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Cost of Alzheimer's disease

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The progressive deterioration associated with Alzheimer's disease (AD) results in high economic cost to the patients, caregivers, and the society as a whole. Cost-of-AD studies conducted over the last decade have produced discrepant results, mainly as a consequence of the different methodologies employed. The present review is an attempt to present the methodology of the cost studies in AD and provide the reader with the tools necessary for a critical assessment of the results.

Because the prevalence of Alzheimer's disease (AD) is age-dependent and the number of the oldest old is rising, the cost of this disease will increase considerably in the forthcoming decades, without obvious sources to fund it. This is true in the western world where the ratio of working force/retirees is decreasing,¹ as well as the third world where progress in health care has raised the life expectancy. Studies of AD cost conducted over the last decade have produced discrepant results, a fact that has not prevented interested parties

(consumers, providers, and government agencies) to use the results to advance their respective, at times opposed, agendas. The present review is an attempt to present the limitations of the cost studies in AD and provide the reader with the tools necessary for a critical assessment of the results.

What is the cost of AD to society?

The cost of AD to society is the value of all goods and services that society gives up in order to prevent, diagnose, treat, and deal with the disease. The overall cost is made up of direct and indirect costs. In addition to these costs, society also absorbs expenses associated with AD research and education programs.² *Table I* summarizes the definitions of different costs and provides some examples of the components of the cost of AD.

Reasons for discrepancies in the results of cost-of-illness studies on AD

As often in economic analysis, results depend on study methodologies, which can differ in many aspects, thus leading to significant discrepancies. In the USA, for example, the annual cost of caring for an AD patient ranges from \$27 700 to \$47 000 (*see Table II*). Following are a number of examples illustrating how the methodology employed to calculate the cost affects the final results. The first type of examples relates mainly to the reliability and accuracy of the data collected, while the second type relates directly to the methods by which the cost itself is calculated.

Some of the published studies on cost of AD follow cohorts of patients prospectively, while other studies collect data retrospectively. Also, some studies interview

Keywords: *Alzheimer's disease; cost of illness; cost-effectiveness*

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| Component of cost | Definition | Example |
|--------------------------|--|---|
| Direct cost | Goods and services for which money is explicitly exchanged | Physicians' fees, fees for hospitalization, nursing home, drugs |
| Indirect cost | Resource lost or invested for which no money is exchanged | Unpaid care and services provided by family members, years of productive life lost because of the illness |
| Cost of research | Research devoted to AD | Government funding discovery of diagnostic and treatment tools, epidemiology and pathogenesis of AD |
| Cost of education | Training staff to care for patients, training researchers | Nursing, training of caregivers |

Table I. Components of cost of Alzheimer's disease (AD).

| Country | Cost year | Annual cost per patient | Type of study | Participating groups | N | Reference |
|---------|-----------|-------------------------|---|--|-----|--|
| USA | 1990 | \$47 000 | Prospective (12 months) | Community and institution | 187 | Rice et al, ³ 1993 |
| USA | 1991 | \$33 600-\$35 000* | Data from published resources and other researchers | — | — | Ernst & Hay, ⁴ 1994 |
| UK | 1994 | \$75 000 | Retrospective (3 months) | Community and control | 128 | Souetre et al, ⁵ 1999 |
| USA | 1996 | \$27 700 | Retrospective (1 month) | Academic medical center, managed care plan, assisted living facility, and nursing home | 679 | Leon et al, ⁶ 1998 |
| Canada | 1996 | \$9451-\$36 794† | Retrospective (1 month) | Community and institution | 750 | Hux et al, ⁷ 1998 |
| Israel | 1999 | \$16 330-26 900‡ | Prospective (6 months) | Community, institution, and control | 121 | Beeri et al, ⁸ in preparation |

Table II. Cost-of-illness studies. (Numbers are rounded.)

* First number, cost of first year; second number, cost of second and later years.
 † First number, mild disease severity; second number, severe disease.
 ‡ First number, community-dwelling patient's cost; second number, institutionalized patient's cost.

caregivers, and others use patients' medical records and insurance databases. Each method presents advantages and disadvantages. Retrospective data obtained from databases are not dependent on the caregiver recollection and interpretation. On the other hand, databases belonging to medical insurance companies and other medical databases contain information on direct cost, but no data on indirect cost. Finally, prospective studies, which supply the most complete set of data,

are very expensive to conduct and are biased by the fact that they include selected patient populations who seek help in academic centers where such studies are conducted.

As presented in *Table II*, the length of time covered by the study—which varies from 1 month to 12 months—also affects the final results. The longer information is collected, the more stable and generalizable are the results. For example, a single respite hospitalization of an

| Type of analysis | Definition | Example |
|---------------------------|---|--|
| Cost-effectiveness | Cost of care is related to a nonmonetary outcome measure | Comparison of caregiver burden in AD patients who participate and who do not participate in day care |
| Cost-benefit | Both costs and benefits are expressed in monetary terms | The cost of a medication to treat AD compared with the monetary benefit resulting from delayed institutionalization |
| Cost-minimization | Outcome is assumed or proven to be equal, and the purpose is to identify the cheapest alternative | Comparison of prices of two medications for AD that have the same therapeutic effect |
| Cost-utility | Costs are related to well-being or QALY | A medication to treat AD that improves quality of life by 0.2 for each of 5 patients will result in the equivalent of 1 QALY if the benefit is maintained over a 1-year period |

Table III. Type of cost analysis. AD, Alzheimer's disease; QALY, quality-adjusted life years.

AD patient for 1 week would increase significantly the cost of care if the follow-up period is 1 month, but would not make a significant difference if this cost is spread over a 12-month follow-up study. Similarly, in any kind of clinical study, results are more representative when the sample size is larger, yet cost studies of AD report samples ranging from 120 to 750 subjects (*Table II*).³⁻⁸ A corollary problem is that some,³ but not all^{6,7} of the samples cover a very specific geographic area and specific populations. Specific populations may have a health service utilization profile that differs from the general population, and, not surprisingly, in higher-level socioeconomic geographic areas, the *out-of-pocket* expenses on health services are higher than in a poorer area. Also, some studies employ a control group, while others do not. Having or not a control group of nondemented elderly helps account for the cost associated with other comorbid, age-related diseases, hence highlighting the costs specifically related to AD.

Even when studies survey similar populations for similar period of times, there are still large discrepancies between results of the studies related to the components that are included in the calculations and summation of the total cost of AD. For example, one study included as direct cost fees for the general practitioner and as indirect cost lost years of productive life. On the other hand, in the same study, the indirect economic burden imposed

on family members was not included.⁹ In contrast, very detailed direct and indirect care costs were estimated in a study carried out in the US,³ but this analysis did not include the cost of the productive years lost because of the illness.

Not only the components included in calculating the total cost of illness differ between studies, but also the definition of each component. For example, it is not easy to decide whether a particular activity constitutes spending leisure time with a sick spouse or should be considered an effort related to the patient's care and therefore part of the indirect cost. Is watching a TV program with a patient, who, if left alone, will leave the house, get lost, and maybe harm him- or herself in the process, leisure or supervision?

Finally, even if the methodologies are impeccable, the components of cost utilized to come up with a total cost identical, and the definition-of-cost components identical between studies, comparison between studies conducted in different countries can only be interpreted if considered relatively to the average wage or acquisition power of the citizens of the respective country.

Other types of cost analysis

Although cost-of-illness studies are important by themselves and serve as basis for social and health care policy

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debate, they do not enable alternatives to be assessed. Studies that assess alternatives are called cost-effectiveness analyses, cost-benefit analyses, cost-minimization analyses, and cost-utility analyses, and are summarized in *Table III*. The goal of these analyses is to find the alternative that provides the best care for the lowest cost, or even better, describes the optimal balance between benefits and costs.¹⁰ For example, results of a study evaluating cost effectiveness of day care for patients with dementia indicated that it was less expensive to pay for day care than to incur the indirect, informal and formal, cost associated with keeping the patient at home.¹¹

Pharmacoeconomic studies are health economic studies used increasingly by insurance companies, governments, and other providers of health services to decide whether to adopt a new drug. Because the efficacy of anti-AD drugs is not very great, the issue of cost effectiveness was raised as soon as these drugs were approved for marketing. For example, in a study of donepezil's effect on health care cost and utilization, potential savings derived from decrease in medical cost were found to be neutralized by increase in the direct cost due to the high cost of medication.¹²

Nevertheless, there is a trend indicating that these treatments have the potential to offer cost savings,¹²⁻¹⁴ but these trends are mostly expressed as economic models rather than real-life studies. For example, in some studies,^{13,15} tacrine reduced the cost of caring for an AD patient by reducing cost of both institutionalization and home care. Finally, in a recent Canadian study, it was found that rivastigmine delayed the transition to more severe stages of AD. As severity of illness is related to higher costs, the consequence of this delay is cost savings.¹⁶ The main limitation of pharmacoeconomic studies is that they are very rarely designed a priori to address pharmacoeconomic questions. Most often, they are pivotal phase 3 drug trials, to which secondary measurements addressing pharmacoeconomics are added. Hence, they suffer from all the limitations of controlled trials (selected patient populations, restricted outcome measurements and laboratory instead of real life clinical care).

Whose costs are we measuring?

In the final analysis, whether a treatment, intervention, or service is cost-effective depends very much on who is paying for it.¹⁷ Too often, "novel, innovative" interventions and services result in cost shifting rather than sav-

ing resources or providing better care. For example, depending on the organization of health care and the insurance status of the patient, the transfer of a patient from home to institutionalization may decrease the family out-of-pocket expenses and increase the insurer expenses, who now has to cover the cost of institutionalization. Similarly, a drug that delays institutionalization might increase the expenses of the local authorities, which are often covering the cost of day-care centers, and decrease the cost of the private or governmental insurance agency that covers the cost of a nursing home. Finally, indirect cost related to the care provided for free by a healthy spouse or child has monetary meaning only if the caregiver can obtain gainful employment instead of being a caregiver. This is particularly relevant in AD where most of the caregivers are spouses who are often, but not always, retired. In this case, quality of life rather than cost is the relevant variable, but pricing the quality of life of a demented individual or even of an elderly caregiver is a daunting task.

In summary, because economic considerations are expected to play an increasing role in the medical decision-making process including new interventions for AD, health-care workers should familiarize themselves with cost-analysis techniques and become critical consumers of the literature describing these analyses. This will prevent interested parties from using meaningless numbers to advance partisan agendas. □

Costo de la Enfermedad de Alzheimer

El deterioro progresivo que se asocia con la Enfermedad de Alzheimer (EA) se traduce en un alto costo económico para los pacientes, los cuidadores y la sociedad en su conjunto. Los estudios acerca del costo de la EA realizados en la última década han producido resultados discrepantes, principalmente debidos a las diferentes metodologías utilizadas. Este artículo de revisión intenta presentar la metodología empleada en los estudios de costo en la EA y entregar al lector las herramientas necesarias para una evaluación crítica de los resultados.

Coût de la maladie d'Alzheimer

La détérioration progressive de l'état de santé liée à la maladie d'Alzheimer est à l'origine du coût économique important pour les patients, le personnel soignant et la société dans son ensemble. Les études de coût de cette maladie menées au cours de la dernière décennie ont donné des résultats divergents, dus principalement à l'utilisation de méthodologies différentes. Cet article s'efforce de présenter la méthodologie des études de coût de la maladie d'Alzheimer et de fournir au lecteur tous les outils nécessaires à une évaluation critique de ces résultats.

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