

Featured Article

# The worldwide costs of dementia 2015 and comparisons with 2010

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## Abstract

**Introduction:** In 2010, Alzheimer's Disease International presented estimates of the global cost of illness (COI) of dementia. Since then, new studies have been conducted, and the number of people with dementia has increased. Here, we present an update of the global cost estimates.

**Methods:** This is a societal, prevalence-based global COI study.

**Results:** The worldwide costs of dementia were estimated at United States (US) \$818 billion in 2015, an increase of 35% since 2010; 86% of the costs occur in high-income countries. Costs of informal care and the direct costs of social care still contribute similar proportions of total costs, whereas the costs in the medical sector are much lower. The threshold of US \$1 trillion will be crossed by 2018.

**Discussion:** Worldwide costs of dementia are enormous and still inequitably distributed. The increase in costs arises from increases in numbers of people with dementia and in increases in per person costs.

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## Keywords:

Dementia; Alzheimer's disease; Cost; Economics; Costs of illness

## 1. Introduction

In 2010, Alzheimer's Disease International (ADI) presented estimates of the global societal economic impact of dementia [1,2] also included in the World Health Organization/ADI 2012 joint report, "Dementia: a public health priority" [3]. The global cost in 2010 was estimated to be United States (US) \$604 billion (bn). This figure equated to around 1% of the aggregated world gross domestic product (GDP), indicating a particularly significant global socioeconomic impact for this one disorder. Although most people with dementia live in lower middle-income countries (LMIC), almost 90%

of the costs were incurred in high-income countries (HIC). The estimates of the likely prevalence of dementia have been updated for some regions since 2010, and the numbers affected have increased for all regions in line with the increase in the older population [4]. Cost of illness (COI) estimates have improved, with more recent and comprehensive studies carried out across the world. Thus, it is timely to update the global estimates of the economic impact of dementia. This article summarizes the major findings of the global COI estimates in the World Alzheimer Report of 2015 [4].

## 2. Methods

### 2.1. General approach

The current estimates of the global societal economic cost of dementia have been generated using the same general

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approach as for 2010 [2]. Costs are estimated at the country level and then aggregated in various combinations (worldwide cost, by World Bank [WB] country income level, by Global Burden of Disease world regions, and cost for G7 and G20 countries). For each country, there is a cost per person (per capita) estimate, which is then multiplied by the number of people estimated to be living with dementia in that country. The costs are divided into three cost subcategories: direct medical costs, direct social care costs, and costs of informal care.

The new estimates for 2015 should be considered to be a partial update of the 2010 estimates, rather than a full-scale revision. Regarding the numbers affected by dementia, this is based on a fully systematic updated review of prevalence studies [4]. We did not carry out a fully systematic review of COI studies. We identified several important COI studies published since 2010 (and used these to replace older COI data). We have included new cost estimates from the USA [5], UK [6], Germany [7], Norway [8], Sweden [9], and Ireland [10]. For low- and middle-income countries (LAMIC), there is more information available regarding costs of dementia care from seven countries surveyed by the 10/66 Dementia Research Group: China, India, Cuba, Peru, Venezuela, Dominican Republic, and Mexico (PhD thesis by Liu [11]).

As in 2010, for countries with no cost data, cost estimations are derived by imputation [1]. The assumption for the imputation is that there is a relationship between a country's per capita GDP and annual per capita direct costs of dementia. In the 2010 report, for LAMIC, the partitioning of the imputed total direct costs into direct medical and social care sector costs was derived from one Chinese study (Wang et al. [12]), where two-thirds of the direct costs were medical and one-third derived from the social care sector. These proportions were used as a basis for imputation in many Asian and African countries. Now, there is more information available from the 10/66 COI studies (China, India, Cuba, Peru, Venezuela, Dominican Republic, and Mexico) [11], where the proportions are similar to those from Wang et al. [12], but with a somewhat higher proportion of medical care costs in Latin America (74% of direct costs). Thus, the presumptions for imputations in LAMIC have improved considerably. Equivalent data from Africa are still lacking; therefore, we used the same principles for imputation as in the 2010 estimates.

For the 2010 cost estimates, there was only one published COI study from Latin America [13], which was used for imputation of estimates across the region. The thesis of Liu [11] has broadened the available information from Latin America considerably, making the imputations much more representative. The correlation between GDP per capita and annual direct costs of dementia per person in the updated set of COI studies used in the current report is 0.86 ( $P < .001$ ).

## 2.2. Updating cost estimates from 2010 to 2015

For the current estimates, all costs are expressed as 2015 US dollars. The International Monetary Fund/World Eco-

nomics Outlook (IMF/WEO) database of consumer price indices (CPIs) was used to generate cost adjustments, between 2010 and 2015, for each country [14]. For countries where no such figures were available, imputations based on trends from 2010 to the latest available CPIs were used. For a few countries with very small populations and not included in the WEO database, United Nation country profiles were used [15]. Such imputations were not required for any country with a major impact on the costs.

Two other issues are also important when interpreting comparisons between 2010 and 2015 costs. First, there have been shifts in the WB classification of country income level between 2010 and 2015 (several countries have been "upgraded"). To facilitate "like-for-like" comparisons between 2015 and 2010, the 2015 costs by country income level are presented according to a) the current 2015 WB classification and b) the 2010 WB classification. Second, the revised estimates of regional dementia prevalence arguably provide a better estimate of numbers of people with dementia in 2010 and 2015. For the World Alzheimer Report 2009 [16], we estimated 35.6 million people with dementia in 2010. However, if we apply the prevalence estimates from the current report, we would have estimated 40.1 million in 2010. The estimated numbers for China have increased considerably as have those for some countries in Northern Africa, whereas the estimates for some HIC (e.g., the USA and UK) are somewhat lower. The 2010 estimates based on the original prevalence estimates from the World Alzheimer Report 2009 are labelled in Tables 1-3 as "WAR 2009," whereas those based on the prevalence estimates from the current report are labelled as "WAR 2015."

Using the trends (2010–2015) in per capita cost and numbers of people with dementia, each based on WAR 2015 prevalence, it is technically possible to make tentative forecasts of rates of future growth in costs. We present the estimated costs in 2030 and an estimate of the date when global cost will cross the threshold of US \$1 trillion. To make a forecast of future trends in the global cost of dementia, we need to estimate trends in the numbers of people with dementia and trends in the per person costs. Trends per annum between 2010 and 2015 need to be estimated on a like-for-like basis. This means a) applying the WAR 2015 prevalence estimates to the 2010 and 2015 population structures to estimate numbers of people with dementia at both time points and b) using the same approach to weight the mean per capita costs.

## 2.3. Sensitivity analyses

Three sensitivity analyses have been included. In the 2010 report, the most significant effect in the sensitivity analysis was the method of quantifying informal care [1,2]. In the main option, informal care is quantified in terms of time spent assisting with basic and instrumental activities of daily living (ADLs), whereas a lower cost (only basic ADLs) and a higher cost (basic and instrumental ADLs and time spent in supervision) are included.

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