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Case 2 : Teleophthalmology Screening: Economic Evaluations in Health Care Decision Making

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CASE 2

Teleophthalmology Screening: Economic Evaluations in Health Care Decision Making

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Funds for public health are scarce across Canada, as they are in most of the world. Funds for ocular public health programs are even more limited, demanding strategic resource allocation. Yet, that is not the main obstacle in achieving better ocular health in the Province of Ontario; it is that vision care is not covered by the Ontario Health Insurance Plan (OHIP). This means that acquiring treatments presents a challenge to many members of the public, and negatively affects eye health.

Dr. Hodge, the Chair Ophthalmologist-in-Chief at the Ivey Eye Institute, had finished examining Doug, a 52 year old patient, and was about to tell him that the recent laser treatment slowed down the progression of his diabetic retinopathy (DR) but did not cure it, which is why his vision was getting worse (see Exhibit 1). According to the Canadian Diabetes Association, DR is the leading cause of blindness in people of working age (Cheng et al., 2013). It is mostly due to late diagnosis that DR progresses rapidly. Early diagnosis makes treatment easier and is more likely to preserve vision.

The next provincial budget was going to be released in six months. Dr. Hodge was looking for evidence of the cost-effectiveness of teleophthalmology screening programs. Thus, a formal systematic review of studies, which examined cost-effectiveness of screening for retinopathy, would provide information to help him advocate for a teleophthalmology screening program. He believed that obtaining the best outcomes for every dollar spent was an essential public health perspective that was needed to help guide policy makers in making the best possible decisions.

DIABETIC RETINOPATHY

Diabetic retinopathy (DR) is one of the complications of diabetes mellitus, which is an illness that affects how the body handles sugar usage and storage. Excess sugar in the body may lead to complications in the circulatory system of the retina resulting in DR. Any changes that happen to the blood vessels in the retina such as swelling, leaking, or even ischemia can result in retinal damage. Duration of diabetes is a risk factor for the incidence of DR (Cheng et al., 2013).

Diabetic retinopathy is usually divided into two types: non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR). NPDR is the first period of the illness when minimal or no vision related symptoms exist (American Diabetes Association, 2015a). This is why yearly eye examinations are recommended in diabetic patients to catch this early stage of the disease before progressive retinal damage leads to vision loss (American Diabetes Association, 2015b). PDR represents a more advanced stage of the illness in which abnormal blood vessels start developing. These vessels often leak blood into the vitreous, resulting in

severe visual consequences. Retinal detachment and glaucoma may occur as complications of DR.

Treatment of DR is based on the stage of the illness. For non-proliferative retinopathy no treatment is usually required unless there is diabetic macular edema (DME). As for patients suffering from proliferative or severe non-proliferative retinopathy, DME, or vitreous hemorrhage, anti vascular endothelial growth factor therapy, laser therapy and/or vitrectomy is the recommended treatment. The time at which treatment is given is critical in DR. It is optimal before leakage of the new abnormal blood vessels occurs. Nonetheless, treatment may still be beneficial if started after leakage occurs, provided it is small (American Diabetes Association, 2015b).

Diabetic retinopathy is a common cause of blindness in adults (Kempen et al 2004). Data from the United States indicate that while prevalence of retinopathy in adult diabetics is approximately 40%, visual loss occurs in nearly one in 10 such patients (Kempen et al 2004). Visual loss can lead to increased risk of falls, hip fractures, and increased mortality (Vu, Keefe, McCarty & Taylor, 2005).

The challenge in treating DR lies in the fact that it has a long preclinical phase (which may last up to seven years) during which diagnosis is difficult as the patient does not report any vision changes (Engerman & Kern, 1987; Sander, Larsen, Engler, Lund-Andersen, & Parving, 1994; Wilkinson et al., 2003). Usually, the patient seeks medical care after retinal damage has occurred, for which treatment may be less effective (Ciulla, Amador, & Zinman, 2003).

VISION CARE IN CANADA

Canada's healthcare system is perceived as being publicly funded. In reality though, less than three quarters of the money spent on healthcare comes from the public, while the remainder of expenses are covered privately (Canadian Institute of Health Information, 2015).

The breadth of coverage of the public health insurance plan varies slightly across provinces. Usually, the plan covers all medically necessary costs incurred by physicians and hospitals. Other services including dental care, physiotherapy, many drugs, and eye care are privately paid for by patients. The Ontario Health Insurance Plan (OHIP) follows this model.

An example of the variation in coverage is Nova Scotia, which has an "Optometric Benefit", which covers visual analysis by optometrists (Health Canada, 2008). Vision analysis is defined as "an examination that includes the determination of 1) the refractive status of the eye; 2) the presence of any observed abnormality in the visual system, and all necessary tests and prescriptions connected with such determination" (Health Canada, 2008). This plan applies to residents under 10 years and those over 65 years of age, where one routine vision analysis is covered every two years. Otherwise, patients between 10 and 65 are covered and receive care in medical emergencies but not for routine checkup visits. Provinces also cover services like prescription drugs, eye exams, and eyeglasses for vulnerable populations such as low-income families and children 18 and younger (Unite for Sight, 2015).

Barriers to optimal care identified in Canada include an increased demand for services from an ageing population, limited resources, gaps in provincial health plans, lack of provider coordination, low reimbursement rates for vision care services, lack of provider knowledge about availability of vision rehabilitation, and a low compliance with referral among patients (Unite for Sight 2015; Gold & Zuvela, 2005).

IMPORTANCE OF SCREENING

"Research has shown that 95 percent of the cases of blindness caused by diabetic retinopathy are preventable, if the disease is detected and treated promptly" (Erikson, 2015).

Despite being preventable, DR is one of the leading causes of blindness in adults (Cheng et al., 2013). As described above, a long preclinical phase and lack of early symptoms make early detection challenging. In addition, diabetic patients tend to be non-compliant to eye examination guidelines; less than 50% attend annual screening as advised by the American Academy of Ophthalmology (Coronado, 2014). Low availability of eye care professionals to assess DR, lack of awareness about the effects of diabetes on vision, and reluctance to undergo a dilated eye examination are among the main reasons for noncompliance (Coronado, 2014). Teleophthalmology screening could be a potential mechanism to address this public health crisis.

Most of the diabetic patients who develop DR do not complain of symptoms of the illness until they develop macular edema (ME) and/or the disease progresses into the proliferative type, thus making screening imperative. An additional impetus for screening is that laser therapy is effective in preventing further progressive visual loss from PDR and ME (rather than making lessened visual acuity better) (McCulloch, 2015). Therefore, early detection of DR is critical in order to preserve vision (McCulloch, 2015).

In addition to the health benefits screening provides, economic benefits may also result from an effective screening program. A recent population based study in Sweden concluded that progression of DR in patients is directly related to their healthcare expenses, which implies costs could be reduced by halting the progression of DR (Heintz, Wiréhn, Peebo, Rosenqvist, & Levin, 2010). Evidence from the Indian Health Service Division of Diabetes Treatment and Prevention in Arizona suggests that teleophthalmology saves hundreds of millions of dollars a year in medical care and support services that would be required for people who go blind (Erikson, 2015).

TELEOPHTHALMOLOGY SCREENING

Teleophthalmology, a branch of telemedicine, which is a fusion between telecommunication and information technologies, is utilized in situations where health care is optimally provided at a distance. Distance and access to services are barriers that often face patients in need of clinical care especially in communities that are distant or rural. Teleophthalmology provides a solution for such barriers and thus enhances the public health of such communities. In teleophthalmology, skilled professionals take images of the eye which can be helpful in screening, diagnosing, and monitoring ophthalmic disease when patients are far away from eye specialists (Yogesan, Cuadros, & Goldschmidt, 2012).

The teleophthalmology service, if funded, would be covered and just require a requisition from the primary care practitioners of patients diagnosed with diabetes. Screening would be carried out at a local health unit or community health center. Results of the screening would then be forwarded to the primary care physicians who would review it and refer patients who need more thorough eye care or follow up according to the screening results. In this way, patients with diabetes would be monitored more closely and any effect from their illness to their eyes would be caught early. This increases the chance of halting the progression of disease, which may otherwise lead to blindness.

ECONOMIC EVALUATIONS

Teleophthalmology is an example of an intervention that is often introduced to facilitate health care delivery and benefit the health of the public. Yet, resources are not always at hand to fund such new propositions and often there is more than one intervention that may be beneficial if implemented. The decision then lies in the hands of decision makers at various positions who are faced with the tough job of choosing and supporting one intervention over another. Though they rely on many factors to make their choice, costs are often of paramount importance – especially in situations where resources are limited, which happens to be the more common situation. Interventions are then considered optimal and worth implementing if they prove to be cost effective, which simply means that they are worth spending the money on and will be beneficial once adopted.

To measure the cost of an intervention and its possible effects on the public an analysis of the situation needs to be undertaken in the form of an economic appraisal or evaluation. The cost of an intervention is measured in monetary units but the benefits may vary according to the type of economic evaluation. Different types of economic evaluations exist including cost benefit analysis where the benefits are measured in monetary units; cost-utility analysis where the benefits are measured in quality adjusted life years (QALYs); and cost-effectiveness analysis where benefits are measured in natural units such as life years gained.

COST-EFFECTIVENESS ANALYSIS (CEA)

Economic evaluation is “the comparative analysis of alternative courses of action in terms of both their costs and consequences” (Drummond et al, 2015). Cost-Effectiveness Analysis (CEA) is one type of economic evaluation that may be used optimally to assess the effects and benefits of healthcare interventions that may not be monetized. CEA is usually expressed as a ratio where the denominator is a measure of health gained (for example, years of life, etc.) and the numerator is the cost incurred for that health gain (Gupta, 2009). When two interventions are compared, the difference in costs (incremental cost) between the two divided by the difference in health gain (incremental gain) is called the incremental cost-effectiveness ratio (ICER).

Cost-effectiveness analyses can be interpreted as a plane with four quadrants (Sandrucci, 2014). The x-axis represents the incremental gains, while the y-axis represents the incremental costs (see Exhibit 2). Outcomes plotted in the top right quadrant are more effective and more costly. Those placed in the bottom right quadrant are more effective and less costly representing the most desirable option. Others that may be plotted in the bottom left quadrant are less effective and less costly, which would not be optimal but may be considered in certain situations. Interventions whose ICER places them in the top left quadrant are less effective and more expensive, which means that they should be rejected. The allocation of an intervention in one of these quadrants in comparison to an existing status aids decision making to determine whether the proposed intervention would be desirable or not.

The dotted line in Exhibit 2 represents the threshold ICER, above which new interventions in general, including treatments as shown in the graph, would not be desirable and below which, would. In other words, it represents a cost-effectiveness threshold. Choosing the threshold depends on the perspective from which the analysis is performed; whether it is of the payers, of the patients, or of the government, which will determine whose costs and gains are explored. Other factors affecting the choice of the threshold are the values the decision maker places on health outcomes and on money, the level of willingness to substitute health for money, and the attitude about risk (Owens, 1998). Availability of resources would also affect the choice of cost-effectiveness threshold.

Economic evaluations in the form of assessing cost-effectiveness constitute an important part of the process of deciding whether an intervention is worth implementing. Due to the importance of such assessment measures, agencies are built specializing in evaluation of health technology. One such agency that is recognized worldwide is the National Institute for Health and Care Excellence (NICE) in the United Kingdom, which is considered one of the leaders in implementing cost-effectiveness analysis in decision-making.

IMPLICATIONS OF CEA

Although cost-effectiveness analysis is valued as useful when determining the fate of an intervention, it cannot be interpreted similarly in every situation. Thus, certain issues are present that need consideration when choosing cost-effectiveness analysis as an aid in the decision making process. Such issues include:

- When given more than one choice of an intervention that needs implementation, cost-effectiveness analysis may help guide the choice and reveal which route will provide the best value for money. Yet, when faced with comparisons across different healthcare sectors, the cost-effectiveness analysis may not provide a similar effectiveness measure due to the difference in outcome measures that may be adopted. This idea presents a conditional comparative requisite, where as long as the outcome measures are the same, the cost-effectiveness analysis may provide an acceptable interpretation of the situation.
- One of the important factors of a reliable cost-effectiveness analysis is the presence of a detailed sensitivity analysis in the study. The role of the sensitivity analysis is to assess the extent to which variations in any of the parameters adopted in the study may lead to changes in the final results obtained. Exhibit 3 shows a useful checklist that can be used in assessing cost-effectiveness studies.
- In reality, decisions are not based solely on cost-effectiveness analysis. Economic evaluations represent only one factor amongst many others that need considering, reviewing, and assessing during the decision making process. Other factors include whether or not a community actually needs the proposed intervention and whether the suggested project is a priority in terms of burden of illness. Issues of equity should also be explored during the decision making process to determine whether the intervention under evaluation addresses and considers equity in its application.

HEALTHCARE DECISION MAKING

It is commonly perceived that cost-effectiveness analysis is all about minimizing costs. However, it is important to consider CEA as a tool to prevent wasting of money and resources. Its proper use helps decision makers in avoiding investments in interventions that may turn out to be minimally beneficial to the community in relation to their incurred costs. In fact, this is where cost-effectiveness analysis is most effective during decision making. Its role is not only to explore whether or not an intervention would bring about health benefits in relation to its costs; it also helps decision makers understand what they can expect their community to gain due to their investment in health care.

As mentioned earlier, CEAs are only one of many factors that need examination and consideration when evaluating interventions. It is a tool worth using but cannot be expected to take the place of value judgments that may be provided by experienced professionals aware of current circumstances and needs. Such valuable opinions may help decision makers determine the amount of money they are willing to spend in order to improve their community's health.

Healthcare decision-making is a process that is overwhelming and complex. It involves more than one institution and is not limited to one profession. It is a crucial component to the globally desired enhancement and reform of healthcare. It needs careful consideration of many issues and cannot be driven by a single imperative.

AT THE IVEY EYE INSTITUTE

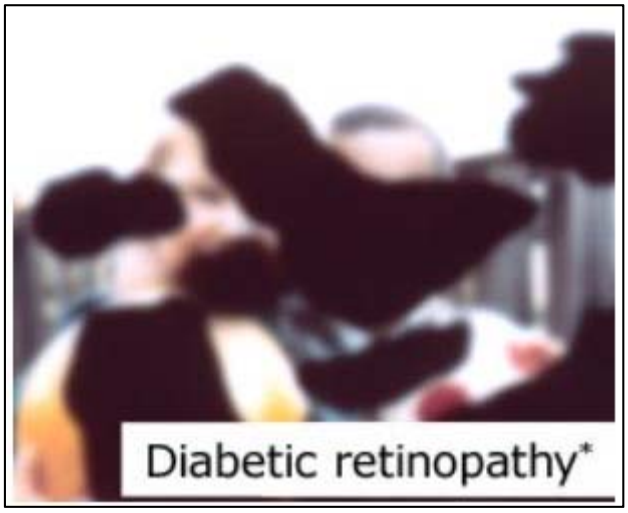
Dr. Hodge, being an eyewitness to the burden of DR in his patient population, intends to propose a teleophthalmology screening program. Teleophthalmology screening would be implemented as one of the public health strategies to mitigate the visual disabilities caused by DR which, along with diabetes, represent a growing health problem worldwide. He believes that teleophthalmology screening has the potential to provide another way of diagnosis that would be more convenient and accessible to some patients. It will also address the low availability of eye care specialists since teleophthalmology screening does not require one.

However, given the scarcity of funds for public health interventions, he feels the need to back up his proposal by a review of the cost-effectiveness of screening in order to guide decision-making in favor of his proposal.

Dr. Hodge feels that such a review would provide a sound source of evidence through the rigorous examination of research material relevant to the topic in question. Systematic review evidence is a necessary ingredient for making good decisions. He thus hopes that presenting a high quality review could satisfy the need for decision makers to explore the benefits of any proposed intervention they would consider. It would provide the information on the effectiveness and meaningfulness of implementing teleophthalmology screening for DR.

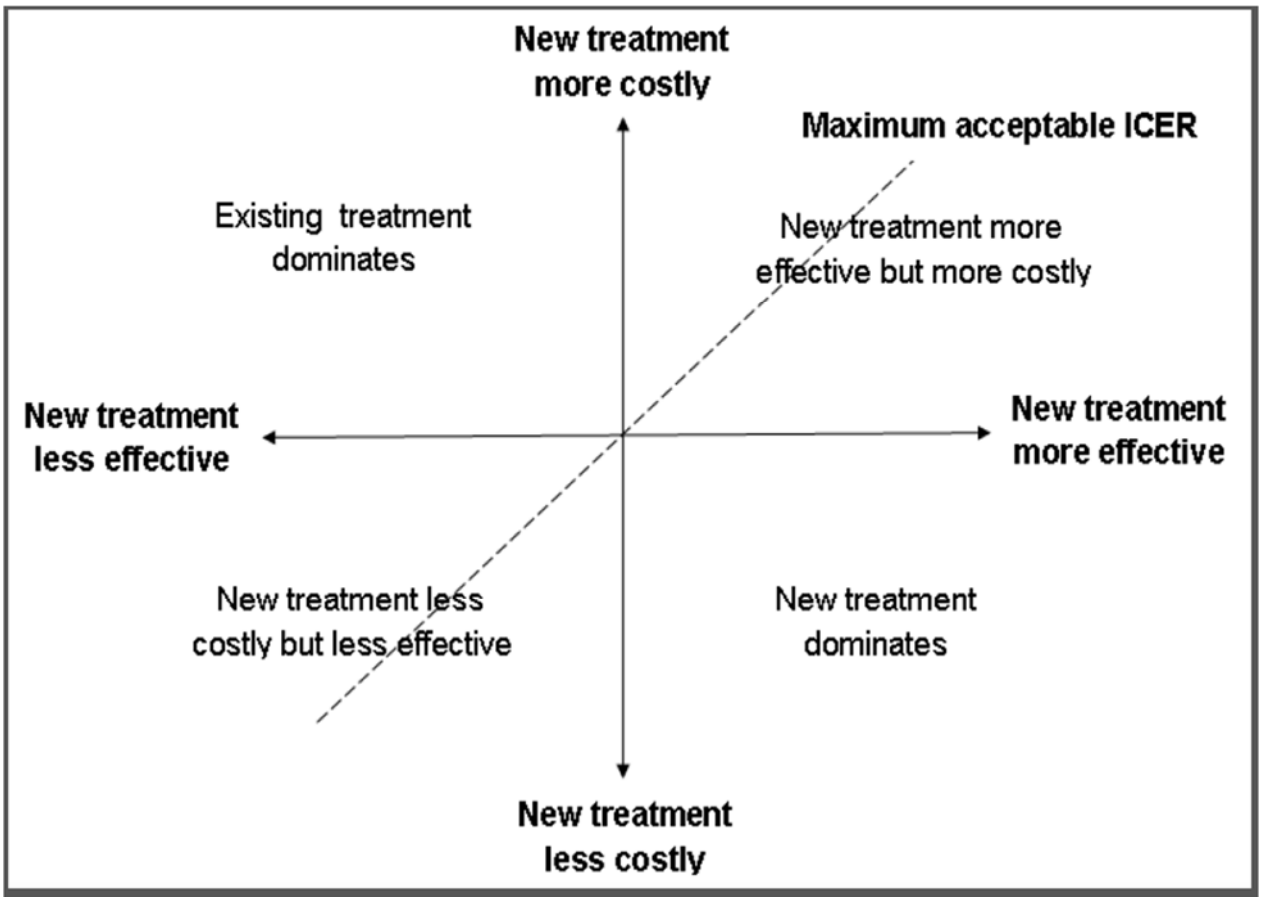
On the other hand, Dr. Hodge knows that such a review would also be beneficial to future research endeavours through facilitating knowledge synthesis. Being a researcher himself, he recognizes how such a review could be useful to researchers who usually examine high quality reviews to guide their work and direct their objectives in new projects.

EXHIBIT 1



Source: CNIB.ca, 2015.

EXHIBIT 2
Cost-Effectiveness Plane



Source: Hounton & Newlands, 2012.

EXHIBIT 3
Checklist for Assessing Cost-Effectiveness Studies

Study design

(1) The research question is stated
(2) The economic importance of the research question is stated
(3) The viewpoint(s) of the analysis are clearly stated and justified
(4) The rationale for choosing the alternative programmes or interventions compared is stated
(5) The alternatives being compared are clearly described
(6) The form of economic evaluation used is stated
(7) The choice of form of economic evaluation is justified in relation to the questions addressed

Data collection

(8) The source(s) of effectiveness estimates used are stated
(9) Details of the design and results of effectiveness study are given (if based on a single study)
(10) Details of the method of synthesis or meta-analysis of estimates are given (if based on an overview of a number of effectiveness studies)
(11) The primary outcome measure(s) for the economic evaluation are clearly stated
(12) Methods to value health states and other benefits are stated
(13 Details of the subjects from whom valuations were obtained are given
(14) Productivity changes (if included) are reported separately
(15) The relevance of productivity changes to the study question is discussed
(16) Quantities of resources are reported separately from their unit costs
(17) Methods for the estimation of quantities and unit costs are described
(18) Currency and price data are recorded
(19) Details of currency of price adjustments for inflation or currency conversion are given
(20) Details of any model used are given
(21) The choice of model used and the key parameters on which it is based are justified

Analysis and interpretation of results

(22) Time horizon of costs and benefits is stated
(23) The discount rate(s) is stated
(24) The choice of rate(s) is justified
(25) An explanation is given if costs or benefits are not discounted
(26) Details of statistical tests and confidence intervals are given for stochastic data
(27) The approach to sensitivity analysis is given
(28) The choice of variables for sensitivity analysis is justified
(29) The ranges over which the variables are varied are stated
(30) Relevant alternatives are compared
(31) Incremental analysis is reported
(32) Major outcomes are presented in a disaggregated as well as aggregated form
(33) The answer to the study question is given
(34) Conclusions follow from the data reported
(35) Conclusions are accompanied by the appropriate caveats

Source: Drummond & Jefferson, 1996, p. 281 (by permission of BMJ Publishing Group Ltd.).

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INSTRUCTOR GUIDANCE

Teleophthalmology Screening: Economic Evaluations in Health Care Decision Making

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BACKGROUND

This case presents a dilemma that can happen to anyone with an intervention to offer, which they are confident would alleviate a problem they believe is worth addressing. Many public health professionals will find themselves in one of two positions. The first, a position of believing so much in a proposal but not sure of how to make it go through. The second, a position of a decision maker who would be faced with more than one needed, effective, feasible, and sustainable proposal but could implement one or a few due to limited resources.

The case is meant to shed light on both situations with more focus on Dr. Hodge's position, wanting to advocate for a teleophthalmology screening program. Through introduction of this situation the case presents vision care status in Canada, economic evaluation concepts, cost-effectiveness analysis, and health care decision-making.

This case would be suitable for use in a health economics course, to provide real life situations that facilitate understanding of its dominant theoretical content. Health economics is an essential aspect of decision making that can be utilized in most public health career positions. At one point or another money will be scarce and the ability to understand costs in relation to public health will be a necessary skill.

OBJECTIVES

1. To learn that there are different types of economic evaluations, with various measuring units.
2. To understand the role of economic evaluation in health care decision-making.
3. To learn about cost-effectiveness analysis in relation to public health.
4. To have a basic understanding of key concepts of economic evaluations such as QALYs, ICER, and threshold of ICER in the economic context.
5. To recognize the importance of looking at incremental costs and interpreting the ICER.

DISCUSSION QUESTIONS

1. In this case, a review of economic evaluations of teleophthalmology screening is recommended to support implementation of a new intervention by proving that it maximizes the benefits from healthcare spending. What are some other uses of economic evaluations in health care decision making?

2. In this case, cost-effectiveness was a factor, which Dr. Hodge addressed to support his proposal. What other factors would decision makers have to examine before funding a proposal?
3. Who else may benefit from the systematic review Dr. Hodge plans to undertake?
4. Would a different approach altogether be more effective in supporting his proposal?

KEYWORDS
Healthcare decision making; systematic reviews; health economics; economic evaluations; cost-effectiveness analysis; ICER.