers who participated in survey*

		Respondents	
		n	%
Gender	Male	14	30
	Female	32	70
Years of clinical teaching experience	< 1 year	3	7
	1-5 years	23	50
	6-10 years	4	8
	11-15 years	7	15
	15+ years	9	20
Works as an optometrist	At least one day per month	36	78
	Less than one day per month	10	22
Personal experience of physical discomfort	Yes	22	48
	No	24	52
Adapts own clinical technique to enhance physical comfort	Yes	43	93
	No	3	7

Table 4. *Student preferences for learning and teaching methods employed by clinical teachers*

	Students FIRST preference for learning		Students who would accept this teaching method*		Teachers who use this method*	
	n	%	n	%	n	%
Informal instruction from clinical supervisor	18	28	40	63	41	64
Formal instruction in practical classes	17	27	33	52	19	30
One-on-one supervision by lecturer/supervisor	9	14	15	23	n/a	
Videos shown in practical classes	6	9	19	30	2	3
Trial and error	5	8	26	40	n/a	
Group discussion	3	5	15	23	2	3
Watching other colleagues	2	3	25	39	n/a	
Advice from seniors/friends who have experienced discomfort	2	3	34	53	n/a	
Lectures	1	1.5	17	27	5	8
Other (not specified)	1	1.5	n/a		n/a	

** Percentages total more than 100% because respondents could select more than one option*

Discussion

Optometry students report discomfort associated with performing clinical procedures and female students are more likely to report discomfort than male students. This is similar to reports of medical (3) and dental (5) students and of trends within the optometry profession (2). Reports of upper body and upper limb discomfort associated with specific ophthalmic techniques are also consistent with unpublished data from this multistage project and with descriptions in the ophthalmic literature (14).

A small number of students report that they have actively sought solutions for their discomfort. Only some students recalled receiving instruction in lectures and practical classes. This inability to recall receiving instructions is similar to comments made by clinical optometrists during interviews (15). Further investigation is required to determine whether teachers need to state more explicitly why this knowledge is important (16) and has practical value (17) or whether instruction needs to be given through a variety of methods to cater for different learning preferences (18-19).

Clinical teachers are not given formal instruction how to teach students to perform clinical techniques to reduce work-related discomfort, nor is this an assessable component of the optometry course. Therefore, it is encouraging that the majority of clinical teachers who participated in this study report that they provide feedback to students during clinic supervision to assist their physical comfort. This type of instruction is valued by students, who rated this learning method highly. There are probably many reasons optometry students rate their own comfort secondary to patient comfort, and it is interesting that this attitude also occurs in other healthcare student populations (7-8). There is an opportunity for clinical teachers, who are effectively role models for the next generation of professionals, to provide guidance to students to assist their physical comfort (20).

Limitations

There was response bias as students who experience discomfort may have been more likely to participate. On the other hand, variations in clinical case load could contribute to discomfort (3, 5) – if so, then the figures reported in this study may underestimate the actual discomfort experienced by students engaged in clinical work. Further investigation is required to determine if distributing the survey later in the teaching session influences reports of discomfort (21).

There was also likely response bias in that 93% of clinical teachers reported adapting their own clinical techniques to improve physical comfort; this heightened awareness may have influenced their participation. Despite this, 48% of participants reported work-related physical discomfort, indicating a need for the profession to better understand discomfort, especially if clinical teachers give advice to students.

It is possible that there might be recall bias in asking participants to report their experience of discomfort, leading to an overestimate of actual discomfort (22), particularly if currently experiencing symptoms (23). On the other hand, 22 teachers (48%) and 36 students (56%) reported discomfort while performing clinical procedures, indicating that for some, at least, this is a very real issue during their working day.

Developing strategies for reducing discomfort in optometry students

Continuing to work while injured is a risk factor for severe discomfort in optometrists (2). If students experience discomfort while performing clinical techniques, then this can have consequences for their longevity in the profession and their personal health. Further investigation is required to determine how best to address this issue, for example, developing teaching materials and making them widely assessable. However, the results of this study and evidence reported in other professions indicate that a three way strategy may need to be developed: educate the students, educate the educators, and maximise student exposure to best practice.

Educating students

"Give me a fish and I eat for a day. Teach me to fish and I eat for a lifetime." (Chinese Proverb)

Work-related discomfort could be raised as an issue among students by providing students with a short information sheet describing the risk factors, possible symptoms, and suggestions for remediation (24). A longer term strategy would be to teach students practical methods to identify and solve work-related discomfort issues (24), which can be applied throughout their career (25), and to any working environment. This is an area optometrists have previously indicated a lack of confidence (26). Engaging students in problem solving to reduce work-related discomfort is one method of education and could help influence attitudes, as students share their new-found knowledge with their colleagues (27), particularly senior students who supervise junior students during practical classes (6) or who act as peer-mentors for junior students. This is consistent with this study's results which indicate that students like to learn by watching others and obtaining advice from those who have experienced discomfort.

Educating the educators

"Who dares to teach must never cease to learn." (John Cotton Dana)

Clinical teachers and supervisors, both within optometry clinics and at external placements, help shape student perceptions and attitudes (11, 17, 20, 28) and are well placed to help students understand the importance of self-comfort. Therefore, it is important that clinical teachers give correct and uniform advice to students; otherwise students may receive mixed messages which they then need to interpret on their own (11). Clinical teachers need to receive regular information about current best practice (9), which in turn could assist their own clinical practice (28), and reduce their own personal discomfort.

Maximising student exposure to good practice

"By learning you will teach, by teaching you will learn." (Latin Proverb)

Australian optometry students may encounter unsafe work environments or observe techniques contrary to what they have learnt at university when attending external placements. Although they may have skills to identify unsafe work environments and change their own practice accordingly, they may not have the authority or resources to implement change (6-7, 9) (for example, use alternative equipment or change workplace design) and so may view poor practice as ubiquitous (24). Teaching institutions need to develop mechanisms for students to report poor practice to the workplace or to the course facilitator. This provides opportunities for students to reflect on and discuss issues arising in their placements (9), e.g. as group discussion activities. There is also the opportunity for workplaces to learn best practice from interacting with students (20), which could include clinical techniques and equipment and workplace design. This could be promoted to workplaces as a benefit of participation.

To the future

Educating students and educators is considered a sound strategy for reducing the risk of work-related discomfort (7, 20, 29-30) and has been shown to be effective in changing knowledge and attitudes within nursing (30). Further investigations are required to develop appropriate curricula for teaching optometry students and educators how to reduce the risk of work-related discomfort and to develop outcome measures for assessing the success of such programs. However, a three-way strategy, as described in this paper, ensures a consistent message for reducing work-related discomfort at all stages of the learning process and this may have a flow-on effect for reducing work-related discomfort within the profession.

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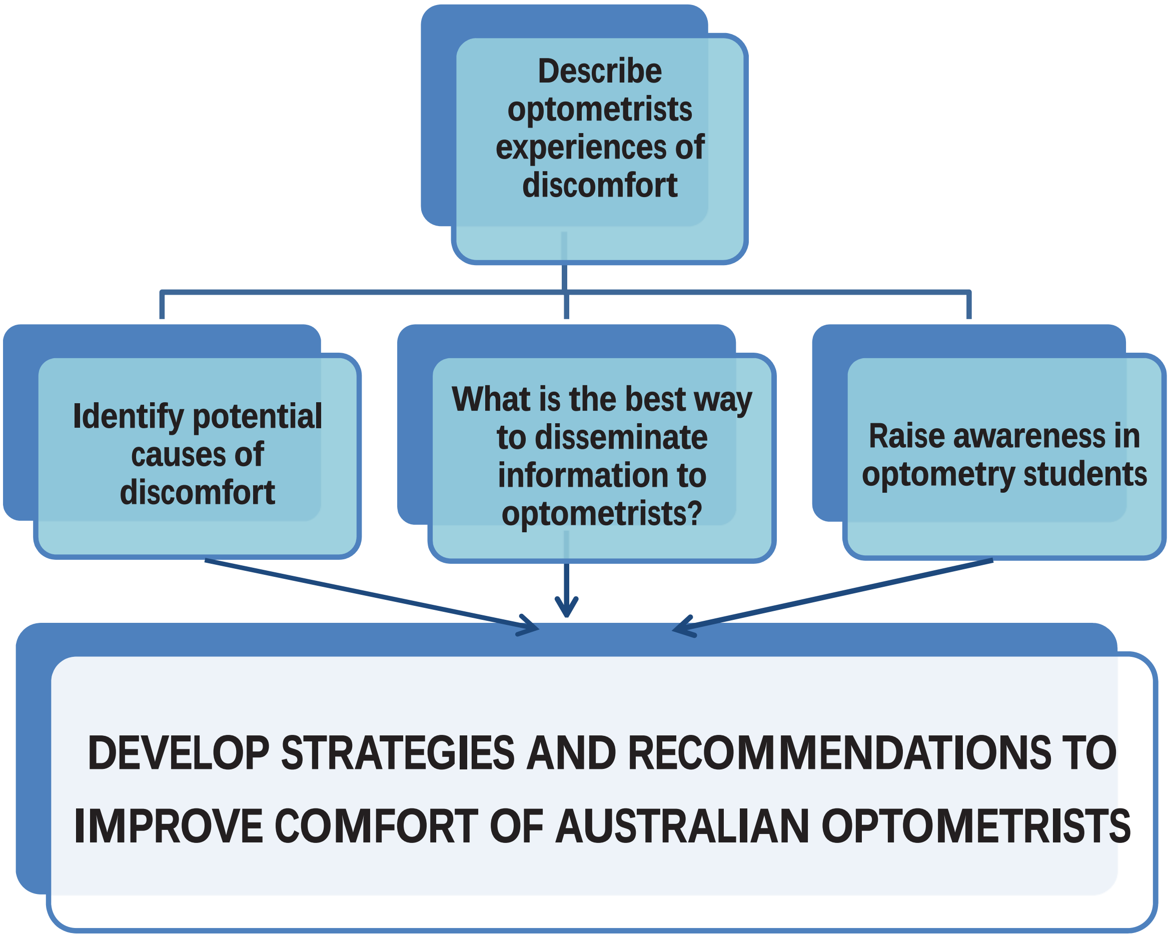
Cite this article as: *Long et al.* Developing strategies for reducing work-related discomfort in optometry students. *Ergonomics Australia – HFESA 2011 Conference Edition* 2011 11:6.

PART 6: Strategies and recommendations



Chapter 9: Implementing change to reduce work-related discomfort in optometrists

One of the goals of this thesis was to develop strategies and recommendations to improve the comfort of Australian optometrists. It was therefore timely to be asked to write a review article for *Optometry in Practice,* a peer-reviewed journal published by the British College of Optometrists. The journal editor specifically requested a paper which was practical for UK, Australian and New Zealand optometrists working in a clinical setting.

There are similarities between the health and safety legislation in each of these countries, so this paper adopts a risk-management approach.

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Optometry in Practice 2012 Volume 13 Issue 1 33 – 44

This paper is part of the *Optometry in Practice* Australian series. Guest Editor: Professor Fiona Stapleton PhD, University of New South Wales

Optometry – a comfortable job for life: a review

Jennifer Long BOptom(Hons) MSafety Sc

School of Optometry and Vision Science, University of New South Wales, Sydney, Australia

Introduction and background

For many people, the term 'work-related injuries' conjures up images of heavy industry, data processing or manual handling. How could an optometry consultation room pose such hazards? It is a relatively clean job, patients are generally mobile and an optometrist typically performs a variety of clinical procedures during any one consultation.

Unfortunately for some optometrists, work-related discomfort and injuries are very real parts of their working day. A recent Australian survey (Long et al. 2011b) estimated that work-related discomfort is experienced by at least 20% of Australian optometrists. It also established that neck, shoulder and back discomfort is commonly experienced by clinical optometrists; this is similar to reports within ophthalmology (Chatterjee et al. 1994; Dhimitri et al. 2005) and anecdotal reports within optometry (Bruce and Snibson 2007; Hutchins and Schneebeck 2004). Clinical tasks which frequently contribute to discomfort are slit-lamp, ophthalmoscopy and refraction (Long et al. 2012), which is consistent with other descriptions within the ophthalmic literature (Chams et al. 2004; Marx et al. 2005). Females and optometrists who perform more than 11 consultations per day are among those who are in a higher risk category for any discomfort (Long et al. 2011b).

Work-related discomfort can have personal and financial costs for individuals (Chiang et al. 2010) and for business (White et al. 2005). These costs may be direct (cost of medical treatment, sick leave and absenteeism) or indirect (loss of productivity (Hagberg et al. 2002; Koopman et al. 2002), wages for replacement staff). There is also a loss to the profession should an optometrist leave optometry altogether, the cost associated with retraining new optometrists and the psychosocial impact for individual optometrists and their families if they are unable to work (Alnaser 2009).

It is a legislative requirement in Australia (Model Work Health and Safety Act 2011), New Zealand (Health and Safety in Employment Act 1992) and Great Britain (Health and Safety at Work etc. Act 1974) that employers should look after the health and safety of their employees. This responsibility extends to the self-employed and to employees to take responsibility for their own health and safety and not put themselves or others at risk. Minimising risks to ourselves and to others is also sound business practice (West 2011).

The purpose of this paper is to review what is currently known about ophthalmic work-related discomfort and to offer practical tips for optometrists to help reduce the risk of discomfort for themselves and others in the workplace.

Stop! If you are in pain

> Initially I put up with the pain and took painkillers ... I had seen specialists and no one could put a finger on what was wrong and regrettably I kept working ... [eventually] we changed various things ... we made the refractor head higher ... a chair with a back rest on it. But by then I think that the damage was already done. Really, the problems still persist (clinical optometrist, now retired).

Optometry is a profession in which clinicians form professional relationships with patients, often within the context of a small business environment. This may create an incentive for optometrists to 'soldier on', despite discomfort, in order to manage their busy appointment books and keep their businesses functioning. Yet continuing to work while injured and performing repetitive tasks increase the risk of severe discomfort and injury (discomfort present for more than 30 days) (Long et al. 2011b).

Should an optometrist cease work until his or her injury is resolved? Probably not: there is evidence that workers who have prolonged absence from work may experience poorer health outcomes, both physically and psychologically, compared with workers who attempt to continue ordinary activities (Bultmann et al. 2007; Waddell and Burton 2001). It is also estimated that stopping work when injured will only reduce the risk of severe discomfort in optometrists by 12%; combining this with ceasing to perform repetitive tasks reduces the risk by only 28% (Long et al. 2011b). This indicates that there are many factors contributing to work-related discomfort (Long et al. 2012), which is similar to conclusions made for other healthcare professions such as nursing (Nelson et al. 2006), physical therapy (Cromie et al. 2001) and dentistry (Valachi and Valachi 2003).

Date of acceptance: 23 January 2012. Address for correspondence: Ms J Long, School of Optometry and Vision Science, University of New South Wales, Sydney, NSW 2052, Australia. j.long@unsw.edu.au

Hoping that discomfort will resolve on its own accord increases the risk that an injury will become chronic. Therefore, it may be appropriate to incorporate stopping work as part of a larger, integrated plan which includes obtaining medical advice during the acute phase of an injury, modifying tasks until the injury is resolved and educating workers how to recognise the early warning signs of injury (Isernhagen 2000). It also provides an opportunity for optometrists to (1) consciously evaluate any underlying factors within the workplace exacerbating their discomfort and (2) take steps to address the source of their discomfort.

Evaluating the cause of discomfort and managing it

> Everybody is after a safe workplace ... [but] it is things that you don't think of that are most likely to cause problems (clinical optometrist who does not report work-related discomfort).

Solutions and strategies for solving work-related discomfort exist in the ophthalmic literature. For example, there are several publications offering general advice for equipment set-up (Marx et al. 2005) and adopting good posture (Green 2008; Hutchins and Schneebeck 2004; Kirby 2007) in ophthalmic environments. Yoga (Chiang et al. 2010), daily stretches (Anonymous 2007; Hutchins and Schneebeck 2004) and general fitness (Green 2008) have also been advocated as solutions to work-related physical discomfort for ophthalmic practitioners.

There are wide variations in equipment, practice styles and room design as well as differences in the physical stature and fitness of individual optometrists. This means that strategies one optometrist may find beneficial for reducing discomfort may not be beneficial for another (Long et al. 2012). For example, there are different views on the most effective posture for preventing discomfort when refracting a patient: is it better to sit or to stand (Hutchins and Schneebeck 2004) or to alternate sitting and standing (Anonymous 2007)? These different viewpoints might be explained by differences between individuals and practices.

Although there is some evidence that exercise may reduce work-related physical discomfort (Silverstein and Clark 2004; Tullar et al. 2010), it is reliant on the practitioner having the initiative, time and opportunity to perform the exercises. Therefore, while some optometrists may gain benefit by incorporating this strategy into their daily routine, this should not be the only control measure (Silverstein and Clark 2004) or a substitute for good workplace practices.

Since it is difficult to provide specific advice for reducing work-related discomfort without assessing an individual in his or her work environment, optometrists need to have skills to evaluate their own work environments and implement strategies which are relevant and workable within their own practices. This can be achieved by a risk management approach.

Risk management

A risk management approach is one way for optometrists to evaluate and manage work-related discomfort and comply with occupational health and safety legislation. This process (described in AS/NZS ISO 31000:2009) includes identifying, analysing, evaluating and treating the risk, communicating and consulting with the stakeholders within the practice (eg employees) at all stages of the process and monitoring any interventions to ensure that they are effective.

It is preferable if risk management plans are implemented by the employer or manager of a practice as this will allow the application of a wider range of treatment options and solutions. However, it is also important for individual optometrists, particularly those who work on short-term placements and as locums, to evaluate any new work environment and then modify it to suit their own physical requirements. Although some solutions for managing discomfort may not be possible (eg rearrange the equipment or furniture in the consultation room), working through the risk management process in a systematic way may give optometrists confidence to discuss issues with their employer or be selective when choosing employment (eg do not accept work in practices where there are known hazards which cannot be resolved).

Table 1. Examples of questions which can be used during the consultation process to identify potential issues and generate ideas for improvement

Identifying issues within the practice	Experience of work-related discomfort	Do you experience physical discomfort associated with your work?
		Is there anything in particular in the workplace which you feel contributes to this?
	Current work area	What do you like about the current arrangement/equipment?
		Is there anything which you find difficult/awkward/inefficient? If so, please describe
Generating ideas for improvement	Experience in other practices	Do you recall any features in other consultation rooms that you found comfortable or efficient? (What did you like?)
		Do you recall anything which you found difficult/awkward/inefficient? (What did you not like?) If so, please describe
	Your wish list	In a perfect world (where money is no object), what do you think would improve your physical comfort in the consultation room?

Identifying potential issues in the work environment

Four techniques for identifying potential issues within the work environment are:

1. consultation with staff
2. checklists
3. observation
4. review of workplace documentation.

Optometrists have a legislative duty to consult with all workers within the workplace (optometrists, ophthalmic assistants and other ancillary staff) since those actually performing the work will have first-hand knowledge of issues contributing to discomfort, and may even be able to offer suggestions for improvement. Questions which may be useful for identifying potential issues within optometry practices are listed in Table 1.

Checklists are a useful tool for identifying issues which are known or established risk factors. There are generic publications for office and workstation design (Comcare 2008) and checklists for optometry practices (Long 2008). Despite their apparent comprehensiveness, a checklist is not usually specific for a particular workplace and so is not a replacement for other methods such as consultation and observation.

Observation of people at work and systematically recording the sequence of actions within a task is called 'task analysis'. Although some task analysis tools can be complex, eg verbal protocol analysis and cognitive modelling (Stammers and Shepherd 1990), its simple form – live observation or observation by video recording – can still be effective and time-efficient. Task analyses are useful because they can identify inefficiencies in procedures which may not otherwise be evident. When used to observe multiple practitioners, it may be possible to determine why one practitioner experiences difficulties and others do not. An example of the task analysis process is given in Table 2. It should be noted that this example is merely an illustration of the process, and for those in practice, a similar analytical process would be ideal for a management decision. For example, when deciding where to position an item of equipment, the initial choice might be based on finances and ease of implementation, but if it caused problems for staff, then it would be rejected in favour of a more expensive solution. Subsequently, a full task analysis would clearly be very worthwhile (and could save money).

In some jurisdictions it is a requirement to keep records of incidents and injuries within the workplace. Reviewing this documentation can provide valuable insight into patterns of injury, particularly if there are multiple practices or a large number of staff employed within an organisation.

Table 2. Task analysis for an optometrist performing direct ophthalmoscopy

Observation	Comment	Options for improvement
Stand next to patient and explain what will happen		
Reach for ophthalmoscope in desktop charger located on desk		
Switch off room lights	Optometrist walks five steps to operate light switch located on other side of room	Light switch that can be operated within easy reach of patient chair
Bend over to reach controls on stand which will raise the patient chair	Optometrist bends over to operate switch on control panel which is located 60cm above floor height	Control panel which is easy to operate while standing, eg higher position, foot control or remote control
Depress button on control panel until chair is the correct height	Optometrist needs to depress switch on control switch for 10 seconds until chair reaches its maximum height	Control panel which is easy to operate while standing, eg higher position, foot control or remote control
Stand on patient's right-hand side and perform ophthalmoscopy on the patient's right eye	This task takes 45 seconds to complete and requires the optometrist to bend and twist significantly	Consider alternative clinical techniques, eg slit-lamp fundoscopy, digital retinal imaging
Stand on patient's left-hand side and perform ophthalmoscopy on the patient's left eye	Limited space between instrument stand and the patient inhibits optometrist from bending and twisting. Examination appears cursory as optometrist only spends 20 seconds examining patient's left eye	Consider alternative clinical techniques, eg slit-lamp fundoscopy, digital retinal imaging Chair and stand that have adequate space for the optometrist to work on both sides of the patient
Place ophthalmoscope in desktop charger		
Switch on room lights	Optometrist walks five steps to operate light switch located on other side of room	Light switch that can be operated within easy reach of patient's chair
Sit at workstation		
Identify correct field on computer program to record information		
Type findings		

Evaluating and treating risks

It can be overwhelming to generate a list of 'problems' within a practice – which problem do you fix first? One tool for establishing the priority with which issues are dealt with is a risk matrix. This tool assigns a rating for each issue based on the likelihood and consequences of injury or discomfort – the higher the rating, the more urgently an intervention is required. Although there are limitations with this type of tool (Pickering and Cowley 2010) (eg there may be differences of opinion between observers for the rating and hence the priority given to risks), risk matrices provide a platform for discussion of hazards and risks within the workplace. Table 3 shows how a risk matrix can be applied to the task of slit-lamp fundoscopy and how ratings may vary between different staff.

Appropriate options for problem solving can be generated using the questions listed in Table 1. It is best to treat this part of the process as a brainstorming exercise where any idea, no matter how outlandish, is recorded as a possible treatment option. These ideas can then be allocated into categories based on the hierarchy of hazard controls (Comcare 2008): engineering and design controls, administrative controls and personal protective equipment. Control measures which eliminate or 'design out' the risk are usually considered more effective than administrative controls such as providing training or instruction. After considering all options, appropriate control measures based on the practice context (ie available resources and ability to implement change) can be selected for implementation. Table 4 gives an example of work-related discomfort associated with using a manual phoropter and how the risk management process can be used to reduce discomfort.

The risk management process does not stop with the implementation of a particular control measure. Instead, it is a continuous process whereby interventions need to be monitored and reviewed to ensure new risks are not introduced. Table 4 describes possible risks associated with substituting a manual phoropter with a computerised phoropter.

Documenting the process

Depending on legislative requirements, it may be necessary to document the risk management process formally so that due diligence can be demonstrated in the event someone is injured. An example of documentation formats is available from the UK Health and Safety Executive (Health and Safety Executive 2003).

Table 3. A risk matrix applied to performing slit-lamp fundoscopy. Although both optometrists experience discomfort most times they perform the task, optometrist number 1 assigns a different rating to optometrist number 2 based on the consequences of the discomfort. Subsequently, optometrist number 2 may perceive a greater urgency for action

		Likelihood				
		Rare (rarely experience discomfort)	Unlikely (discomfort only present when task is performed for prolonged periods)	Possible (discomfort present some times task is performed)	Likely (discomfort present most times task is performed)	Almost certain (discomfort present every time task is performed)
Consequences	Insignificant (no discomfort)	Low priority				
	Minor (discomfort present but can still work)				Optometrist number 1 	
	Moderate (limited ability to perform task)				Optometrist number 2 	
	Major (medical assistance required)					
	Extreme (cannot work)					High priority

Table 4. The risk management process applied to managing shoulder pain associated with use of the phoropter

Risk management stage	Comments
Establish the context	Who is the decision maker within the workplace? What resources are available?
Identify the risk	Shoulder pain is experienced while using the phoropter
Analyse the risk	Observation/photography/video footage shows several possible causes of discomfort: • Arms outstretched to operate controls • Arched back and neck to read displays • Optometrist only stands on the patient's right-hand side, even when refracting patient's left eye 
Evaluate the risk	What is the likelihood of this continuing to be a problem? For example: • How frequently is this task performed? • What is the current level of discomfort? • What are the consequences of discomfort? Risks which are performed more frequently and which have a higher personal or financial cost (eg the optometrist is unable to work) require more urgent attention (see Table 3)
Treat the risk	Using the hierarchy of controls, there are several ways in which this issue can be managed: Eliminate the risk • Cease performing refractions • Do not work in this practice/consultation room Substitute tasks/equipment • Replace manual phoropter with a computerised phoropter Engineering options • Install a patient chair which can be raised higher • Attach labels on phoropter which are easier to read Administrative controls and training Instruct the optometrist to: • stand closer to patient • raise patient higher in the chair • sit down while refracting • work bilaterally, ie stand on the patient's left-hand side when refracting the left eye • perform stretching exercises between patient appointments The control measures which are selected will depend on the practice context, ie available resources and the ability to implement change
Monitor and review	If a decision is made to install a computerised phoropter, then this may eliminate the risk of shoulder discomfort but introduce hand and wrist discomfort from operating a computerised control panel. Therefore: • Consultation/communication with workers is required to identify any new problems arising from use of the new equipment • These risks need to be evaluated and treated as per the above process

Participatory ergonomics

A variation on the 'evaluate and treat' stage of the risk management process is participatory ergonomics.

Ergonomics is a scientific discipline in which tasks, jobs, products, organisations and environments are planned and designed to 'make them compatible with the needs, abilities and limitations of people' (International Ergonomics Association 2011). Ergonomics has three domains: (1) physical (eg workstation design, furniture); (2) cognitive (eg work complexity); and (3) organisational (eg allocation of work duties). An overview of the three domains of ergonomics applied to office work is given in Comcare's (2008) publication *Officewise – A Guide to Health and Safety in the Office*. Examples of how the three domains of ergonomics can be applied to optometry practices are given in Table 5.

Participatory ergonomics is a process whereby someone external to an organisation (eg an ergonomist) provides training and information about ergonomics to all workers in the workplace. Instead of the ergonomist setting up the work area and 'fixing issues', the workers devise their own solutions and strategies for improving comfort and performance under the facilitation and guidance of an ergonomist (Institute for

Table 5. The three domains of ergonomics and examples of how this can be applied to optometry practices

Domain of ergonomics	How this may contribute to work-related discomfort	Examples within optometry practice	
Physical	Forces and postures may exceed the physical capabilities of the individual	Manual handling	Assisting less mobile patients in and out of the consultation chair Carrying and lifting equipment for home visits Moving equipment, eg a visual field machine mounted on a table with wheels Accessing supplies stored in cupboards
		Posture	Bent postures, eg for direct ophthalmoscopy Shoulder abduction, eg standing on patient's right-hand side while refracting patient's left eye Neck rotation, eg twisting to talk to patient while typing on the computer Repetitive actions, eg typing Static postures, eg holding an occluder or prism bar in front of patient's eye Pinched grip, eg holding trial lenses, screwdrivers
Cognitive	Reduced efficiency, dissatisfaction with work systems and work stress can indirectly contribute to physical discomfort issues	Information displays and computer systems	Computer programs which require many mouse clicks to navigate a program. This can: • cause arm and hand discomfort from mouse clicking • increase the amount of time required to record information
		Task complexity	High caseloads of patients which require intensive concentration, eg special needs patients, consultations which have legal implications Adequate time to make correct clinical decisions
		Task variety	Variety of consultation types throughout the day Integration of consultations with other tasks throughout the day, eg administration, dispensing
		Work volume	Mental fatigue from high and/or complex patient loads
Organisational	Reduced efficiency, dissatisfaction with work systems and work stress can indirectly contribute to physical discomfort issues	Rest breaks	Natural breaks within the work day, eg between patients Formal breaks within the work day, eg scheduled lunch breaks
		Control over work environment	Ability to arrange consultation room to suit personal work requirements, eg room arrangement, thermal environment Number of patients per day
		Deadlines	Appointment scheduling
		Communication	Interaction with others in the workplace, eg ancillary staff who assist with pretesting of patients, reception staff who manage appointment scheduling

Work & Health 2008). Since the process engenders ownership of the problem-solving process, the interventions are more likely to be accepted by workers within the workplace (Wilson 1995). Participatory ergonomics incorporates the three domains of ergonomics, which is important if work-related discomfort is multifaceted. This broad approach has been shown to be effective for reducing work-related injuries (Rivilis et al. 2006, 2008; Straker et al. 2004).

Feasibility studies within optometry indicate that participatory ergonomics may be accepted within optometry practices (Long et al. 2010) but its success does require commitment (eg time, interest in participating) by all within the workplace. Combining a prescriptive element (eg 'here are some ideas for what you can do and what others have found useful') within a participatory approach could be a useful strategy for optometry practices as this would give direction to the problem-solving process while enabling participants to enact practice-specific interventions (Long et al. 2010).

Purchasing decisions

> I look at how things are put in the room and I think 'nobody has actually thought about how this was going to be used at all when they put this together' (locum optometrist).

The ideal time to consider strategies for reducing the risk of work-related discomfort is when planning a practice and purchasing equipment, before problems are experienced.

Predicting work-related discomfort can be achieved by using consultation, checklists and task analysis, as described in the above section on risk management. Table 1 gives some ideas for questions which can be used to generate ideas for improvement, while Table 2 illustrates how the task analysis process can be used to generate options for possible modification.

Unfortunately, these tools may not identify all potential problems. After all, it is a difficult process to imagine how a new consultation room will look or gauge how much space will be available around equipment until the consultation room is actually constructed or the equipment installed. If estimates are incorrect, this can result in inefficiency and additional costs postinstallation to rectify problems (Long and Hughes 2011).

Three-dimensional computer simulations (eg Google Sketchup, available from http://sketchup.google.com/) are a useful adjunct to traditional architectural floor plans as they allow the viewer to pan around the proposed room and judge, for instance, if the work area is likely to be congested. Cardboard mock-ups representing the size and location of proposed equipment (Long and Hughes 2011) are useful for estimating what the actual work area will look and 'feel' like before final installation and for determining if equipment (desk and equipment location) and services (power points, light switches and sinks) will allow efficient and comfortable working.

Viewing equipment at trade fairs and in ophthalmic showrooms can be useful for comparing the features of different items of equipment but is not equivalent to using these items in a consultation environment. Optometrists purchasing equipment this way might consider taking along someone who is a similar size to a typical patient (eg a child if the optometrist works in a paediatric practice) so that they can 'work through' a typical consultation to ensure that the equipment suits their needs (Long 2008). Trialling equipment before purchase, eg loaning equipment from ophthalmic companies or trying out equipment in the practices of colleagues, is another way to predict likely problems.

Integrating new technology into existing infrastructure

New technology has revolutionised the practice of optometry, enabling optometrists to perform advanced diagnostic techniques, store and retrieve digital records and transfer information easily between practices and practitioners. As these advances occur over time and require a significant financial investment, the technology is often integrated with existing consulting-room design and equipment. Subsequently, computers may be installed at workstations originally designed for reading and writing tasks and additional large items of equipment may reduce space within the consultation room. This can have an impact on comfort and efficiency.

Work-related discomfort associated with computer use has been reported as an issue by Australian optometrists (Long et al. 2012), for example, twisting to talk to the patient while recording information (Figure 1a). Although optometrists may not sit at their computers for prolonged periods, it is still important that workstations are arranged correctly. There are many resources which provide guidance on this issue (Comcare 2008; Health and Safety Executive 2006) but incorporating these principles (eg ensuring adequate space on and around workstations for comfortable posture) into an optometry practice may require some lateral thinking. Options which could solve the postural issues illustrated in Figure 1a include repositioning the computer to an alternative work surface (Figure 1b), mounting the keyboard and monitor on an articulated arm near the patient, using hand-held tablet devices to enable a more traditional writing posture or installing voice-activated software for recording information. Care should also be taken that work surface heights are appropriate and do not introduce additional hazards (Figure 2).

Figure 1a. Digital record keeping is increasingly common in optometry practices but can contribute to discomfort if the optometrist has to twist between speaking with the patient and using the computer.

Figure 1b. An alternative room set-up with the monitor and keyboard next to the patient consultation chair may allow better comfort since the optometrist can adopt a more neutral posture when using the computer.

Figure 2a. A digital imaging system had been installed in this practice and was controlled by a mouse and keyboard located on a 70cm-high table. Subsequently, the optometrist experienced neck and shoulder discomfort from bending to one side.

Figure 2b. The table height was raised by mounting the table on a 17cm-high wooden platform. This resulted in better posture for the optometrist and improved comfort.

Be a role model for the next generation

> You [need to] teach [students] really good habits right from the start (clinical optometrist with some experience of work-related discomfort).

During the course of their education, optometry students have the opportunity to learn from a wide variety of practitioners: academics, preclinical teachers, clinical supervisors within university clinics and optometrists within clinical practice. Optometrists who have taken on any of these roles can probably recall instances when ex-students have told them: 'I remember when you said...', substantiating the fact that teachers are role models for the next generation (Dunsky 1982).

Teachers therefore have a responsibility to set a good example and give advice if they notice students are putting themselves at risk of work-related discomfort. There is evidence that optometry students experience discomfort associated with clinical procedures, that this increases with clinical exposure and is similar to the discomfort sites and clinical tasks reported by optometrists in practice (Long et al. 2011a). Providing constructive feedback for students is considered a quality of effective supervision (Kilminster and Jolly 2000; Mullin 2010) and reported as the most popular way students would prefer to learn how to reduce work-related discomfort (Long et al. 2011a).

Addressing work-related discomfort during training may reduce the incidence and impact of work-related discomfort in future generations of optometrists. There are three levels at which this can be incorporated (Long et al. 2011a):

1. Developing teaching curricula which: (1) increase awareness among students that optometry work-related discomfort is possible; and (2) provide students with resources and skills to manage this issue, should it arise. Teaching resources could range from short information sheets for various clinical procedures through to formal instruction on how to apply the risk management process.

2. Communication of evidence-based knowledge about work-related discomfort to all clinical teachers, whether in private practice or within educational institutions. This will ensure students receive a consistent message, irrespective of the teaching mode (Werner 1989). If students receive conflicting advice they need to determine themselves which information is 'correct' (Spafford et al. 2004) and this may be influenced by other factors, such as the status of the teacher or whether the student likes the teacher.

3. Reinforcing information students are taught at university by maximising their exposure to comfortable and efficient working practices when they attend external placements. This does not necessarily mean that external placements should be 'perfect' before students are allowed to attend, but does provide an opportunity for practitioners to learn from students. For example, if practitioners are open to, and invite comments from, students on their experience and impression of practice placements, this may stimulate improvements within the practice (Long et al. 2011a).

Conclusion

> Ergonomics sounds really boring but ... [this is about your] ability to work comfortably as an optometrist ... This is a maintenance programme for life (self-employed optometrist who wishes she had known this information years ago).

Work-related discomfort is a widespread and complex issue within optometry. Although individual optometrists may find simple remedies helpful (eg performing exercises, adjusting posture), a systematic analysis, as demonstrated in this paper, is an effective strategy for solving work-related discomfort. The multifaceted nature of work-related discomfort indicates that strategies need to be developed and implemented by the whole profession – clinicians, students, academics, professional bodies and industry (equipment manufacturers). This is consistent with recommendations made in other healthcare professions: physical therapy (Cromie et al. 2001), dentistry (Valachi and Valachi 2003) and nursing (Collins and Bell 2010). A combined approach requires communication between the various stakeholders. This could be facilitated through formal working groups, resource websites and blogs/email discussion forums.

There are costs (time, financial) associated with implementing the strategies described in this paper, but these might be offset by savings associated with efficiency and productivity, with medical and insurance costs (eg workers' compensation) (Collins and Bell 2010; Nelson et al. 2006) and with retention of optometrists in the profession.

Our ability to earn an income is an asset – it is up to us as individuals and as a profession to look after it.

Summary

Work-related discomfort is experienced by many optometrists and this can have high personal and financial costs for individuals and for business. This is a multifaceted problem with many contributing factors. Although individuals can apply simple interventions such as adjusting their posture or performing exercises, the problem is best addressed in a systematic way and should involve the whole profession – clinicians, students, academics, professional bodies and industry.

This paper outlines the current knowledge of ophthalmic work-related discomfort. It also discusses approaches optometrists can adopt to reduce the risk of discomfort for themselves and others so that compliance is achieved with work health and safety legislation. Practical examples illustrate how risk management plans can be implemented within optometry practice and how optometrists can predict potential issues before designing consultation rooms and purchasing equipment.

Optometrists in teaching roles, both within academic institutions and in private practice, have an opportunity to be role models for students by offering advice if students are placing themselves at risk of work-related discomfort, giving students exposure to examples of good practice and being open to improvements within their own practices. This may reduce the incidence and impact of work-related discomfort in future generations of optometrists.

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CPD Exercise

After reading this article can you identify areas in which your knowledge of occupational health and safety has been enhanced?

How do you feel you can use this knowledge to offer better patient advice?

Are there any areas you still feel you need to study and how might you do this?

Which areas outlined in this article would you benefit from reading in more depth, and why?

Chapter 10: Blueprint for change – Developing a strategy for reducing work-related discomfort in the optometry profession

This thesis started with a simple question “Do Australian optometrists experience work-related discomfort?” and grew into a multi-stage study involving more than 500 participants.

During the course of this investigation, many of these participants asked what would become of the all the data which was collected. Would it be published? Will there be guidelines or recommendations to improve the physical comfort of optometrists at work? Honouring the generosity of those who contributed their time and who shared their experiences was the driving force for having the majority of this work published.

One only has to pick up a safety or an ergonomics professional publication to be aware of the challenges facing these professions in effecting change within workplaces. Too often, safety and ergonomics is perceived as a legislative requirement or an added burden which detracts from the day-to-day requirements of running a business. Yet at the heart of these “administrative burdens” are real people with families and personal lives who want to participate in the workforce but may be limited by injuries or discomfort sustained or exacerbated by their work.

This thesis has established that:

- Work-related discomfort exists in the Australian optometry profession and independent risk factors for discomfort are female gender and performing more than 11 consultations per day. Independent risk factors for severe discomfort are performing repetitive tasks and continuing to work while injured. The most common sites of discomfort are the neck, shoulder and lower back (chapter 3).
- The clinical tasks most commonly reported as contributing to discomfort are using the phoropter, slit lamp, ophthalmoscope and computer. Optometrists older than 41 years were more likely to report that they adjust their posture and females were more likely to report that they alter their work schedule (chapter 3). Factors contributing to discomfort include sustained postures, awkward postures, inability to adjust equipment and inadequate space (chapter 4 and 5).
- The severity of discomfort experienced by Australian optometrists ranges from mild to severe with several participants in this project reporting that they have retired from

clinical work or who work reduced hours (chapter 3). Despite this, clinical optometrists generally like their work, particularly the clinical challenge and interacting with their patients (chapter 6) and “soldier on” with their work rather than take time off for their discomfort (chapter 3).

- Work-related discomfort can manifest early in an optometrists career, sometimes even before graduation, and optometry students rate their patients comfort more important than their own comfort (chapter 8).

The publication of the research papers in this thesis has raised the profile of work-related discomfort in the optometry profession. It has also resulted in exposure through different media. This represents an application of the findings presented in chapter 7 which recommended that information about work-related discomfort should be disseminated to optometrists via multiple channels to cater for different learning styles. For example:

- Journalists in Australia and the USA have used these publications as a platform for articles in Australian Optometry (Anonymous, 2011), Practice (Carter, 2012), Insight (Anonymous, 2012) and Review of Optometry (Mullarkey, 2012).
- A practical review paper for clinical optometrists was commissioned by the British College of Optometrists for their publication “Optometry in Practice” (chapter 9)(Long, 2012).
- In 2011 preliminary results of this project were presented at a single-stream optometry conference, the Australian Vision Convention, to an audience of approximately 400 clinical optometrists (Johnson, 2011).
- In 2012 the results reported in chapter 5 were presented at the Vaegan Seminar within the School of Optometry and Vision Science. This seminar was attended by 15 clinical educators within the school.

Anecdotal reports also indicate that some optometrists have actively made changes to their working environment to reduce their discomfort since participating in the surveys, interviews and observations. This is an encouraging outcome and augers well for implementing formal strategies, such as the participatory ergonomics approaches explored in chapter 7.

A strategy for the optometry profession

Chapter 4 presented the argument that strategies for reducing work-related discomfort should be broader than simply providing postural advice to individuals. This is important because some poor postures are also the result of equipment and consultation room design. Effective change will be best achieved by involving the whole profession – clinicians, academics, students, designers, manufacturers – in the problem solving process (chapter 2).

A model for reducing work-related discomfort which could be modified for use by the optometry profession is one which has been adopted by the nursing profession in the USA. This project, which is coordinated by the National Institute for Occupational Safety and Health (NIOSH) (Collins & Bell, 2010) is described in more detail in chapter 1 (section 1.4.5, page 24).

Although nursing is a much larger profession than optometry and the majority of nurses work for large organisations (e.g. hospitals, aged care facilities), it is still feasible to adapt the nursing model for use within the optometry profession.

The following avenues of investigation are strategies which could be run independently. However, a more effective outcome is likely if they are implemented as part of a larger multifaceted project, as NIOSH has done with nursing in the USA.

How widespread is the issue within optometry?

There were 339 optometrists who reported work-related discomfort in the original questionnaire issued to Australian optometrists (chapter 3). It is likely that this is an underestimate of the true extent of the issue in Australia. Another questionnaire with facility for tracking non-respondents could provide prevalence estimates for the profession.

This thesis also described a range of personal consequences of discomfort and injury in the Australian optometry profession (chapter 3). Although optometry is a small profession, it may be possible to obtain data from the Workers Compensation Commission, private insurers, ophthalmic companies and private businesses which document the type and consequences of injuries reported by optometrists.

Alternatively, the results presented in chapter 3 provide a basis for developing tools for surveying the optometry workforce. Questions relating to consequences and costs could be included in prevalence surveys of the profession.

Engagement with stakeholders

Four groups of stakeholders were consulted in this thesis: clinical optometrists, clinical teachers, optometry students and the Head of the School of Optometry and Vision Science, UNSW, who was the primary supervisor of this thesis. Representation among clinical optometrists included business owners, employees and locum optometrists.

In-kind support was provided to this thesis by the Optometrists Association of Australia and the Heads of School of 4 optometry teaching institutions in Australia and New Zealand who distributed surveys to their members and staff.

More formal engagement is required with equipment manufacturers, optometry practice designers, health and safety personnel within ophthalmic companies, the Optometrists Association of Australia and Heads of optometry teaching institutions to determine their opinion of existing problems and potential solutions. Investigation is also required to determine who key opinion leaders are and who could act as ambassadors for change within the profession. Since this is an issue which is likely to have implications for optometrists worldwide, engagement with the World Council of Optometry would also be worthwhile.

Laboratory and field research

Rapid Upper Limb Assessment (RULA) data reported in chapter 5 indicate postures and equipment which pose a greater risk of discomfort for optometrists. Further laboratory and field research could be conducted to assess specific postures and to document improvements when using alternative items of ophthalmic equipment. Investigative tools could include 3-dimensional motion analysis, biomechanical analysis and electromyography.

Since clinical optometrists and optometry students appear to have a culture of placing their patients comfort above their own (chapter 3 and chapter 8), laboratory and field research should also evaluate the implications for patient comfort and demonstrate positive patient outcomes. This is likely to be a key issue for optometrists adopting interventions.

Inefficiency associated with consultation room and equipment design was reported by participants in this thesis, e.g., twisting to talk to patients while entering data into the computer (chapter 4 and 5) and handwriting information during the consultation and then later entering the data into the computer (chapter 4). There is scope for assessing the efficacy of different consultation room designs, e.g. by analysis of productivity and work satisfaction. These data could be used to demonstrate a business case for change within the profession.

Intervention trials

A participatory ergonomics approach could work within optometry practices. The findings reported in chapter 7 indicate that programs should be facilitated by someone who understands the industry, the facilitator should help optometrists prioritize issues, there should be a prescriptive element and the process should not be time intensive.

Initially, it might be best to conduct participatory ergonomics trials in medium-size optometry practices (up to about 10 employees) as these practices are likely to have a range of different staff members who work on-site and who can contribute to the process e.g. optometrists, optical dispensers, ophthalmic assistants and receptionists. Later, the implementation could be expanded to include smaller practices (e.g. less than 5 employees) and corporate optometry practices which may have less than 5 employees onsite but have other employees (e.g. human resources manager, general manager) within the organisation. The long-term effectiveness of the intervention should also be evaluated, as there is the risk that interventions will not be maintained unless they are embedded into workplace culture and company strategies.

Development of informative materials for distribution via multiple channels

The dissemination of information about work-related discomfort has already commenced. This has been achieved by the publication of research papers and review articles based on the thesis results, articles published by journalists in ophthalmic magazines and conference presentations.

The results of further laboratory and field research (as proposed above) could form the basis of further research papers, information sheets and guidelines for the profession.

Other avenues for knowledge transfer could include:

- Personal case studies. For example, one participant who is medically retired as a result of his discomfort reported that he would be happy to tell his story to the optometry profession as a case report in an ophthalmic publication. Using genuine cases, rather than generic cases, would provide greater credibility.
- Business case studies which demonstrate the financial and productivity benefits of change (as discussed above).
- Teleconference options for providing remote assessments and advice, as proposed for rehabilitation providers (Bruce & Sanford, 2006). Some telephone interview participants in this project reported that they received a benefit by participating and that this has assisted in reducing their work-related discomfort. For example, after

discussing options during the interview, one participant now takes a barstool for patients to sit on at external clinics (Chapter 4). A telephone hotline could be implemented as a service to Optometrists Association of Australia members, similar to existing hotlines which provide advice about human resources, industrial relations and general workplace issues.

- Information booths at trade fairs for optometrists to ask advice. This option was proposed by 2 participants during the interviews (chapter 7).

Develop evidence based practice and incorporate this into optometry curricula

Chapter 8 of this thesis describes a three way strategy for reducing discomfort in optometry students. This includes:

- Educating students e.g. provide short information sheets, teach risk management skills
- Educating the educators about current best practice
- Maximising student exposure to good practice.

Further investigation is required to develop:

- appropriate curricula for teaching optometry students and educators how to reduce the risk of work-related discomfort and
- outcome measures for assessing the success of such programs.

There may also be a role for engaging the profession and industry in student education to reinforce the message that everyone is a stakeholder in reducing work-related discomfort in the optometry profession.

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APPENDIX A: Survey Tools

Questionnaire sent to Australian Optometrists 2010

Part 1

This questionnaire includes questions about eight body regions:

Neck	Wrist / Hand
Shoulders	Elbow
Upper back	Knee
Lower back	Ankle / foot

Some of these body parts overlap so you will need to decide for yourself which part you have experienced discomfort (if any).

You only need to fill in the section that applies to you. For example, if you only experience neck discomforts, fill in the section for neck only.

If you experience discomfort in more than one region, you will need to complete the questionnaire for each body region.

N.B. The term "Discomfort" includes pain, ache, difficulty with movement and numbness. In this questionnaire, please only respond to work related discomfort.

Have you experienced discomfort in any of the following body regions while working as an optometrist in the last 12 months? (You may check more than 1 box)

- ☐ neck
- ☐ shoulder
- ☐ upper back
- ☐ lower back
- ☐ elbow
- ☐ wrist / hand
- ☐ knee
- ☐ ankle/foot
- ☐ I have not experienced discomfort in any of the nominated body regions over the last 12 months

Part 2

1. Have you ever been hospitalised because of neck discomfort?

☐ No ☐ Yes

2. Have you ever had to change jobs or duties because of neck discomfort?

☐ No ☐ Yes

3. What is the total time length that you have had neck discomfort during the last 12 months?

☐ 0 day

☐ 1-7 days

☐ 8-30 days

☐ More than 30 days, but not everyday

☐ Everyday

4. Has your neck discomfort prevented you from performing certain tasks?

a. Work-related activities?

☐ No ☐ Yes

b. Leisure or Home activities?

☐ No ☐ Yes

5. What is the approximate length of time that neck discomfort has prevented you from doing normal tasks (at home or at work) during the last 12 months?

☐ 0 days

☐ 1-7 days

☐ 8-30 days

☐ More than 30 days

6. Have you been seen by a doctor, physiotherapist, chiropractor or other health care provider because of neck discomfort?

☐ No ☐ Yes

7. Have you had neck discomfort at any time during the last 7 days?

☐ No ☐ Yes

8. The following list describes tasks at work which could contribute to work related discomfort. Have any of these factors contributed to your neck discomfort? (You may check more than one box)

☐ Performing repetitive tasks

☐ Examining a large number of patients per day

☐ Insufficient rest breaks during the workday

☐ Working in awkward and cramped positions

☐ Working in the same position for long periods (e.g. standing, bent over, sitting)

☐ Bending or twisting your back in an awkward way

☐ Working near or at your physical limits

☐ Reaching or working away from your body

☐ Continuing to work while injured or hurt

☐ Lifting or moving dependant patients

☐ Carrying, lifting or moving heavy objects or equipment

☐ Work scheduling (overtime, length of workday)

☐ None of these factors apply to me

9. Do any specific work tasks or ophthalmic techniques increase your neck discomfort?

☐ No ☐ Yes

If yes, please specify: ____

10. Have you been able to modify your work or your work space to decrease your discomfort?

☐ No ☐ Yes

If yes, please specify: ____

Part 3

We would like to now ask you some questions about yourself and your work as an optometrist:

- **Gender** ☐ Male ☐ Female
- **Age** ☐ 21-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61-70 ☐ 71+
- **Are you right-handed or left-handed?** ...... ☐ Right handed ☐ Left handed
- **What mode of practice best describes your work as an optometrist?**
  - ☐ Self employed
  - ☐ Full-time or part-time employee
  - ☐ Locum
- **How many years have you been practicing as an optometrist?**
  - ☐ <5 years ☐ 5-10 years ☐ 10-15 years ☐ >15 years
- **What tasks do you usually perform at work? (please check all that are appropriate)**
  - ☐ Frame Selection
  - ☐ Dispensing/Repairs
  - ☐ Eye examinations
  - ☐ Administration
  - ☐ Other (please specify): ____
- **On average, how many hours per week do you work as an optometrist? (include all tasks such as administrative, dispensing etc)**
  - ☐ <10 hours
  - ☐ 10-19 hours
  - ☐ 20-29 hours
  - ☐ 30-39 hours
  - ☐ 40+ hours

- **On average, how many eye examinations do you conduct per day?**
  - ☐ 0-5
  - ☐ 6-10
  - ☐ 11-15
  - ☐ 16+

Schedule of questions for interviews with optometrists 2009-2010

PART 1: The type of work you do

1. What is your employment status?
   - ☐ Self employed
   - ☐ Employee
   - ☐ Locum
2. Do you **primarily** work in an:
   - ☐ Urban practice?
   - ☐ Rural practice
   - ☐ Regional practice?
3. Is the practice at which you **primarily** work:
   - ☐ Independent
   - ☐ Chain. If so, please specify ______________________________
   - ☐ Franchise. If so, please specify ___________________________
4. How many days per week do you work as an optometrist in clinical practice?
5. On average, how many patients do you examine per day?
6. During a typical week, what proportion of your time is spent doing the following tasks?
   - _____% Eye examinations and other consultations with patients (this includes tasks such as vision training and contact lens instruction)
   - _____% Frame selection
   - _____% Dispensing (i.e. glazing and assembly of spectacles, repairs)
   - _____% Administration

7. Just thinking about the eye examinations and other consultations, what proportion of your time is spent performing the following consultations?
   - _____% Routine eye examinations (10900, 10918 etc), co-management e.g. Lasik, cataract
   - _____% Contact lens delivery, aftercares, instruction
   - _____% Vision therapy
   - _____% Domiciliary visits
   - _____% Surgical assisting (i.e. gowning up with an ophthalmologist and assisting in a surgical environment)
8. How many people work in the practice where you **primarily** work?

________ Optometrists

________ Optical Dispensers

________ Practice managers

________Receptionists

________ Ophthalmic assistants

Other, please specify ______________________________

PART 2: Your job and job satisfaction

9. How much input did you have into the choice of equipment and furnishing in the practice where you work?

   If you furnished the practice yourself, were the bench heights custom built or off-the-shelf?

10. How much control do you have over the type of work you do as an optometrist? For example, do you see whoever comes through the door and then refer any patients who you are not equipped to manage? Or do the front desk staff pre-screen patients so that you only perform a particular type of consultation (e.g. only see kids, don't do contact lenses etc)?

11. How much control do you have over your pace of work? For example,? Are length of appointments, appointment scheduling, lunch and other comfort breaks set by someone else, e.g. the practice manager? If you are seeing another patient, do the front-desk staff ask you first if you can fit in another patient, or do you come out after your patient to find "surprises" in the appointment schedule?

12. What do you like about working as an optometrist in clinical practice?

13. What do you like about your job where you currently work?

14. In general, how stressful do you find your work as an optometrist? Why? Why not?

PART 3: Work-related discomfort that you experience

Over the past 12 months have you experienced work-related discomfort in any of the following body regions?

☐ Neck	☐ Shoulder	☐ Upper back	☐ Lower Back
☐ Elbow/arm	☐ Wrist/hand	☐ Knee/leg	☐ Ankle/foot

If the participant indicated more than one body region they were asked if the discomfort the same entity. For example," if you experience neck and shoulder pain:

- *"Are they both caused by using the slit lamp?"*
    - *If so, then this section was completed once, combining the neck and shoulder discomfort.*
- *"...or do you get neck pain when you use the slit lamp and shoulder pain when you are refracting?"*
    - *If so, then this section was completed twice – once for neck discomfort and then once for shoulder discomfort.*

If the participant did not report work-related discomfort then this section was omitted.

15. Can you describe the discomfort you experience?
16. Are there any particular optometry tasks that make this discomfort worse? If so, please describe
17. Are there any activities that you do in your non-work time which you think contribute to the discomfort you experience at work? For example, playing a musical instrument, using the computer, playing sport, driving.
18. Are there any strategies that you adopt to minimise or reduce this discomfort? If so, please describe.
19. Have you tried any strategies that don't work? If so, please describe
20. Have you ever had any medical treatment for this condition?
    a. What sort of treatment? For example, were you hospitalised? Did you see a medical practitioner? Did you see another type of healthcare worker?
    b. How many treatments? Over what time period?
    c. What was / is of cost for treatment?
        i. Cost before and after claiming from Medicare or a health fund
        ii. Cost of medications

    d. Did you need to take time off for treatment? If so, how much time? Did you employ another optometrist to do your work while you were away?
    e. Has your treatment been claimed under Workers Compensation?

21. Have you had to stop work as a result of your discomfort? Or have you continued to work while uncomfortable?

PART 4: Ergonomics

22. Have you ever obtained information about ergonomics to assist you with your physical comfort at work? This could take the form of reading books, doing a course, looking up the internet.

    If so, what type?
23. If you were sent unsolicited written material about ergonomics and how it applies to optometrists in clinical practice (e.g. an insert in Australian Optometry), what is the likelihood you would read it?
24. If you were sent a DVD (unsolicited) about ergonomics and how it applies to optometrists in clinical practice, what is the likelihood you would watch it?
25. If you were sent an email with a link to a website or an attachment about ergonomics and how it applies to optometrists in clinical practice, what is the likelihood you would watch it?
26. If there were a lecture or a workshop at an optometry conference about ergonomics and how it applies to optometrists in clinical practice, what is the likelihood you would attend
    a. If it was a single stream conference? (i.e. you have the option of attending the session or wagging and going to a coffee shop or the bar).
    b. If it were held at the same time as another clinical topic you are interested in? (i.e. you have to choose between the ergonomics session and say, a diseases lecture)
27. The following is a description of an ergonomics intervention. I would like you to tell me if this is something which could be implemented in the practice where you work.

    You or a staff member has an injury. An ergonomist comes out to your practice and looks at what you are doing. But instead of telling you what to do to fix the problem, they give you and your staff information about ergonomics and how to reduce injuries. With the other staff members, you discuss this information and come up with ideas for how it could be implemented in your practice, for example, changing how work is scheduled or how the work space is arranged. The *ergonomist has monthly chats with you and your staff to see how you are going and gives you guidance in the process.*

That is, instead of a prescriptive approach where someone tells you what to do, you are given the resources and guidance to come up with your own solutions.

Would it work? Why?

If not, why not?

Could any adaptations be made to make such a plan more likely to work in your practice?

28. The next stage of this project is to visit optometrists in their workplace and observe how they perform different clinical tasks and procedures. There will also be some measurements made, such as how much you need to reach and bend, and would include making a video recording for analysis of posture. This will probably be in about 8 months time. If you meet our selection criteria, would you be interested in taking part?

☐ Yes ☐ No

Survey of optometry clinical teachers 2010

Please note:

- **Instruction in clinical techniques includes lectures, practical classes and clinical supervision.**
- **Physical discomfort includes pain, ache, difficulty with movement and numbness.**

1. What is your gender?
   ☐ Female
   ☐ Male

2. At which university do you primarily teach?*

☐	Australian College of Optometry
☐	Queensland University of Technology
☐	University of Auckland
☐	University of Melbourne
☐	University of New South Wales

*(*N.B. The Australian College of Optometry is located in Melbourne and provides clinical services to the general public. Melbourne teachers who received the invitation to participate could teach at either the University of Melbourne or at the Australian College of Optometry)*

3. How many years have you been involved in clinical technique instruction?

☐	Less than 1 year
☐	2-5 years
☐	6- 10 years
☐	11-15 years
☐	16+ years

4. What type of clinical technique instruction do you **currently** give? (select all that apply)

	Undergraduate					Postgraduate
Lectures	☐ Year 1	☐ Year 2	☐ Year 3	☐ Year 4	☐ Year 5	☐
Practical classes	☐ Year 1	☐ Year 2	☐ Year 3	☐ Year 4	☐ Year 5	☐
Clinical supervision	☐ Year 1	☐ Year 2	☐ Year 3	☐ Year 4	☐ Year 5	☐

5. Are you engaged in other optometry teaching (non-clinical)?
   ☐ No (Please go to question 6)
   ☐ Yes. What form does this take?

	Undergraduate					Postgraduate
Lectures	☐ Year 1	☐ Year 2	☐ Year 3	☐ Year 4	☐ Year 5	☐
Practical classes	☐ Year 1	☐ Year 2	☐ Year 3	☐ Year 4	☐ Year 5	☐

6. Do you actively instruct students with a view to improving their physical comfort when performing clinical techniques? (select as many as apply to you)

☐ Verbal information in lectures.	If so, please describe:
☐ Verbal instruction in practical classes.	If so, please describe
☐ Photographs shown in lectures.	If so, please describe
☐ Photographs shown in practical classes.	If so, please describe
☐ Videos shown in lectures.	If so, please describe
☐ Videos shown in practical classes.	If so, please describe
☐ Informal instruction or comments to students when needed e.g. raise the patient chair	If so, please describe
☐ Direct students to information displayed on wall charts	If so, please describe
☐ Refer students to Internet sources.	If so, which ones?
☐ Direct students to text books or journal articles.	If so, which ones?
☐ Give students on-line exercises to complete in their own time	If so, please describe
☐ Include this as a topic for group/class discussion	If so, please describe
☐ Other	If so, please describe

7. Do you adapt your clinical techniques or posture to enhance your own physical comfort?
   ☐ No (please go to question 8)
   ☐ Yes. What do you do?

   ____

   ____

   ____

8. Do you experience physical discomfort when performing clinical techniques?
   ☐ No (please go to question 9)
   ☐ Yes. Please specify

   ____

   ____

   ____

9. Do you examine private patients yourself (i.e. as the primary clinician, not as a clinical supervisor)?

   ☐ Yes, at least one day a week

   ☐ Yes, at least one day a fortnight

   ☐ Yes, at least one day a month

   ☐ No, I haven’t seen a private patient for up to one year

   ☐ No, I haven’t seen a private patient for 1 – 5 years

   ☐ No, I haven’t seen a private patient for more than 5 years

   ☐ Other, please explain

   ____

Can we contact you for future investigations related to this topic? If so, please include your contact details (please note, this is optional):

Survey of undergraduate optometry students 2010

PART A

1. Your gender ☐ Male ☐ Female

2. Your age? ___________ (years)

3. What stage of the optometry course are you in?

   ☐ Year 1 ☐ Year 2 ☐ Year 3 ☐ Year 4 ☐ Year 5

4. What is your enrolment?

   ☐ Full time ☐ Part time

5. Over the past 7 days, how many hours of clinical optometry practical classes have you had? (This includes internal clinics, external clinics and pre-clinical labs)

   ☐ 0 hours ☐ 1-3 hours ☐ 4-6 hours ☐ 7-9 hours ☐ 10+ hours

6. Have you ever received instruction or advice on how to improve your physical comfort while performing clinical procedures?

   ☐ No (please go to question 7) ☐ Yes

   Which methods? (tick as many as apply)

   ☐ Lectures

   ☐ Formal instruction in practical classes

   ☐ Informal advice from supervisors during practical classes or clinics

   ☐ Advice from seniors or friends who have experienced physical discomfort

   ☐ Other (please specify) _______

7. Have you actively sought information to improve your physical comfort while performing clinical procedures?

   ☐ No (please go to question 8) ☐ Yes

   Which methods? (tick as many as apply)

   ☐ I have asked other optometrists or classmates what they do

   ☐ I have looked on the Internet

   ☐ I have consulted textbooks

   ☐ Other (please specify) _________

8. How would you prefer to learn about physical comfort while performing clinical procedures? (tick as many as apply)

- ☐ Lectures
- ☐ Internet resources (e.g. YouTube videos)
- ☐ Videos shown during clinical optometry practical classes
- ☐ Wall charts displayed in consultation room/bay
- ☐ Formal instructions given during clinical optometry practical classes
- ☐ Written instructions in text books
- ☐ Informal instruction or comments from supervisors while performing clinical procedures
- ☐ On-line exercises to complete in own time
- ☐ One-on-one supervision by lecturers/supervisors
- ☐ Trial and error experimentation while practicing yourself
- ☐ Advice from seniors / friends who have experienced work-related injuries/discomfort
- ☐ Group discussion with friends
- ☐ Watching other colleagues while practicing

9. Of the options you selected in Question 8, which is your first preference for learning?

____

10. Please rate the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
When I perform clinical techniques, I aim for accuracy in measurements	☐	☐	☐	☐	☐
When I perform clinical techniques, I aim for time-efficiency	☐	☐	☐	☐	☐
When I set up the consultation room / equipment, I ensure that I am physically comfortable	☐	☐	☐	☐	☐
When I set up the consultation room / equipment, I ensure that my “patient” is physically comfortable	☐	☐	☐	☐	☐

Part B:

This section relates to any physical discomfort you may experience while performing clinical procedures. Please complete this section even if you do not experience discomfort. ***N.B. The term "discomfort" includes pain, ache, difficulty with movement and numbness***

Please answer the questions for each body region.

Body regions	Over the past 7 days, have you experienced any physical discomfort while performing clinical procedures?	Over the past 12 months, have you experienced any physical discomfort while performing clinical procedures?	Over the past 12 months, have you been seen by a doctor, physiotherapist, chiropractor or other health professional because of optometry-related physical discomfort?	If you experience physical discomfort, which tasks contribute to your discomfort?					
				VA - Visual acuity assessments Ret.- Retinoscopy Ophthal.- Ophthalmoscopy SL - Slit Lamp Biomicroscopy BV- Binocular vision assessments Perkins- Perkins tonometer			**Goldmann- Goldmann tonometer Gonio.- Gonioscopy BIO- Binocular Indirect Ophthalmoscopy Fundo.- Slit Lamp Fundoscopy ?- Others—please specify. N/A- I do not experience optometry related physical discomfort**		
Neck	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ VA ☐ Ret.	☐ Ophthal. ☐ SL	☐ BV ☐ Perkins	☐ Goldmann ☐ Gonio.	☐ BIO ☐ Fundo.	☐ ? ________ ☐ N/A
Shoulders	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ VA ☐ Ret.	☐ Ophthal. ☐ SL	☐ BV ☐ Perkins	☐ Goldmann ☐ Gonio.	☐ BIO ☐ Fundo.	☐ ? ________ ☐ N/A
Elbows/arms	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ VA ☐ Ret.	☐ Ophthal. ☐ SL	☐ BV ☐ Perkins	☐ Goldmann ☐ Gonio.	☐ BIO ☐ Fundo.	☐ ? ________ ☐ N/A
Wrists/hands	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ VA ☐ Ret.	☐ Ophthal. ☐ SL	☐ BV ☐ Perkins	☐ Goldmann ☐ Gonio.	☐ BIO ☐ Fundo.	☐ ? ________ ☐ N/A
Upper back	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ VA ☐ Ret.	☐ Ophthal. ☐ SL	☐ BV ☐ Perkins	☐ Goldmann ☐ Gonio.	☐ BIO ☐ Fundo.	☐ ? ________ ☐ N/A
Lower back	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ VA ☐ Ret.	☐ Ophthal. ☐ SL	☐ BV ☐ Perkins	☐ Goldmann ☐ Gonio.	☐ BIO ☐ Fundo.	☐ ? ________ ☐ N/A
One or both knees/legs	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ VA ☐ Ret.	☐ Ophthal. ☐ SL	☐ BV ☐ Perkins	☐ Goldmann ☐ Gonio.	☐ BIO ☐ Fundo.	☐ ? ________ ☐ N/A
One or both ankles/feet	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ VA ☐ Ret.	☐ Ophthal. ☐ SL	☐ BV ☐ Perkins	☐ Goldmann ☐ Gonio.	☐ BIO ☐ Fundo.	☐ ? ________ ☐ N/A

APPENDIX B: Acceptance letter received for in-press manuscript

Clinical and Experimental Optometry - Decision on Manuscript ID CEOptom-12-147-OP.R1

onbehalfof+hbcollin+unsw.edu.au@manuscriptcentral.com on behalf of Barry Collin

Sent: Thursday, October 11, 2012 2:01 PM
To: Jennifer Long; jlong@iprimus.com.au
Attachments: Attached standard file: * ~1.pdf (26 KB) ; Attached standard file: * ~2.pdf (40 KB)

10-Oct-2012

Dear Jennifer:

I am pleased to advise that your manuscript entitled "What do clinical optometrists like about their job?" has been accepted for publication in Clinical and Experimental Optometry. There may be some minor editorial changes made as we prepare your paper for publication, which you will be able to check and approve when the page proofs are sent to you.

IMPORTANT - COPYRIGHT FORMS
Attached are two documents which MUST be completed and returned to us as soon as possible if you have not already done so in your original submission. If the authors or the title of the paper has changed, please complete new forms.

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We look forward to seeing your paper in publication and your continued contributions to the Journal.

Sincerely,
Professor Barry Collin
Editor in Chief, Clinical and Experimental Optometry
hbcollin@unsw.edu.au