MODEM

modelling outcome and cost impacts
of interventions for dementia

PROJECT SUMMARY

This short paper summarises current findings from the MODEM project.

It outlines what has already been produced, and describes the final project outputs, which will be published over the next few months.

This summary was prepared by the International Longevity Centre UK as part of the MODEM project team.

LSE PSSRU Personal Social Services Research Unit
Newcastle University
brighton and sussex medical school
ilc... International Longevity Centre UK

Contents

Introduction: About MODEM

As the UK population continues to age, the number of people living with dementia will grow considerably and is set to reach over 1.2 million by 2035. Continuing with today's treatment, care and support arrangements is widely seen as unsustainable and unaffordable. A major challenge is how to provide high-quality treatment and support to these individuals at a cost seen as affordable.

In response to these challenges, the MODEM project (MOdelling outcome and cost impacts of interventions for DEMentia) brought together leading figures from the fields of simulation modelling, social gerontology, health and social care economics, clinical evaluations, qualitative methods and knowledge exchange to improve our understanding of dementia care (see opposite).

Since March 2014, following a funding grant from the Economic and Social Research Council (ESRC) and National Institute for Health Research (NIHR) received as part of their Dementia Initiative, MODEM has been exploring how changes in arrangements for the future treatment and care of people living with dementia, and support for carers, could result in better outcomes and more efficient use of resources. The MODEM project aimed to answer the following questions:

- How many people living with dementia will there be over the period to 2040; and what will be the costs and outcomes of their treatment, care and support under present arrangements?
- How do those costs and outcomes vary with the characteristics and circumstances of people living with dementia and their carers?
- How could future costs and outcomes change (in level and distribution) if evidence-based interventions were more widely implemented?

Our protocol paper[1] set out our approach. MODEM concludes in 2018 with the remaining research outputs to be published in early 2019. It is hoped that the research developed will influence policy and practice in dementia care.

How MODEM involved users and carers

There has been a strong focus on ensuring the involvement of people living with dementia and their carers in the MODEM project. A reference group of users and carers was set up in the early months of the MODEM project. People living with dementia and carers and also some front-line practitioners were invited to join the group. The group generally met twice-yearly during the course of the project, always engaging with members of the research team who came to the meetings to discuss progress and outcomes of the project as it progressed. The reference group was supported by a Research Involvement Manager, who had experience of caring for her husband with Alzheimer's disease and her mother who had dementia.

Over the 54 months of the project, there has been some movement of members, some members unable to continue and others invited to join. However, a core membership has been retained and they have expressed an interest in being engaged with further projects. Being engaged specifically with a dementia focused project has been particularly positive in that members have been able to share their experiences to the benefit of the research and therefore people living with dementia and their carers.

How MODEM involved other dementia experts

An Advisory Group was set up to advise on the general strategy for the MODEM project and to support the project team in its impact-generating activities. The Advisory Group met twice a year and was chaired by Professor Nick Black, Professor of Health Services Research at the London School of Hygiene and Tropical Medicine. The Group includes prominent figures with expertise in dementia, the health and social care system, academia and government, such as stakeholders from NHS England, Public Health England, local government, the Department of Health and Social Care, Dementia UK and the Alzheimer's Society.

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[1] https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-016-1945-x

MODEM project team

London School of Economics and Political Science (PSSRU)	Martin Knapp Adelina Comas-Herrera Raphael Wittenberg Bayo Adelaja Annette Bauer Margaret Dangoor Jackie Damant Josie Dixon Bo Hu Derek King Daniel Lombard Klara Lorenz David McDaid A-La Park Sanna Read Amritpal Rehill
LSE (Social Policy Department)	Emily Grundy (now University of Essex)
Newcastle University	Carol Jagger and Andrew Kingston
Southampton University	Ann Bowling (now retired) Jitka Pikhartova (now Brunel University)
Sussex University (Brighton and Sussex Medical School)	Sube Banerjee Nicolas Farina with research assistance from: Sharne Berwald, Clare Burgon, Elizabeth Bustard, Ruth Habibi, Yvonne Feeney Laura Gallaher
International Longevity Centre UK	Baroness Sally Greengross OBE
Reference Group of Users and Carers	**Advisory Group**
Jenny Bailey Toni Battison Karen Block Maria Boyd Louise Capitelli Stella Chattle Lucia Dedear Janet Fevrier Carol Fordyce Jane Goodrick U Hla Htay Lynn James Shamime Lakda Bernadette Menasse Denise Menasse Batcho Notay Jaquie Nunn Derek Pigott Chris Roberts Elizabeth Sallis Marilyn Wilkins Peter Wilkins Barbara Witzenfeld John Witzenfeld	Nick Black, London School of Hygiene and Tropical Medicine (chair) Charles Alessi, Public Health England Carol Brayne, University of Cambridge Alistair Burns, University of Manchester Bob Butcher, Department of Health and Social Care Margaret Dangoor, MODEM RGUC representative Martin Green, Care England Joanne Goddard, Economic and Social Research Council Karen Harrison-Dening, Dementia UK Jill Manthorpe, King's College London Kayleigh McNamara, Public Health England Matt Norton, Alzheimer's Research UK David Pearson, Nottingham County Council James Pickett, Alzheimer's Society Marcus Richards, University College London Martin Rossor, University College London Allison Smith, Centre for Ageing Better Wendy Weidner, Alzheimer's Disease International Members of the research team in attendance

MODEM Research

The MODEM project was organised into interlinked work packages which involved:

- Building models to estimate the future numbers of people living with dementia, to estimate the current and future costs of their care, and to understand the impact of making more widely available interventions that have been found to be cost-effective;
- Mapping the dementia care pathway to understand better the current situation;
- Cataloguing 3,700 international empirical papers and systematic reviews of the effectiveness and cost-effectiveness of dementia care and treatment interventions, provide plain language summaries of the evidence and create an easy to use, searchable database;
- Gathering evidence on the lives of people living with dementia and their carers by talking to 300 people and their carers who live with dementia, charting their lives over the course of a year;
- Creating a Legacy Model to project future numbers of people living with dementia, their dependency and other needs, co-morbidities, levels of unpaid and formal care and associated expenditure for use by service commissioners, policy makers, providers, advocacy groups, and individuals and families affected by dementia; and
- Publishing academic papers addressing knowledge gaps in dementia treatment, care and prevention.

MODEM MODELS

Micro-simulation epidemiological model

Current models used to forecast the future care needs of different populations are limited in the risk factors they include, and in assumptions about the health and health behaviours of incoming cohorts.

We have developed a dynamic microsimulation model, the Population Ageing and Care Simulation (PACSim) model, which addresses most of the limitations of previous models, and we used this to estimate the numbers of older people in England requiring care at different intensities, the years spent in different care states, and how dementia and other co-morbidities contribute.

PACSim combines three studies (Understanding Society, the English Longitudinal Study of Ageing, the Cognitive Function and Ageing Study II) to simulate individuals' sociodemographic factors, health behaviours, 12 chronic diseases and geriatric conditions, and dependency categorised as: high (24-hour care); medium (daily care); low (less than daily); independent.

Key findings

Between 2015 and 2035 in England, both the prevalence of, and numbers with, dependency will fall for the young-old (65-74 years) whilst for very old adults (≥85 years) numbers with low dependency will increase by 148% and with high dependency (24-hr care) will almost double (increase of 91.8%) though prevalence will change little. For men aged 65 there will be a compression of dependency as gains in years independent (4.1 years) exceed gains in life expectancy (3.5 years). In contrast for women there will be an expansion of mainly low dependency. In 2015 just over half (58%) of older adults with dementia and substantial (medium or high) dependency will have at least two other concurrent conditions whilst by 2035 this proportion will rise to 81%. Multi-morbidity prevalence and years spent with multi-morbidity are estimated to increase over the same period, but the largest increases will be seen in 4+ diseases where the proportion will rise from 9.8% to 17%, and most of the life expectancy gains will be in years spent with 4+ diseases.

Recommendations

Over the next 20 years further ageing of the older English population will result in more complex care needs, particularly for the very old. Our projections highlight the importance of ensuring that health and social care services adapt so that they can adequately respond, particularly as this is occurring alongside extension of the retirement age which will reduce the ability of adult children to provide care, as well as an increase in older spouse carers who will be increasingly living with disabilities and multiple conditions. In addition, the greater levels of low dependency found in women than men suggest a focus on disabling long-term conditions, such as arthritis, that are more prevalent in women than men, as well as promoting the development of interventions to improve recovery from low dependency and slow down further decline.

Publications

Kingston A, Robinson L, Booth H, Knapp M, Jagger C for the MODEM project (2018) Projections of multi-morbidity in the older population in England to 2035: estimates from the Population Ageing and Care Simulation (PACSim) model, *Age and Ageing*. Published online at https://academic.oup.com/ageing/article/47/3/374/4815738 on 23 January.

Kingston A, Comas-Herrera A, Jagger C for the MODEM project (2018) Forecasting the care needs of the older population in England over the next 20 years: estimates from the Population Ageing and Care Simulation (PACSim) modelling study, *Lancet Public Health*, 3, e447–455.

■ Macro-simulation projection model

We built models to estimate the total costs of care for people living with dementia in England. The costs relate to both older people living with dementia aged 65 and over and people with early onset dementia aged between 35 and 64. We conducted analyses of Cognitive Function and Ageing Study (CFASII) data and of data from the Modem Cohort to develop the models. We estimated the number of people with mild, moderate and severe dementia by age, gender and type of care. We calculated the annual total costs and average costs of unpaid care, community-based social care, residential care and healthcare.

We estimated that there are around 690,000 people living with dementia in England, of whom 650,000 are aged 65 and over. The annual total costs of dementia in 2015 were estimated to be £24.2 billion, of which around half related to unpaid care. Average costs of mild, moderate and severe dementia are estimated to be £24,400, £27,450, and £46,050 per person per year, respectively.

We made projections of the demand for unpaid care, social care and healthcare for the older population with dementia and of the associated costs of care from 2015 to 2040. We conducted regression analyses to identify the key drivers of receipt of unpaid care and of care services. Our projections take account of expected changes in the prevalence of dementia from the PACSim model, changes in the number of older people by age and gender published by the Office for National Statistics (ONS) and expected real rises in wages reported by the Office for Budget Responsibility (OBR).

The total number of older people living with dementia in England is projected to increase from 650,000 in 2015 to 1,350,000 in 2040. The total costs of dementia are projected to increase from £23.0 billion in 2015 to £80.1 billion in 2040. Please note that these are provisional estimates which should not be quoted as final.

Findings from these models will be available in early 2019.

■ Social participation model

Our findings suggest that the social activities of individuals and their social networks help to maintain steady levels of cognition, in addition to their education. We focused on two interlinked areas of research.

Social participation and cognition

We investigated associations between life-course social engagement (civic participation) and cognitive status at age 50, adjusting for social networks and support, behavioural, health, social and socio-economic characteristics.

Previous studies have indicated that social engagement is associated with better cognitive outcomes. We examined a sample of 9119 men and women born in 1958 through analysis of the

National Child Development Study (1958 Birth Cohort Study), a general population sample in England, Scotland and Wales.

Key findings

The analysis showed that cognitive status at age 11; participation in civic activities (recorded at ages 33 and 50); frequent participation in sport (recorded at age 42); having higher level qualifications by age 50, and female gender were all positively and significantly associated with cognitive outcomes at age 50. Having a father in manual socio-economic groups at age 11, and reporting oneself to be in a manual group, were negatively associated with cognitive outcomes at age 50.

Recommendations

We concluded that adult social engagement through civic activities could potentially maintain cognitive function at age 50, independently of behavioural and socio-economic circumstances.

In addition to the continuing emphasis on physical activity, we recommend that encouragement of civic participation, at least as early as mid-life, should be a targeted policy to potentially promote and protect cognitive function in later mid-life.

Publications

Bowling A, Pikhartova J, Dodgeon B (2016) Is mid-life social participation associated with cognitive function at age 50? Results from the British National Child Development Study (NCDS), *BMC Psychology*, 4, 1, 58.

Fertility history and cognition

We investigated the association between fertility history (i.e. how many children a person has, and at which point in their lives their first was born,) and cognition in older men and women.

Previous studies utilising longitudinal data have indicated that social contacts, strong social networks, and social participation are protective of cognitive function; that sparse social interaction is associated with poorer cognitive functioning, and that having children provides social stimulation both through interaction with them and because parenthood promotes involvement in other social relationships and activities.

However, we noted that associations between parenthood and social factors related to cognitive function may vary by gender, and that some countervailing influences and certain types of parenting pathways may be less protective, or indeed harmful to cognitive function. Therefore, we analysed associations between number of children, and timing of births with the level and change in cognition among 11,233 men and women aged over 50 in England.

Key findings

Associations between fertility history and cognition were to large extents accounted for by socio-economic position, partly because this influenced health and social engagement. However, poorer cognition in childless people suggests factors related to childbearing/rearing that are beneficial for later life cognitive functioning.

Recommendations

The poorer cognitive functioning of childless people suggests that there may be aspects of rearing children that are beneficial for cognitive function. For example, nurturance of others may promote self-esteem and self-efficacy and social interaction and activities with children, such as reading, playing games, and helping with homework, may be cognitively stimulating.

Given changes in fertility patterns, including increasing rates of childlessness, and other changes in patterns of social interaction, further work on linkages between family patterns, social interaction, and cognitive function is warranted.

Publications

Read S, Grundy E (2016) Fertility history and cognition in later life, *Journal of Gerontology – Series B Psychological Sciences and Social Science*s, 72, 6.

■ Generating new evidence using our models

One of the core questions addressed in MODEM is how future dementia costs and outcomes might change if evidence-based interventions were made more widely available. To investigate this question, we started with estimates of the projected numbers of people living with dementia over the period to 2040 (generated by our microsimulation model), and calculated the associated costs and quality of life that would be expected if treatment, care and support remained the same in the future as they are today.

We conducted searches to find interventions that had been shown to be effective – for example, in slowing cognitive decline, improving health-related quality of life or improving carer wellbeing. (The MODEM Evidence Toolkit website (http://toolkit.modem-dementia.org.uk) captures the full wealth of our searches.) We were particularly interested in interventions that are cost-effective. This is either because they generate (net) cost savings or because, even if they raise costs above present levels, the outcomes they achieve are considered to be 'worth it' (for example, in the way that these judgements are made by bodies such as NICE).

There are not many cost-effective interventions in the dementia field. So far we have identified three interventions:

- cognitive stimulation therapy
- anti-dementia medications when taken in combination: an acetylcholinesterase inhibitor (AChEI) in combination with memantine
- carer support (specifically the START intervention)

In the future we hope to have findings for at least one more intervention (for people living with dementia living in care homes) and possibly one or two more. However, the evidence base is relatively weak.

We estimated what happens to costs and outcomes when these interventions are scaled up to everyone who might be considered eligible for them, taking into account that not everyone would be likely to agree to receive some interventions.

Findings from our modelling will be available in early 2019.

MAPPING CARE PATHWAYS

Making interventions that work in the treatment, care and support for people living with dementia more widely available will require enough capacity in the health and social care system to deliver those interventions. In practice, this also requires that people are able to access the services that are potentially able to deliver those interventions.

In order to understand better the current situation, we have mapped the full dementia care pathway in England. By the dementia care pathway, we mean the stages of care that people living with dementia and carers may experience, from the very first symptoms or concerns, to the end of life, considering health, social care and community services. We have done this through a wide consultation that enabled us to map graphically the sequence of services that are potentially available, and then proceeded to look for data on the numbers of people living with dementia and carers that are able to access those services in practice.

Key findings

This process has highlighted that, while there is a wide variety of services available in England, the system is very fragmented and complex, suggesting that, without good care coordination, it is not easy for people living with dementia and their carers to access services. It is also evident that there is a relatively well-established health care pathway and data on what happens up to the point of diagnosis, but, in contrast, there is very little information to enable the monitoring of how well the current dementia care services are able to provide adequate care, treatment and support beyond diagnosis.

Findings from out care pathway will be available in early 2019.

Mapping technology onto the dementia care pathway

We provided an overview of the role of technology in dementia care, treatment and support by mapping existing technologies by function, target user and disease progression.

The technologies we identified were classified into seven functions: memory support, treatment, safety and security, training, care delivery, social interaction, and other. Different groups of potential users were distinguished: people with mild cognitive impairment and early stages of dementia, people with moderate to severe dementia, and unpaid carers and health and social care professionals.

We also identified the care settings in which the technologies are used (or for which the technologies are developed): at home, in the community, and in institutional care settings. We drew evidence from a literature review, expert interviews, and web and social media searches.

Key findings

Most of the technologies included in the review were targeted at people with moderate or severe dementia, living at home in the community. Most technologies targeted the safety and security of people living with dementia. Most of these safety and security technologies were for people with moderate and severe dementia.

When focusing on people with moderate to severe dementia in institutional care, such as day care or care home settings, the largest number of technologies identified are technologies with therapeutic effects such as pet robots, or simulated presence therapy.

Recommendations

The expert interviews we conducted for this study suggested that a primary factor in perceived low levels of utilisation is the lack of awareness of the options on the part of all of the potential users (i.e. people living with dementia, their paid and family carers, care home staff, and the professionals whose function is to assess the needs of people living with dementia and provide timely information and referrals regarding the best available resources). Wider distribution of resources such as the MODEM Dementia Evidence Toolkit would address this issue.

Publications

Lorenz K, Freddolino PP, Comas-Herrera A, Knapp M, Damant J (2017) Technology-based tools and services for people with dementia and carers: Mapping technology onto the dementia care pathway, *Dementia*, published online at https://journals.sagepub.com/doi/10.1177/1471301217691617 on January 2017.

EVIDENCE REVIEW

We undertook a systematic mapping of literature from 2009 to 2017 to populate the MODEM Evidence Toolkit. This toolkit provides an online searchable bibliographic and categorised database of several thousand empirical studies focused primarily on interventions to treat mild cognitive impairment and dementia, as well as comorbidities and adverse events. Examples of interventions include different types of pharmaceuticals, cognitive behavioural and cognitive stimulation therapies, exercise, dance and music. Interventions targeted at carers such as the use of respite care and interventions targeted at health and social care professionals including dementia management training programmes are also covered.

We also prepared lay summaries on the strength of the evidence for selected interventions. The mapping review can also be used to identify trends in the direction of research such as the growing increased interest in use of psychosocial interventions and in actions to support carers.

It is crucial to continue to advance what we know about the budgetary and economic implications of investing in new forms of effective action against dementia. We also undertook a systematic review to identify changes in the state of the art between 2009 and 2018 in economic evaluations of interventions to address dementia and mild cognitive impairment. Over 90 studies were included in the analysis of which only 25% were focused on pharmaceuticals, and few of these drug studies were published after 2013. Despite the increased profile of dementia in international health policy and research, the use of economic analysis as part of the evaluation of interventions remains limited. Most studies identified focus on non-pharmacological interventions, including new approaches to care management and supporting family carers. While almost one third of studies were from the UK, it is of concern that there are very few replication studies looking at cost effectiveness. Such studies would help strengthen the case for implementation in the UK and elsewhere.

The toolkit can be found at http://toolkit.modem-dementia.org.uk.

Evidence on advance care planning

As part of our evidence review, we also focused on the evidence of the effectiveness of advance care planning (ACP) in improving end of life outcomes for people living with dementia and their carers. We conducted systematic searches of academic databases to identify research studies, published between January 2000 and January 2017 and involving statistical methods, in which ACP is an intervention or independent variable, and in which end-of-life outcomes for people living with dementia and/or their carers are reported. We identified a total of 18 relevant studies. Most found ACP to be associated with some improved end-of-life outcomes. Studies were predominantly, but not exclusively, from the U.S. and care home-based. The type of ACP and outcome measures varied. Quality was assessed using National Institute of Health and Care Excellence quality appraisal checklists. Over half of the studies were of moderate to high quality. Three were randomized controlled trials, two of which were low quality.

Key findings

There is a need for more high-quality outcome studies, particularly using randomized designs to control for confounding. These need to be underpinned by sufficient development work and process evaluation to clarify the appropriateness of outcome measures, explore implementation issues and identify 'active elements'.

Publication

Dixon J, Knapp M, Karagiannidou M (2018) The effectiveness of advance care planning in improving end of life outcomes for people with dementia and their carers: A systematic review and critical discussion, *Journal of Pain and Symptom Management*, 55 , 1 , 132–150

EVIDENCE ON THE LIVES OF PEOPLE LIVING WITH DEMENTIA AND THEIR CARERS

Alongside reviewing the evidence and our modelling work, we carried out new data collection.

Cohort study

Within this cohort study we aimed to recruit and interview 300 people living with dementia and their primary carer. As a novel component of the research, we aimed to get an equal split based on disease severity (100 mild, 100 moderate and 100 severe dementia). Within the interview, participants were asked a range of questions relating to their quality of life, health, cognition, carer burden, and services accessed. Participants were followed up one year later.

In collecting this data, we were able to get a clearer understanding of impact of severity on a number of outcomes, including quality of life. Data from this cohort study has been fed into other MODEM projects including micro-simulation projection models and macro-simulation projection models. We have analysed the impact of dementia severity on the quality of life of people living with dementia and their carers, cross-sectionally and longitudinally.

Key findings

We were successful in recruiting 307 people living with dementia and their primary carer. Cross-sectional data analysis revealed:

- Proxy-report, but not self-report, quality of life of the person with dementia is associated with dementia severity.
- Carer quality of life is not affected by dementia

severity, even after controlling for key confounding variables.

- Factors such as the quality of life of the person with dementia and carer burden, are significantly associated with carer quality of life.

250 participants were available to participate at follow-up. Longitudinal data analysis revealed:

- Between testing, approximately 45% of participants experienced at least one of the following; a) hospital admission, b) moving into residential care, c) commenced formal home care, d) had a fall in quality of life (0.10 decline in EQ5D).
- Having severe dementia is associated with poorer generic quality of life at follow-up when compared to mild severity participants. This was not found in the disease-specific quality of life outcome.
- Disease-specific quality of life at follow-up is significantly associated with greater behavioural disturbance.

Findings from this cohort study will be available in early 2019.

Analysis of MODEM cohort to measure care hours

We used data from the MODEM cohort study to help answer a pertinent methodological question with regards to measuring the hours of care provided by family carers. This is really important as estimates of the hours of care are an important predictor of outcomes for carers such as quality of life, health status and ability to remain in employment. Hours of unpaid care are also needed to estimate the costs of unpaid care; both for estimations of the costs of dementia (and how much of the cost is borne by families) and for economic evaluations that seek to assess whether an intervention is cost-effective. However, there are competing methods for estimating the hours of care provided.

Key findings

We estimated hours of unpaid care as reported by carers of community dwelling participants in the MODEM cohort using three different methods used in other studies, and we found that these different methods led to significantly different estimates. On average, the 'simplest' method of calculating hours of care yielded the lowest estimates of 71 hours per week. A mixed approach, asking co-resident and extra-resident carers separate questions, provided an estimate of 90 hours of care per week. The most comprehensive measure, collecting data on individual care tasks, yielded the largest estimate of 105 hours per week - almost 50% higher than the simplest approach. Factors associated with differences in care hours reported were explored. Factors including dementia severity, sleep disruption and behavioural disturbances were associated with differences in estimations across methods.

Findings from this cohort study will be available in early 2019.

The well-being and quality of life of carers

As part of a MODEM studentship, we investigated if and how well-being and quality of life of carers of people living with dementia are affected by differences associated with carer gender and age. We conducted the research using mixed methods. First, we used a literature review to investigate how well-being and quality of life of carers of people living with dementia have been measured. Second, we used qualitative research based on interviews with family carers to investigate aspects that carers reported as important to their well-being.

We conducted quantitative analyses using three datasets (MODEM, START and SHIELD-CSP-RYCT) that focused on carers of people living with dementia in England. Carers in these datasets were compared to carers in population-representative datasets (Census 2011, the English Longitudinal Study of Ageing (Wave 6)). Overall, carers in the dementia-specific datasets reflected well characteristics of older carers in England providing care in the community. Next, we used quantitative analysis employing the three dementia-specific datasets to investigate factors influencing measures of carer well-being and quality of life.

The final analysis focused on factors influencing the time carers spent on personal care, instrumental activities of daily living, supervision and total time spent caring. We conducted this analysis using cross-sectional MODEM data.

Key findings

Results from the quantitative analysis cautiously suggested that women might experience worse outcomes than men with respect to health-related quality of life, happiness and life satisfaction. Carer age influenced mental health outcomes in two of the studies, but results were not conclusive. Results from the final analysis showed that women spent more time than men on personal care and instrumental activities of daily living tasks. No statistically significant difference was found for carer gender regarding time spent on supervision or total time spent caring. Similarly, carer age was not found to significantly affect the time carers spent on any of the task groups investigated. This suggests that carer age does not play a significant role in determining the intensity of care provided.

Findings from this studentship will be available in early 2019.

DEVELOPING A LEGACY MODEL

We are developing, and will soon make publicly available, a web-tool to enable commissioners, providers, advocacy groups, individuals and families to access the findings and outputs of the MODEM project and to make their own projections of expected outcomes and costs of services for people living with dementia at a local level. The tool will produce projections for local areas of future numbers of older people living with dementia, numbers of recipients of unpaid care, health services and social services and costs to the NHS, social services and service users. These projections will relate to current patterns of care and allow interventions shown to be cost-effective to be shared more widely. Users of the tool will be able to select an intervention from a list of those examined in the study and enter their own scenario for the future local take-up of that intervention. The tool will then show an estimate of the impact of the changed uptake on costs and outcomes.

The legacy model will be available in early 2019.

FURTHER ACTIVITIES BUILDING ON MODEM

We have given a variety of talks and presentations throughout the course of the MODEM project and MODEM researchers are members of key stakeholder groups and initiatives which are utilising MODEM findings. The study has also led to further research awards.

Examples include:

■ STRiDE: Strengthening responses to dementia in developing countries (Global Challenges Research Fund)

The MODEM study has informed a new study funded by UKRI's Global Challenges Research Fund to strengthen responses to dementia in seven developing countries (Brazil, India, Indonesia, Jamaica, Kenya, Mexico and South Africa). The study (STRiDE) started in October 2017 and will run until 2021.

One component of the study will be to develop the MODEM Dementia Evidence Toolkit into an international evidence database. The aim is to build research capability using economics, epidemiology and policy analyses to help low and middle income countries (LAMICs) respond to the needs of the growing numbers of people living with dementia in an ethical and sustainable way.

Through this research, we aim to generate practical tools for use directly by stakeholders to develop services and improve practice, or to influence policy.

For more information about STRiDE, please visit the project's website: www.stride-dementia.org

Alzheimer's Society taskforce on dementia research

We were part of a taskforce established by the Alzheimer's Society of leading UK clinicians and researchers in dementia, UK funders of dementia research, people living with dementia, and carer representatives to develop, using iterative consensus methodology, goals and recommendations to advance dementia research by 2025. Emerging findings from the MODEM study fed into this taskforce which published its recommendations in the International Journal of Geriatric Psychiatry in February 2018.

Other papers and outputs associated with MODEM

Knapp M, Barlow J, Comas-Herrera A, Damant J, Freddolino P, Hamblin K, Hu B, Lorenz K, Perkins M, Rehill R, Wittenberg R, Woolham J (2015) *The Case for Investment in Technology to Manage the Global Costs of Dementia*, Policy Innovation Research Unit, London.

Knapp M, Comas-Herrera A, Wittenberg R, Hu B, King D, Rehill A, Adelaja B (2014) *Scenarios of dementia care: what are the impacts on cost and quality of life?* Report to the Department of Health, Personal Social Services Research Unit, London. **Referenced in the Prime Minister's Challenge on Dementia 2020, 21 February 2015**

Prince M, Knapp M, Guerchet M, McCrone P, Prina M, Comas-Herrera A, Wittenberg R, Adelaja B, Hu B, King D, Rehill A, Salimkumar D (2014) *Dementia UK: second edition – overview*, Alzheimer's Society, London.

Other research projects related to MODEM

Alzheimer's Research UK: Economics of future therapies for Alzheimer's disease, (2017–2018) [LSE]

Alzheimer's Society: Cost of dementia in Wales and Northern Ireland (2017, 2018) [LSE]

Alzheimer's Society: Primary care-led post diagnostic Dementia care (PriDem): developing evidence-based, person-centred sustainable models for future care (2018–2021) [Newcastle, UCL, LSE]

Department of Health: WHO Observatory on Dementia (pilot) (2016) [LSE]

ESRC: The economic case for dementia prevention (2018) [UCL, LSE]

NHS England: Dementia treatment and care: the economic case (2016–2017) [LSE]

Public Health England: Commissioning effective and cost-effective primary prevention services for dementia (2016–2017) [LSE]

Further information about MODEM

For more information about the MODEM project and to stay up-to-date with the latest developments, visit www.modem-dementia.org.uk

You can email the MODEM Team at pssru.modem@lse.ac.uk

To speak to a member of the team, call 020 7955 6238.

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