

**63<sup>rd</sup> Edward Jackson Lecture**

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**Eye Care: Dollars and Sense**

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It is a great honour to be invited to give the 63<sup>rd</sup> Edward Jackson Lecture. Since my first Academy meeting I have enjoyed and learnt much from the giants of ophthalmology who have been selected to receive this recognition over the years by the American Ophthalmic Publishing Company and the Academy.<sup>1</sup> I am proud to be the ninth international Jackson Lecturer and the first from Australia.

Previous Jackson lecturers including Paul Lichter and Dan Albert have given wonderful descriptions of Edward Jackson's life and contributions.<sup>1-4</sup> For those of you who are not familiar with these may I recommend strongly these reviews as being of high interest.

### **The Priority Given to Vision Loss**

Like all ophthalmologists, Jackson instinctively knew the importance of good vision and eye health. The treatment of eye disease and the prevention of blindness is our highest priority; it is our calling. As ophthalmologists, we all accept the importance of good vision without question.

In 1980, the World Health Organization asked me to review eye services in Pakistan at the request of the Government. When I presented my report to the Pakistani Minister of Health, he received the report, but then he stated vision loss was just not a priority for him. As Health Minister, he was faced with many problems; infant

mortality, maternal deaths, the provision of primary health care. He had expensive hospitals to run, and also the health problems of a million Afghani refugees present in Pakistan at that time.

The problem I faced was how to convince others of the importance of eye care services and to prioritize them relative to other pressing health demands. This is a challenge we all face, both as individual ophthalmologists and as a profession, whether we are working in our own hospitals, or lobbying politicians and policy makers. On every side there is competition for health dollars.

### **Population-based Evidence**

Epidemiologic field studies can provide a wide range of information. In ophthalmology they have given us great information about the prevalence and incidence of eye diseases and disease risk factors. In 1991, there were no coherent data on the magnitude or causes of vision loss in Australia. At best, only fragmented reports were available. To address this gap, the “Melbourne Visual Impairment Project” was started. It was a large, population-based survey to determine the prevalence and causes of vision loss, examine the risk factors for it and identify barriers to the provision of eye care.

The study design built on the experience gained from field work done in both developed and developing areas.<sup>5-9</sup>

The Melbourne VIP took five years to complete the first round of the field work that included urban, rural and nursing home samples.<sup>11</sup>

The Blue Mountains Eye Study started somewhat later and we were able to share and harmonize some of our survey methodology and later combine some of our analysis.<sup>11</sup>

In many aspects the Melbourne VIP was similar to the other, large population-based studies of eye disease; East Baltimore<sup>9</sup>, Beaver Dam,<sup>12</sup> Rotterdam,<sup>13</sup> Blue Mountains,<sup>14</sup> Barbados,<sup>15</sup> Proyecto Ver<sup>16</sup> and Andra Pradesh.<sup>17</sup> However, it differed from most other studies in that the Melbourne study not exclude those over 80 or 85 years of age. Instead, we included even the oldest people, who turned out to have even higher rates of vision loss.<sup>10</sup> In addition, our sample was representative of the population. It included urban, rural and institutionalized populations rather than just those from a single geographic location and minorities were present in a similar proportion to the national average.

### **The Prevalence and Causes of Vision Loss**

These various epidemiologic surveys carried out in different countries show a remarkably consistent picture. Even though there may be large differences in ethnic minorities, economic status and health care delivery in these different developed economies, the age-specific rates and causes of vision loss are remarkably consistent. These studies demonstrated that the amount of vision

loss and eye disease increases dramatically with increasing age. For each decade over the age of 40 the amount of blindness and vision loss increases by three-fold (Figure 1). Our Australian data have been combined with data from other studies to give an estimate for vision loss and eye disease in the US.<sup>18-23</sup> (Figure 2)

The distribution and causes of vision loss are vastly different from 100 years ago when Edward Jackson was in practice. Then, the average life expectancy was about 40 years and most blindness was seen in young people. Nowadays, in Australia and the US, over 80% of those with vision loss are over the age of 65.<sup>11,18</sup> One hundred years ago, ophthalmia neonatum and corneal infection, and injury in young adults were the leading causes of blindness.<sup>24</sup> (Figure 3)

Today, half the blindness in Australia and other developed countries is due to Age-Related Macular Degeneration (AMD). Just five conditions account for three quarters of vision loss; AMD, cataract, diabetic eye disease, glaucoma and under-corrected refractive error.<sup>25</sup> (Figure 4) Similarly with vision impairment (less than 20/40) these same five conditions again cause three quarters of the vision loss, although this time under-corrected refractive error is of much greater importance (Figure 5).

When asked what health condition they fear most, one third of people will identify blindness, another third will identify cancer, and a third will identify a wide range of other ailments or fears.<sup>26,27</sup>

However, although the development of blindness is something that is feared, most people regard blindness and vision loss as being so rare that they are unlikely to be affected. Similarly, most health planners and health policy-makers also regard vision loss as being of little importance or priority. People have recognized neither the frequency with which vision loss occurs nor its impact.

### **The Impact of Vision Loss**

Over the last few years, studies in Australia and in the US have shown that even relatively small degrees of visual impairment can have a major impact on the quality and length of life. The critical level of vision is that level usually required for an unrestricted driving licence. People with less than 20/40 vision have a significantly increased risk of falls,<sup>28,29</sup> hip fractures<sup>30,31</sup> and depression.<sup>32,33</sup> They have a substantial loss of social independence,<sup>34,35</sup> and they are likely to be admitted to nursing homes three years earlier than those with normal vision.<sup>36</sup> Even this relatively moderate reduction in vision prevents people from enjoying healthy and independent ageing.

### **The Costs of Vision Loss**

More recently, we have analysed the economic impact and cost of vision loss in Australian communities.<sup>37,38</sup> We found that vision loss and its costs had been totally overlooked.

Throughout the following analyses I have used Australian dollars. The exchange rate is usually \$AU1.00 to between \$US0.70 to \$US0.75. International dollars have been introduced to give a comparison of the relative Purchasing Power Parity of a currency in its own country, sometimes called the “Big Mac Index”.<sup>39</sup> In these terms, the Australian dollar is very nearly equivalent to the US Dollar and \$AU1.00 is approximately equal to \$US1.05. For all intents, we can talk dollar for dollar. However, the US population is 14 times larger than Australia’s.

We were surprised to discover that vision loss is the seventh leading cause of disability in Australia (Figure 6). It causes nearly 3% of the national total of years of life lost due to disability. It has a similar impact to that of diabetes or coronary heart disease and has a much greater impact than conditions such as breast cancer, prostate cancer, or HIV/AIDS. The loss of well being and the premature death associated with vision loss costs Australia \$ 4.8 billion each year.<sup>38</sup>

Data published in 2006 on the Global Burden of Disease show that world-wide, vision loss in aggregate ranks as the sixth most important cause of disability.<sup>40,41</sup> (Table 1)

We found that the indirect costs of vision loss add another \$3.2 billion (Figure 7). The indirect costs include the loss of earnings, the cost of carers, additional age care and other costs.<sup>38</sup>

The direct health costs for eye disorders total \$1.9 billion per year (Figure 7).<sup>38</sup> Direct costs include hospital care, outpatient and office visits, optometry costs, drugs and other direct medical expenses. Cataract surgery is the single largest condition cost. Four out of 10 people over the age of 60 have at least some cataract and in Australia 10% have already had surgery. Last year, 180,000 cataract operations were performed in Australia.<sup>42</sup> This gives a Cataract Surgery Rate of 9000 per million people per year which may be even higher than the rate in the US which is variably quoted to be between 6000 and 9000.<sup>43</sup>

The direct health costs for vision disorders rank seventh in the Australian national ranking.<sup>37</sup> (Figure 8) The direct costs for vision loss exceed those of arthritis, stroke or depression. In fact, vision disorders cost as much as diabetes and asthma combined.

Altogether, the total cost of vision loss in Australia last year was nearly \$10 billion.<sup>38</sup> (Figure 7).

But this is only part of the story. This is the current situation, what will happen in the future? With the ageing of our community linked to our increasing life expectancy and falling birth rate, the number of people in Australia over the age of 65 will double in the next 20 years, at the same time the overall population only increase by about 20%.<sup>44</sup> This is the baby boomers aging. The US and other countries face the same issue. This means that the number of Australians with vision impairment will increase from 480,000 to nearly 800,000 over the next 20 years.<sup>37</sup> The costs of eye care will increase much faster than the population growth because of the increasing proportion of older people. In fact, the costs will double by 2020.

National health policy makers and health planners need to take vision loss seriously; blindness and low vision already have huge and broad-ranging impacts on our society. These will continue to grow in the coming years.

However, we should be well placed to plan and manage this developing problem because we now have the evidence base that allows us to predict the future.

## **The Costs of Eye Care**

Most blindness and vision loss now can be prevented or treated, usually by highly cost-effective measures. You will remember that WHO considers an intervention to be cost-effective if it costs less than three times GDP per capita to avert one lost Quality Adjusted Life Year or QALY (an economic measure of a year of good health).<sup>45</sup> In Australia this threshold is set at less than \$112,000 per QALY . However, if an intervention costs less than one GDP per capita, \$37,000 per QALY, then is very cost effective. Cataract surgery costs less than \$3,000 per QALY, and that makes it extraordinarily cost-effective.<sup>46</sup> Screening for diabetic retinopathy, even in rural and remote areas, is also highly cost-effective at about \$20,000 per QALY.<sup>47</sup>

It has been shown over and over again; prevention is much more cost-effective than cure. Faced with the magnitude of impending disease burden and its associated costs, now is the time for us to act. We must reverse the projected increase in the prevalence, the economic costs and the loss of well-being associated with vision loss. There are three measures to accomplish this, and they are quite straightforward.

First we must prevent the vision loss that is preventable. We need appropriately resourced, long-term promotion of eye health to reduce vision loss from causes that are already known and

avoidable. The Vision Initiative in Victoria is a model example of this,<sup>48</sup> and similar efforts are needed elsewhere. The National Eye Health Program of the National Eye Institute (NEHEP) is another good model.<sup>49</sup> These efforts really mean ensuring that people have the appropriate eye examinations and simple preventative measures like smoking reduction and UV-B protection are promoted.

Second, we must treat the eye diseases that we can treat. We need to provide adequate funding for eye care services for the treatable eye conditions, and also provide low vision support services to those whose vision loss cannot be reversed. For example, It is both unconscionable and uneconomic to have people on long waiting lists for cataract surgery.<sup>50</sup> We must increase our capacity to handle these conditions now and build the capacity needed to manage the increasing workload of the future.

We costed a platform of 14 specific interventions to eliminate avoidable vision loss in Australia.<sup>51</sup> (Table 2) For each dollar spent, the country would save five dollars. We have shown that preventing and treating eye disease actually saves money.

Third, there must be a substantial increase in funding for targeted research into the causes of vision loss and blindness that cannot, at present, be either prevented or treated. This is especially true for conditions such as macular degeneration and glaucoma.

AMD affects one person in four over the age of 60, but the prevalence of AMD increases dramatically in the oldest age groups, and for those in their 90's, nearly two-thirds will have at least early macular degeneration and nearly 20% are blind.<sup>23,52</sup> (Figure 9) AMD is strongly linked to both cigarette smoking<sup>53</sup> and as shown more recently to genes for several complement factors,<sup>54</sup> but for most people, there is still no effective prevention or treatment.

However, if we could slow the progression of macular degeneration by just 10%, we could save an average of \$250 million each year for the next 20 years.<sup>52</sup> (Figure 10) This provides a very strong argument for additional funding for research to delay vision loss from AMD. Our economic modelling of AMD also showed the sensitivity of the cost-effectiveness of new treatments to the actual cost of the drugs and their delivery.

### **Dollars and Sense**

At long last, armed with this information, we now are able to discuss priorities with health bureaucrats and policy makers, and Ministers of Health, in a way we could not do in the past. We now have the information that is required to place the needs for eye care in perspective and to compare it with other health priorities. We can quantify and rank the impact of vision loss and of even more importance, the cost of not addressing it.

In November 2005, the Australian governments released a National Eye Health Framework that incorporates and endorses many of these ideas.<sup>55</sup> This is the first time Australia has had a national plan for eye health and in the May 2006 Budget the Australian Government committed \$14 million to eye health promotion. Australia is well placed to tackle the increasing problem of vision loss head on. Of course, the next challenge will be to translate these plans into action.

Although most of the information I have referred to is from Australia, there are many similarities with the situation in the US and other developed countries. We have had the unique opportunity to do these analyses within Australia as we had access to good data on all the factors involved including the epidemiology of eye disease, the population structure, the total national health care costs, and the impact of vision loss both in economic terms and in terms of the quality of life. However, once this detailed analysis has been done in one jurisdiction with access to complete national data sets, such as Australia, the outcome may be used in many other countries with developed economies. For example, the cost of vision loss in other countries could be extrapolated by looking at the ratios of costs such as those within eye care or the relative ranking between eye-related costs and other health conditions. However the situation needs to be assessed in each country and ideally national data sets

used to provide national figures. As the epidemiologic data show the pattern of vision loss and the numbers affected is quite dynamic. Periodic reassessment using representative sampling is required to evaluate current activities and to predict future needs.

We believe that these data on the health economic impact of vision loss will be broadly useful in helping others argue the importance of eye care and ensure that eye care receives the priority that Edward Jackson instinctively knew it should have.

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## FIGURE LEGENDS

Figure 1: Age-specific prevalence of visual impairment and blindness in Australia in 2004 for those aged 40 years and above.<sup>11</sup> (Taylor HR et al. Vision loss in Australia. *MJA* 2005; 182:565-568. © Copyright 2005. *The Medical Journal of Australia* – reproduced with permission.)

Figure 2: Age-specific prevalence of vision loss from 6 population-based studies  
(A) Prevalence of blindness (best-corrected visual acuity  $\leq 20/200$ ) in the better-seeing eye).

(B) Prevalence of low vision (best-corrected visual acuity  $< 6/12$  ( $< 20/40$ ) in the better-seeing eye).

BMES indicates Blue Mountains Eye Study, Sydney, New South Wales, Australia; BDES, Beaver Dam Eye Study, Beaver Dam, Wis; VIP, Visual impairment project, Melbourne, Victoria, Australia; and RS, Rotterdam Study, Rotterdam, the Netherlands.<sup>18</sup>

(Reproduced from Congdon N et al. Causes and prevalence of visual impairment among adults in the United States. *Arch Ophthalmol* 2004; 122:477-485.

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- Figure 3: The major causes of blindness in the US in 1909.<sup>24</sup>
- Figure 4: The major causes of blindness in Australia in 2004 for those aged 40 years and above.<sup>37</sup>
- Figure 5: The major causes of visual impairment in Australia in 2004 for those aged 40 years and above.<sup>37</sup>
- Figure 6: Comparison of Years of Life Lost to Disability in Australia for 12 major diseases.<sup>37</sup>
- Figure 7: The total costs of vision disorders in Australia in 2004.<sup>37</sup>
- Figure 8: A comparison of the direct health costs in Australia 2000 – 2001.<sup>37</sup>
- Figure 9: The prevalence of vision loss from AMD in Australia, defined as the presence of AMD of any stage and –  
Early: vision 20/40 or better; Mild:<20/40 to 20/60;  
Moderate: :<20/60 to 20/200; Severe:20/200 or worse.<sup>51</sup>

Figure 10: Total annual costs of AMD in Australia over the next 20 years and the impact of different interventions.<sup>51</sup>