Children's Eye Foundation

Economic Analysis of the Consequences of Failure to Prevent Childhood Blindness from Amblyopia

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Blindness in children takes tolls that are large and small, loud and quiet but always regrettable. But much can be done to prevent childhood blindness from amblyopia. What is more, we are all better off for preventing it. Quantifiably.

The Disease

Amblyopia is a failure of visual developmental the level of the visual brain consequent from a number of causes, including misaligned eyes, refractive errors and other developmental abnormalities of the eye. It is generally unilateral. It is best treated when identified early. When identified too late, treatment is not effective.

Put simply, vision loss from amblyopia is treatable and consequent blindness is preventable.

Amblyopia has roughly the same infliction rates in children as diabetes has in the population as a whole…somewhere in the three to five percent range. And like diabetes, amblyopia is well worth treating early and widely in order to prevent mounting ongoing costs of living with the disease.

Screening, Treating and Costs

Screening for amblyopia in children is wise because it is treatable if detected early. Screening techniques are straightforward and have been employed for many years. When used, they have cut the disease's toll in half. The cost of screening and treating those children diagnosed have been estimated to be $1.24 billion annually nationwide. This total is based on screening 4.14 million children annually and treating the expected three percent, or 124,000, who are diagnosed.

The cost of not treating amblyopia is the cost of dealing with the resulting vision impairment in an afflicted group of children and aging impaired persons. There are two general types of costs for dealing with the impacts of afflictions.

The first cost is the out-of-pocket cost of dealing with the medical and custodial needs of children who have impaired or failed vision. Examples of these are higher medical care and surgical costs, costs of building facilities to the needs of the visually impaired, costs of caregivers to assist in coping, etc. These costs are borne both by the individual and family and by society as a whole. These costs are very difficult to quantify but very real.

Diminished Utility

The second cost is the foregone cost of what could have been in the lives of these individuals but was not due to their impaired vision. The impaired persons who may have become renowned artists, pilots, astronauts, brain surgeons in the absence of preventable blindness are merely the examples of these costs. If vision impairment holds a child back later in life, by however a small margin, the overall costs multiply by the large number of children potentially involved.

In addition to these impediments, amblyopia patients suffer from the disease as a result of worry, fretting over what might have been, what should have been done, what will not happen as a result, etc. Clinicians report that patients with one good eye tend to worry about the loss of the normal eye and likely forgo some otherwise normal life activities as a result in order to protect that eye. And it turns out that this risk is not entirely imagined. The Rotterdam Study[1], a population-based cohort of 5,220 subjects aged 55 years or over, including 192 persons with amblyopia (3.7 percent) concluded that amblyopia nearly doubles the lifetime risk of losing the use of the other eye. The toll from the loss of the second eye is enormous for this afflicted group.

Thus, in both physical and emotional dimensions, their utility from life is diminished. Drawing on the work of C. Beauchamp et al[2], G. Beauchamp [3], Cutler and Richardson [4], Konig and Barry [5], and Membreno, et al [6]**.,** the estimated value of these personal costs and diminished utility is about $10 billion annually.

U.S. Census Bureau Estimates of Vision Loss Costs

Are there other measures of the economic toll of visual disabilities? The U.S. Census Bureau is perhaps the most comprehensive collector of data and information in America. It is by far the oldest. Census reports on some aspects of the costs of disabilities as part of its responsibilities under the American with Disabilities Act. The Bureau's most recent report, issued May 29, 2007, documents significant decrements to income as a result of disabilities. It indicated that median earnings for people with "nonsevere" disabilities is $22,000 annually, versus $25,000 for those with no disability, indicating a 12 percent reduction for these persons. For those with "severe" disabilities, annual earnings average $12,800, or about half those of individuals without disabilities. These figures are for persons who are disabled but still able to work.

This same Census document states that 1.8 million Americans age 15 and older report "being unable to see." Being unable to see is classified as a severe disability, and it may well interfere with the ability of some persons to work at all. For the persons in this group who work, the total income loss as a result of being unable to see is $23 billion annually. By definition, it is also a loss to the production of the economy as a whole. Since a person's income fuels spending, the multiplier effects of this large income decrement could sum to something approaching $100 billion annually. And these estimates are likely on the low side because they assume that all those people who are unable to see are working. It seems likely that many are not, and for these the income decrement is $25,000 each annually. This fact seems likely to raise the $23 billion income loss figure by at least an additional $5 billion annually.

Amblyopia Toll

As noted above, most people with amblyopia retain normal use of one eye. These people would not be classified as severely disabled, but they lack the full abilities of persons without amblyopia. It seems reasonable to apply the nonsevere categorization to this group. Their average decrement to income would be in the range of $3,000 annually. How large is this group? We estimate it to include approximately 4.5 million persons, (3% incidence times 300 million population [equals 9 million], times 50% successful treatment with current methods [effectiveness for current "investment"] = 4.5 million persons). Multiplying this number by the $3,000 income reduction gives $13.5 billion of impact from

vision disabilities from amblyopia. When we add in utility costs from worry and related reduction in quality of life the direct sum of costs is approximately $23 billion. This figure could approach $100 billion when multiplier effects of reduced income on subsequent rounds of re-spending are added.

What about the future? The above are actual decrements to income due to the severe vision disabilities that already exist in the U.S. They give us a way to quantify the impact of vision loss on persons and on society.

A "Median" Child

To put the costs in perspective, consider a "median" child with amblyopia. The life expectancy of this child is 77.7 years (according to the U.S. Census Bureau), and his likely working span is 47 years. A child without disabilities could expect to earn the median income level over these work years. That is presently $25,000 annually, but this will grow in dollar terms over his lifetime with inflation and growth in productivity. Conversely, these future income streams need to be discounted back by an appropriate discount rate to put income flows in current dollars. We have used as a discount rate the rate of growth of median income to discount future income streams. In present value terms, then, each future year's income in today's dollars will be $25,000. For the 47 working years of his life, he will earn a total of $1,175,000 in today's dollars. If he has amblyopia, on average his earnings will be cut by 12 percent, or by $141,000. This will happen for each child suffering from amblyopia. Multiplying the per lifetime decrement in earnings ($141,000) by the annual estimated incidence of amblyopia (124,000) gives a total of $17.5 billion of lifetime income loss for each year's cohort of children who develop amblyopia. If these children are screened and treated at a 50 percent expected effectiveness rate, the lifetime costs of amblyopia for a year's cohort will drop by $8.75 billion. This results in a net economic benefit of $7.5 billion and a ratio of benefits to the costs of the screening and treatment of seven-to-one.

Improved Screening and Treatment

This favorable outcome assumes that technology and procedures remain as they are now. But it may be possible to increase detection effectiveness by more elaborate screening techniques, such as newer and automated technologies such as computer-assisted photorefraction. Suppose that additional screening

enables clinicians to raise the detection and successful treatment rate from 50 percent to 90 percent, but at, for example, triple the cost of present detection techniques and procedures. That tripled cost would be $3.72 billion But the gains—the reduction in economic costs of the illness--would climb to 90 percent of $17.5 billion, or $15.75 billion. That would result in a net economic benefit of $12 billion and a positive benefit-to-cost ratio in excess of four-to-one, attractive from a public policy standpoint.

Texas' Share

Assuming approximately 10 percent of U.S. births occur in Texas, the state's share of this net economic benefit of "renewable" and sustainable economic growth would be $1.6 billion for an investment of $372 million, to say nothing of the fundamental human good of seeing an end to preventable vision loss in children.

For more information, or for any questions on this analysis, email Thomas Rogers, Children's Eye Foundation Executive Director, at t.rogers@childrenseyefoundation.org.

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