

Estimation of informal care unit costs

TABLE OF CONTENTS

Selection of studies and unit cost extraction	2
List of bibliographical references used for informal care unit costs by country.....	4
France	4
Germany	6
Italy	8
Poland.....	9
Portugal	10
Slovenia	11
Spain	12
Sweden	15
United Kingdom.....	17



Selection of studies and unit cost extraction

In order to get data for the nine countries (France, Germany, Italy, Poland, Portugal, Slovenia, Spain, Sweden, United Kingdom) which are going to be part of the online database, we have used the information from the case studies performed on the economic evaluations on different diseases (Alzheimer's disease¹, rare diseases, depression², diabetes, and multiple sclerosis), as well as the results on cost-of-illness studies from a search launched in PubMed (Medline), complementing the one performed by Oliva-Moreno et al (2017)³.

Unit costs from case studies

In those case studies, two types of societal costs had to be considered in the economic evaluations so as to be selected as included studies: productivity losses and informal care costs. Regarding the information on unit costs for the latter type of social costs, the data extraction procedure was as follows:

1. Search strategy

We used two databases to identify potential references for the review: (i) Medline (PubMed) and (ii) the Cost-Effectiveness Analysis (CEA) Registry from the Tufts University. With respect to the former literature database, the following search strategy was launched, including both formal terms (MeSH terms) and natural language: "Costs"; "Cost Analysis"; "cost-effectiveness"; "cost-utility"; "cost-benefit"; "economic evaluation"; "economic analysis"; "QALY"; "quality-adjusted life years".

2. Inclusion criteria

Once the records had been identified and in order to extract the data on informal care unit costs, we selected the studies that met the following criteria: i) being an original economic evaluation study published in a scientific peer-reviewed journal; ii) being written in English; iii) including informal care costs; iv) being an economic evaluation performed of any intervention related to any of the next diseases: Alzheimer's disease, rare diseases, depression, multiple sclerosis or diabetes.

¹ Peña-Longobardo, L.M., Rodríguez-Sánchez, B., Oliva-Moreno, J. et al. How relevant are social costs in economic evaluations? The case of Alzheimer's disease. *Eur J Health Econ* 20, 1207–1236 (2019). <https://doi.org/10.1007/s10198-019-01087-6>

² Duevel, J.A., Hasemann, L., Peña-Longobardo, L.M. et al. Considering the societal perspective in economic evaluations: a systematic review in the case of depression. *Health Econ Rev* 10, 32 (2020). <https://doi.org/10.1186/s13561-020-00288-7>

³ Oliva-Moreno, J., Trapero-Bertran, M., Peña-Longobardo, L. M., & del Pozo-Rubio, R. (2017). The valuation of informal care in cost-of-illness studies: a systematic review. *Pharmacoeconomics*, 35(3), 331-345.

Unit costs from cost-of-illness studies

Following the search strategy by Oliva-Moreno et al. (2017)³, a search was launched in PubMed using the following code:

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(((((cost[Title/Abstract]) OR (costs[Title/Abstract]) OR (economic*[Title/Abstract]) OR (value*[Title/Abstract]) OR (impact[Title/Abstract]) OR (burden[Title/Abstract]) OR (willingness[Title/Abstract]) OR (resource*[Title/Abstract]) OR (use*[Title/Abstract]) OR (utilisation[Title/Abstract]))) AND (informal care[Title/Abstract]) AND ((cancer[Title/Abstract]) OR (tumour[Title/Abstract]) OR (tumor[Title/Abstract]) OR (stroke[Title/Abstract]) OR (cerebrovascular[Title/Abstract]) OR (multiple sclerosis[Title/Abstract]) OR (dementia[Title/Abstract]) OR (Alzheimer[Title/Abstract]) OR (arthritis[Title/Abstract]) OR (osteoarthritis[Title/Abstract]) OR (schizophrenia[Title/Abstract]) OR (bipolar[Title/Abstract]) OR (depression[Title/Abstract]) OR (mental[Title/Abstract]))) Filters: Publication date from 2015/11/01 to 2019/10/31; Humans
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167 records were identified, from which 45 were finally included as they met our inclusion criteria (being a cost-of-illness study published in a scientific journal in which informal care costs were included, being written in English and within one of the nine countries previously listed). These 45 finally selected articles were added to the 91 studies selected from the original systematic review performed by Oliva-Moreno et al. (2017)³.

Data extraction

Once the inclusion of informal care costs has been confirmed, only the articles that provided with a unit cost per hour or with any other measure that could be converted into hourly terms were used to collect information on informal care unit costs. Then, the following information was extracted: first author's family name, year of publication, disease, country, method to estimate informal care costs, sample size of the study (if available), number of hours of care provided (if available), unit of measurement (currency/hour), year of value, unit cost, comments on the unit cost applied, source, and full reference of the corresponding study.

Those unit costs were then updated to 2019 euros using the Gross Domestic Product (GDP) deflator and the Price Consumer Index for each country.

In addition, those articles that did include informal care costs but the authors did not give any information on the unit cost applied to the amount of informal care were listed in a separate Excel sheet in which the following information was collected as well: first author's family name, year of publication, disease, country, method to estimate informal care costs (if available), sample size of the study (if available), number of hours of care provided (if available), comments on the unit cost applied (if available), source, and full reference of the corresponding study.

List of bibliographical references used for informal care unit costs by country

France

Opportunity cost method

Rapp, T., Andrieu, S., Chartier, F., Deberdt, W., Reed, C., Belger, M., & Vellas, B. (2018). Resource use and cost of alzheimer's disease in France: 18-month results from the GERAS Observational Study. *Value in Health*, 21(3), 295-303.

Bayen, E., Laigle-Donadey, F., Prouté, M., Hoang-Xuan, K., Joël, M. E., & Delattre, J. Y. (2017). The multidimensional burden of informal caregivers in primary malignant brain tumor. *Supportive Care in Cancer*, 25(1), 245-253.

Hornberger, J., Bae, J., Watson, I., Johnston, J., & Happich, M. (2017). Clinical and cost implications of amyloid beta detection with amyloid beta positron emission tomography imaging in early Alzheimer's disease—the case of florbetapir. *Current medical research and opinion*, 33(4), 675-685.

Wübker, A., Zwakhalen, S. M., Challis, D., Suhonen, R., Karlsson, S., Zabalegui, A., ... & Sauerland, D. (2015). Costs of care for people with dementia just before and after nursing home placement: primary data from eight European countries. *The European Journal of Health Economics*, 16(7), 689-707.

Gervès, C., Chauvin, P., & Bellanger, M. M. (2014) Evaluation of full costs of care for patients with Alzheimer's disease in France: the predominant role of informal care. *Health Policy*, 116(1), 114-122.

Wimo, A., Reed, C. C., Dodel, R., Belger, M., Jones, R. W., Happich, M., ... & Haro, J. M. (2013) The GERAS study: a prospective observational study of costs and resource use in community dwellers with Alzheimer's disease in three European countries—study design and baseline findings. *Journal of Alzheimer's Disease*, 36(2), 385-399.

Biasutti, M., Dufour, N., Ferroud, C., Dab, W., & Temime, L. (2012). Cost-effectiveness of magnetic resonance imaging with a new contrast agent for the early diagnosis of Alzheimer's disease. *PloS one*, 7(4).

Gustavsson, A., Jonsson, L., Rapp, T., Reynish, E., Ousset, P. J., Andrieu, S., ... & Wimo, A. (2010) Differences in resource use and costs of dementia care between European countries: baseline data from the ICTUS study. *The journal of nutrition, health & aging*, 14(8), 648-654.

Leal, J., Luengo-Fernández, R., Gray, A., Petersen, S., & Rayner, M. (2006) Economic burden of cardiovascular diseases in the enlarged European Union. *European heart journal*, 27(13), 1610-1619.

Replacement cost method

Bayen, E., Laigle-Donadey, F., Prouté, M., Hoang-Xuan, K., Joël, M. E., & Delattre, J. Y. (2017). The multidimensional burden of informal caregivers in primary malignant brain tumor. *Supportive Care in Cancer*, 25(1), 245-253.

Wübker, A., Zwakhalen, S. M., Challis, D., Suhonen, R., Karlsson, S., Zabalegui, A., ... & Sauerland, D. (2015). Costs of care for people with dementia just before and after nursing home placement: primary data from eight European countries. *The European Journal of Health Economics*, 16(7), 689-707.

Gervès, C., Chauvin, P., & Bellanger, M. M. (2014) Evaluation of full costs of care for patients with Alzheimer's disease in France: the predominant role of informal care. *Health Policy*, 116(1), 114-122.

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Fagnani, F., Lafuma, A., Pechevis, M., Rigaud, A. S., Traykov, L., Seux, M. L., & Forette, F. (2004). Donepezil for the treatment of mild to moderate Alzheimer's disease in France: the economic implications. *Dementia and geriatric cognitive disorders*, 17(1-2), 5-13.

Chevreur, K., Prigent, A., Bourmaud, A., Leboyer, M., & Durand-Zaleski, I. (2013). The cost of mental disorders in France. *European Neuropsychopharmacology*, 23(8), 879-886.

Contingent valuation approach

Bayen, E., Laigle-Donadey, F., Prouté, M., Hoang-Xuan, K., Joël, M. E., & Delattre, J. Y. (2017). The multidimensional burden of informal caregivers in primary malignant brain tumor. *Supportive Care in Cancer*, 25(1), 245-253.

Caplan, B., Bogner, J., Brenner, L., Arciniegas, D., Bayen, E., Jourdan, C., ... & Weiss, J. J. (2016) Objective and subjective burden of informal caregivers 4 years after a severe traumatic brain injury: results from the Paris-TBI study. *Journal of Head Trauma Rehabilitation*, 31(5), E59-E67.

Wübker, A., Zwakhalen, S. M., Challis, D., Suhonen, R., Karlsson, S., Zabalegui, A., ... & Sauerland, D. (2015). Costs of care for people with dementia just before and after nursing home placement: primary data from eight European countries. *The European Journal of Health Economics*, 16(7), 689-707.

Gervès, C., Chauvin, P., & Bellanger, M. M. (2014) Evaluation of full costs of care for patients with Alzheimer's disease in France: the predominant role of informal care. *Health Policy*, 116(1), 114-122.

Germany

Opportunity cost method

Buntrock, C., Berking, M., Smit, F., Lehr, D., Nobis, S., Riper, H., ... & Ebert, D. (2017). Preventing depression in adults with subthreshold depression: health-economic evaluation alongside a pragmatic randomized controlled trial of a web-based intervention. *Journal of medical Internet research*, 19(1), e5.

Michalowsky, B., Thyrian, J. R., Eichler, T., Hertel, J., Wucherer, D., Flessa, S., & Hoffmann, W. (2016). Economic analysis of formal care, informal care, and productivity losses in primary care patients who screened positive for dementia in Germany. *Journal of Alzheimer's Disease*, 50(1), 47-59.

Wübker, A., Zwakhalen, S. M., Challis, D., Suhonen, R., Karlsson, S., Zabalegui, A., ... & Sauerland, D. (2015). Costs of care for people with dementia just before and after nursing home placement: primary data from eight European countries. *The European Journal of Health Economics*, 16(7), 689-707.

Wimo, A., Reed, C. C., Dodel, R., Belger, M., Jones, R. W., Happich, M., ... & Haro, J. M. (2013). The GERAS study: a prospective observational study of costs and resource use in community dwellers with Alzheimer's disease in three European countries—study design and baseline findings. *Journal of Alzheimer's Disease*, 36(2), 385-399.

Hartz, S., Getsios, D., Tao, S., Blume, S., & Maclaine, G. (2012). Evaluating the cost effectiveness of donepezil in the treatment of Alzheimer's disease in Germany using discrete event simulation. *BMC neurology*, 12(1), 2.

Leicht, H., Heinrich, S., Heider, D., Bachmann, C., Bickel, H., van den Bussche, H., ... & Pentzek, M. (2011). Net costs of dementia by disease stage. *Acta Psychiatrica Scandinavica*, 124(5), 384-395.

Guo, S., Hernandez, L., Wasiak, R., & Gaudig, M. (2010). Modelling the clinical and economic implications of galantamine in the treatment of mild-to-moderate Alzheimer's disease in Germany. *Journal of medical economics*, 13(4), 641-654.

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Koenig, H. H., Born, A., Heider, D., Matschinger, H., Heinrich, S., Riedel-Heller, S. G., ... & Roick, C. (2009). Cost-effectiveness of a primary care model for anxiety disorders. *The British Journal of Psychiatry*, 195(4), 308-317.

Teipel, S. J., Ewers, M., Reisig, V., Schweikert, B., Hampel, H., & Happich, M. (2007). Long-term cost-effectiveness of donepezil for the treatment of Alzheimer's disease. *European Archives of Psychiatry and Clinical Neuroscience*, 257(6), 330-336.

Kobelt, G., Berg, J., Lindgren, P., Elias, W. G., Flachenecker, P., Freidel, M., ... & Straube, E. (2006). Costs and quality of life of multiple sclerosis in Germany. *The European journal of health economics*, 7(2), 34-44.

Leal, J., Luengo-Fernández, R., Gray, A., Petersen, S., & Rayner, M. (2006) Economic burden of cardiovascular diseases in the enlarged European Union. *European heart journal*, 27(13), 1610-1619.

Icks, A., Haastert, B., Gandjour, A., John, J., Löwel, H., Holle, R., ... & Rathmann, W. (2004) Cost-effectiveness analysis of different screening procedures for type 2 diabetes: the KORA Survey 2000. *Diabetes Care*, 27(9), 2120-2128.

Replacement cost method

Michalowsky, B., Thyrian, J. R., Eichler, T., Hertel, J., Wucherer, D., Flessa, S., & Hoffmann, W. (2016). Economic analysis of formal care, informal care, and productivity losses in primary care patients who screened positive for dementia in Germany. *Journal of Alzheimer's Disease*, 50(1), 47-59.

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Wimo, A., Reed, C. C., Dodel, R., Belger, M., Jones, R. W., Happich, M., ... & Haro, J. M. (2013) The GERAS study: a prospective observational study of costs and resource use in community dwellers with Alzheimer's disease in three European countries—study design and baseline findings. *Journal of Alzheimer's Disease*, 36(2), 385-399.

Leicht, H., Heinrich, S., Heider, D., Bachmann, C., Bickel, H., van den Bussche, H., ... & Pentzek, M. (2011) Net costs of dementia by disease stage. *Acta Psychiatrica Scandinavica*, 124(5), 384-395.

Contingent valuation approach

Wübker, A., Zwakhalen, S. M., Challis, D., Suhonen, R., Karlsson, S., Zabalegui, A., ... & Sauerland, D. (2015). Costs of care for people with dementia just before and after nursing home placement: primary data from eight European countries. *The European Journal of Health Economics*, 16(7), 689-707.

Italy

Opportunity cost method

Kobelt, G., Eriksson, J., Phillips, G., & Berg, J. (2017) The burden of multiple sclerosis 2015: Methods of data collection, assessment and analysis of costs, quality of life and symptoms. *Multiple Sclerosis Journal*, 23(2_suppl), 4-16.

Luengo-Fernandez, R., Leal, J., Gray, A., & Sullivan, R. (2013) Economic burden of cancer across the European Union: a population-based cost analysis. *The lancet oncology*, 14(12), 1165-1174.

Gustavsson, A., Jonsson, L., Rapp, T., Reynish, E., Ousset, P. J., Andrieu, S., ... & Wimo, A. (2010). Differences in resource use and costs of dementia care between European countries: baseline data from the ICTUS study. *The journal of nutrition, health & aging*, 14(8), 648-654.

Kobelt, G., Berg, J., Lindgren, P., Battaglia, M., Lucioni, C., & Uccelli, A. (2006). Costs and quality of life of multiple sclerosis in Italy. *The European Journal of Health Economics*, 7(2), 45-54.

Leal, J., Luengo-Fernández, R., Gray, A., Petersen, S., & Rayner, M. (2006) Economic burden of cardiovascular diseases in the enlarged European Union. *European heart journal*, 27(13), 1610-1619.

Replacement cost method

Lazzaro, C., Bianchi, C., Peracino, L., Zacchetti, P., & Uccelli, A. (2009). Economic evaluation of treating clinically isolated syndrome and subsequent multiple sclerosis with interferon β -1b. *Neurological sciences*, 30(1), 21-31.

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Poland

Opportunity cost method

Kawalec, P., & Stawowczyk, E. (2018). Relationship between physician-based assessment of disease activity, quality of life, and costs of ulcerative colitis in Poland. *Przegląd gastroenterologiczny*, 13(1), 61.

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Holko, P., Kawalec, P., Mossakowska, M., & Pilc, A. (2016). Health-related quality of life impairment and indirect cost of Crohn's disease: a self-report study in Poland. *PloS one*, 11(12).

Macioch, T., Zalewska, U., Sobol, E., Rakowska, B. M., Krakowiecki, A., & Hermanowski, T. (2015). The indirect costs of diabetic foot ulcers in Poland. *J Diabetes Metab*, 6(540), 2.

Szurło, D., Fundament, T., Ziobro, M., Kruntorádová, K., Doležal, T., & Głogowski, C. (2014). Costs of multiple sclerosis—extrapolation of Czech data to Polish patients. *Expert review of pharmacoeconomics & outcomes research*, 14(3), 451-458.

Luengo-Fernandez, R., Leal, J., Gray, A., & Sullivan, R. (2013) Economic burden of cancer across the European Union: a population-based cost analysis. *The lancet oncology*, 14(12), 1165-1174.

Leal, J., Luengo-Fernández, R., Gray, A., Petersen, S., & Rayner, M. (2006) Economic burden of cardiovascular diseases in the enlarged European Union. *European heart journal*, 27(13), 1610-1619.

Portugal

Opportunity cost method

Kobelt, G., Eriksson, J., Phillips, G., & Berg, J. (2017) The burden of multiple sclerosis 2015: Methods of data collection, assessment and analysis of costs, quality of life and symptoms. *Multiple Sclerosis Journal*, 23(2_suppl), 4-16.

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Marques, A., Lourenço, Ó., & Da Silva, J. A. P. (2015) The burden of osteoporotic hip fractures in Portugal: costs, health related quality of life and mortality. *Osteoporosis international*, 26(11), 2623-2630.

Luengo-Fernandez, R., Leal, J., Gray, A., & Sullivan, R. (2013) Economic burden of cancer across the European Union: a population-based cost analysis. *The lancet oncology*, 14(12), 1165-1174.

Leal, J., Luengo-Fernández, R., Gray, A., Petersen, S., & Rayner, M. (2006) Economic burden of cardiovascular diseases in the enlarged European Union. *European heart journal*, 27(13), 1610-1619.

Replacement cost method

Tavares, A. I., & Freitas, C. (2019) The Burden of Informal Caregivers of Alzheimer's Patients: An Estimation to Portugal. In *Evaluation of Health Programs*. IntechOpen, 2019

Pires, C., Teixeira, L., Ribeiro, O., & Oliveira, S. (2016). Custo dos cuidados informais a pessoas idosas da região Norte de Portugal: aplicação do método do bem substituto.

Slovenia

Opportunity cost method

Luengo-Fernandez, R., Leal, J., Gray, A., & Sullivan, R. (2013) Economic burden of cancer across the European Union: a population-based cost analysis. *The lancet oncology*, 14(12), 1165-1174.

Leal, J., Luengo-Fernández, R., Gray, A., Petersen, S., & Rayner, M. (2006) Economic burden of cardiovascular diseases in the enlarged European Union. *European heart journal*, 27(13), 1610-1619.

Spain

Opportunity cost method

Ortega-Ortega, M., del Pozo-Rubio, R. (2019) Catastrophic financial effect of replacing informal care with formal care: a study based on haematological neoplasms. *The European Journal of Health Economics* 20, 303–316

Ortega-Ortega, M., Montero-Granados, R., & Jiménez-Aguilera, J. D. D. (2019). Differences in the economic valuation and determining factors of informal care over time: the case of blood cancer. *Gaceta sanitaria*, 32, 411-417.

Olazarán, J., Agüera-Ortiz, L., Argimón, J. M., Reed, C., Andrade, P., & Dilla, T. (2017). Costs and quality of life in community-dwelling patients with Alzheimer's disease in Spain: results from the GERAS II observational study. *International psychogeriatrics*, 29(12), 2081-2093.

Hornberger, J., Michalopoulos, S., Dai, M., Andrade, P., Dilla, T., & Happich, M. (2015). Cost-Effectiveness of Flortetapir-PET in Alzheimer's Disease: A Spanish Societal Perspective. *The journal of mental health policy and economics*, 18(2), 63-73.

Peña-Longobardo, L.M., Oliva-Moreno, J. (2015) Economic valuation and determinants of informal care to people with Alzheimer's disease. *The European Journal of Health Economics*, 16(5), 507-515.

Wübker, A., Zwakhalen, S. M., Challis, D., Suhonen, R., Karlsson, S., Zabalegui, A., ... & Sauerland, D. (2015) Costs of care for people with dementia just before and after nursing home placement: primary data from eight European countries. *The European Journal of Health Economics*, 16(7), 689-707

Gustavsson, A., Jonsson, L., Rapp, T., Reynish, E., Ousset, P. J., Andrieu, S., ... & Wimo, A. (2010) Differences in resource use and costs of dementia care between European countries: baseline data from the ICTUS study. *The journal of nutrition, health & aging*, 14(8), 648-654.

López-Bastida, J., Hart, W., García-Pérez, L., Linertová, R. (2009) Cost-effectiveness of donepezil in the treatment of mild or moderate Alzheimer's disease. *J Alzheimers Dis* 16(2), 399-407

Kobelt, G., Berg, J., Lindgren, P., Izquierdo, G., Sanchez-Solino, O., Perez-Miranda, J., Casado, M. A. (2006) Costs and quality of life of multiple sclerosis in Spain. *The European Journal of Health Economics*, 7(2), 65-74

Leal, J., Luengo-Fernández, R., Gray, A., Petersen, S., Rayner, M. (2006) Economic burden of cardiovascular diseases in the enlarged European Union. *European heart journal*, 27(13), 1610-1619.

Lopez-Bastida, J., Serrano-Aguilar, P., Perestelo-Perez, L., Oliva-Moreno, J. (2006) Social-economic costs and quality of life of Alzheimer disease in the Canary Islands, Spain. *Neurology*, 67(12), 2186-2191.

Oliva-Moreno, J., López-Bastida, J., Osuna-Guerrero, R., Montejo-González, A. L., Duque-González, B. (2006) The costs of schizophrenia in Spain. *The European Journal of Health Economics*, 7(3), 179-184.

Replacement cost method

Delgado-Ortega, L., González-Domínguez, A., Borrás, J. M., Oliva-Moreno, J., González-Haba, E., Menjón, S., ... & Simón, S. (2019). The economic burden of disease of epithelial ovarian cancer in Spain: the OvarCost study. *The European Journal of Health Economics*, 20(1), 135-147.

Ortega-Ortega, M., del Pozo-Rubio, R. (2019) Catastrophic financial effect of replacing informal care with formal care: a study based on haematological neoplasms. *The European Journal of Health Economics* 20, 303–316

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Alvarez-Sabín, J., Quintana, M., Masjuan, J., Oliva-Moreno, J., Mar, J., Gonzalez-Rojas, N., ... & Yebenes, M. (2017). Economic impact of patients admitted to stroke units in Spain. *The European Journal of Health Economics*, 18(4), 449-458.

Olazarán, J., Agüera-Ortiz, L., Argimón, J. M., Reed, C., Andrade, P., & Dilla, T. (2017). Costs and quality of life in community-dwelling patients with Alzheimer's disease in Spain: results from the GERAS II observational study. *International psychogeriatrics*, 29(12), 2081-2093.

Farré, M., Haro, J. M., Kostov, B., Alvira, C., Risco, E., Miguel, S., ... & Zabalegui, A. (2016). Direct and indirect costs and resource use in dementia care: A cross-sectional study in patients living at home. *International journal of nursing studies*, 55, 39-49.

Turró-Garriga, O., Garre-Olmo, J., Rene-Ramirez, R., Calvó-Perxas, L., Gascón-Bayarri, J., & Conde-Sala, J. L. (2016). Consequences of anosognosia on the cost of caregivers' care in Alzheimer's disease. *Journal of Alzheimer's Disease*, 54(4), 1551-1560.

Darbà, J., Kaskens, L., & Lacey, L. (2015). Relationship between global severity of patients with Alzheimer's disease and costs of care in Spain; results from the co-dependence study in Spain. *The European Journal of Health Economics*, 16(8), 895-905.

Darbà, J., & Kaskens, L. (2015). Relationship between patient dependence and direct medical-, social-, indirect-, and informal-care costs in Spain. *ClinicoEconomics and outcomes research: CEOR*, 7, 387.

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Sweden

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United Kingdom

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