THE ECONOMIC AND SOCIETAL COST OF ALZHEIMER'S DISEASE IN AUSTRALIA, 2021-2041

REPORT PREPARED FOR BIOGEN AUSTRALIA
BY PROFESSOR LAURIE BROWN, PROFESSOR JINJING LI AND DR HAI ANH LA
NATSEM AT THE UNIVERSITY OF CANBERRA.

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NATSEM at the University of Canberra

UNIVERSITY OF CANBERRA

The National Centre for Social and Economic Modelling
University of Canberra, ACT 2601, Australia
Building 11, Kirinari Street, University of Canberra, Bruce, ACT 2617

Director: Professor Brenton Prosser
Email: Brenton.Prosser@canberra.edu.au

Phone: + 61 2 6201 2782
Email: natsem@canberra.edu.au
Website: http://www.canberra.edu.au/centres/ucigpa or http://www.natsem.canberra.edu.au/

ABOUT NATSEM

For over 25 years the National Centre for Social and Economic Modelling (NATSEM) has been one of Australia's leading economic and social policy research centres. It is regarded as one of the world's foremost centres of excellence for microsimulation, economic modelling and policy evaluation. NATSEM was initially established at the University of Canberra (UC) in 1993 with the support of the Federal Government. NATSEM has constructed numerous models — at first for Commonwealth, State and Territory Government departments and agencies engaged in policy development, but increasingly also for the commercial sector seeking to understand their current and future markets as for well as not-for-profit organisations wanting to understand and plan for the current and future needs of their client bases.

NATSEM is a member of the Institute for Governance and Policy Analysis which was established in January 2014. IGPA was formed to harness the research strengths of the Centre for Deliberative Democracy and Global Governance; the Centre for Change Governance; the 50/50 Foundation and NATSEM. The Institute has a strong social mission committed to the production of leading-edge research and research-driven education programs with genuine public value and, by implication, policy impact.

A key strength of NATSEM is its proven ability to analyse and interpret complex data from a range of sources in the context of existing and possible future policy settings. Now based within the Faculty of Business, Government and Law at UC, NATSEM remains an independent and impartial source of specialist research. NATSEM continues to be a key contributor to social and economic policy debate and analysis in Australia through economic modelling of the highest quality and supplying valued commissioned research services to commercial, government and not-for-profit organisations.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

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A range of data sources were used to generate the epidemiological and economic estimates and projections presented in this report, including national survey data from the Australian Bureau of Statistics, health datasets held by the Australian Institute for Health and Welfare and unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) survey.

The findings and views reported here are those of the authors and should not be attributed to Biogen Australia or to the custodians or owners of the data that was used.

SUGGESTED CITATION

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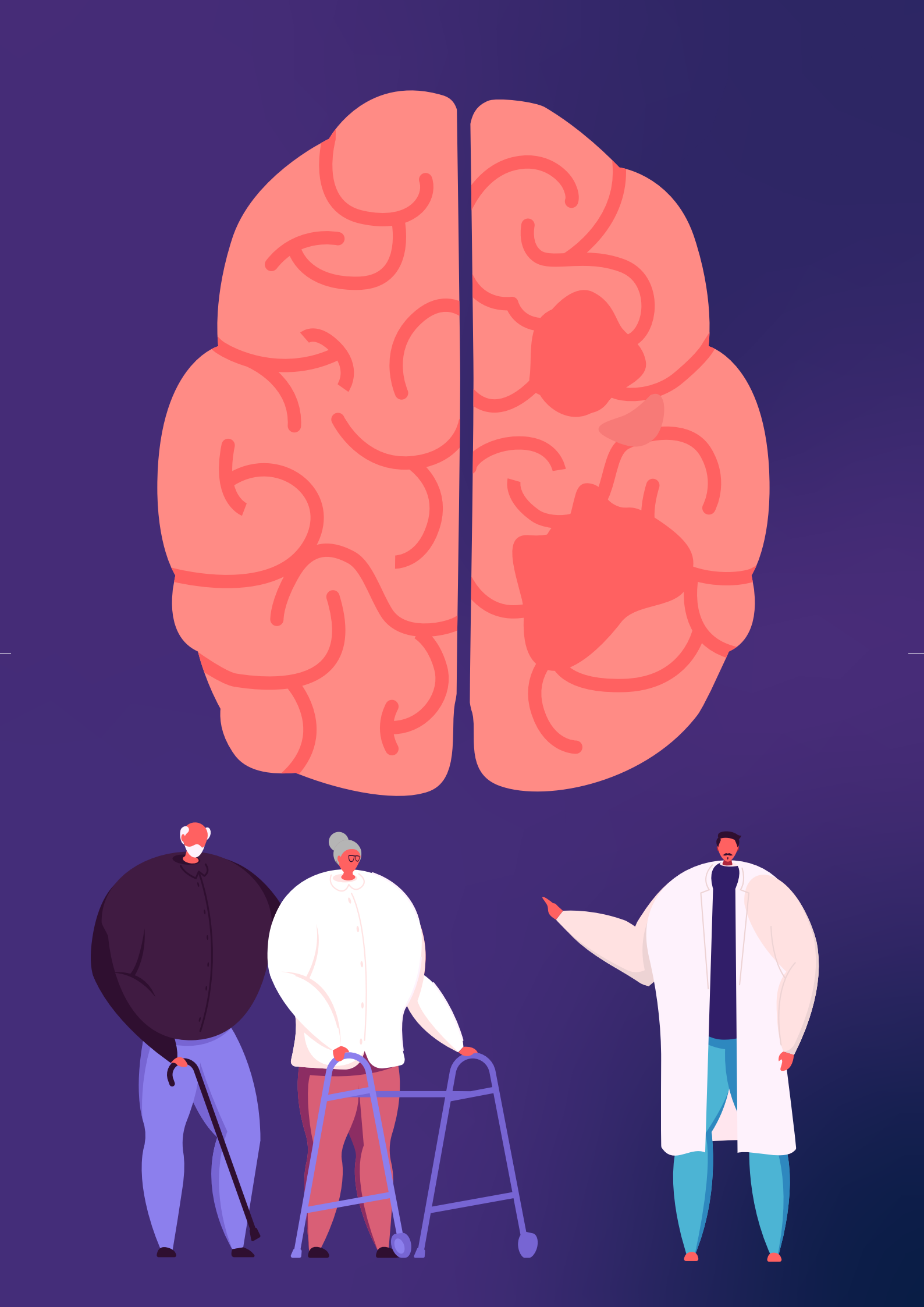
ABBREVIATIONS

aMCI	Amnestic Mild Cognitive Impairment
Aβ	Amyloid Beta
ABS	Australian Bureau of Statistics
ACAP	Aged Care Assessment Program
ACAS	Aged Care Assessment Service
ACAT	Aged Care Assessment Team
ACFI	Aged Care Funding Instrument
AD	Alzheimer's Disease
ADI	Alzheimer's Disease International
ADL	Activity of Daily Living
AIBL	Australian Imaging Biomarkers and Lifestyle Study
AIHW	Australian Institute of Health and Welfare
ALOS	Average Length of Stay

BEACH	Bettering the Evaluation and Care of Health
BIA	Budget Impact Analysis
CACP	Community Aged Care Package
CCC	Community Care Census
CDR	Clinical Dementia Rating
CoI	Cost of Illness
CSF	Cerebrospinal Fluid
CURF	Confidentialised Unit Record File
DAE	Deloitte Access Economics
DALY	Disability-Adjusted Life Year
DBMAS	Dementia Behaviour Management Advisory Service
DMT	Disease-Modifying Therapy
DRG	Diagnosis Related Group
DYNOPTA	Dynamic Analyses to Optimise Ageing
EACH	Extended Aged Care at Home
EACHD	Extended Aged Care at Home Dementia
FDA	U.S. Food and Drug Administration
GP	General Practitioner
HACC	Home and Community Care
HDS	Hospital Dementia Services
ICD-10-AM	International Statistical Classification of Diseases and Related Health, 10th Revision, Australian Modification
MBS	Medicare Benefits Schedule
MCI	Mild Cognitive Impairment
MMSE	Mini-Mental State Examination
NHCDC	National Hospital Cost Data Collection
NHMD	National Hospital Morbidity Database
NHPA	National Health Priority Area
naMCI	Non-Amnestic Mild Cognitive Impairment
NMD	National Mortality Database
PBAC	Pharmaceutical Benefits Advisory Committee
PBS	Pharmaceutical Benefits Scheme
PET	Positron Emission Tomography
RACF	Residential Aged Care Facility
RPBS	Repatriation Pharmaceutical Benefits Scheme
SDAC	ABS Survey of Disability, Ageing and Carers
SMR	Standardized Mortality Ratio



EXECUTIVE SUMMARY

INTRODUCTION AND AIMS

Alzheimer's disease (AD) is the most common cause of dementia, with the prevalence increasing rapidly with age. It involves the progressive loss of neurons that affects a person's behaviour, memory and cognitive processes. As cognitive impairment progresses, a person's ability to maintain their activities of daily living declines and their need for care increases with the growing loss of independence and autonomy. Though the symptomatic burden of dementia typically occurs late in life, it is preceded by a long preclinical phase, characterized by the pernicious accumulation of neuropathology in the brain (Lupton et al., 2020).

AD is a pathophysiological and clinical continuum which has three broad phases: preclinical Alzheimer's disease; mild cognitive impairment (MCI) due to Alzheimer's disease as a prodromal phase; and dementia due to Alzheimer's disease which is typically divided into mild, moderate and severe AD dementia. AD dementia is characterised by specific pathological changes in the brain including amyloid beta (Aβ) plaques, neurofibrillary tangles, and neuronal degradation which accumulate over many years. Patients meeting the clinical criteria for MCI and who have positive biomarkers for AD are defined as having MCI due to AD, and patients meeting the clinical criteria for dementia and who have positive biomarkers for AD are defined as having AD dementia. Although symptoms might be very concerning to the individual and/or their family, MCI due to AD typically does not impact on the person's overall functional abilities, their activities of daily living or their level of independence.

The existence of biomarkers in the early stages of AD dementia provides an opportunity for the use of disease modifying therapies that delay or slow the progression of AD dementia. Without a clinical intervention to prevent or slow disease progression, the prevalence of AD dementia is likely to double in Australia over the next 25 years (Brown et al, 2017; AIHW, 2018). The cost of dementia is enormous and poses a significant challenge to formal and informal health and social care systems.

The project aims to estimate:

1. the societal cost of dementia due to Alzheimer's disease (AD) in Australia's population aged 50 and above years under usual care; and

2. the economic impact on both direct and indirect costs of an effective hypothetical disease-modifying therapy (DMT) as an early intervention in persons with mild cognitive impairment (MCI) due to AD or mild dementia due to AD to prevent or delay the progression to more severe dementia health states.

An economic dynamic simulation model was built to examine the impact of the DMT relative to usual care. The model framework is based on the screening of persons with early-stage AD involving biomarker testing of Aβ in persons with MCI or mild dementia suspected to be due to AD to confirm AD as the underlying pathology (testing positive to Aβ) and then introducing the use of the DMT to prevent or delay disease progression in those individuals . The model captures changes in population-level patient outcomes such as the prevalence of AD dementia by disease state, incidence, disease progression and mortality, as well as residential setting - persons living in a home setting in the community versus those living in permanent residential aged care - as well as a range of direct and indirect societal costs across mild, moderate and severe AD dementia. The modelling aims to estimate the potential savings that could be realised or additional costs that might be incurred in the event that a DMT becomes available in Australia.

The current project is an extension of an earlier report 'Economic Cost of Dementia in Australia, 2016-2056' (Brown et al., 2017), but differs by focussing specifically on Alzheimer's disease rather than all-cause dementia.

METHODS

Approach

This study undertakes a budget impact analysis (BIA) which is essentially the difference between two cost of illness (CoI) studies – the first based on usual care versus the introduction of the new therapy (intervention) into the treatment mix. The focus of the research in a CoI study is on understanding the likely cost of the resources that are expended or foregone as a result of a health problem i.e. the economic impact incurred not only by the people with the health problem, their families and carers but also employers, the Government and society at large. BIAs are based on CoI methods with BIAs increasingly being required in the approval processes and reimbursement decisions for new medicines and health technologies. A BIA estimates the expected changes in resource use and cost for the budget holder for the mix of interventions and the condition-related outcomes in the population of interest over a given period after the introduction of the new intervention (Mauskopf and Earnshaw, 2017). These estimates are compared with the outcomes from usual care i.e. if the new intervention was not introduced. The resource and budget impact is calculated as the population-level difference between the two scenarios (Sullivan et al. 2014; Mauskopf and Earnshaw, 2017).

The perspective taken in a BIA is that of the budget holder which in this study is society at large. The modelling framework is a dynamic multi-state model where the progressive nature of AD dementia is considered as a Markov process where there is a predictable annual risk of people transitioning to more severe disease states or death. In essence the model is made-up of stocks and flows. Transition probabilities are dependent on age, gender and disease state. It is assumed that the age-sex mortality, incidence and disease transition rates are constant over time. An individual may remain in the same AD dementia state, move to a more severe state or die. Although studies have shown that some people revert to a less severe disease state on follow-up, in the modelling it is assumed that disease progression is irreversible i.e. there are no backward flows in the model. A 20-year time horizon is used in the modelling, covering the period 2021 to 2041, with the simulation using 1-year transition cycles. Once the prevalent MCI due to AD and AD dementia patient groups are estimated for each year, they are then divided into those who are living in the community and those living in permanent residential aged care.

All data came from publicly available secondary data sources, accessed online or from published data sources, including data extracts from the literature. It was difficult to directly populate the model with data that fully reflected the definition of MCI due to AD and AD dementia. Data inputs for broader categories of dementia and dementia severity had to be applied. Preference was, however, given to Australian data and data specific to AD. The societal direct and indirect costs were derived by applying standardised unit costs to formal and informal resources. Although much of the cost data was based on people with dementia, and not specifically AD dementia, these are likely to be representative of the costs of living with AD dementia.

The DMT Intervention

A hypothetical DMT is modelled. The patient population eligible for the DMT are persons aged 50-84 years who have MCI due to AD or mild AD dementia i.e. they have tested positive for the biomarker Aβ, confirming AD as the underlying pathology. It is assumed that 80% of AD biomarker testing will be conducted with Aβ PET and 20% with CSF biomarker assay testing. Following testing, patients would have a follow-up visit with their dementia specialist to discuss their results and possible commencement of treatment.

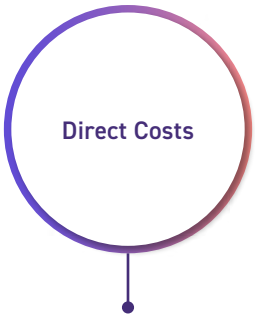
The DMT is assumed to be delivered through a course of intravenous infusions, taking place in hospital outpatient clinics. The drug is administered approximately every four weeks over the course of 12 months (52 weeks) for a total of 13 infusions per patient. The expected infusion time is around 1 hour. The efficacy of the DMT is modelled as a reduction in dementia progression rates of 25% for patients with MCI due to AD or mild AD dementia. According to Budd et al. (2011) a 25% reduction in the risk of progression is only assuming a 'modest' impact on the course of disease progression.

It is assumed that the clinical steps needed to implement the DMT intervention e.g. screening, diagnosis and treatment are not constrained by limitations in resource capacity.

Cost Items

The cost items included in the analysis are:

The cost of any diagnostic test (e.g. PET scans or CSF assays) or screening that is required to identify eligible individuals and consultations with medical practitioners such as visits to dementia specialists and allied health professionals as well as the direct cost of the supply and use of the DMT. While a price for the DMT drug is needed to provide a complete budget impact analysis, no DMT for AD is currently funded on any drug formulary in Australia, and only one is available internationally. In the absence of a reliable price, the cost of the DMT drug was therefore not included in the analyses.



These included: a) direct health expenses such as admitted hospitalisation; outpatient visits; emergency department presentations; GP, specialists and allied health visits; prescribed dementia specific medications and medications used in the management of dementia; and b) direct non-medical expenses on formal care including residential care and community-based formal care services.

These include the cost of informal care and the value of lost productivity by persons with AD dementia who reduce their working hours or withdraw from the labour force. A 'human capital' approach to valuing productivity losses is taken in which it is assumed that labour earnings reflect productive capacity. The replacement cost method is used to value informal care.

BIAs use constant prices, therefore, all costs are expressed in 2021 dollars.

Model Parameters

AD DEMENTIA POPULATIONS

The epidemiological parameters used to determine the MCI due to AD population who are eligible for treatment with the DMT are listed in Table i. below, and those used to determine the confirmed AD dementia population eligible for treatment with the DMT are listed in Table ii.

It is assumed that AD will have been confirmed as the underlying pathology in patients with moderate or severe dementia as most patients who are in these two dementia states will have progressed there from MCI and mild dementia in which AD was required to be confirmed through biomarker testing.

Table i. Model parameters for estimating the MCI due to AD population

Parameter	Value	Primary Data Source
Australian population aged ›50+ years		ABS (2018) 3222.0 Population Projections, by age and sex, Australia - Series B
Proportion of population with aMCI	2% for ›65 yrs various <65 yrs	Sachdev et al (2015) AIHW (2012)
Proportion of patients with MCI suspected to be due to AD	75%	Knopman et al (2016)
Proportion of patients with MCI suspected to be due to AD accessing biomarker testing (clinical diagnosis)	36%	Baxi et al (2019) RAND Report - Proportion based on product of estimates below = 80% x 50% x 90%
(a) Share of patients who receive cognitive screening each year	80%	Baxi et al (2019) RAND Report
(b) Share of the MCI population (a) who receive further evaluation by a dementia specialist each year	50%	Baxi et al (2019) RAND Report -
(c) Share of MCI patients (b) eligible for and uptake biomarker test	90%	Baxi et al (2019) RAND Report -
Proportion of patients that are amyloid positive (confirmed MCI due to AD)	51%	Average from the literature: Van Maurik et al (2019); Ong et al (2015); Doraiswamy et al (2014); Cerami et al (2018); Rabinovici et al (2019); Jansen et al (2015).

MORTALITY

People with dementia have an increased risk of dying compared with persons of a similar age and gender but who do not have dementia (Rait et al. 2010; Brodaty et al. 2012; Garcia-Ptaceka et al, 2014; Park, 2015). The probability of mortality for each age-sex group in each dementia state is estimated as the mortality rate in the age-sex matched general population, multiplied by the relative risk ratio (RR) for people with dementia. The RRs were obtained from the literature. There is no excess mortality observed for individuals with MCI due to AD and mild AD dementia with death rates being the same as for the general population. The risk of death decreases from being 8-fold higher in the 50-54 year age group with moderate AD dementia and 10-fold for those with severe AD dementia to 25% and 50% excess mortality in those aged 90 years or above respectively.

ANNUAL TRANSITION PROBABILITIES

The transition probabilities were derived through an iterative process. The starting disease progression values reflected the findings in the literature on transition rates. These were then iteratively modified so that the annual prevalence estimates for each age-sex-AD severity state cohort generated through the transition probabilities and ageing replicated as close as possible matched estimates produced using the age-sex specific prevalence rates and ABS age-sex population projections. As with other studies, the transition probabilities indicate that the majority of patients are most likely to stay in the same health state year to year, and that progressing patients are most likely to transition one stage.

Table ii. Model parameters for dementia suspected or confirmed due to AD in persons aged 50 and above years

Parameter	Value	Primary Data Source
Australian population aged ⩾50+ years		ABS (2018) 3222.0 Population Projections, by age and sex, Australia - Series B
Prevalent probable dementia population		Anstey et al (2010), AIHW (2012)
Proportion of persons aged ⩾ 65 years with dementia suspected to be due to AD	75%	Knopman et al (2016)
Proportion of persons aged < 65 years with dementia suspected to be due to AD	27%	Vieira et al (2013)
Proportion of patients with mild dementia	55%	AIHW (2012)
Proportion of patients with moderate dementia	30%	AIHW (2012)
Proportion of patients with severe dementia	15%	AIHW (2012)
Proportion of patients with moderate AD dementia who are clinically diagnosed	51%	Lopponen et al (2003), Sawa and Arthur (2015)
Proportion of patients with severe AD dementia who are clinically diagnosed	75%	Lopponen et al (2003), Sawa and Arthur (2015)
Proportion of patients with mild dementia suspected to be due to AD accessing biomarker testing (clinical diagnosis)	36%	Baxi et al (2019) RAND Report - Overall proportion based on product of estimates below = 80% x 50% x 90%
(a) Share of patients who receive cognitive screening each year	80%	Baxi et al (2019) RAND Report
(b) Share of patients (a) who receive further evaluation by a dementia specialist each year	50%	Baxi et al (2019) RAND Report
(c) Share of mild AD patients (b) eligible for and uptake biomarker test	90%	Baxi et al (2019) RAND Report
Proportion of patients that are amyloid positive (confirmed dementia due to AD)	88%	Ossenkoppele et al (2015), van Maurik et al (2019)

Overall, 16.2% of males with MCI due to AD progressed in the modelling to mild or moderate AD dementia over a 1-year cycle and 21.9% from mild AD dementia to moderate or severe disease. These rates were slightly lower for females with 12.2% of females with MCI due to AD progressing to mild or moderate AD dementia over 12 months and 18.8% from mild AD dementia to moderate or severe AD dementia.

The probabilities of transitioning from 'normal' to MCI due to AD or AD dementia are the annual incidence rates. It was assumed that there are no incidence cases with severe AD dementia i.e. people do not transition from 'normal' to severe AD dementia within an annual cycle. Also, persons with MCI due to AD can progress to mild or moderate AD dementia within a year but not convert to severe AD dementia.

COST ESTIMATION METHODS AND PARAMETERS

The costs estimated in these analyses should be interpreted as the total costs for people with AD dementia, not excess costs due or attributable to AD dementia. By definition MCI due to AD does not impact on daily activities of living or functioning, and therefore MCI due to AD is not included in the cost analyses other than in the costs of the DMT treatment. Unless otherwise specified, all costs are presented in Australian dollars at 2020-21 prices.

Direct Costs

DMT TREATMENT COSTS

The unit costs for AD biomarker testing, additional consultation with a dementia clinical specialist and administering the DMT infusion are given in Table iii, along with the assumptions underpinning these costs. The cost of the DMT drug is not included in the modelling as there is very little evidence to indicate a likely price in Australia.

Table iii. Unit costs for the DMT

Cost item	Description/Assumption	Unit Cost ($) July 2021
AD biomarker testing		
80% conducted with Aβ PET using PET/CT scanner.	The cost of Aβ PET is guided by MBS item 61559	$918.00
	Use of PET/CT scanner for Aβ PET based on MBS item 61505	$100.00
20% with CSF biomarker assay testing.	A CSF sample is obtained from the patient by lumbar puncture (LP) procedure conducted as a day private hospital admission. Lumbar puncture reimbursed under MBS items 21945, 39000, 23010	$201.95
	day private hospital charge for the performance of lumbar puncture (based on fees for minor medical procedures)	$550.00
	CSF assay NDDL fees for one protein (Aβ)	$150.00
Dementia clinical specialist (e.g. geriatricians, neurologists, and psychiatrists)		
follow-up visit to discuss biomarker test results and possible courses of treatment	Average of Government rebate (85%) and patient payment for consultation with a geriatricians, neurologist or psychiatrist 47% of patients bulk-billed 53% with a patient out-of-pocket payment	$85.03 $175.80
Administering the DMT		
Infusion	admitted as day surgery patient or to outpatient setting, based on private health hospital costs for chemotherapy intravenous infusion	$550
	The expected infusion time is approximately 1 hour. The cost of intravenous drug administration guided by MBS items 14245 and 13950.	$107.15
Drug	The cost of the DMT drug is not included in the modelling	--

DIRECT HEALTH CARE COSTS

Costs were estimated for hospitalisations where AD dementia was recorded as the principal diagnosis i.e. the hospitalisations were due to dementia and where AD dementia was an associated diagnosis to a different principal diagnosis. To capture the likely impact of the DMT on costs of hospitalisation, distributions of the number of hospital separations with Alzheimer's disease as the principal diagnosis, patient days and average length of stay were constructed by age and dementia severity. The average cost per hospitalisation with AD as the principal diagnosis in 2020-21 was estimated to $12,193.91. Cost weights were derived from the ratio of age-AD severity average length of stay (ALOS) to the overall ALOS and applied to the average cost per hospitalisation with AD as the principal diagnosis in 2020-21 to create unit costs for a hospital separation for each age and AD severity group.

In the absence of data on the hospitalisations with principal diagnoses where dementia was an additional diagnosis, public hospital outpatient clinic attendance, and public hospital emergency department care by dementia severity, annual costs of these services were calculated as a percentage of the costs estimated for hospitalisations with AD as the principal diagnosis. These ratios were based on the total expenditures for these services relative to the expenditure for hospitalisations due to AD using the expenditure data in AIHW's Dementia in Australia, Direct health and aged care expenditure due to dementia—data tables.

The introduction of the DMT is assumed not to impact on the behaviour of GPs and specialists in prescribing medications used in the management of AD dementia. Four dementia-specific medicines for the treatment of Alzheimer's disease are currently subsidised on the PBS and RPBS. Donepezil, galantamine and rivastigmine are approved in Australia for the treatment of mild to moderate Alzheimer's disease while memantine is approved for the treatment of moderately severe to severe AD (AIHW, 2019a and 2021). An average number of scripts dispensed per person annually in each age-AD dementia severity group was derived and used to project script volumes and costs over the simulation period under the usual care and DMT intervention scenarios. Data on script numbers (services) and benefits paid by patient category (general or concessional by ordinary or safety net) were downloaded from Medicare Australia's PBS online statistics. The unit costs used in the modelling were: $22.14 per script for donepezil; $38.84 galantamine; $83.10 rivastigmine; and $42.28 memantine. The unit costs include both the Government subsidy and out-of-pocket payments (co-payments) made by patients.

There is also a range of other medications prescribed by GPs and specialists for the management of AD dementia symptoms, especially behavioural and psychological symptoms (AIHW 201 and 2019a). There is no data on how these medications are prescribed that is stratified by AD dementia severity. Therefore, the cost of these medications was tied to the expenditure on the four specific AD dementia medicines. A ratio of 15.1% of the total combined expenditure on donepezil, galantamine, rivastigmine and memantine was applied across the simulation time horizon.

The use of diagnostic imaging and pathology services by AD dementia severity is also not known. Therefore, the expected cost of these services was estimated as a ratio of the combined expenditure on outpatient hospital care and GP, medical specialist and allied health consultations. Over the simulation period, the cost of diagnostic imaging services was estimated as 8.6% of the expenditure on outpatient hospital care and GP, medical specialist and allied health professional services and pathology services 2.5%.

For general practice, specialist and allied health services a similar approach was adopted benchmarking the 2020-21 expenditure to other direct costs and using the ratio to project costs in future years under both scenarios. In this case the benchmark was the combined total expenditure in 2020-21 on prescribed dementia specific medicines and other medicines used in the management of AD and public hospital outpatient clinics, both of which would be reflective of the underlying activity of GPs, medical specialists and allied health professionals. The ratio of expenditures was 0.244.

DIRECT COSTS OF CARING

The direct costs of care are those involved in providing formal care in the community and the cost of residential (institutional) care. Three steps were taken in estimating the cost of caring: 1) dividing the AD dementia population into those living in the community and those in residential aged care by dementia severity i.e. persons with mild, moderate and severe AD dementia; 2) estimating the extent of informal care, the use formal care services in the community, and the likelihood of being in residential aged care; and 3) identifying the average unit costs of informal care, formal home care and residential care and apply these to the overall use of these services and support.

The likelihood a person with AD dementia lives in the community or in permanent residential care was calculated as given in Table iv.

Table iv. Probability of persons with AD dementia living in permanent residential care or in the community

Severity AD Dementia	In Residential Care			In the Community		
	Males (%)	Females (%)	Persons (%)	Males (%)	Females (%)	Persons (%)
Mild	2.1	2.7	2.4	97.9	97.3	97.6
Moderate	33.2	52.7	44.1	66.8	47.3	55.9
Severe	33.4	52.7	44.2	66.6	47.3	55.8
Total	20.9	32.9	27.6	79.1	67.1	72.4

The type of assistance received by people with dementia living in the community by disability status is given in Table v.

Table v. Type of assistance received by people with dementia living in the community by disability status

	Mild/ Moderate (%)	Severe/ Profound (%)
Informal assistance only	30.4	35.8
Informal and formal assistance	39.6	63.3
Formal assistance only	10.9	0.9
No assistance	19.2	0.0

Source: 2015 and 2018 SDAC

Aged care service use data appears to underestimate the number of people with dementia accessing community-based formal aged care services. Rather than trying to directly estimate the cost of home care provided through the Home Care Packages Program (HCPP) and home support provided through the Commonwealth Home Support Programme (CHSP), an alternative approach was taken. The cost of this care was calculated as the full-time equivalent number of paid care workers multiplied by their average annual wage plus salary on-costs and organisational overheads. It was assumed that persons with mild AD dementia who receive assistance from formal carers, receive 3 hours of care per week on average (equivalent to HCP levels 1-2 - basic or low level care needs), those with moderate AD dementia 8 hours (level 3 intermediate care needs) and severe AD dementia 12 hours (level 4 high level care needs). These hours of care equate to 0.08 FTE formal paid carer providing care to a person with mild AD dementia, 0.21 FTE for those with moderate AD dementia and 0.32 FTE for those with severe disease.

In terms of the cost of residential care, it is recommended that both user paid fees and the Aged Care Funding Instrument (ACFI) based Government subsidy are used to estimate residential care costs in Australia (Department of Health, 2016; Gnanamanickam et al., 2018). The usual practice of taking the 85% of the Australian single person age pension that is charged to all users of residential care in Australia as the user fee component is followed in these estimations (Brown et al., 2017; Gnanamanickam et al., 2018).

The calculations of both the direct and indirect costs of care are based on the unit costs given in Table vi.

Table vi. Unit costs for estimating direct and indirect costs of caring (2021 prices)

Cost Item	Unit Cost per year ($)	Source
Paid carer in the community	per FTE carer	
Annual gross wages and salary	$62,400.00	Fair Work Ombudsman Pay Guides Payscale Australia, Seek and Indeed job searches Department of Jobs and Small Business Job Outlook initiative
Salary on-costs	35%	Westpac cost of an employee calculator
Organisational overheads	20%	Diminic et al. (2016)
Total	***$96,720.00***	
Government benefits+	per recipient	
Carer Payment#	$24,770.20 single $37,341.20 couple combined	Service Australia Department of Social Services
Carer Allowance	$3,429.40	Service Australia Department of Social Services
Carer Supplement	$600 per payment type	Service Australia Department of Social Services
Disability Support Pension	$24,770.20 single $37,341.20 couple combined	Service Australia Department of Social Services
Residential Care	per resident	
Government subsidy	$74,352.00	Productivity Commission Department of Health ACFI Monitoring Report – March 2021
Basic daily fee	$19,239.15	Department of Health Services Australia MyAgedCare website
Total	***$93,591.15***	

+ as at 20 March 2021

these rates include the maximum basic rate plus the pension and energy supplements

Indirect Costs

INFORMAL CARE

The replacement method uses a shadow price approach where the time spent on informal caregiving is valued at the (labour) market price of a close market substitute (Koopmanschap et al., 2008; Oliva-Moreno et al., 2019) such as a home support worker or personal care assistant. This measures the cost of care if the formal paid carer workforce had to provide this care in the absence of informal carers i.e. the cost of 'buying' an equivalent amount of care from the formal sector if the informal care was not supplied (Goodrich et al., 2012; Deloitte Access Economics, 2020).

The Australian Government does provide income support through the carer payment, carer allowance and carer supplement to carers of people with AD dementia. If all informal care was replaced with paid formal care, then the annual Government expenditure on these payments would not be incurred. The 'savings' represent a cost-offset to the replacement value of informal care (Diminic et al., 2016).

Based on data from the 2015 and 2018 Survey of Disability, Ageing and Carers (SDAC), it was assumed that people with dementia with a mild level of disability had an average of 0.6 informal carers per person, those moderately limited in core activities 1.0 informal carer per person and those with severe or profound disability 1.3 informal carers. Based on hours of care provided

1. https://www.myagedcare.gov.au/aged-care-home-costs-and-fees

per week, the replacement value of each informal carer providing care to a person with severe AD dementia was calculated at the cost of 1.447 FTE paid formal carer. For those with more moderate forms of dementia, the hours of informal care were less but still averaged 42 hours of care per week or 1.105 FTEs and those with mild dementia 31 hours or 0.816 FTE.

Pooled data from the 2015 and 2018 SDACs indicate that 29% of primary carers of people with severe dementia and 18% with moderate dementia receive the Carer Payment and 50% and 42% respectively the Carer Allowance. It is assumed that 70% of carers for people with AD dementia are their husband, wife or partner and therefore get the partner rates, and 30% are single.

LOST PRODUCTIVITY

Quoting Dementia Australia (2020) "Too often, a diagnosis of dementia brings about the end of employment". Unfortunately, there is a lack of data indicating employment patterns of persons with dementia and AD dementia in particular. The Alzheimer's Society (2015) in the UK report that only 18% of people with dementia under the age of 65 years in the UK continue to work after their dementia is diagnosed.

The cost of lost productivity is the difference in earnings between 'observed' employment rates and what would be expected if persons with AD dementia had the same employment patterns as the general population. Age-sex employment rates for full-time and part-time workers and the respective average annual incomes from wages and salaries were obtained from wave 19 of the Household, Income and Labour Dynamics in Australia (HILDA) Survey. Wave 19 was used in the modelling to avoid the impact of COVID 19 on labour force participation and income. It was assumed that all persons with AD dementia aged 65 years and above are out of the paid workforce, and for persons with younger onset AD dementia, using the UK employment rate, that 18% of persons with mild younger onset AD dementia are employed while those with moderate or severe disease have left the workforce. The parameters for estimating the cost of lost productivity are given in Table vii.

Table vii. Employment rates, annual wages and lost productivity

Age Groups	EMPLOYMENT GENERAL POPULATION				EMPLOYMENT PERSONS WITH AD DEMENTIA						DIFFERENCE IN EMPLOYMENT RATES (LOST PRODUCTIVITY)					
					MILD		MODERATE		SEVERE		MILD		MODERATE		SEVERE	
	Full-time (%)	Annual full-time wage ($)	Part-time (%)	Annual part-time wage ($)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)
Male																
50 - 64	63.1	90,552	10.7	36,194	16.4	2.8	0	0	0	0	46.7	7.9	63.1	10.7	63.1	10.7
65 - 74	11	65,393	11.6	27,479	0	0	0	0	0	0	11	11.6	11	11.6	11	11.6
75+	0	0	3.8	11,710	0	0	0	0	0	0	0	3.8	0	3.8	0	3.8
Female																
50 - 64	36.3	77,043	29	37,665	9.4	7.5	0	0	0	0	26.9	21.5	36.3	29	36.3	29
65 - 74	4.3	73,445	11.6	29,320	0	0	0	0	0	0	4.3	11.6	4.3	11.6	4.3	11.6
75+	0	0	0.7	8,079	0	0	0	0	0	0	0	0.7	0	0.7	0	0.7

Derived from Wave 19 HILDA data

GOVERNMENT INCOME SUPPORT – THE DISABILITY SUPPORT PENSION

Few people with younger onset dementia receive the DSP. Dementia Australia states that the assessment and determination process can be overwhelming, confusing and distressing for people living with younger onset dementia, their families and carers. Administrative data on the number of DSP recipients with dementia listed as a medical condition was obtained from the Department of Social Services. Based on the general prevalence of dementia, it was assumed that 75% of the DSP recipients aged ≥ 65 years with dementia had AD dementia and 27% of persons aged < 65 years. It was assumed that AD dementia recipients of the DSP had moderate or severe dementia. Trend data was used to project recipient numbers by age and sex over the simulation period to 2041.

RESULTS

Epidemiology

The expected changes in the number of prevalent cases, deaths and incidence of MCI and dementia due to AD in Australia over the period 2021 to 2041, under the usual care and the DMT intervention scenarios, are shown in Table viii.

In 2021 there were an estimated 15,448 persons aged 50 years and above living in Australia who had MCI due to AD and 153,888 persons with dementia due to AD. Of those with AD dementia, 40% were expected to have mild disease and 60% more severe AD dementia. Of the153,888 persons with AD dementia, 27.6% (42,478 persons) were expected to be living in permanent residential aged care and 72.4% (111,410 individuals) living in the community. However, 44.1% of those with moderate or severe AD dementia were in institutional care but only 2.4% of those with mild AD dementia.

As expected, the DMT scenario shows a reduction in the rates of disease progression in those aged 50-84 years leads to the number of persons with early-stage AD dementia increasing compared with prevalent cases under usual care while the number of persons with moderate or severe disease decreases. Under usual care, the number of Australians aged 50 years and above who have MCI due to AD is expected to increase by 40% over the next 20 years (to 21,631 persons in 2041) and those with mild, moderate or severe AD dementia by 73% (266,114 persons with AD dementia by 2041).

In contrast, with the introduction of the DMT, the prevalence of persons with moderate AD dementia is expected to increase by only 63% leading to 5,464 fewer persons having moderate AD dementia by 2041. The rise in the number of persons with severe AD dementia is 14 percentage points lower than under usual care, indicating that 5,607 fewer older Australians would have severe AD dementia in 2041 compared to the number if current trends continue. With the delayed progression of the disease, the number of persons with MCI due to AD is expected to increase by 65% rather than 40%, leading to 3,827 more cases in 2041 compared with the usual care scenario. The number of persons with mild AD dementia nearly doubles (94% increase) to 118,546 cases compared with the 105,345 cases under usual care.

With more people having early-stage rather than more severe disease under the DMT, relatively more persons with AD dementia would be expected to be living in the community than in residential aged care. The modelling shows that there would be 4,602 fewer persons in residential aged care with AD dementia in 2041 under the DMT scenario compared with usual care. This represents a 6.3% reduction in the number of aged care residents with AD dementia.

Table viii. Prevalence, mortality and incidence of MCI and dementia due to AD under the usual care and DMT intervention scenarios, 2021 and 2041

Severity of AD	2021 (Baseline)			2041 (End of Simulation)								
	Both Usual Care and DMT			Usual Care			DMT			Difference DMT and Usual Care		
	Prevalence	Deaths	Incidence	Prevalence	Deaths	Incidence	Prevalence	Deaths	Incidence	Prevalence	Deaths	Incidence
MCI due to AD	15,448	423	2,958	21,631	668	4,190	25,458	779	4,186	3,827	111	-4
Dementia due to AD	153,888	16,438	19,197	266,114	29,816	33,805	268,244	29,359	33,765	2,130	-457	-40
Mild AD Dementia	60,976	4,183	16,690	105,345	7,684	29,646	118,546	8,233	29,609	13,201	549	-37
Moderate AD Dementia	53,543	5,491	2,507	92,610	10,020	4,159	87,146	9,811	4,156	-5,464	-209	-3
Severe AD Dementia	39,369	6,764	-	68,159	12,112	-	62,552	11,315	0	-5,607	-797	-
All Persons with AD	**169,336**	**16,861**	**22,155**	**287,745**	**30,484**	**37,995**	**293,702**	**30,138**	**37,951**	**5,957**	**-346**	**-44**

In 2021, there were an estimated 16,861 deaths in persons with AD dementia. Since the risk of death is a function of disease severity, the DMT leads to a significant overall reduction in deaths in persons with AD over the simulation period of 2021 to 2041 (7,494 fewer deaths). The substantial reduction in deaths per year for those with moderate or severe AD dementia is partially offset by the increase in the number of deaths in those with early-stage AD dementia as the prevalence of MCI due to AD and mild AD dementia in the population increases.

There is little difference in the number of persons being newly diagnosed each year with MCI due to AD or mild or moderate AD dementia under each scenario. At present, on average every day some 8 older Australians are expected to have a diagnosis of MCI due to AD confirmed, 46 persons mild AD dementia, and another 7 moderate AD dementia. Of all new cases, 75 -78% will be diagnosed at the mild AD dementia stage, 11-13% will be diagnosed with MCI due to AD, and 11% when dementia has already progressed to moderate disease severity (as stated previously the model excludes people transitioning from no cognitive impairment to severe AD dementia within an annual cycle).

COSTS

DIRECT COSTS

A summary of the direct costs under the usual care and DMT intervention scenarios over the 20-year simulation period 2021-2041 is provided in Table ix. Total direct costs over the 20 years summed to $162.017bn under the base case of usual care compared with $157.967bn under the DMT scenario - the DMT producing an overall saving of $4.051bn in direct costs.

The cumulative direct costs of biomarker testing, follow-up with a dementia specialist and administering the DMT infusion over the 20 years was estimated to be $4.109bn. These treatment costs were offset by the $8.159bn generated in savings with the DMT compared with the direct costs estimated to occur under usual care. Thus, the DMT produced an overall reduction of $4.051bn in direct costs over the 20 years when the costs of implementing the DMT are taken into account.

In the absence of a price on the DMT drug, the cost of implementing the DMT represented 2.6% of total direct costs. The cost of implementing the DMT contributed to 8.8% of total direct costs in year 1 when it was first introduced, falling to 2.2% of the direct costs estimated for 2041.

The cost of formal aged care dominates the direct costs of AD dementia. Costs of residential care contributed to 69-70% of the non-DMT direct costs. Formal care in the community accounted for a further 18-19% of the other direct costs in both scenarios and hospital care around 10%. The reduction in the number of persons with AD dementia in permanent residential care under the DMT scenario contributed to 86.1% of the reduction in direct costs over the simulation period. By 2041 under the DMT scenario compared with usual care, there is expected to be 2,427 fewer residents with moderate AD dementia and 2,490 with severe AD dementia living in permanent residential aged care, with only an increase of 315 residents with mild disease. This changes the mix of care needs of persons with AD dementia in permanent care, and the associated costs.

INDIRECT COSTS

A summary of the indirect costs under the usual care and DMT intervention scenarios over the 20-year simulation period 2021-2041 is provided in Table x. Total indirect costs amounted to $280.227bn from 2021 to 2041 under the usual care scenario and $275.509bn under the DMT. Thus, the DMT intervention generated an expected accumulated savings of $4.718bn. The cost of informal care, under both scenarios, accounted for a staggering 96% of the indirect costs incurred over the 20 years. This is after offsetting Government payments to carers. The estimated number of full-time equivalent informal carers of persons with AD dementia in the community increased from 103,542 carers in 2021 to 179,564 carers in 2041 under usual care and to 176,648 carers under the DMT intervention. This is an overall 1.6% reduction in the FTE amount of informal care provided.

SUMMARY OF COSTS

A summary of the direct and indirect costs of AD dementia over the period 2021-2041 under the base case of usual care and the DMT intervention is provided in Table xi. Under existing health and aged care i.e. usual care, the cost of AD dementia in 2021 is estimated to be nearly $15.5bn and this is expected to rise by more than 70% over the next 20 years to around $26.6bn in 2041 in today's dollars. Indirect costs accounted for 63% of total costs under both scenarios, and direct costs 37%. The cost of aged care dominated both direct and indirect costs with informal care accounting for 60-62% of total non-DMT costs and formal aged care another 32%. The cost of informal care was substantial, contributing to 96% of indirect costs and 63% of all non-DMT related costs.

The DMT produced estimated cumulative savings over the 20 years of $8.159bn in direct costs and $4.718bn in indirect costs. These represented a 5.0% and 1.7% reduction in costs respectively compared to usual care. The estimated cumulative expenditure on the DMT, excluding an indicative drug cost, was $4.109bn giving an overall net reduction in the cost of AD dementia of $8.769bn over the period 2021-2041. Such a savings would pay the total cost of residential aged care for all persons with AD dementia for two years.

Table ix. Summary of direct costs under usual care and DMT intervention, 2021-2041 ($millions)

Direct Cost Component	2021			2041			2021-2041		
	Usual Care	DMT	Diff	Usual Care	DMT	Diff	Usual Care	DMT	Diff
DIRECT COSTS – DMT INTERVENTION									
Biomarker testing	0.0	72.6	72.6	0.0	26.4	26.4		528.5	528.5
Specialist Follow-up	0.0	9.7	9.7	0.0	3.5	3.5		70.7	70.7
Administering infusion	0.0	461.7	461.7	0.0	177.2	177.2		3,509.7	3,509.7
DMT drug	-	-	-	-	-	-	-	-	-
Total	**0.0**	**544.0**	**544.0**	**0.0**	**207.1**	**207.1**		**4,109.0**	**4,109.0**
DIRECT COSTS - OTHER									
Hospital Care									
Admitted principal diagnosis	89.5	89.5	0.0	154.7	152.7	-2.0	2,573.8	2,529.9	-44.0
Admitted associated diagnosis	322.3	322.3	0.0	557.1	549.8	-7.2	9,265.8	9,107.5	-158.3
Public hospital outpatient clinics	141.9	141.9	0.0	264.2	263.2	-1.0	4,226.5	4,188.9	-37.6
Public hospital emergency departments	2.7	2.7	0.0	4.8	4.7	0.0	78.2	77.1	-1.1
Total	*556.5*	*556.5*	*0.0*	*980.8*	*970.5*	*-10.3*	*16,144.3*	*15,903.4*	*-241.0*
Out-of-Hospital Health Services									
Dementia specific medications	19.8	19.8	0.0	35.5	36.2	0.7	580.1	584.8	4.7
Other drugs	3.0	3.0	0.0	5.4	5.5	0.1	87.6	88.3	0.7
Diagnostic imaging services	15.7	15.7	0.0	29.2	29.1	-0.1	467.4	463.5	-3.9
Pathology services	4.5	4.5	0.0	8.4	8.3	0.0	134.0	132.8	-1.1
GPs, specialists, allied health	40.2	40.2	0.0	74.5	74.5	0.0	1,195.9	1,188.0	-7.9
Total	*83.2*	*83.2*	*0.0*	*152.9*	*153.6*	*0.7*	*2,464.9*	*2,457.4*	*-7.4*
Formal Aged Care									
Residential Care	3,975.6	3,975.6	0.0	6,848.3	6,417.5	-430.7	113,513.1	106,491.6	-7,021.6
Community Care	1,039.9	1,039.9	0.0	1,804.0	1,754.3	-49.7	29,895.0	29,005.4	-889.5
Total	*5,015.5*	*5,015.5*	*0.0*	*8,652.2*	*8,171.8*	*-480.4*	*143,408.1*	*135,497.0*	*-7,911.1*
Total	**5,655.2**	**5,655.2**	**0.0**	**9,786.0**	**9,296.0**	**-490.0**	**162,017.3**	**153,857.8**	**-8,159.5**
GRAND TOTAL	**5,655.2**	**6,199.2**	**544.0**	**9,786.0**	**9,503.1**	**-282.9**	**162,017.3**	**157,966.8**	**-4,050.6**

Table x. Summary of indirect costs under usual care and DMT intervention scenarios, 2021-2041 ($millions)

Direct Cost Component	2021			2041			2021-2041		
	Usual Care	DMT	Diff	Usual Care	DMT	Diff	Usual Care	DMT	Diff
Informal Care									
Gross replacement value	10,014.6	10,014.6	0.0	17,367.4	17,085.4	-282.0	287,813.4	282,268.2	-5,545.2
Government carer payment offsets	-651.0	-651.0	0.0	-1,130.9	-1,042.3	88.6	-18,731.1	-17,451.2	1,280.0
Total (net cost)	9,363.6	9,363.6	0.0	16,236.5	16,043.1	-193.5	269,082.3	264,817.1	-4,265.2
Lost Productivity									
Loss of earnings from wages & salary	456.4	456.4	0.0	575.6	551.6	-24.1	10,953.1	10,528.2	-424.9
Income Support									
Disability support pension	5.4	5.4	0.0	13.0	10.8	2.2	191.8	163.5	-28.3
TOTAL	**9,825.4**	**9,825.4**	**0.0**	**16,825.2**	**16,605.5**	**-215.3**	**280,227.2**	**275,508.8**	**-4,718.4**

Table xi. Summary of direct and indirect costs under usual care and DMT intervention scenarios, 2021-2041 ($millions)

Cost Component	2021			2041			2021-2041		
	Usual Care	DMT	Diff	Usual Care	DMT	Diff	Usual Care	DMT	Diff
Direct Costs - DMT	0.0	544.0	544.0	0.0	207.1	207.1	0.0	4,109.0	4,109.0
Direct Costs - Other									
Hospital Care	556.5	556.5	0.0	980.8	970.5	-10.3	16,144.3	15,903.4	-241.0
Out-of-Hospital Health Services	83.2	83.2	0.0	152.9	153.6	0.7	2,464.9	2,457.4	-7.4
Formal Aged Care	5,015.5	5,015.5	0.0	8,652.2	8,171.8	-480.4	143,408.1	135,497.0	-7,911.1
Total	*5,655.2*	*5,655.2*	*0.0*	*9,786.0*	*9,296.0*	*-490.0*	*162,017.3*	*153,857.8*	*-8,159.5*
Indirect Costs									
Informal Care	9,363.6	9,363.6	0.0	16,236.5	16,043.1	-193.5	269,082.3	264,817.1	-4,265.2
Lost Productivity	456.4	456.4	0.0	575.6	551.6	-24.1	10,953.1	10,528.2	-424.9
DSP Income Support	5.4	5.4	0.0	13.0	10.8	2.2	191.8	163.5	-28.3
Total	*9,825.4*	*9,825.4*	*0.0*	*16,825.2*	*16,605.5*	*-215.3*	*280,227.2*	*275,508.8*	*-4,718.4*
TOTAL	**15,480.6**	**16,024.6**	**544.0**	**26,611.1**	**26,108.5**	**-498.2**	**442,244.6**	**433,475.6**	**-8,769.0**

DISCUSSION AND CONCLUSIONS

The annual societal costs in Australia of dementia due to Alzheimer's disease are enormous. Such costs pose a major challenge not only to the Government through pressure on Government health and aged care systems but also to individuals with AD dementia, their families and the community at large. Without any new intervention to prevent or delay the progression of AD dementia, 14% of persons with MCI due to AD will transition to mild or moderate AD dementia each year and one in five persons' mild AD dementia will progress to a more severe and costly state. It is therefore of utmost importance that new cost-effective treatments that prevent or delay disease progression are developed.

The patterns and growth in the costs of AD dementia are consistent with other reports of direct health and related costs in Australia (Brown et al., 2017; Gnanamanickam 2017; Standfield et al., 2019). The costs presented in the Report are also consistent with those reported recently by the AIHW (2021). Differences arise because of the different study populations – all cause dementia vs. AD dementia - and the manner in which costs are attributed.

Over the 20-year simulation period, 410,833 persons with MCI due to AD or mild AD dementia are expected to be treated by the DMT. As Wimo et al. (2020) noted, it is unrealistic to assume a hypothetical future DMT for AD would result in absolute cost savings over the long-term because of the cost associated with the treatment and the prolonged survival of treated patients. Treated persons are expected to live longer through the reduced exposure to higher mortality rates by spending less time in more severe AD dementia stages and more time in the early stages of AD dementia where the risk of death is similar to the general population. In the cost estimates presented in this Report, savings were still occurring in the cost of formal and informal care after 20 years under the DMT scenario, but the annual savings were reducing.

The results presented here are for a budget impact analysis of a hypothetical DMT intervention in early AD dementia undertaken from a societal perspective. This is not a cost-effectiveness study. However, when comparing a DMT with usual care, other researchers found their estimates were cost-effective and considered value for money even if costs increased with the DMT when applying relatively modest base case assumptions on treatment effectiveness (Sköldunger et al., 2013; Green et al., 2019; Wimo et al., 2020).

In the absence of a price on the hypothetical DMT drug, the modelling shows significant cost savings over the 20 years. However, what is of interest is not simply potential cost savings but other important health and social outcomes such as decreased mortality and extended life expectancy, greater time persons with AD dementia are able to live in the community rather than in institutional care, improved quality of life and the reduction in intangible costs in terms of the social and emotional burden associated with a family member having dementia. As noted by Wimo et al. (2020) commented, an appropriate approach to assessing the economic value of a DMT for preventing or delaying the progression of AD is the societal willingness to pay (WTP) for these specific outcomes.

The number of people that may be eligible for the DMT is relatively large. For modelling purposes, it was assumed there were no resource constraints in screening of persons suspected of having early-stage AD, biomarker testing, follow-up and treatment with the DMT infusion. In the first year it was assumed all persons in the population meeting eligibility criteria for the DMT (54,045 persons) could access treatment, and thereafter new incidence cases of MCI or mild dementia due to AD would become the treated population. However, the uptake could be staggered, and ways found to identify persons that may benefit the most from the DMT treatment.

Due to limitations around availability of specific data inputs, the model employs a number of assumptions. However, it is clear that the modelled efficacy of the hypothetical DMT will affect its ability to demonstrate budget impact and potential cost-effectiveness. Treatment options for AD dementia are limited. Currently, one DMT - aducanumab (ADUHELM) - has been approved in the US for the treatment of early-stage AD. Early biomarker screening and the use of potential DMTs will have significant implications for the treatment strategies adopted for persons suspected of having early-stage AD and the resultant societal costs of the disease. Models, such as the one developed for this Report, are urgently needed to provide policy-makers with tools to help inform their decisions regarding future treatment options for AD dementia and to prompt broad-based public discussions around the community's willingness to pay for these interventions and the additional resources (i.e. screening, testing/scans) required to identify those who are more likely to benefit from these interventions.

1. INTRODUCTION

Alzheimer's disease (AD) is the most common cause of dementia, with the prevalence increasing rapidly with age. It involves the progressive loss of neurons that affects a person's behaviour, memory and cognitive processes. As cognitive impairment progresses, a person's ability to maintain their activities of daily living declines and their need for care increases with the growing loss of independence and autonomy. Though the symptomatic burden of dementia typically occurs late in life, it is preceded by a long preclinical phase, characterized by the pernicious accumulation of neuropathology in the brain (Lupton et al., 2020).

The current view of AD is that it manifests along a continuum (Figure 1) rather than having categorical stages. On this continuum, there are three broad phases: preclinical Alzheimer's disease, mild cognitive impairment (MCI) due to Alzheimer's disease and dementia due to Alzheimer's disease (Figure 1). As will be discussed, MCI is associated with a significantly increased risk of dementia, and importantly recent studies indicate that the incidence and prevalence of MCI in the Australian community is higher than previously thought (Anstey et al., 2010; Brodaty et al., 2013; Sachdev et al., 2015; Davis et al., 2018). Without a medical breakthrough to prevent or slow the progression to dementia, the prevalence of AD is likely to double in Australia in the next 25 years (Brown et al., 2017; AIHW, 2018). There are no treatments available to halt, slow, or cure AD. Thus, there is an unmet need for therapies that can achieve this goal.

The aim of this project is two-fold:

1. to model the societal cost of dementia due to Alzheimer's disease (AD) in Australia's population aged 50 and above years; and

2. to estimate the economic impact on both direct and indirect costs of a hypothetical disease-modifying therapy (DMT) as an early intervention in persons with mild cognitive impairment (MCI) due to AD or mild dementia due to AD to prevent or delay the progression to more severe dementia states.

In 2016, NATSEM was commissioned by Dementia Australia (then Alzheimer's Australia) to model the societal costs of dementia in Australia over the 40 years 2016 to 2056 (Brown et al., 2017). The population studied were those with 'probable dementia'[2] based on prevalence rates from the Australian DYNOPTA study (Anstey et al., 2010). A cost of illness (CoI) approach was used to estimate the direct and indirect costs of dementia over the 40 years. The impact on costs of a hypothetical intervention that reduced the annual age-sex incidence rates of probable dementia by 5% in people aged 65 years and above was modelled. The current project is an extension of this earlier report by focusing specifically on Alzheimer's disease. While it similarly adopts a CoI and budget analysis approach, there are differences and adaptations in the methodology to that used in the 2017 Report. These are summarised below. This latest Report

- focusses on Alzheimer's disease rather than probable dementia due to all causes;

- provides a more detailed model by disease stage, namely, MCI due to AD, mild dementia due to AD, moderate or severe dementia suspected or confirmed as due to AD, and death as well as by institutional status (living in the community vs residential care);

- uses more specific definitions and diagnostic criteria including the incorporation of biomarker testing in diagnosing AD as the underlying pathology of dementia; and

- simulates the profile and likely impact of a DMT that while also being hypothetical, better reflects DMTs that are currently being trialled and are expected to enter the market in the next couple of years. In this modelling, the eligible population for the DMT are patients with a clinical diagnosis of early-stage AD and also confirmation of brain amyloid beta (Aβ) deposition (i.e. those with MCI confirmed as being due to AD/prodromal AD or mild dementia also confirmed as being due to AD).

2. Probable dementia was defined as individuals having a Mini-Mental State Examination (MMSE) score of less than 24.

This Report documents the approach, methods and parameters of the simulation modelling and the results generated for the 20-year time horizon from 2021 to 2041. Only secondary data sources are used in the epidemiological and economic analyses. Using existing data and applying findings in the literature to a new situation is a common practice in health economic analyses when local data are absent or undertaking a survey for primary data collection is not practical. The key is to ensure the appropriateness of the data to the problem being researched.

2. DEFINITIONS, TERMINOLOGY AND CLASSIFICATION

AD is a pathophysiological and clinical continuum, where specific pathological changes (Aβ plaques, neurofibrillary tangles, and neuronal degradation) accumulate in the brain over many years prior to the emergence of clinical symptoms of cognitive decline that progress over a period of time (Albert et al., 2011; Sperling et al., 2011; Dubois et al., 2014; McKhann et al., 2011; Morris et al., 2014; Jack et al., 2018) (Figure 1). Different diagnostic criteria have been proposed and modified over time reflecting the increasing understanding of AD pathogenesis and the evolving recognition of MCI as an early disease state in the AD continuum (McKhann et al., 2011; Bradfield and Ames, 2020; Casper et al., 2020). The diagnosis of AD is usually made according to standard criteria as specified, for example, in the various editions of the Diagnostic and Statistical Manual of Mental Disorders (DSM–5 or earlier versions are commonly used in the United States and Canada), the International Classification of Diseases (ICD) (often used in Europe), and National Institute on Aging-Alzheimer's Association (NIA-AA) diagnostic criteria.

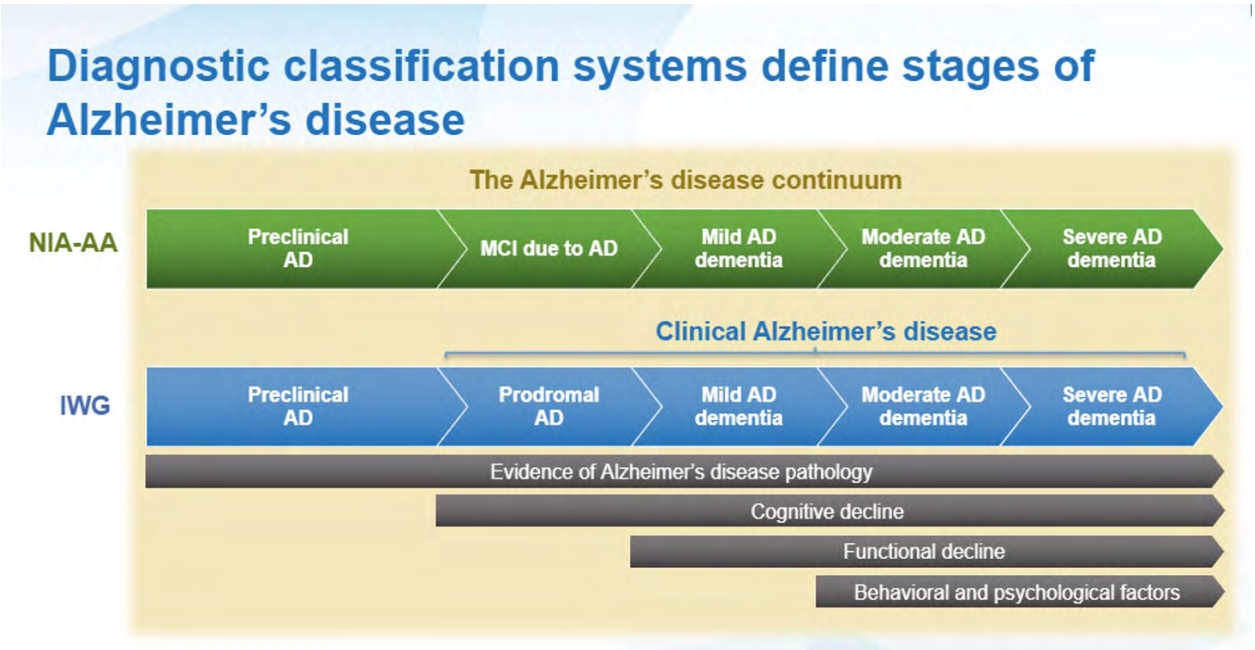
Different ways and terminologies have been used to define the AD continuum that spans from asymptomatic to a final dementia stage (Frisoni et al., 2017). The taxonomy proposed by the NIA-AA) is adopted in this Report. As shown in Figure 1, the stages are essentially equivalent to those in the International Working Group (IWG) classification scheme.

1. At the **preclinical stage**, there is evidence on testing of brain changes, including amyloid buildup and other nerve cell changes, but there is no presence of significant clinical symptoms. The AD pathology develops slowly, and it may take over 20 years before clinical symptoms appear (Martin et al., 2018; Bradfield and Ames, 2020).

2. Then follows a phase of **'mild cognitive impairment due to Alzheimer's disease' (MCI due to AD)** when individuals experience a gradually progressive cognitive decline that results from the accumulation of AD pathology in the brain. This stage is marked by symptoms of memory and/or other thinking problems that are greater than normal for a person's age and education, but these do not interfere with his or her activities of daily living and independence. People with MCI may or may not progress to AD dementia.

3. When the cognitive impairment is sufficiently great, such that there is interference with daily function, the patient is diagnosed with **Alzheimer's disease dementia (AD dementia)**. Dementia may then be subdivided into mild, moderate, and severe stages depending on impairment. These final stages of the disease which include symptoms such as memory loss, word-finding difficulties, and visual/spatial problems, are significant enough to impair a person's ability to function independently (https://www.nia.nih.gov/health/alzheimers-disease-diagnostic-guidelines; Jack et al., 2018). By the time a clinical diagnosis is made, there is widespread synaptic loss and neuronal death, microglial infiltration, and brain shrinkage appears (Martin et al., 2018).

Figure 1 Alzheimer's Disease Continuum



AD, Alzheimer's disease; IWG, International Working Group; MCI, mild cognitive impairment; NIA-AA, National Institute on Aging and Alzheimer's Association
Source: Albert 2011; Dubois 2014; McKhann 2011; Morris 2014; Sperling 2011.

The update of the NIA-AA criteria in 2011 incorporated two notable differences from earlier taxonomies: 1) the use of Aβ PET neuroimaging and cerebrospinal fluid (CSF) assay measurement of Aβ in symptomatic individuals to confirm AD as the underlying disease pathology; and 2) the formalisation of different stages of disease in the diagnostic criteria (Jack et al., 2011; Jack et al., 2018). The NIA-AA divided the biomarkers into two major categories: 1) amyloid-beta (Aβ) accumulation in the form of plaques; and 2) neuronal degeneration or injury with a focus on tau deposition in neurofibrillary tangles (Jack et al., 2011). The different biomarkers of Aβ plaques, of fibrillar tau and of neurodegeneration or neuronal injury are indicative of the neuropathological structural changes in the brain (Safieh et al., 2019).

Importantly, the NIA-AA criteria explicitly addressed MCI due to AD. The criteria require cognitive impairment in any cognitive domain and abnormal Aβ deposition markers or neuronal injury markers to distinguish MCI due to AD from MCI due to other causes. Patients can be stratified further into those with a high versus intermediate likelihood of MCI due to AD based on the biomarker results:

- the high AD likelihood group are those showing any cognitive impairment, an abnormal Aβ marker scan or cerebrospinal fluid (CSF) $A\beta_{42}$, and a positive biomarker of neuronal injury; and
- the intermediate AD likelihood group show any cognitive impairment, one biomarker tested and abnormal i.e. either Aβ markers or neuronal injury markers as abnormal, while the other is untested (Albert et al., 2011; Bradfield and Ames, 2020).

When Aβ markers and markers of neuronal injury are both negative then MCI is unlikely to be due to AD (Albert et al., 2011).

As Jack et al. (2018) state, it is possible that amyloid β plaques and neurofibrillary tau deposits are not causal in AD pathogenesis, but it is these abnormal protein deposits that define AD as a unique neurodegenerative disease among different disorders that can lead to dementia.

As Bradfield and Ames (2020) comment the NIA-AA classification combines core clinical criteria with clinical research criteria, which incorporated the biomarker evidence of disease, and in doing so, these criteria moved beyond MCI as a pre-clinical definition incorporating history and examination findings to a prodromal state with biological evidence of incipient disease. Jack et al. (2018, p536) argue

> ***...the term AD is often used to describe two very different entities: prototypical clinical syndromes without neuropathologic***

verification and AD neuropathologic changes. However, a syndrome is not an etiology but rather a clinical consequence of one or more diseases. A biological rather than a syndromal definition of AD is a logical step toward greater understanding of the mechanisms underlying its clinical expression. Disease modifying interventions must engage biologically defined targets, and the dementia syndrome does not denote a specific biological target(s). Furthermore, in order to discover interventions that prevent or delay the initial onset of symptoms a biologically-based definition of the disease that includes the preclinical phase is needed. Thus, a framework suitable for interventional trials should be founded on a biologically based definition of AD".

However, while the definition of AD has moved towards a biologic construct based on the presence of biomarkers (Jack et al., 2018), the core clinical criteria for AD dementia continue to be the cornerstone of the diagnosis in clinical practice. AD is typically still diagnosed on a combination of clinical manifestations of symptoms of cognitive impairment (and decline from a previous level of functioning) in memory and other domains of intellectual function, and demonstration of consequent social or occupational impairment (ADI, 2015). Clinical assessment may include multi-domain cognitive testing, disability assessment, a clinical interview and an informant interview (ADI, 2015).

It is now widely accepted that relying on cognitive symptoms alone is not an ideal way to define AD (Jack et al., 2018). Between 10% and 30% of individuals clinically diagnosed as having AD dementia by experts do not display AD neuropathological changes at autopsy, and a similar proportion have normal amyloid PET or CSF Aβ (Jack et al., 2018). While the biomarkers of functional impairment, neuronal loss, and protein deposition are increasingly being recommended to diagnose AD, their use is still largely restricted to research studies and to some specialist clinical settings such as academic memory clinics (Frisoni et al., 2017; Rabinovici et al., 2019).

Imaging techniques using PET that show gradual Aβ accumulation in the brain as well as the measurement of CSF levels of Aβ are now considered to be relatively reliable indicators of imminent AD (Martins et al., 2018). Certainly, the operational use of biomarker evidence for amyloid pathology and neuronal injury is facilitating earlier diagnosis and allowing the likelihood of progression to AD dementia at the MCI stage to be assessed (Vos et al., 2015). However, drawing on their experiences with the Australian Imaging Biomarker and Lifestyle (AIBL) study and the international Dominantly Inherited Alzheimer's Network (DIAN) (which includes several Australian sites), Martins et al. (2018) comment that biomarker testing is not easily accessible, is relatively expensive and involves invasive diagnostic techniques. While serving as a gold standard for investigative work and clinical trials, it is still thought that applying biomarkers in general population screening for AD would be difficult (Martins et al., 2018). Internationally, the widespread adoption of biomarkers in clinical practice and the reimbursement or subsidisation of the costs of biomarker testing by government funding bodies or health insurance providers have been hampered, in part by a perceived view that the clinical usefulness of these biomarkers in the diagnosis of both MCI due to AD and AD dementia needs ongoing validation (McKhann et al., 2011; Frisoni et al., 2017).

The NIA-AA guidelines recommend that biomarkers are used to support a diagnosis of AD in symptomatic individuals i.e. it is assumed that to make a diagnosis of AD dementia based on the presence of biomarkers, the core clinical diagnosis of AD dementia is first satisfied (McKhann et al., 2011; Jack et al., 2018). This is the approach adopted in the modelling. The terminology used in the Report to describe the early stages of AD with/without biomarker confirmation is as follows:

a. Before biomarker confirmation of Aβ:
   - MCI suspected due to AD
   - Mild dementia suspected due to AD

b. After biomarker confirmation of Aβ:
   - MCI due to AD (equivalent to prodromal AD)
   - Mild AD dementia

2.1 MCI DUE TO AD

While different criteria may differ in their definition of MCI and biomarker abnormality, it is generally agreed that MCI due to AD is a prodromal phase of AD dementia (Albert et al., 2011; Dubois et al., 2014; Langa et al., 2014; Vos et al., 2015). The diagnostic criteria using biomarkers now allow for a diagnosis of Alzheimer's disease to be

made at the prodromal stage i.e. before the development of 'full-blown' dementia (Frisoni et al., 2017; Martins et al., 2018; Roberts et al., 2018). Patients meeting the clinical criteria for MCI and with positive biomarkers for AD should be diagnosed as having MCI due to AD (prodromal AD) (Portet et al., 2006; Palmqvist et al., 2015; Frisoni et al., 2017).

However, as Baxi et al. (2019) suggested that there is no standard way of diagnosing MCI due to AD in clinical practice; rather, a diagnosis is made only after thorough clinical consultation and biomarker testing. MCI suspected to be due to AD is characterized by objective impairment in cognition that is not severe enough to significantly affect usual activities of daily living (i.e. independence is maintained in completing daily activities, although some may be performed not as efficiently) and by an absence of behavioural disturbances and a lack of significant impairment in social or occupational functioning (Langa et al., 2014; Jansen et al., 2015; Frisoni et al., 2017; Petersen et al., 2018). There are signs of memory problems or impaired judgment and decision-making (greater than expected from ageing alone) which reflect the underlying pathology, but these are insufficient for the diagnosis of AD (Jansen et al., 2015; Dementia Australia, 2017; Davis et al., 2018; Petersen et al., 2018; Giovannoni et al., 2019). Although symptoms might be very concerning to the individual and/or their family, MCI typically does not impact significantly on the person's overall functional abilities or their level of independence (Dementia Australia, 2017).

The main distinction between MCI due to AD and mild AD dementia is whether or not there is evidence of significant interference in the ability to function at work or to undertake usual daily activities. This is inherently a clinical judgment made by a skilled clinician on the basis of the individual circumstances of the patient and the description of daily affairs of the patient obtained from the patient and from a knowledgeable informant such as a family member or doctor (McKhann et al., 2011; Knopman and Petersen 2014).

A common practice has been to define MCI on the basis of the presence or absence of memory difficulties into **amnestic (aMCI)** vs. **non-amnestic MCI (naMCI)** subtypes, respectively. These are essentially phenotypes where impairments may occur in single or multiple cognitive domains (Casper et al., 2020; Derrig et al., 2020). In particular:

- In **aMCI**, memory loss or dysfunction is the most prominent symptom. This is the most common form of MCI; and
- In **naMCI**, impairment occurs in other cognitive domains (such as language, attention, visuospatial, executive) without memory impairment (Sachdev et al., 2015; Csukly et al., 2016; DA/Woodward, 2017; Petersen et al., 2018; Derrig et al., 2020).

Csukly et al. (2016) comment that aMCI and naMCI are theoretically different entities and structural differences are backed by structural imaging methods and neuropsychological tests. Significantly for defining the model populations, aMCI is the clinical phenotype suggestive of and highly likely to predict later diagnosis of AD (Lupton et al., 2020) i.e. people with aMCI have a considerable risk of progressing to AD over time. People with na-MCI are more likely to convert to other (non-Alzheimer) forms of dementia (such as dementia with Lewy bodies, frontotemporal dementia, or vascular dementia) (Albert et al., 2011; Sachdev et al., 2015; Csukly et al., 2016; DA/Woodward, 2017; Casper et al., 2020; Derrig et al., 2020; Lupton et al., 2020). Frisoni et al. (2017) and Jansen et al. (2015) report up to two-thirds of patients with amnestic mild cognitive impairment have underlying Alzheimer's pathology (these individuals are considered to be at the prodromal Alzheimer's disease stage).

2.2 SEVERITY OF ALZHEIMER'S DISEASE

As Figure 1 shows AD dementia may progress from mild to moderate to severe disease. The Clinical Dementia Rating (CDR) scale provides details of the clinical characteristics, organised into 6 domains (memory, orientation, judgement and problem solving, community affairs, home and hobbies, and personal care) against which the severity stage of dementia (due to AD or other causes) can be clinically assessed (Morris, 1993 and 1997; AIHW 2012). Based on the CDR, the AIHW (2012) describes mild, moderate and severe dementia as shown in Table 1.

Table 1 Clinical characteristics of the stages of AD dementia

Stage	Description
Mild	Deficits and difficulties are evident in a number of areas such as memory, planning, organisation and personal care, but the person can still function with minimal assistance. Symptoms include moderate memory loss especially for recent events, some disorientation in time, moderate difficulties with problem solving, reduced interest in hobbies, and the need for prompting regarding personal care tasks.
Moderate	Deficits and difficulties become more obvious and severe, and increasing levels of assistance are required to help the person maintain their functioning in the home and community. Symptoms include severe memory loss, considerable difficulty orienting to time and place, obvious difficulties in finding words, severe impairment of judgement and problem solving, need for assistance with personal care tasks, and emergence of behavioural difficulties (for example, wandering, aggression, sleep disturbance and disinhibited behaviour).
Severe	Characterised by almost total dependence on the care and supervision by others. Symptoms include very severe memory loss, very limited language skills, unable to make judgements or solve problems, regularly not recognising familiar people, frequent incontinence, requires substantial assistance with personal care, and increased behavioural difficulties. By this stage the majority of people with dementia are in residential care.

Source: AIHW, 2012; AIHW, 2021

Epidemiological and clinical studies typically use the CDR scale or Mini-mental State Examination (MMSE) scores to classify patients by disease severity (Table 2). As Table 2 shows there is variation in these cut-offs especially for MCI and mild dementia. In the clinical setting, identifying the stage that a person has reached in the progression of AD dementia is not always straightforward - distinguishing between MCI and mild dementia suspected or due to AD is particularly difficult (Draper, 2011). Symptoms and patient experiences often overlap between these disease states.

In the widely referenced Australian study, Anstey et al. (2010) defined probable dementia being MMSE <24, and possible cognitive impairment being MMSE 24 to 26 (Table 1). The PATH Through Life study did provide clinical data to validate the diagnoses of mild cognitive disorders using these MMSE ranges. However, Anstey et al. (2010) state that the range from 24 to 26 has less empirical support for defining possible cognitive impairment than the cut-off of <24 does for defining probable dementia (Anstey et al., 2010).

Table 2 Stages of dementia suspected or due to AD

Stage	MCI	Mild Dementia	Moderate Dementia	Severe Dementia
Budd et al., 2011	MMSE 26-30	MMSE 21-25	MMSE 10-20	MMSE <10
AIHW, 2012	CDR=0.5	CDR=1	CDR=2	CDR=3
Bond et al., 2012		MMSE 21-26	MMSE 10-20	MMSE <10
Sachdev et al., 2015	MMSE 24-27			
	CDR=0.5			
Garcia-Ptacek et al., 2014	MMSE ⩾25	MMSE 20-24	MMSE 10-19	MMSE 0-9
Frisoni et al., 2017	MMSE 24-30			
Anderson et al., 2018		MMSE 21-26 CDR=1	MMSE 10-20 CDR=2	MMSE <10 CDR=3
Green et al., 2019		MMSE 21-26	MMSE 10-20	MMSE 0-9
Wimo et al., 2020	MMSE 21-30		MMSE 10-20	MMSE 0-9
		Probable Dementia		
Anstey et al., 2010	MMSE 24-26	MMSE <24		
Doraiswamy et al., 2014	MMSE 25-28	MMSE 10-24		

Estimates of prevalence, incidence, disease progression and mortality have varied widely between studies in the literature reflecting different diagnostic criteria used, the disease subtype being investigated, the setting (e.g. community vs clinic), the duration of follow-up, and the sample size (Tifratene et al., 2015).

Only secondary data is used to determine the epidemiological parameters in the modelling and therefore these reflect the definitions and methods used in each study. Using different definitions and estimates will give rise to variability in the model results – the aim, therefore, was to estimate the model parameters based on findings in the literature: 1) that are most relevant to the aims of the modelling; 2) where there is consistency in the definition of MCI and AD dementia; and 3) where there is consensus (or consistency) in the reported findings in the literature.

3. RESEARCH APPROACH

3.1 MODEL LOGIC

The logic underpinning the modelling is as follows:

- AD is a progressive disorder that can be detected using biomarkers at a prodromal phase where there are signs or symptoms reflecting the underlying pathology but these are insufficient for a clinical diagnosis of dementia.
- This provides an opportunity for intervention to prevent or delay disease progression.
- The societal cost of AD - which is made up of the direct and indirect costs incurred by individuals with AD, their family, Government and society at large - in Australia is significant.
- Consistent with the NIA-AA definitions, the AD population is taken to include individuals who have MCI due to AD and those with mild, moderate or severe AD dementia.
- In Australia, as elsewhere, many people are given a clinical diagnosis of AD. A large proportion of these individuals are likely to have AD as the underlying pathology but without biomarker testing, AD cannot be confirmed as the cause of their MCI or dementia.
- An efficacious DMT would prevent or delay the progression of disease along the AD continuum i.e. from early-stage AD (MCI due to AD and mild AD dementia) to later stages of AD (moderate or severe AD dementia) stages.
- The DMT is most beneficial in persons with brain amyloid who are in the early stages of AD.
- The population who are eligible for treatment with the DMT are those with MCI due to AD and mild AD dementia and who are 50-84 years of age.
- Having fewer persons with moderate or severe AD is expected to result in substantial reductions in the overall societal costs of AD, even though the numbers with MCI due to AD and mild AD will increase.

3.2 A COST OF ILLNESS STUDY AND BUDGET IMPACT ANALYSIS

There are many different approaches to the economic evaluation of a health disorder and healthcare interventions (WHO, 2009; Drummond et al., 2015). The type of economic evaluation to be chosen depends on the questions being asked in terms of whether or not both the costs and outcomes associated with an intervention (or health problem) are of interest, and whether or not these costs and/or outcomes need to be compared with some alternative. This study undertakes a budget impact analysis (BIA) which is essentially the difference between two cost of illness (CoI) studies – the first based on usual care versus the introduction of the new therapy (intervention) into the treatment mix (Sullivan et al., 2014).

The 'cost of Illness' has been defined as the value of the resources that are expended or foregone as a result of a health problem (Segal, 2006; Tarricone, 2006; WHO, 2009). Thus, in COI studies the focus of the research is on understanding the likely 'resource' cost i.e. the economic

impact incurred not only by the people with the health problem, their families and carers but also employers, the Government and society at large. Traditional COI studies involve identifying the direct and indirect costs[3] associated with the health condition. Following standard CoI study methods (Tarricone, 2006):

1. a bottom-up method is used to estimate costs where data is at a micro rather than macro level with actual or imputed costs incurred by a representative sample of patients being itemised and then weighted to get an estimate for the entire population i.e. the quantity of inputs or resources used are estimated and then multiplied by the unit costs to get the aggregate costs;

2. the epidemiological data used in the modelling involves prevalence, incidence, transition and mortality rates for MCI due to AD and AD dementia. However, as the aim is to estimate total annual costs of AD without and with the DMT each year over the simulation period, a prevalence based approach to the CoI is used where the direct and indirect costs attributable to all cases of MCI due to AD and AD dementia occurring in each year is calculated; and

3. the study is retrospective in that already collected demographic, epidemiological and economic data is used in the simulations and cost calculations.

BIAs are based on CoI methods with BIAs increasingly being required in the approval processes and reimbursement decisions for new medicines and health technologies (Ghabri and Mauskopf, 2018). A BIA is essentially a forecast of rates of use (or changes in rates of use) with their consequent short and medium-term effects on budgets that helps budget-holders plan changes that are likely to result from the introduction of a new health technology (Cuyler, 2014). A BIA estimates the expected changes in resource use and cost for the budget holder for the mix of interventions and the condition-related outcomes in the population of interest over a given period after the introduction of the new intervention (Mauskopf and Earnshaw, 2017). These estimates are compared with the outcomes from usual care i.e. if the new intervention was not introduced. The resource and budget impact is calculated as the population-level difference between the two scenarios (Sullivan et al., 2014; Mauskopf and Earnshaw, 2017).

Guidelines for performing these analyses have been issued by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) (Sullivan et al., 2014). Australia is, however, one of a number of countries with country-specific guidelines for BIA required in the assessment of new medicines or health technologies for national or local formulary listing or reimbursement (PBAC, 2015; Ghabri and Mauskopf, 2018). In Australia, companies are required to model the cost impact of a new medicine on the Australian Government budget in their submission to the Pharmaceutical Benefits Advisory Committee (PBAC) for listing of the medicine on the Pharmaceutical Benefits Scheme (PBS). The methods used in this study will follow the ISPOR guidelines for BIAs. While the proposed methods are in keeping with the more targeted PBAC BIA guidelines, this study does not purport to meet the specific requirements of a PBAC budget impact analysis.

The components of the BIA are outlined below.

Perspective

The perspective taken in a BIA is that of the budget holder, usually a government or private sector entity. This determines the costs that are included in the analyses. However, the perspective adopted in this study is a societal one. Total costs are captured and the impact on Australia as a whole are estimated. An epidemiological (rather than market share) approach to generating resource utilisation and cost estimates is therefore taken (PBAC, 2015).

Time Horizon

As a BIA is often used for resource allocation purposes, BIAs typically use a short-term time horizon, commonly 1 to 5 years (Sullivan et al., 2014; Mauskopf and Earnshaw, 2017). The PBAC guidelines indicate the financial impact should be estimated over 6 years (PBAC, 2015). However, the time horizon for a simulation depends on what is most relevant to the budget holder (in this case the Australian community), the expected impact of the intervention on disease progression and the possible cost-savings that may occur in future years.

In AD, a long-term time horizon is warranted although going beyond a few years usually requires considerable assumptions to be made. The typical time horizon used previously in dementia Markov modelling studies is around 20 years - ranging from Budd et al. (2011)

3. Because of the difficulties in measuring and monetising intangible costs (pain, quality of life, emotional or social burden of disease) these are typically excluded from CoI studies.

with a 10-year time horizon; to Green et al. (2019) and Sköldunger et al. (2013) with 20 years; to Davis et al. (2018) at 35 years and Wimo et al. (2020) with a 40-year horizon. In assessing the preparedness of Australia's health care system for the introduction of a DMT for AD, the modelling by Baxi et al. (2019) focussed on a 13-year period 2022-2035.

A 20-year time horizon is used in this modelling, covering the period 2021 to 2041, with the simulation using 1-year transition intervals.

Modelling Framework

The progressive nature of AD can be considered as a Markov process where there is a predictable annual risk of people transitioning to more severe disease states or death. Markov modelling is one of the most widespread modelling techniques in health economic evaluations. Decision-analytic Markov multi-state models have been built to simulate disease progression in a number of MCI and dementia populations. and have been used by other researchers to examine the potential impacts of DMTs in dementia – see for example Budd et al., 2011; Sköldunger et al., 2013; Anderson et al., 2018; Davis et al., 2018; Baxi et al., 2019; Green et al., 2019; Patel et al., 2019; and Wimo et al., 2020.

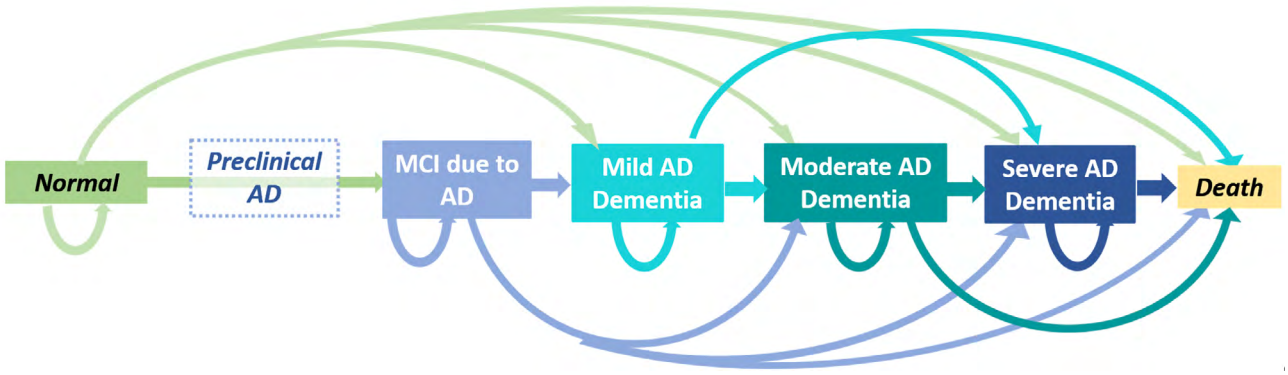
In essence these models are made-up of stocks and flows (Vickland et al., 2011 and 2012). The stocks are the prevalent populations of the different disease states at each time point (t) in the simulation and the flows are the network of inflow and outflow movements of individuals through the discrete disease states from time t to t+1. Flows are determined by the number of people in a state and the transition probabilities for being in a particular disease state at t+1 conditional on an initial state at t (Pierse et al., 2020).

The modelling involves the aggregate flows of older persons between dementia states, 5-year age groups and death for males and females. Generating the simulation model of AD prevalence over time rates requires assumptions about the initial prevalence of MCI due to AD and AD in the Australian population; incidence rates (of new cases from the general 'normal 'population) over the study period; disease progression rates and mortality rates for both the AD and non-dementia populations (Pierse et al., 2020).

> ***Transition rates are dependent on age, gender and disease state. It is assumed that the age-sex mortality, incidence and disease transition rates are constant over time.***

The modelling framework is depicted in Figure 2 in combination with Figure 1.

Figure 2 Model disease states and flows

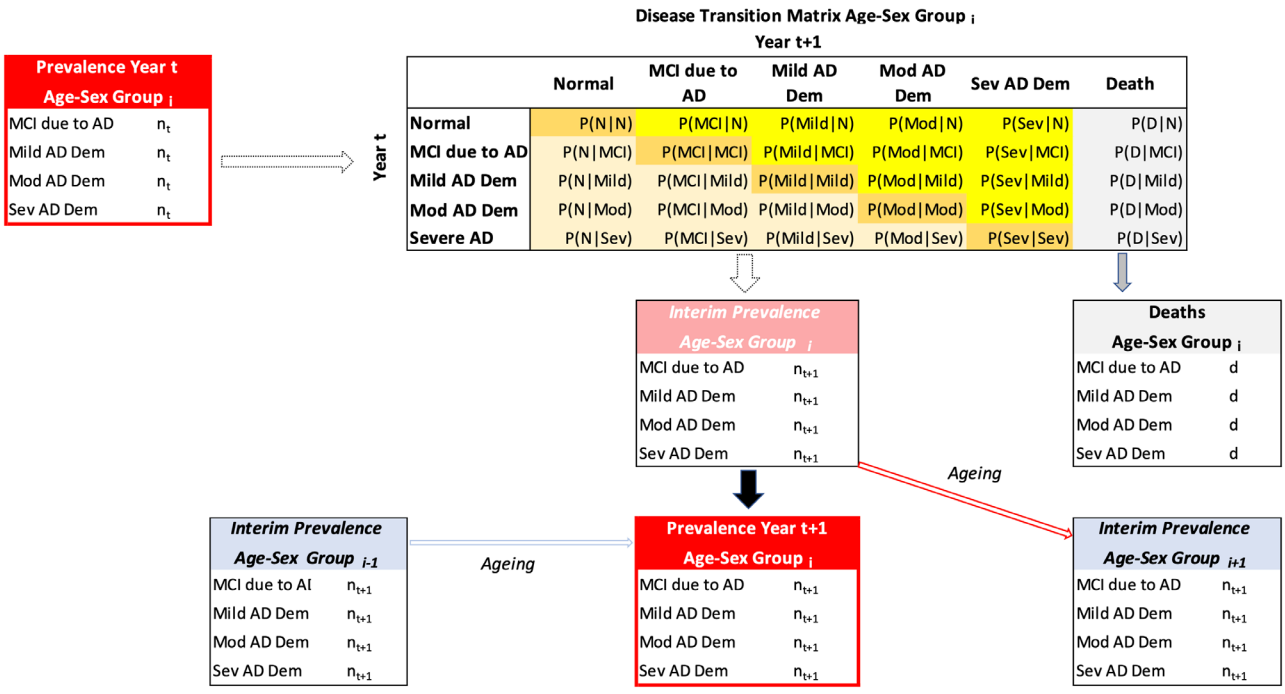


- ***An individual may remain in the same state, move to a more severe state or die. Progression need not be linear*** – depending on the timing of diagnosis and follow-up an individual could progress two or more stages. Although uncommon, it is possible for example, for a person to be deemed as having normal cognition at one time point and then be diagnosed as having severe AD in the next time period.
- ***The NIA-AA's preclinical stage of AD is recognised as part of the AD continuum in Figure 1. However, while preclinical AD is acknowledged it is not included in the modelling***. There is a very little empirical data on individuals transitioning from a 'normal' cognitive status to preclinical AD or on the pathways from preclinical AD to the other AD states. Also, the target populations for the DMT are MCI due to AD and mild AD dementia, and not preclinical AD (although there may be a call in the future to intervene at this earliest stage of AD).
- ***Although studies have shown that some people revert to a less severe disease state on follow-up, in the modelling it is assumed that disease progression is irreversible*** i.e. there are no backward flows in the model. Other researchers have also assumed no backward transitions occur in their models (e.g. Sköldunger et al., 2013; Anderson et al., 2018). This is a reasonable assumption as the majority of the studies reporting reversion are based on clinical definitions of AD. The use of biomarkers in the diagnosis and assessment of patients gives a higher specificity with reversion in AD being less likely to be observed.

The modelling is undertaken for 5-year age-sex groups from age 50-54 years top-coded to 90 years and above. As shown in Figure 3, for each simulation cycle, there are two transition steps - disease progression including death (generating an interim prevalence for each age-sex cohort i at time t+1) followed by the ageing of individuals where some individuals will move into the next age-sex cohort (i+1) while others (from i-1) will enter cohort i in t+1.

In order to capture the differential costs of care, once the prevalent MCI due to AD and AD dementia patient groups are estimated for each year, they are then divided into those who are living in the community and those living in an institutional setting i.e. in residential aged care. This approach follows Budd et al. (2011), Davis et al. (2018) and Green et al. (2019) who also thought it important to include the risk of people with AD moving from a community-based setting to institutional care. Davis et al. (2018) and Green et al. (2019) combined the risk of going into residential care with AD severity.

Figure 3 Model transitions for age-sex group $_i$



The DMT Intervention

BIAs consider all patients who would be eligible for the new intervention within the jurisdiction of the health-care budget holder whether they use the new intervention or not (Sullivan et al., 2014; Mauskopf and Earnshaw, 2017). The number of patients diagnosed with the medical condition, the number who are eligible for the intervention and the number who are likely to take up the treatment all need to be estimated. In this study this includes estimating the number of patients with MCI due to AD or mild AD dementia, with the patient population being eligible for the DMT being those aged 50-84 years. In the modelling, the eligible population is open in the sense that individuals enter or leave the states of MCI due to AD and mild AD dementia depending on incidence, disease progression and the rate of mortality.

A hypothetical DMT is modelled. This is based on the characteristics and clinical effectiveness of DMTs currently being trialled. Like Baxi et al. (2019) it is assumed that the DMT is delivered through a course of intravenous infusions, taking place in hospital outpatient clinics. The drug is administered approximately every four weeks over the course of 12 months (52 weeks) for a total of 13 infusions per patient. The expected infusion time is around 1 hour. Patients previously diagnosed with mild AD dementia and already receiving symptomatic treatment would be able to continue to receive their existing therapy alongside the new DMT. If patients transition from MCI due to AD or mild AD dementia to moderate or severe AD dementia then treatment is discontinued.

> ***The clinical effectiveness of the DMT is modelled as a reduction in dementia progression rates of 25% for those patients with MCI due to AD or mild AD dementia.***

The re-analysed data from the phase 3 multi-centre EMERGE clinical trial (NCT02484547) showed 23% less cognitive decline in patients on the DMT aducanumab (10mg/kg) compared with placebo (Budd Haeberlein et al., 2019, Servick, 2019; Kaplon et al., 2020; Schneider, 2020). The U.S. Food and Drug Administration (FDA) approved aducanumab (ADUHELM) for the treatment of AD on 7 June 2021 using the accelerated approval pathway[4]. The FDA's accelerated approval can be based on a drug's effect on a surrogate endpoint that is reasonably likely to predict a clinical benefit to patients, with a required post-approval trial to verify that the drug provides the expected clinical benefit. The surrogate endpoint with aducanumab is the reduction of Aβ plaque in regions of the brain expected to be widely affected by Alzheimer's disease pathology (clinical trials showing aducanumab reduced Aβ plaques by 59 to 71% at 18 months of treatment[5]). Under the accelerated approval process, Biogen, the company that developed aducanumab in conjunction with Eisai Co., Ltd., is required to conduct a follow-up randomised, controlled clinical trial to verify the drug's clinical benefit in preventing or delaying cognitive decline and functional impairment in patients with early stages of AD (mild cognitive impairment and mild dementia) with confirmed presence of amyloid pathology.

In other modelling studies, Davis et al. (2018) assumed a 20% reduction in the annual risk of transitioning from normal cognition to MCI due to AD; and Wimo et al. (2020) assumed their simulated hypothetical intervention reduced the progression rate from MCI-AD to mild AD-dementia by 25%. Anderson et al. (2018) modelled reductions through the use of a hypothetical DMT therapy in annual transition rates in prodromal subjects to AD of 10%, 30% or 50% with other scenarios ranging from 5%-50%.

Cost Measures

The cost of AD is estimated for all persons with mild, moderate or severe AD dementia taking into account patients' residential setting. Budd et al. (2011), Sköldunger et al. (2013), Anderson et al. (2018) and Wimo et al. (2020) also modelled disease severity but only Anderson et al. (2018) modelled the absence or presence of biomarkers in people with MCI.

BIAs use constant prices, making no allowance for inflation and does not use discounting. BIAs typically focus on direct costs but given the societal perspective of this BIA both direct and indirect costs are included in the economic estimations. The following costs are commonly included in MCI and dementia CoI studies (see for example Kang et al., 2007; Wimo et al., 2013; Zhu et al., 2013; Brown et al., 2017; Robinson et al., 2020) and these cost items are included in this analysis.

4. https://www.fda.gov/news-events/press-announcements/fda-grants-accelerated-approval-alzheimers-drug; https://investors.biogen.com/news-releases/news-release-details/fda-grants-accelerated-approval-aduhelmtm-first-and-only; https://www.abc.net.au/news/2021-06-08/us-approves-first-alzheimers-drug-in-20-years/100197170

5. https://investors.biogen.com/news-releases/news-release-details/fda-grants-accelerated-approval-aduhelmtm-first-and-only

- ***Treatment-Related Direct Costs:*** The cost of any diagnostic test (e.g. PET scans or CSF assays) or screening that is required to identify eligible individuals and consultations with medical practitioners such as visits to dementia specialists and allied health professionals as well as the direct cost of the supply and use of the DMT. While a price for the DMT drug is needed to provide a complete budget impact analysis, no DMT for AD is currently funded on any drug formulary in Australia, and only one is internationally. In the absence of a reliable price, the cost of the DMT drug is therefore not included in the analyses.
- ***Direct Costs:*** the direct costs included in this modelling are: a) direct health expenses such as admitted hospitalisation; outpatient visits; emergency department presentations; GP, specialists and allied health visits; prescribed dementia specific medications and medications used in the management of dementia; and b) direct non-medical expenses on formal care including residential care and community-based formal care services.
- ***Indirect costs:*** these include the cost of informal care and the value of lost productivity by persons with AD dementia. Indirect costs are not routinely included in a BIA as these are not generally relevant to the budget holder. The potential productivity gains, especially from reductions in the need for informal care, are important from a societal perspective. Thus, estimating changes in forgone earnings for people with more severe AD dementia and in the lost productivity of their carers warrant inclusion in this BIA.

The econometric modelling of the loss of productivity is located within a labour economics theoretical framework. Appropriate labour market theories and dynamics inform not only the selection of variables but also the relationships between variables and behavioural equations in the modelling. Similar to many academic studies on labour market performance, emphasis is placed on four key elements determining labour force status and income from salary and wages, namely, basic demographic attributes, the return to education, the return to experience, and residuals. This is in line with the classical human capital accumulation approach which is used widely in the labour economics literature and generally offers a good description of the relationship of education, experience and labour market performance.

An accumulation of human capital through either education or experience is expected to increase the chance of an individual securing higher income.

Productivity losses are derived from reductions in working hours, absenteeism or sick leave, presenteeism and permanent retirement from the work force. In keeping with the discussion above, indirect costs for persons with AD dementia is calculated using national gender-stratified average gross hourly and annual earnings. This is a 'human capital' approach to valuing productivity losses in which it is assumed that labour earnings reflect productive capacity.

Because of a lack of detailed data, especially up-to-date information, on the demographic, employment and income characteristics of carers of people with AD dementia in Australia, the replacement cost method of valuing informal care is adopted. This approach is commonly used in COI studies, and is discussed in detail in Section 5.4.1.

NATSEM's microsimulation model of Australia's tax and transfer system STINMOD+ provided the information necessary to measure the productivity impact and resultant effects on indirect costs through lost productivity. STINMOD+ reads input data from the Australian Bureau of Statistics Survey of Income and Housing (SIH), and the Household Income and Labour Dynamic Australia (HILDA) survey. Thousands of calibrations and validations are built into STINMOD+ to ensure the base data is representative of the current Australian population.

Estimation of Uncertainty and Sensitivity Analysis

There are uncertainties in the values of the model parameters (e.g. levels of resource use, the eligibility for the DMT and its update rates, transition and mortality rates) as well as the model structure and its assumptions. In BIA it is difficult to quantify these uncertainties and therefore it is important to undertake scenario analyses to test alternative values and their impact on the epidemiological and cost outcomes. Sensitivity analyses were undertaken to check that both the direction of impact on the estimates is correct as well as the level of magnitude is fitting. In general, the more sensitive the overall economic implications are to a particular source of uncertainty, the more important it is to minimise this uncertainty (Sullivan et al., 2014).

Validation of the BIA estimates

Model validation was undertaken to ensure that the results generated represented what they are intended to represent. This included face validity checking, checking of model logic, code walk throughs, tracing and verification of the calculations. The results were also compared with the findings of similar published studies.

3.3 CLINICAL PATHWAYS - IMPLEMENTATION OF THE DMT INTERVENTION

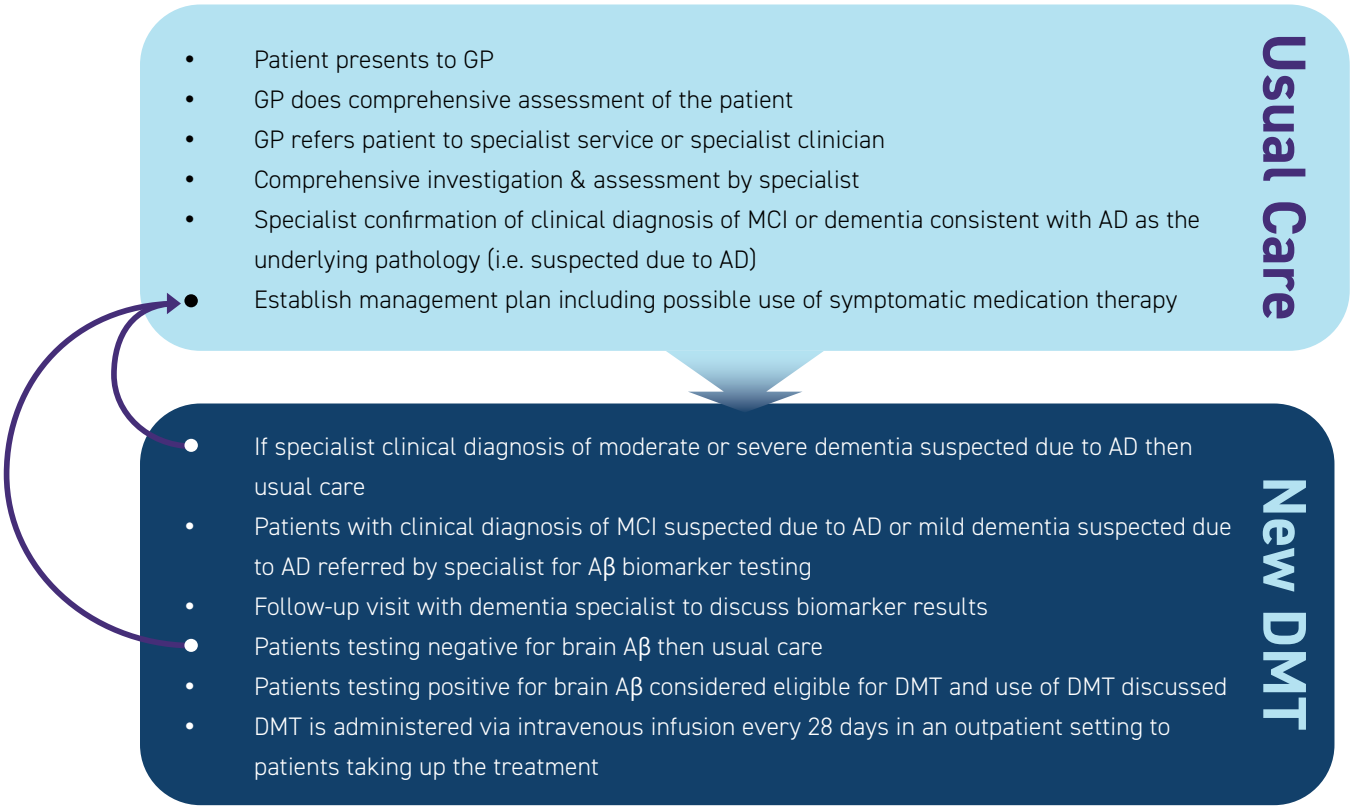
Accurate clinical diagnosis is particularly difficult in early-stage AD. Patients to be eligible for the DMT require evidence they have underlying AD pathology. As stated earlier this specifically means the presence of Aβ plaque deposition in the brain detected through positron emission tomography (PET) scan or cerebrospinal fluid (CSF) assay evidence of brain Aβ. AD biomarker testing is not routinely conducted in clinical practice in Australia. Therefore, an additional diagnostic phase to usual care is required to identify suitable candidates for treatment. The clinical pathways under current clinical practice (usual care) and with the introduction of the DMT (new DMT) are shown below in Figure 4.

Figure 4 Clinical management pathways under usual care and new DMT

It is assumed that the cognitive screening for and clinical diagnosis in general practice, in a memory or other specialist clinic, or by a specialist clinician, of MCI suspected due to AD and mild dementia suspected due to AD continues as usual. The investigation, management, and referral pathway for patients in the lead up to being considered eligible for the DMT follows current pathways for the confirmation (which is usually made by a specialist clinician such as a geriatrician, psycho-geriatrician, neurologist, or psychiatrist) of a diagnosis of MCI or mild dementia with clinical features consistent with AD as the underlying pathology. A patient would be considered eligible for biomarker testing at the point at which a specialist makes a clinical diagnosis of early-stage disease.

It is assumed that 80% of AD biomarker testing will be conducted with Aβ PET and 20% with CSF biomarker assay testing. Following testing, patients would have a follow-up visit with their dementia specialist to discuss their results and possible courses of treatment. In patients found to be positive for brain amyloid, a discussion would occur to decide if treatment with the DMT was suitable for that particular individual.

It is assumed in the modelling that the clinical steps needed to implement the DMT intervention e.g. screening, diagnosis and treatment are not constrained by limitations in resource capacity.



4. MODEL PARAMETERS AND ASSUMPTIONS

4.1 PREVALENCE OF MCI DUE TO AD

The prevalence of MCI due to AD and AD dementia is not always reported in studies. In Australia, rates of MCI and dementia have been estimated but these do not differentiate between the subtypes of dementia or whether AD is the underlying pathology. The estimates also vary depending on the criteria used to define MCI and dementia and on the source of the data. However, the likely proportion of MCI and dementia cases that have AD as the underlying pathology have been reported in the literature and these can be used to estimate the prevalence and incidence of AD in the population.

4.2 MODELLING APPROACH FOR MCI DUE TO AD

Clinical and epidemiological studies estimate the general prevalence of MCI in adults aged ⩾65 years to be 10- 20%, with risk increasing with age (Langa and Levine, 2014; Langa et al., 2014; Behrman et al., 2017; Hu et al., 2017; Petersen et al., 2018). The Alzheimer's Association (of the US) state that 15% to 20% of people age 65 years or older have MCI (https://www.alz.org/alzheimers-dementia/what-is-dementia/related_conditions/mild-cognitive-impairment). The prevalence of MCI in the Australian community appears to be higher than previously thought with prevalence being 15-20% in those aged 65 and above years (Anstey et al., 2010; Brodaty et al., 2013; Radford et al., 2015; Davis et al., 2018).

AD is the most common aetiology of MCI (Knopman & Petersen 2014), and there appears to be no significant differences between men and women in the prevalence or incidence of MCI, including aMCI (Sachdev et al., 2015; Au et a.l, 2017).

The general prevalence of MCI (as given above) is not appropriate for the modelling as it does not measure the prevalence of MCI due to AD. Only a proportion of MCI cases prevalent within the general population (as revealed through community-based epidemiological studies) present to the health system, are clinically diagnosed with MCI, the aetiology suspected to be due to AD and then confirmed as MCI due to AD following positive biomarker testing (Gillis et al., 2019). Also, around 15-30% of participants who are diagnosed with MCI at baseline in clinical and epidemiological studies that report the prevalence and incidence of MCI revert to no cognitive impairment at follow-up (Brodaty et al., 2013; Petersen et al., 2018). Therefore, the following modelling approach is adopted to estimate the prevalence of MCI due to AD.

4.3 MCI SUSPECTED TO BE DUE TO AD

To calculate the prevalence of MCI due to AD, it is assumed that the aMCI population represents the 'MCI suspected to be due to AD' population. Sachdev et al. (2015) applied uniform criteria to harmonize data from 11 studies from USA, Europe, Asia and Australia (known as the COSMIC collaboration). MCI prevalence estimates were then determined using three separate definitions of cognitive impairment. The analysis did not use the full population of each study, rather samples comprised individuals aged 60 or more years who were not identified as having dementia and/or did not have a CDR ⩾1. The prevalence rates reported for aMCI from the 9 studies that measured aMCI (involving episodic memory impairment with or without impairment in other cognitive domains) are shown in Table 4.

Table 3 Modelling approach for estimating MCI due to AD population

MCI Population	Modelling assumptions
(a) Patients with MCI suspected to be due to AD	• age-sex prevalence of amnesic MCI (aMCI) x proportion who are suspected to have AD as the underlying pathology
(b) Patients with MCI suspected to be due to AD accessing biomarker testing	• patients with MCI suspected to be due to AD population (a) x proportion of patients accessing biomarker testing • proportion of patients accessing biomarker testing = share of the population (a) who receive cognitive screening each year x share of population who then receive further evaluation by a dementia specialist each year x share of these MCI patients then eligible for and uptake biomarker testing
(c) Patients with MCI due to AD	• patients with MCI suspected to be due to AD accessing biomarker testing (b) x proportion of patients who test positive to Aβ

There were two Australian studies: the Personality and Total Health Through Life Project (PATH) (Anstey et al., 2012) and the Sydney Memory and Ageing Study (Sydney MAS) (Sachdev et al., 2010). The respective crude prevalence rates for aMCI were 1.0% and 4.0%. The prevalence of aMCI in the Sydney MAS in Table 2 is significantly lower than that reported by Brodaty et al. (2013) who also studied participants in the Sydney MAS. Brodaty et al. (2013) report a prevalence of single-domain amnestic MCI of 11.3% (95% CI: 3.4-9.2) and amnestic multidomain MCI of 9.3% (95% CI: 7.4–11.2). They note that their study participants did not have full neuropsychological data as in the previous study but rather sufficient data to be classified as having MCI – the criteria being there was a participant or informant cognitive complaint, there was cognitive impairment on objective testing, they showed no symptoms of dementia, and they had normal function or minimal impairment in instrumental activities of daily living. Thus, the criteria for MCI were not as rigorous as in the Sachdev et al. (2010) study.

In their systematic review of European studies, Alexander et al. (2015) found two Italian and one Spanish study reported prevalence of aMCI in persons aged ⩾ 65 years between 4.9% and 8.7%, but, again there are issues with the criteria used for defining amnestic MCI. What is clear is that the studies present substantial heterogeneity in their results, even for studies conducted in the same countries (Alexander et al., 2015) - rates differ among studies because there are variations in the characteristics of the study populations and in the diagnostic criteria used for MCI.

Table 4 Prevalence of amnestic mild cognitive impairment (aMCI) (percentage prevalence and 95% confidence interval).

Study	Mean Age ± SD	Age Range	Crude Rate	Standardized Rate
EAS	78.3 ± 5.4	63–100	1.8 (1.3–2.6)	1.4 (0.9–1.9)
ESPRIT	73.1 ± 5.6	65–96	1.2 (0.8–1.7)	1.3 (0.7–1.8)
HK-MAPS	72.3 ± 7.2	60–96	1.0 (0.4–2.6)	0.5 (0.0–0.9)
Invece.Ab	71.2 ± 1.3	70–75	3.9 (3.0–5.2)	3.0 (2.3–3.7)
MoVIES	74.2 ± 5.4	66–97	2.6 (1.9–3.6)	2.6 (1.7–3.5)
PATH	70.6 ± 1.5	68–74	1.0 (0.6–1.6)	1.0 (0.6–1.5)
SLAS	68.5 ± 6.3	60–97	2.0 (1.4–2.9)	2.2 (1.3–3.1)
Sydney MAS	78.8 ± 4.8	70–90	4.0 (2.9–5.5)	3.6 (2.5–4.7)
WHICAP	76.4 ± 6.5	63–103	1.6 (1.3–2.1)	1.5 (1.1–1.9)
Total			2.0 (1.7–2.2)	2.0 (1.7–2.2)

Note. Standardized prevalence estimates were directly standardized for age group and sex, with the standard population being the total sample of all studies included in the analysis

Source: Sachdev et al., 2015.

Sachdev et al. (2015) also found that the prevalence estimates of aMCI did not differ significantly across age groups or by sex. The three studies providing estimates of aMCI examined by Alexander et al. (2015) also gave conflicting results on the relationship of aMCI prevalence with age - one was flat, one positive and one had a negative relationship with age.

Based on the prevalence rates presented in Table 1 and findings on gender and age, it is assumed that the prevalence of aMCI is 2.0% for all age groups ≥ 65 years and for both males and females.

There is an absence of data on the prevalence of aMCI in younger age groups. Therefore, for simplicity:

It is assumed that the prevalence rate for aMCI in persons aged 50-64 years is the same as for dementia (Table 5).

Table 5 Prevalence rate (%) of amnestic mild cognitive impairment (aMCI) in the 50-64 year age groups.

	Male (%)	Female (%)
50-54	0.114	0.042
55-59	0.257	0.118
60-64	1.517	1.596

After: AIHW (2012)

In general, it has been estimated that 40% to 60% of individuals aged 58 years and older with MCI have underlying AD pathology (Jansen et al. 2015; Gillis et al. 2019). There is limited data indicating what proportion of aMCI cases are actually due to AD. Results from the US Atherosclerosis Risk in Communities (ARIC) Neurocognitive study showed that AD was the primary aetiology in 66% of aMCI cases and primary or secondary aetiology in 75% of aMCI participants (Knopman et al., 2016). Knopman et al. (2016) state that the diagnosis of AD as an aetiologic diagnosis of MCI or dementia in ARIC as a primary diagnosis is a clinical one and is based on the presence of the cognitive syndrome that is not of abrupt onset and includes memory impairment and the absence of features of other specific diagnoses sufficient to cause the cognitive impairment. The criteria follow those from the NIA-AA.

Thus, it is assumed that the proportion of aMCI patients with MCI suspected to be due to AD is 75%, based on Knopman et al. (2016).

4.4 MCI DUE TO AD

The number of persons who would be confirmed as having MCI due to AD depends on how many individuals would access amyloid biomarker testing and then test positive for Aβ.

Screening and Clinical Diagnosis

It is difficult to know what proportion of persons with MCI or dementia suspected to be due to AD are clinically diagnosed. Those with mild symptoms of cognitive impairment are more likely to be undetected. Only 15% of participants with MCI in the US Ageing, Demographics and Memory Study had a prior diagnosis of MCI (Sawa and Arthur, 2015). Baxi et al. (2019) assessed the preparedness of the Australian health care system infrastructure for an AD modifying therapy. The clinical pathway involves people with undiagnosed/untreated MCI going through screening and diagnosis clinical phases. Screening would include cognitive assessment of older adults in primary care settings while the diagnostic phase would involve the referral of individuals to dementia specialists for further evaluation using additional cognitive and functional assessments. After this evaluation, the dementia specialist may refer the patient for testing of amyloid. Based on expert advice, Baxi et al. (2019) assumed that 80% of individuals aged 50 years and over would be screened each year in general practice and 50% of those who screen positive for MCI would be followed up with a dementia specialist evaluation (giving a clinical diagnosis rate of 40% = 80% x 50% – which is consistent with rates of diagnosis reported in the literature). It is thought that 90% of persons with MCI suspected to be due to AD would then be referred and consent to biomarker testing (Baxi et al., 2019).

Based on these rates of screening, clinical diagnosis and referral for biomarker testing, it is assumed that 36% (80% x 50% x 90%) of the population aged ≥50 years with aMCI suspected to be due to AD will access biomarker testing. In the absence of age-sex specific data, it is assumed that that the proportion of 36% applies across age groups and gender.

Amyloid Positivity

A number of studies have examined amyloid positivity in persons with MCI and dementia, especially in those with suspected AD pathology. For example, Van Maurik et al. (2019) examined amyloid positivity confirmed by PET scans in MCI patients from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database. A positive amyloid PET scan was found in 46% (144 of 311) of participants with MCI-stable. In assessing the clinical utility of Aβ imaging in MCI, Ong et al. (2015) reported that 53% (24 of 45) MCI patients undergoing amyloid PET scan were amyloid positive. Doraiswamy et al. (2014) undertook a longitudinal study of cognitive decline over 36 months in 52 subjects with recently diagnosed MCI and 31 with probable AD. Of the MCI participants 37% were Aβ+ at baseline. Cerami et al. (2018) studied patients with aMCI but who had a long-term clinical course (i.e., more than 4 years) and a slow rate of progression of memory deficits. They found 58% (15 of 26) tested Aβ+ with some evidence of amyloid deposition visualised by CSF or PET imaging.

Rabinovici et al. (2019) undertook amyloid PET scans in a large sample of US participants (n=11,409) with MCI (60.5% of participants) or dementia of uncertain cause. Alzheimer's disease was the leading suspected pre-PET aetiology of cognitive impairment in 73% of persons with MCI and 83% of those with dementia. Amyloid PET results were positive in 55% (n=3817) of patients with MCI. Jansen et al. (2015) who undertook a meta-analysis using individual participant data from 3972 persons with MCI to estimate the prevalence of amyloid pathology. The prevalence among patients with MCI of amyloid positivity on PET or in CSF was 52.9% and 50.7% respectively.

Based on these findings, it is assumed that 51% of the aMCI patients having received an amyloid PET scan or CSF test will be brain amyloid positive and will therefore be eligible for the DMT.

4.5 SUMMARY OF MODEL PARAMETERS FOR THE PREVALENCE OF MCI DUE TO AD

The epidemiological parameters used to determine the confirmed MCI due to AD population who are eligible for treatment with the DMT are listed in Table 4 below. In summary, the MCI due to AD population – i.e. the population eligible for the DMT - is calculated as the 'MCI suspected to be due to AD population' x 36% x 51%.

In the modelling it is assumed that there are no capacity constraints regarding the availability and access to PET or CSF biomarker tests and there are no lags in the uptake of biomarker testing within the pool of prevalent MCI suspected to be due to AD patients.

For the purposes of the modelling, the number of persons who are screened for MCI, who receive further evaluation by a dementia specialist and who are referred for biomarker testing is taken to represent the population who are clinically diagnosed with MCI due to AD.

In the modelling there is no age limit on patients being referred for biomarker testing. However, only persons with MCI confirmed to be due to AD i.e. they tested positive for A*β *and who are aged between 50 and 84 years of age are eligible for treatment with the DMT.

Table 6 Model parameters for estimating the MCI due to AD population

Parameter	Value	Primary Data Source
Australian population aged ›50+ years		ABS (2018) 3222.0 Population Projections, by age and sex, Australia - Series B
Proportion of population with aMCI	2% for ›65 yrs various <65 yrs	Sachdev et al. (2015) AIHW (2012)
Proportion of patients with MCI suspected to be due to AD	75%	Knopman et al. (2016)
Proportion of patients with MCI suspected to be due to AD accessing biomarker testing (clinical diagnosis)	36%	Baxi et al. (2019) RAND Report - Overall rate based on product of estimates below = 80% x 50% x 90%
(d) Share of patients who receive cognitive screening each year	80%	Baxi et al. (2019) RAND Report
(e) Share of the MCI population (a) who receive further evaluation by a dementia specialist each year	50%	Baxi et al. (2019) RAND Report -
(f) Share of MCI patients (b) eligible for and uptake biomarker test	90%	Baxi et al. (2019) RAND Report -
Proportion of patients that are amyloid positive (confirmed MCI due to AD)	51%	Average from the literature: Van Maurik et al. (2019); Ong et al. (2015); Doraiswamy et al. (2014); Cerami et al. (2018); Rabinovici et al. (2019); Jansen et al. (2015).

Based on the parameters in Table 6, the estimated number of persons in 2021 in the different population groups used to calculate the population with confirmed MCI due to AD are given in Table 7. If biomarker testing was conducted on all eligible patients then an estimated 15,449 Australians aged 50 years and above would be expected to be confirmed as having MCI due to AD in 2021.

Using ABS population projections and the model parameters, the prevalence of the population aged 50 years and above with MCI due to AD was projected annually over the period 2021 to 2041 for both males and females.

Table 7 Estimated number of persons aged ›50 years in 'MCI' populations, 2021

Population Group (all aged ›50 years)	Male	Female	Persons
Australian population	4,238,719	4,621,079	8,859,798
Population with aMCI	53,572	58,619	112,191
Population with MCI suspected due to AD	40,179	43,964	84,143
Population with MCI suspected due to AD who receive cognitive screening	32,143	35,171	67,314
Persons with MCI suspected due to AD who receive further evaluation by a dementia specialist	16,072	17,586	33,657
Persons with MCI suspected due to AD having biomarker test	14,464	15,827	30,291
Population with confirmed MCI due to AD – persons testing positive for amyloid	**7,377**	**8,072**	**15,449**

4.6 MODELLING APPROACH FOR AD DEMENTIA

The approach to estimating the three AD dementia populations used in the model – mild, moderate and severe AD dementia - is summarised in Table 8. The majority of patients with moderate or severe dementia will have had AD pathology confirmed previously through biomarker testing at the earlier disease stages of MCI or mild dementia, having then progressed to moderate or severe disease. However, while AD pathology is likely, it may not have been confirmed in new cases with moderate dementia incident from the general population. Some of these individuals with moderate dementia suspected to be due to AD will then progress to severe AD. However, for simplicity all moderate and severe cases are labelled as moderate or severe AD dementia.

Table 8 Modelling approach for estimating AD dementia populations

MCI Population	Modelling assumptions
Patients with dementia suspected due to AD	• age-sex prevalence of amnesic MCI (aMCI) x proportion who are suspected to have AD as the underlying pathology
Prevalence of dementia suspected due to AD by disease severity	• % with mild, moderate and severe dementia
Patients with mild dementia suspected due to AD accessing biomarker testing	• patients with mild dementia suspected to be due to AD population (a) x proportion of patients accessing biomarker testing • proportion of patients accessing biomarker testing = share of the population (a) who receive cognitive screening each year x share of population who then receive further evaluation by a dementia specialist each year x share of these mild dementia patients then eligible for and uptake biomarker testing
Patients with mild AD dementia	• patients with mild dementia suspected to be due to AD accessing biomarker testing x proportion of patients who test positive to Aβ
Patients with moderate or severe AD dementia	• patients with moderate or severe dementia suspected to be due to AD x proportion who are clinically diagnosed

4.7 PREVALENCE OF DEMENTIA IN AUSTRALIA

Data on the prevalence of dementia due to AD are not available in Australia. However, persons having dementia suspected to be due to AD can be estimated from the all-cause dementia population for which prevalence rates are available. As in the original *Cost of Dementia in Australia study* (Brown et al., 2017), prevalence rates for probable dementia from the DYNOPTA study and reported by Anstey et al. (2010) are used to estimate the prevalence of dementia in Australia in persons aged ›65 years. For those aged 50-64 years, rates used by the AIHW are applied. Rates for young onset dementia (YoD) are based on ADI estimates and a study by Harvey et al. (2003). A comparison of the DYNOPTA prevalence rates with rates used by AIHW (2012) and reported by ADI (2015) for Australasia is given in Table 9. The prevalence rates are generally consistent, although the Dynopta rates are slightly higher. Note the prevalence rate reported by Anstey et al. (2010) for probable dementia in women aged 70-74 years of 4.3% has been modified. The original rate is likely to be an underestimate and inconsistent with increasing prevalence with age.

YOD is where symptoms of dementia have an onset before the age of 65 years, an age cut-off chosen for psychosocial rather than neurobiological reasons (Draper & Withall, 2016). Dementia onset before the age of 65 is a relatively rare condition (as shown by the prevalence rates in Table 9) and is estimated to account for 6-9 % of all prevalent cases (ADI, 2015; Kosteniuk et al., 2015). The AIHW estimated that around 8% of people with dementia in Australia are aged under 65 years. In their study in south-east Sydney, Withall et al. (2014) reported a prevalence rate of YOD of 11.6 per 100,000 persons aged 30–44 increasing to 132.9/100,000 in those aged 45–64. Around 75% of YOD cases are aged 50 years and over.

Table 9 Dementia prevalence rates (%) in Australia

	DYNOPTA (Anstey et al., 2010)		AIHW (2012)		ADI 2015 - Australasia
	Male	Female	Male	Female	Persons
50-54			0.00114	0.00042	-
55-60			0.00257	0.00118	-
60-64			0.01517	0.01596	1.8
65-69	3.02	4.47	2.40	2.58	2.8
70-74	6.22	6.99*	3.93	4.37	4.5
75-79	10.74	10.55	6.78	7.72	7.5
80-84	16.92	15.97	11.50	13.68	12.5
85-89	25.13	21.02	19.08	23.44	20.3
90+	42.96	41.03	37.22	47.90	38.3

* modified prevalence rate

4.8 PROPORTION OF DEMENTIA SUSPECTED TO BE DUE TO AD

AD is the most common form of dementia, although people may also exhibit mixed dementia (the oldest old often have more than one type of dementia) (Knopman, 2020). Alzheimer's Disease International (2009 and 2015) estimates 50 to 75% of dementia is due to AD disease; the Alzheimer's Association (of the US) suggests AD accounts for 60-80% of dementia cases (https://www.alz.org/alzheimers-dementia/what-is-alzheimers); and Dementia Australia states that Alzheimer's disease accounts for up to 70% of diagnosed cases (DA, 2018).

Results from some clinical and epidemiological studies are summarised below:

- Bond et al. (2012) reported that AD accounted for approximately 62% of instances of dementia in England and Wales.
- Based on advice from Alzheimer's Research UK (ARUK), Anderson et al. (2018) report that AD accounts for around 70% of dementia cases in the UK when mixed dementia was included in the AD figures.
- In the large US IDEAS study (patients aged 65 years and over were eligible participants) AD was the leading suspected aetiology of cognitive impairment in 77% of all patients (Rabinovici et al., 2019).
- Results from the US ARIC Neurocognitive study showed that AD was the primary or secondary aetiology in 76% of participants with dementia (Knopman et al., 2016).
- In Rochester, Minnesota, data from the early 1990s suggested that AD contributed to around 75-80% of incident cases in those aged 70-84 years and 85-90% in those aged 85 years and above (Rocca et al., 2011).
- In a Rotterdam study 78% of incident dementia cases were classified as having AD (van der Lee et al., 2018).
- Data from the PAQUID, Rotterdam, Framingham Heart Study and the Three-City Studies showed AD accounted for 78.7%, 68.0%, 78.8% and 68.7% respectively of incident cases (an average of 72.8%) (Wolters et al., 2020).
- In another multi-center study of subjective cognitive decline around 65% of incident dementia cases received a diagnosis of AD (Slot et al., 2019)
- In Australian urban/regional Aboriginal and Torres Strait Islander people aged 60 years and older, AD was the most common type of dementia (44%) with mixed dementia contributing to a further 29% of prevalent cases. AD featured in 75% of these mixed presentations, giving an overall prevalence of 66% of dementia cases suspected to be due to AD (Radford et al., 2015).

Although AD is also the most common type of dementia in YOD, the proportion suspected to be due to AD is lower (studies ranging from 15–40% with an average of 27%) when compared with late onset dementia (50–70%) (Vieira et al., 2013). In Harvey et al.'s (2003) study of YOD in London 34% of dementia cases in persons aged 30-64 years were thought to have AD. The study of the prevalence and causes of YOD in Eastern Sydney showed only 17.7% of participants had AD but there were no cases of AD in participants under the age of 45 years, increasing this proportion to 20% in those aged 45-64 years (Withall et al., 2014, Draper & Withall, 2016).

In this modelling, it is assumed that AD is suspected in 27% of YOD cases and 75% of persons with dementia aged ≥65 years.

4.9 SEVERITY OF DEMENTIA

There is a lack of information on how many people with AD are classified as having mild, moderate or severe dementia. The AIHW (2012) used the results from Barendregt and Bonneux's 1998 study to suggest that 55% of people with dementia have mild dementia, 30% moderate and 15% severe. Vickland et al. (2011) stated that a percentage distribution between severity levels of 50% mild, 35% moderate, and 15% severe had been reported in the literature. However, in their base-case (default) scenario modelling, they had percentages varying from around 44-47% for mild, 28-32% moderate and 22-24% severe.

Following the AIHW it is assumed that the 55% of people with suspected AD dementia have mild dementia, 30% moderate and 15% severe disease.

4.10 MILD DEMENTIA DUE TO AD

Patients with mild dementia confirmed as being due to AD are also eligible for the DMT. As with MCI due to AD, the number of persons who would be confirmed as having mild AD dementia depends on the number of individuals who are clinically diagnosed with mild dementia with a suspected underlying pathology of AD, would be referred for and access amyloid biomarker testing, and the proportion of persons who then test positive for Aβ.

Screening and Clinical Diagnosis

It is assumed that the rates of screening, clinical diagnosis and referral for biomarker testing are the same as for MCI identified above by Baxi et al. (2019).

It is assumed that 36% (80% x 50% x 90%) of the population aged ≥50 years with mild dementia suspected to be due to AD will access biomarker testing. In the absence of age-sex specific data, it is assumed that that the proportion of 36% applies across age groups and gender.

Amyloid Positivity

In the van Maurik et al. (2019) study a positive amyloid PET scan was found in 88% (88 of 100) of persons with mild probable AD (labelled in the study as MCI-AD). Ossenkoppele et al. (2015) reported the prevalence of amyloid PET positivity in dementia syndromes using an individual participant data meta-analysis. Data were provided for 1,359 participants with clinically diagnosed AD and 538 participants with non–AD dementia. In AD dementia, the mean prevalence of amyloid positivity was 88%. The prevalence of Aβ was found to decrease with age but was not significantly associated with sex. Rabinovici et al. (2019) reported a lower proportion in their US study. AD was initially thought to be the underlying pathology in 83% of those with dementia with amyloid PET results being positive in 70.1% (n=3154) of persons with probable AD.

Based on these findings, it is assumed that 88% of the dementia patients having received an amyloid PET scan or CSF test will be amyloid positive and confirmed as having AD dementia.

Although Ossenkoppele reported decreasing rates of amyloid positivity with age, there is a lack of data to disaggregate the prevalence of Aβ+ by age and sex. Therefore, the proportion of 88% will be applied uniformly to the mild dementia population undergoing amyloid testing.

4.11 MODERATE AND SEVERE AD DEMENTIA

Patients with moderate or severe AD dementia are not eligible for the DMT intervention but this population will be impacted by any reduction in the rates of transition from MCI due to AD and mild AD dementia to these later disease states. In the modelling, it is assumed that patients with moderate or severe dementia are clinically diagnosed and that AD will have been confirmed as the underlying pathology in the majority of cases. As stated above, in the modelling most patients who are in the moderate and severe dementia disease states will have progressed there from the MCI and mild dementia states in which AD was required to be confirmed through biomarker testing. However, there will be some prevalent and incident cases in which AD may not have been confirmed as the underlying pathology as biomarker testing is not a prerequisite for inclusion in these two groups (as they are not eligible for the DMT).

The proportion of persons with moderate or severe dementia who will be diagnosed is higher than for those with MCI or mild dementia, but there still remain many who go undetected in the community. Lang et al. (2017) undertook a systematic literature review and a meta-analysis to estimate the proportion of dementia cases that are undetected. They found a pooled rate of undetected dementia of 62.9% in North America and 53.7% in Europe. Lopponen et al. (2003) reviewed the proportion of patients with dementia in Finland who had their diagnosis documented in their primary care medical records.

They found only 48.2% of patients had their diagnosis documented by a GP, with the documentation rate of dementia decreasing from 73% in severe, 46% in moderate to 33% in mild dementia.

A cross-sectional analysis of participants of the US Aging, Demographics and Memory Study showed a similar trend of underdiagnosis with only 47.3% of participants with AD having a prior diagnosis of dementia (Sawa and Arthur, 2015). Prior diagnosis rose from 26% among those with CDR=1 (corresponding to mild dementia) to 56% for CDR = 2 (moderate) to 75% in CDR=3 (severe dementia). Connelly et al. (2011) reported significant underdiagnosis of dementia amongst patients 65 years and over in primary care in the UK. Just under half (45.5%) of the expected number of patients with dementia were recognised in GP dementia registers i.e. the prevalence was 54.5% lower than the prevalence observed in epidemiological studies in the UK. A similar but more recent study exploring the variation in actual versus expected diagnosis of dementia in GP practices across England showed a median dementia diagnosis rate of only 41.6% (Walker et al., 2017). Evidence suggests that dementia is often not specifically diagnosed by GPs in Australia as well (Greenway-Crombie et al., 2012).

4.12 SUMMARY OF MODEL PARAMETERS FOR THE PREVALENCE OF DEMENTIA DUE TO AD

The epidemiological parameters used to determine the confirmed AD dementia population who are eligible for treatment with the DMT are listed below in Table 10. Based on these parameters, the estimated number of persons in 2021 in the different population groups used to calculate the population with confirmed mild dementia due to AD or moderate or severe dementia confirmed or suspected to be due to AD are given in Table 11. In 2021 there are nearly 350,000 persons aged 50 years or above suspected to have dementia due to AD in Australia. If biomarker testing was routinely used in the diagnosis then mild dementia due to AD would be expected to be confirmed in some 60,976 persons with a further 53,543 individuals being clinically diagnosed with moderate dementia and 39,370 with severe dementia due to AD.

Based on ABS population projections and the model parameters, the prevalence of the population aged 50 years or above with mild, moderate or severe AD dementia were projected annually over the period 2021 to 2041 for both males and females.

Table 10 Model parameters for dementia suspected or confirmed due to AD in persons aged 50 and above years

Parameter	Value	Primary Data Source
Australian population aged ›50+ years		ABS (2018) 3222.0 Population Projections, by age and sex, Australia - Series B
Prevalent probable dementia population		Anstey et al. (2010), AIHW (2012)
Proportion of persons aged › 65 years with dementia suspected to be due to AD	75%	Knopman et al. (2016)
Proportion of persons aged < 65 years with dementia suspected to be due to AD	27%	Vieira et al. (2013)
Proportion of patients with mild dementia	55%	AIHW (2012)
Proportion of patients with moderate dementia	30%	AIHW (2012)
Proportion of patients with severe dementia	15%	AIHW (2012)
Proportion of patients with moderate AD dementia who are clinically diagnosed	51%	Lopponen et al. (2003), Sawa and Arthur (2015)
Proportion of patients with severe AD dementia who are clinically diagnosed	75%	Lopponen et al. (2003), Sawa and Arthur (2015)
Proportion of patients with mild dementia suspected to be due to AD accessing biomarker testing (clinical diagnosis)	36%	Baxi et al. (2019) RAND Report - Overall rate based on product of estimates below = 80% x 50% x 90%
(d) Share of patients who receive cognitive screening each year	80%	Baxi et al. (2019) RAND Report
(e) Share of patients (a) who receive further evaluation by a dementia specialist each year	50%	Baxi et al. (2019) RAND Report
(f) Share of mild AD patients (b) eligible for and uptake biomarker test	90%	Baxi et al. (2019) RAND Report
Proportion of patients that are amyloid positive (confirmed dementia due to AD)	88%	Ossenkoppele et al. (2015), van Maurik et al. (2019)

Table 11 Estimated number of persons aged ›50 years in AD dementia populations, 2021

Population Group (all aged ›50 years)	Male	Female	Persons
Australian population	4,238,719	4,621,079	8,859,798
Population with probable dementia	214,321	269,383	483,704
Population with dementia suspected to be due to AD	154,245	195,708	349,953
- mild	84,835	107,639	192,474
- moderate	46,273	58,713	104,986
- severe	23,137	29,356	52,493
Population with mild dementia suspected to be due to AD who receive cognitive screening	67,868	86,111	153,979
Persons with mild dementia suspected to be due to AD who receive further evaluation by a dementia specialist	33,934	43,056	76,990
Persons with mild dementia suspected to be due to AD having biomarker test	30,540	38,750	69,291
Population with mild AD dementia – persons testing positive for amyloid	**26,876**	**34,100**	**60,976**
Population with moderate AD dementia	**23,599**	**29,943**	**53,543**
Population with severe AD dementia	**17,353**	**22,017**	**39,370**

4.13 MORTALITY RATES

People with dementia have an increased risk of dying compared with persons of a similar age and gender but who do not have dementia (Rait et al., 2010; Brodaty et al., 2012; Garcia-Ptaceka et al., 2014; Park, 2015). Dementia shortens life expectancy with survival estimates ranging from 1 to 13 years depending on dementia type, gender, cognitive level, neuropathology, cohort, and study design (Garcia-Ptaceka et al., 2014)

As pointed out by AIHW (2012) disentangling the cause of death for older individuals who had multiple comorbidities can lead to the under-reporting of dementia; medical practitioners' views about attributing dementia as the cause of death are thought to influence the recording of dementia as the underlying cause of death; and changes over time in the recognition, diagnosis and classification of dementia are likely to have affected the frequency with which this condition is recorded as a cause of death.

However, the modelling needs to estimate the number of deaths of persons with MCI due to AD and AD dementia, rather than deaths caused by AD. Brown et al. (2017), in the earlier cost of dementia in Australia study found the current rate of identification of dementia as the underlying cause of death on death certificates represents only 15 percent of all deaths in males with dementia and around 22 percent of females. Similar findings have been reported overseas. In South Korea, for example, 18.1% deaths in males with AD were reported as being caused by dementia/AD and 22.4% of female deaths. In Spain, dementia was reported as the primary cause of death in only 20.0% of patients with dementia (Villarejo et al., 2011).

In the modelling, the probability of mortality for each age-sex group in each dementia state is estimated as the product of the mortality rate in the age-sex matched general population and the mortality rate of people with MCI due to AD or AD dementia relative to that of the age-sex matched general cohorts. Death rates and mortality risk ratios (e.g. hazard ratios, relative risk, standardised mortality ratios) by age and/or disease severity have been reported in a number of studies (e.g. Budd et al., 2011; Villarejo et al., 2011; Spackman et al., 2012; Garcia-Ptacek et al., 2014; James et al., 2014; Vassilaki et al., 2015; Anderson et al., 2018; Davis et al., 2018; Baxi et al., 2019; Green et al., 2019; Huh et al., 2020; Pierse et

al., 2020). These studies show mortality rates of people with dementia are around twice those of non-dementia patients, with relative mortality varying by age and sex. Relative mortality rates are especially elevated for the younger age groups while there are smaller differences in the oldest groups. Based on the results in the literature, the following relative mortality ratios are used in the modelling (Table 12). These ratios apply to both males and females. A comparison of the ratio of observed to expected deaths in a cohort of the Swedish Dementia Registry relative to the general Swedish population showed the SMRs did not differ significantly between males and females (Garcia-Ptacek et al., 2014)

There is no excess mortality observed for individuals with MCI due to AD and mild AD dementia with death rates being the same as for the general population. Mortality decreases from being 8-fold higher in the 50-54 year age group with moderate AD dementia and 10-fold for those with severe AD dementia to 25% and 50% excess mortality in those aged 90 years or above respectively. Applying these ratios to the latest (2019) age-sex death rates in Australia[6] gives the following annual probabilities of death (Table 13).

Table 12 Relative mortality ratios by age and AD dementia state

Age Group (Years)	MCI due to AD	MILD AD Dementia	MODERATE AD Dementia	SEVERE AD Dementia
50-54	1	1	8	10
55-59	1	1	6	10
60-64	1	1	3	8
65-69	1	1	2	8
70-74	1	1	2	6
75-79	1	1	2	6
80-84	1	1	2	4
85-89	1	1	1.5	2
90+	1	1	1.25	1.5

It is assumed that the relationship between AD dementia and general mortality in Australia (i.e. the relative mortality ratios) and the general population death rates are constant over the simulation period 2021-2041.

Table 13 Annual probability of death by age, sex and AD dementia state

Age Group (Years)	MALES				FEMALES			
	MCI due to AD	MILD AD Dem	MOD AD Dem	SEV AD Dem	MCI due to AD	MILD AD Dem	MOD AD Dem	SEV AD Dem
50-54	0.0034	0.0034	0.0272	0.0340	0.0020	0.0020	0.0160	0.0200
55-59	0.0052	0.0052	0.0312	0.0520	0.0031	0.0031	0.0186	0.0310
60-64	0.0081	0.0081	0.0243	0.0648	0.0046	0.0046	0.0138	0.0368
65-69	0.0117	0.0117	0.0234	0.0936	0.0069	0.0069	0.0138	0.0552
70-74	0.0182	0.0182	0.0364	0.1092	0.0118	0.0118	0.0236	0.0708
75-79	0.0314	0.0314	0.0628	0.1884	0.0207	0.0207	0.0414	0.1242
80-84	0.0576	0.0576	0.1152	0.2304	0.0399	0.0399	0.0798	0.1596
85-89	0.1080	0.1080	0.1620	0.2160	0.0812	0.0812	0.1218	0.1624
90+	0.2068	0.2068	0.2585	0.3102	0.1901	0.1901	0.2376	0.2852

6. Extracted from ABS.Stat Deaths, Year of registration, Age at death, Age-specific death rates, Sex, States, Territories and Australia

4.14 ANNUAL TRANSITION PROBABILITIES

The annual age-specific transition probabilities between disease states and to death used in the modelling to project disease prevalence under usual care (the base case simulation) for males are given in Table 14 and for females in Table 15. The disease progression rates are generally consistent between the sexes, differences largely reflecting the variation in mortality rates. In very broad terms, it is thought that annually around 10-15% of patients with MCI convert to AD dementia (Roberts and Knopman, 2013; Langa and Levine, 2014; Knopman and Petersen, 2014; Varatharajah et al., 2018; Bradfield and Ames 2020). As Langa et al. (2014) comment patients with MCI are at greater risk of developing dementia compared with the general population but there is currently substantial variation in risk estimates, from <5% to 20% annual conversion rates, depending on the population studied. Lacour et al. (2017) similarly emphasize the heterogeneity in the MCI group of patients studied and the wide variation in the annual progression to AD dementia that is reported.

For example, using the IWG criteria, for patients with the prodromal form of AD i.e. with evidence of AD pathology on the basis of biomarkers, the annual transition rate has been reported to be 26.9% and with the NIA-AA definition in MCI subjects positive for AD biomarkers 25.7% (Vos et al., 2015; Anderson et al., 2018). In their Swedish model, Sköldunger et al. (2013) assumed in their base case an annual conversion rate from MCI-AD to AD-dementia of 10.24%. Their base case, however, related to a broad definition of the MCI-AD population and the conversion risk was increased to 25% for patients with biomarkers indicating an ongoing AD dementia process. Ward et al. (2013) undertook a systematic review of the literature and found annual rates of conversion in patients progressing from aMCI to Alzheimer's dementia ranged from 5.9 to 18.8% for studies recruiting patients from clinics but only 5.6 to 8.5% for community-based recruitment. In their study of patients with aMCI, Lee et al. (2014) found 19.6% transitioned to probable dementia over the course of a year.

The transition probability matrices in Tables 14 and 15 are in keeping with progression rates between dementia severity states reported in other studies (e.g. Anderson et al., 2018; Davis et al., 2018; Green et al.,2018; Standfield et al., 2018). However, it is important to take the age of patients into account as incidence, mortality and disease progression rates vary by age. As with other studies, the transition probabilities indicate that the majority of patients are most likely to stay in the same health state year to year, and that progressing patients are most likely to transition one stage. In summary, 16.2% of males with MCI due to AD will progress in the modelling to mild or moderate AD dementia over a 1-year cycle and 21.9% from mild AD dementia to moderate or severe disease. These crude progression rates are slightly lower for females, with 12.2% of females with MCI due to AD progressing to mild or moderate AD dementia over 12 months and 18.8% from mild AD dementia to moderate or severe AD dementia.

In Tables 14 and 15, the 'normal' state reflects the pool of individuals from which new cases will be diagnosed with MCI due to AD or AD dementia. This state is labelled as 'normal' as the vast majority of individuals in this state will have normal cognitive functioning, but it also includes people with undiagnosed MCI or dementia due to AD who may be screened and diagnosed during the course of the year. The number of persons in each age-sex normal state is the number of people in the general population in each age-sex cohort in year t minus the number of people previously confirmed with MCI due to AD, mild, moderate and severe AD or other forms of MCI or dementia (these latter cases take into account that around 25% of diagnosed cases with MCI or dementia will have a pathology other than AD) in year t. The probabilities of transitioning from normal to MCI due to AD or AD dementia are the annual incidence rates.

It is assumed that there are no incidence cases with severe AD dementia i.e. people do not transition from 'normal' to severe AD dementia within an annual cycle. Also, persons with MCI due to AD can progress to mild or moderate AD dementia within a year but not convert to severe AD dementia.

The transition probabilities were derived through an iterative process. The starting disease progression values reflected the findings in the literature on transition rates. These were then iteratively modified so that the annual prevalence estimates for each age-sex-AD severity state cohort generated through the transition probabilities and ageing (discussed below) replicated as close as possible matched estimates produced using the age-sex specific prevalence rates and ABS age-sex population projections. The first simulation cycle transitioned the 2021 prevalent MCI due to AD and AD dementia populations to 2022. This step was repeated another 19 times until prevalent estimates were produced for 2041.

The transition probabilities used to model the impact of the DMT intervention on the prevalence of MCI due to AD and mild, moderate and severe AD dementia and costs are provided in Appendix A.

Table 14 Annual age-specific transition probabilities, males, usual care (base case) simulation

		Time t+1					
Time t	**50-54 years**	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.996599	0.000001	0.0000	0.0000	0.0000	0.0034
	MCI due to AD	0.0000	0.9856	0.0100	0.0010	0.0000	0.0034
	Mild AD Dem	0.0000	0.0000	0.9636	0.0320	0.0010	0.0034
	Mod AD Dem	0.0000	0.0000	0.0000	0.9538	0.0190	0.0272
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9660	0.0340
	55-59 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.994694	0.000096	0.0000097	0.0000	0.00000	0.0052
	MCI due to AD	0.0000	0.8798	0.0850	0.0300	0.0000	0.0052
	Mild AD Dem	0.0000	0.0000	0.8088	0.1660	0.0200	0.0052
	Mod AD Dem	0.0000	0.0000	0.0000	0.8498	0.1190	0.0312
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9480	0.0520
	60-64 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.991050	0.000740	0.00011	0.0000	0.0000	0.0081
	MCI due to AD	0.0000	0.8489	0.1000	0.0430	0.0000	0.0081
	Mild AD Dem	0.0000	0.0000	0.7499	0.2000	0.0420	0.0081
	Mod AD Dem	0.0000	0.0000	0.0000	0.8287	0.1470	0.0243
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9352	0.0648
	65-69 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.985880	0.000410	0.00151	0.00050	0.0000	0.0117
	MCI due to AD	0.0000	0.8653	0.0900	0.0330	0.0000	0.0117
	Mild AD Dem	0.0000	0.0000	0.7553	0.2000	0.0330	0.0117
	Mod AD Dem	0.0000	0.0000	0.0000	0.8016	0.1750	0.0234
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9064	0.0936
	70-74 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.978790	0.000430	0.0021	0.00048	0.0000	0.0182
	MCI due to AD	0.0000	0.8278	0.1240	0.0300	0.0000	0.0182
	Mild AD Dem	0.0000	0.0000	0.8018	0.1600	0.0200	0.0182
	Mod AD Dem	0.0000	0.0000	0.0000	0.8376	0.1260	0.0364
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8908	0.1092
	75-79 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.962850	0.000650	0.0044	0.0007	0.0000	0.0314
	MCI due to AD	0.0000	0.7436	0.1850	0.0400	0.0000	0.0314
	Mild AD Dem	0.0000	0.0000	0.7386	0.2000	0.0300	0.0314
	Mod AD Dem	0.0000	0.0000	0.0000	0.7832	0.1540	0.0628
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8116	0.1884

Table 14 Annual age-specific transition probabilities, males, usual care (base case) simulation

		Time t+1					
Time t	**80-84 years**	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.933050	0.000700	0.0076	0.00105	0.0000	0.0576
	MCI due to AD	0.0000	0.7124	0.1900	0.0400	0.0000	0.0576
	Mild AD Dem	0.0000	0.0000	0.6924	0.2200	0.0300	0.0576
	Mod AD Dem	0.0000	0.0000	0.0000	0.7248	0.1600	0.1152
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.7696	0.2304
	85-89 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.879640	0.000560	0.0101	0.0017	0.0000	0.1080
	MCI due to AD	0.0000	0.7120	0.1500	0.0300	0.0000	0.1080
	Mild AD Dem	0.0000	0.0000	0.6920	0.1850	0.0150	0.1080
	Mod AD Dem	0.0000	0.0000	0.0000	0.7130	0.1250	0.1620
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.7840	0.2160
	90+ years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.769660	0.000840	0.0203	0.0024	0.0000	0.2068
	MCI due to AD	0.0000	0.5432	0.2000	0.0500	0.0000	0.2068
	Mild AD Dem	0.0000	0.0000	0.5772	0.2000	0.0160	0.2068
	Mod AD Dem	0.0000	0.0000	0.0000	0.6165	0.1250	0.2585
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.6898	0.3102

Table 15 Annual age-specific transition probabilities, females, usual care (base case) simulation

		Time t+1					
Time t	**50-54 years**	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.9979998	0.0000002	0.0000	0.0000	0.0000	0.0020
	MCI due to AD	0.0000	0.9910	0.0060	0.0010	0.0000	0.0020
	Mild AD Dem	0.0000	0.0000	0.9760	0.0210	0.0010	0.0020
	Mod AD Dem	0.0000	0.0000	0.0000	0.9668	0.0172	0.0160
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9800	0.0200
	55-59 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.996846	0.000047	0.000007	0.0000	0.0000	0.0031
	MCI due to AD	0.0000	0.8869	0.0800	0.0300	0.0000	0.0031
	Mild AD Dem	0.0000	0.0000	0.8069	0.1700	0.0200	0.0031
	Mod AD Dem	0.0000	0.0000	0.0000	0.8614	0.1200	0.0186
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9690	0.0310
	60-64 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.994420	0.000820	0.000160	0.0000	0.0000	0.0046
	MCI due to AD	0.0000	0.8554	0.1000	0.0400	0.0000	0.0046
	Mild AD Dem	0.0000	0.0000	0.7354	0.2200	0.0400	0.0046
	Mod AD Dem	0.0000	0.0000	0.0000	0.8362	0.1500	0.0138
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9632	0.0368

Table 15 Annual age-specific transition probabilities, females, usual care (base case) simulation

		Time t+1					
	65-69 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.989490	0.000210	0.0027	0.0007	0.0000	0.0069
	MCI due to AD	0.0000	0.9271	0.0260	0.0400	0.0000	0.0069
	Mild AD Dem	0.0000	0.0000	0.7531	0.2000	0.0400	0.0069
	Mod AD Dem	0.0000	0.0000	0.0000	0.8342	0.1520	0.0138
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9448	0.0552
Time t	**70-74 years**	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.986350	0.000070	0.0015	0.00028	0.0000	0.0118
	MCI due to AD	0.0000	0.9582	0.0200	0.0100	0.0000	0.0118
	Mild AD Dem	0.0000	0.0000	0.8852	0.1000	0.0030	0.0118
	Mod AD Dem	0.0000	0.0000	0.0000	0.8944	0.0820	0.0236
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9292	0.0708
	75-79 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.975020	0.000580	0.0033	0.0004	0.0000	0.0207
	MCI due to AD	0.0000	0.7793	0.1700	0.0300	0.0000	0.0207
	Mild AD Dem	0.0000	0.0000	0.8043	0.1650	0.0100	0.0207
	Mod AD Dem	0.0000	0.0000	0.0000	0.8336	0.1250	0.0414
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8758	0.1242
	80-84 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.952970	0.000630	0.0060	0.0005	0.0000	0.0399
	MCI due to AD	0.0000	0.7501	0.1800	0.0300	0.0000	0.0399
	Mild AD Dem	0.0000	0.0000	0.7501	0.1900	0.0200	0.0399
	Mod AD Dem	0.0000	0.0000	0.0000	0.7932	0.1270	0.0798
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8404	0.1596
	85-89 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.911950	0.000370	0.0057	0.00078	0.0000	0.0812
	MCI due to AD	0.0000	0.7938	0.1050	0.0200	0.0000	0.0812
	Mild AD Dem	0.0000	0.0000	0.7758	0.1380	0.0050	0.0812
	Mod AD Dem	0.0000	0.0000	0.0000	0.7852	0.0930	0.1218
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8376	0.1624
	90+ years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.786540	0.000960	0.0215	0.0009	0.0000	0.1901
	MCI due to AD	0.0000	0.5229	0.2630	0.0240	0.0000	0.1901
	Mild AD Dem	0.0000	0.0000	0.5699	0.2200	0.0200	0.1901
	Mod AD Dem	0.0000	0.0000	0.0000	0.6424	0.1200	0.2376
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.71485	0.28515

4.15 AGEING

Applying the disease progression rates to each age-sex-AD severity state cohort produced an interim time t+1 prevalent population. Individuals were then aged. The number of people shifting into the next age cohort was based on the proportion of the general population aged in the final year of each 5-year age-sex cohort. For example, in 2021 19.819% of Australian males aged 70-74 years were aged 74 years and 19.723% of females. Therefore, 19.819% of males and 19.723% of females aged 70-74 years in each of the dementia states (following annual AD dementia progression) were moved into the same disease state for persons aged 75-79 years. Similarly, the model's starting age cohorts (i.e. males and females aged 50-54 years) were inflated to account for the ageing of persons aged 49 years with MCI due to AD or AD dementia and entry into these two cohorts.

4.16 PERFORMANCE

For males, the transition probabilities (Table 14) and ageing of the cohort populations resulted in less than 0.5% of the estimates (a total of 9 age groups x 4 AD severity states x 20 years) being more than 5% away from the prevalence-based benchmark estimates and all estimates were within an absolute difference of 10%. For females, 3.8% of the estimates differed by more than ±5% from the prevalence-based benchmarks but again all estimates were within an absolute difference of 10%. For both males and females, the estimates that differed by more than 5% from the prevalence rate-based estimates pertained to the 50-54 years age group where the estimated number of males and females with MCI due to AD or mild, moderate or severe AD dementia are relatively small. Numerically, the estimates may have varied by only one or two cases.

Thus, the transition probabilities performed well in replicating the MCI due to AD and the three AD dementia populations derived by applying the age-sex prevalence rates to the Australian population projections. The average annual percentage difference between the dynamic modelling estimates using the transition probabilities and ageing of the model cohorts and the benchmark prevalence rate-based estimates of the numbers of persons with MCI due to AD and AD dementia are given in Table 16.

The prevalence figures generated from the transition modelling are used in the cost estimates and estimating the impact of the DMT intervention.

Table 16 Average annual percentage difference in prevalence numbers produced by the dynamic modelling compared with the benchmark prevalence rate estimates.

		50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+	Total
Male	MCI due to AD	1.7	0.8	0.9	0.2	0.2	1.0	0.5	0.6	0.6	0.3
	Mild AD Dem	1.9	0.9	1.0	1.0	0.4	0.5	0.4	0.4	0.9	0.2
	Mod AD Dem	1.1	1.2	1.0	1.0	0.9	1.6	0.7	0.6	1.5	0.5
	Severe AD Dem	3.6	1.5	1.0	1.3	0.9	1.1	1.1	0.7	1.9	0.4
Female	MCI due to AD	1.9	1.3	1.2	0.3	1.1	1.1	0.4	0.3	0.3	0.6
	Mild AD Dem	2.6	1.2	1.8	0.9	0.6	0.9	0.4	0.4	1.2	0.4
	Mod AD Dem	2.7	0.9	1.6	1.2	0.5	0.5	0.6	0.6	2.2	0.1
	Severe AD Dem	5.1	0.5	1.1	1.3	0.7	0.6	0.8	0.7	2.6	0.2

5. COST ESTIMATION METHODS AND PARAMETERS

The costs estimated in these analyses should be interpreted as the total costs for people with AD dementia, not excess costs due or attributable to AD dementia per se. In contrast, in its recent report "Dementia in Australia -2021"[7] the AIHW examines costs due to dementia, identifying the proportion of costs that can be directly attributable to dementia, including Alzheimer's disease.

> ***By definition MCI due to AD does not impact on daily activities of living or functioning, and therefore MCI due to AD is not included in the cost analyses other than in the costs of the DMT treatment.***

As Anderson et al. (2018) state there is no evidence on the costs of care for MCI. In the absence of suitable evidence Anderson et al. (2018) in their economic modelling of disease-modifying therapies in Alzheimer's disease they assumed that the costs of MCI were zero. Whilst MCI may well be associated with anxiety, for the purpose of their analysis Anderson et al. (2018) assumed that MCI did not impact on quality of life.

Unless otherwise specified, all costs are presented in Australian dollars at 2020-21 prices.

5.1 DMT TREATMENT COSTS

As stated previously the patient population eligible for the DMT are those aged 50-84 years with MCI due to AD and mild AD dementia i.e. those with MCI or mild dementia testing positive for brain amyloid. A patient would be considered eligible for biomarker testing at the point at which a specialist makes a clinical diagnosis of early-stage disease. Patients with a clinical diagnosis of MCI suspected due to AD or mild dementia suspected due to AD would be referred by specialist for Aβ biomarker testing. See Figure 4 for the clinical management pathways associated with the DMT.

The modelling approach adopted is summarised below:

- The 'initial' treatment population is assumed to be all persons in the MCI due to AD and mild AD dementia (amyloid positive) aged 50-84 years prevalent in year 1 (2021), as shown in Table 17.
- The 54,045 persons with MCI or mild dementia due to AD prevalent in the population in 2021 are assumed to commence the DMT during 2021 with 12 month treatment costs assigned to 2021.
- For year 2 (2022) and beyond, the eligible population for the DMT then becomes those persons aged 50-84 years who are newly diagnosed with aMCI or mild dementia and who have tested positive for amyloid i.e. the incident cases of MCI due to AD and mild AD dementia from the general population who are aged 50-84 years (13,701 and 14,540 persons in 2022 and 2023 respectively).
- The DMT would be delivered to eligible patients through a course of intravenous infusions, taking place in hospital outpatient clinics. The drug is administered approximately every four weeks over the course of 12 months (52 weeks) for a total of 13 infusions per patient. The expected infusion time is around 1 hour. Patients are treated for the 12 months only, after which they cease treatment.
- The modelling assumes there are no capacity constraints in people accessing biomarker testing or in the uptake of biomarker testing, All eligible patients are assumed to be treated with the DMT.

7. The online compendium is available at https://www.aihw.gov.au/reports/dementia/dementia-in-aus/contents/about

Table 17 Total number of persons aged 50-84 years treated with the DMT, 2021 – 2023.

		2021	2022	2023
Total MCI patients treated with DMT	Male	6,809	1,459	1,542
	Female	7,182	1,217	1,254
	Total	13,991	2,676	2,796
Total Mild AD patients treated with DMT	Male	18,394	5,419	5,938
	Female	21,660	5,606	5,806
	Total	40,054	11,025	11,744
Total number of patients treated with DMT	Male	25,203	6,878	7,480
	Female	28,842	6,823	7,060
	Total	**54,045**	**13,701**	**14,540**

The unit costs for AD biomarker testing, additional consultation with a dementia clinical specialist and administering the DMT infusion are given in Table 17, along with the assumptions underpinning these costs. Further description of the MBS items is provided in Appendix B.

CSF diagnostic screening for Alzheimer's disease (biomarkers Aβ 1-42/phospho-tau proteins) is currently provided by at least one National Association of Testing Authorities Australia (NATA)/ International Laboratory Accreditation Cooperation (ILAC) accredited diagnostic laboratory in Australia viz. the National Dementia Diagnostics Laboratory (NDDL). The NDDL is located at the Florey Institute of Neuroscience and Mental Health, in conjunction with the University of Melbourne. The NIDDL current diagnostic testing fees (which are Medicare non-rebated) are: $300 for AD assays (Amyloid1-42, P-tau and Total-tau), and $150 for any single protein[8].

Table 18 Unit costs for the DMT

Cost item	Description/Assumption	Unit Cost ($) July 2021
AD biomarker testing		
80% conducted with Aβ PET using PET/CT scanner.	The cost of Aβ PET is guided by MBS item 61559	$918.00
	Use of PET/CT scanner for Aβ PET based on MBS item 61505	$100.00
20% with CSF biomarker assay testing.	A CSF sample is obtained from the patient by lumbar puncture (LP) procedure conducted as a day private hospital admission. Lumbar puncture reimbursed under MBS items 21945, 39000, 23010	$201.95
	day private hospital charge for the performance of lumbar puncture (based on fees for minor medical procedures)	$550.00
	CSF assay NDDL fees for one protein (Aβ)	$150.00
Dementia clinical specialist (e.g. geriatricians, neurologists, and psychiatrists)		
follow-up visit to discuss biomarker test results and possible courses of treatment	Average of Government rebate (85%) and patient payment for consultation with a geriatricians, neurologist or psychiatrist 47% of patients bulk-billed 53% with a patient out-of-pocket payment	$85.03 $175.80
Administering the DMT		
Infusion	admitted as day surgery patient or to outpatient setting, based on private health hospital costs for chemotherapy intravenous infusion	$550
	The expected infusion time is approximately 1 hour. The cost of intravenous drug administration guided by MBS items 14245 and 13950.	$107.15
Drug	The cost of the DMT drug is not included in the modelling	-

Authorities Australia (NATA)/ International Laboratory Accreditation Cooperation (ILAC) accredited diagnostic laboratory in Australia viz. the National Dementia Diagnostics Laboratory (NDDL). The NDDL is located at the Florey Institute of Neuroscience and Mental Health, in conjunction with the University of Melbourne. The NIDDL current diagnostic testing fees (which are Medicare non-rebated) are: $300 for AD assays (Amyloid1-42, P-tau and Total-tau), and $150 for any single protein[8].

Data was accessed from a variety of sources. Medicare Benefits Schedule (MBS) costs were accessed from MBS Online which contains the MBS, a listing of the Medicare services subsidised by the Australian Government. MBS Online contains the latest MBS information and is updated as changes to the MBS occur. Pharmaceutical Benefits Schedule (PBS) and the Repatriation Pharmaceutical Benefits Scheme (RPBS) statistics are based on PBS items and ATC groups, and were also accessed online through Services Australia[9]. Further information was obtained from the Medical Costs Finder[10] which is an online tool providing information on the cost of common specialist medical services in and out of hospital in Australia. The tool's results are based on the most recent publicly available Government data about what people have paid for medical services. The Medical Cost Finder provides information on the rebate that patients receive from the Government via the Medicare Schedule Fee as well as patient out-of-pocket costs for non-bulk-billed services. The cost of follow-up visits to discuss biomarker test results and possible courses of treatment were averaged across geriatric medicine where 69% of patients paid nothing when seeing a geriatrician, attendance on a consultant physician such as a neurologist where 41% of patients had no out-of-pocket payments for their visit to a neurologist, or a psychiatrist where 30% of patients paid nothing as the psychiatrist accepted the direct Medicare payment for their fee.

The cost of the DMT drug is not included in the modelling as there is very little evidence to indicate a likely price in Australia. No DMT to prevent or delay the progression of AD dementia is currently available in Australia. Effective from 1 January 2022, the yearly cost for a maintenance dose for a patient of average weight of aducanumab (ADUHELM), the recent FDA approved DMT for AD in the US, is $US 28,200[11]. This is equivalent to around $AU 39,000 for 13 infusions per year. To be listed on the Australian PBS, a drug has to undergo rigorous cost-effectiveness evaluations with strict pricing controls by the Committees of the PBAC often leading to prices of drugs being lower in Australia than overseas.

5.2 DIRECT MEDICAL COSTS

As stated previously direct costs are divided into direct health and medical costs (e.g. hospitalisation including inpatient, outpatient and emergency services, medical services including GPs, specialists, allied health professionals, prescribed medicines, diagnostic and pathology services) and formal aged care services.

Data on the use and cost of health services used by people with AD dementia was obtained from a range of sources including:

- The AIHW's Dementia in Australia data tables, including Direct health and aged care expenditure due to dementia; Hospital care; Prescriptions dispensed for dementia-specific medications; GP, specialist and other healthcare services; Aged care services and Carers of people with dementia.
- The Pharmaceutical Benefits Scheme online item reports.
- Information on rates and duration of hospitalisation also were obtained directly from AIHW's National Hospital Morbidity Database.
- Pricing of admitted acute care, non-admitted care and emergency department presentation follows the national pricing model specification of the National Weighted Activity Units (NWAU), provided by the Independent Hospital Pricing Authority (IHPA) in the National Hospital Cost Data Collection for public and private sectors.
- The ABS 2015 and 2018 Survey of Disability, Ageing and Caring.

8. https://florey.edu.au/science-research/scientific-services-facilities/national-dementia-diagnostics-laboratory
9. https://www.servicesaustralia.gov.au/organisations/about-us/statistical-information-and-data/medicare-statistics
10. https://www.health.gov.au/resources/apps-and-tools/medical-costs-finder/medical-costs-finder#/choose-hospital-option
11. ADUHELM had an initial annual price listing of $US 56,000 per patient per year (Lin et al., 2021). Effective from 1 January 2022, the yearly cost was reduced to $US 28,200 to improve patient access to the drug. https://investors.biogen.com/news-releases/news-release-details/biogen-announces-reduced-price-aduhelmr-improve-access-patients. https://www.neurologylive.com/view/ptc-s-aadc-deficiency-gene-therapy-durable-developmental-improvements

Hospital Care

Costs were estimated for hospitalisations where AD dementia was recorded as the principal diagnosis i.e. the hospitalisations were due to dementia and where AD dementia was an associated diagnosis to a different principal diagnosis. Around 1 in 5 dementia hospitalisations have dementia as the principal diagnosis and as an additional diagnosis in 4 in 5 (AIHW, 2021). On average, there were 5–6 health conditions (other than dementia) recorded per hospitalisation in public hospitals compared with 3 conditions in private hospitals (AIHW, 2021).

The number of hospital separations may have increased, but the rate of dementia hospitalisations in the population has remained similar for Alzheimer's disease over the last decade (AIHW 2019). For 2018-19, the latest year for which data are available, 30.2% of hospitalisations due to dementia were for Alzheimer's disease (AIHW, 2021).

The majority (57%) of younger onset AD dementia hospitalisations occur among those aged 60–64 followed by those aged 55–59 (26%) with only 2% of separations occurring in those aged <50 years (2018-19 data AIHW National Hospital Morbidity Database). Of younger onset hospitalisations Alzheimer's disease accounts only for 22% of these (AIHW, 2019).

In order to capture the likely impact of the DMT on costs of hospitalisation, hospital services utilisation including number of separations and length of stay need to be known for each AD severity state. This is a major information gap as these are not widely reported (and not included in the AIHW available datasets). The approach taken to model costs of hospital care is as follows.

1. The limited information that is available indicates that the risk of hospitalisation (percentage of patients with ⩾1 inpatient admission or hospitalisation rate) is similar for people with mild, moderate or severe dementia including AD. Using data from the South London and Maudsley case register, Gungabissoon et al. (2020) found the proportion of individuals with mild, moderate and severe dementia who had a hospital admission in the first 12 months after diagnosis was 47.9%, 50.8% and 51.7%, respectively (p= 0.097). The mean number of admissions also did not differ substantially. In their systematic review, Shepherd et al. (2019) also reported moderate confidence in the finding that severity of dementia was not associated with risk of hospitalisation as three studies at low risk of bias consistently found no effect of dementia severity on hospitalisation. A cohort study of 730 people with dementia drawn from the Scottish Dementia Research Interest Register found people with more advanced dementia, based on Clinical Dementia Rating score, were not more likely to be admitted to hospital than people with milder dementia Russ et al.

2. However, Gungabissoon et al. (2020) found that while the risk of hospitalisation did not differ between the dementia severity groups, the median duration of inpatient stay (for all admissions in the 12-month period) increased with higher severity of dementia at diagnosis (p=0.0001). Duration of hospital stay increased with dementia severity from a median of 2 days in mild patients to 3 days for those with moderate severity to 4 days in severe dementia.

3. Distributions of the number of hospital separations with Alzheimer's disease as the principal diagnosis, patient days and average length of stay were constructed by age and dementia severity for 2020-21. In 2018-19 there were a total of 7,006 hospitalisations for AD in persons aged 50 years and above. Using trend data from 2009-10 to 2018-19 for the increase in hospitalisations due to dementia, this was uprated to 7,739 separations expected in 2020-21. The same age breakdown in the 2018-19 data was used for 2020-21. The age group separations were then apportioned to mild, moderate and severe dementia based on their prevalence in the population, thus giving equal risk of hospitalisation by disease severity. Only 88% of the hospitalisations for mild AD were then used to appropriately represent mild dementia due to AD (88% of cases of mild AD are assumed to be amyloid positive), giving a total of 7,342 separations.

4. It was assumed that there was no change in the ALOS for each age group reported in the 2018-19 data. Given Gungabissoon et al. (2020) findings on duration of stay, the ALOS for each age group was taken as the age specific duration of stay for people with moderate AD dementia with those with mild dementia having shorter ALOS and those with severe dementia longer ALOS. Through an iterative process a ratio of 0.774 for mild AD dementia and 1.35 for severe relative to the ALOS for moderate dementia could replicate the total number of patient days for each age group (with very small errors). The estimated age-dementia severity distributions for hospitalisations in 2020-21 with AD as the principal diagnosis are given in Table 19.

Table 19 Estimated hospitalisations where Alzheimer's disease is the principal diagnosis in 2020-21

	Number of Separations				Patient Days				Average Length of Stay			
	Mild AD Dem	Mod AD Dem	Sev AD Dem	TOTAL	Mild AD Dem	Mod AD Dem	Sev AD Dem	TOTAL	Mild AD Dem	Mod AD Dem	Sev AD Dem	TOTAL
50-54 yrs	21	19	13	53	156	183	169	510	7.45	9.63	13.00	9.63
55-59 yrs	36	32	24	92	390	448	453	1,287	10.83	13.99	18.89	13.99
60-64 yrs	79	70	51	200	1,364	1,561	1,536	4,460	17.26	22.30	30.11	22.30
65-69 yrs	157	138	101	396	1,853	2,103	2,078	6,036	11.80	15.24	20.57	15.24
70-74 yrs	359	315	232	906	4,114	4662	4,635	13,408	11.46	14.80	19.98	14.80
75-79 yrs	591	519	382	1,492	6,513	7,391	7,342	21,245	11.02	14.24	19.22	14.24
80-84 yrs	662	581	427	1,670	7,057	8,000	7,938	22,991	10.66	13.77	18.59	13.77
85+ yrs	1,004	881	648	2,533	9,327	10,572	10,498	30,402	9.29	12.00	16.20	12.00
Total	**2,909**	**2,555**	**1,878**	**7,342**	**30,774**	**34,920**	**34,649**	**100,339**	**10.58**	**13.67**	**18.45**	**13.67**

Table 20 Cost weights derived from ratio of age-AD severity ALOS to overall ALOS

	50 - 54	55 - 59	60 - 64	65 - 69	70 - 74	75 - 79	80 - 84	85 - 89	90+
Mild AD Dem	0.545	0.792	1.263	0.863	0.839	0.806	0.780	0.680	0.680
Mod AD Dem	0.705	1.024	1.632	1.115	1.083	1.042	1.008	0.878	0.878
Sev AD Dem	0.951	1.382	2.203	1.505	1.462	1.406	1.360	1.185	1.185

5. Age specific admission rates were calculated using the data in Table 19, noting that these were the same across dementia severity.

6. The average cost per hospitalisation with AD as the principal diagnosis in 2020-21 was estimated to $12,193.91. This assumed the weighted average cost per day for hospitalisations with dementia as the principal diagnosis in public and private hospitals also applied to those for AD. The average cost per hospitalisation in 2018-19 was used for 2020-21. Although the 2018-19 average cost was slightly higher than that for 2017-18, there has been a trend for decreasing average cost of hospitalisation due to dementia.

7. It is assumed that the cost of hospitalisation reflects length of stay. The average length of stay for all admissions due to AD was 13.7 days. The ratios of the ALOS for each age-AD severity group to the overall ALOS of 13.7 days were used as cost weights to calculate the average cost of a hospital separation for each age-AD severity group. See Table 20.

8. In the absence of data on the hospitalisations with principal diagnoses where dementia was an additional diagnosis, public hospital outpatient clinic attendance, and public hospital emergency department care by dementia severity, annual costs of these services were calculated as a percentage of the costs estimated for hospitalisations with AD as the principal diagnosis. These ratios were based on the total expenditures for these services relative to the expenditure for hospitalisations due to AD. Using the expenditure data in AIHW's Dementia in Australia, Direct health and aged care expenditure due to dementia—data tables, a ratio of 3.6 was derived for hospitalisations with AD as an additional diagnosis.

For public hospital outpatient clinic attendance and public hospital emergency department care, expenditure data were available by age group with the average cost per service being uprated to 2020-21 based on recent changes reported in the National Hospital Cost Data Collection. The expenditure ratios are given in Table 21. These ratios assume that 75% of the total expenditure on public hospital outpatient clinics for dementia is attributable to AD dementia (reflecting dementia prevalence) and 30% of public hospital emergency department care reflecting admitted hospitalisations due to AD dementia.

Table 21 Ratio of expenditure to that on hospitalisations with AD as the principal diagnosis, 2020-21

Age (years)	Public hospital outpatient clinics	Public hospital emergency department care
<65	0.173	0.020
65–74	0.893	0.026
75–84	1.388	0.027
85+	2.606	0.039

It is important to note that our approach to calculating expenditure differs to that adopted by the AIHW (2021). In the expenditure for public hospital admitted patient care, the AIHW only includes dementia-specific costs of hospital separations where dementia was a principal or additional diagnosis. It does not include expenditure for the management of conditions other than dementia in estimates for that episode of care. For hospitalisations with a principal diagnosis of dementia, the AIHW estimates represent around 40% of the total cost of hospital care. Total costs are captured in this modelling since the DMT intervention is likely to have an impact on costs broader than those directly attributable to AD dementia.

Alzheimer's Disease Medications

The introduction of the DMT is assumed not to impact on the behaviour of GPs and specialists in prescribing medications used in the management of AD dementia. The volume of scripts and costs will, however, change as the disease severity profile of the AD dementia population changes after the introduction of the DMT in slowing disease progression.

The Australian Government subsidises through the Pharmaceutical Benefits Scheme (PBS) and the Repatriation Pharmaceutical Benefits Scheme (RPBS) four dementia-specific medicines for the treatment of Alzheimer's disease: the acetyl choline esterase inhibitor (AChEI) drugs of donepezil, galantamine and rivastigmine; and memantine which belongs to the N-methyl-D-aspartate (NMDA) receptor antagonist group of medicines. These medications can be prescribed to patients with a confirmed diagnosis of AD made by (or in consultation with) a specialist or consultant physician under specific clinical criteria (AIHW, 2021). To continue use of these medications, patients must demonstrate a clinically meaningful response to the treatment. This may include improvements in the patients' quality of life, cognitive function and/ or behavioural symptoms (AIHW, 2019a and 2021). Donepezil, galantamine and rivastigmine are approved in Australia for the treatment of mild to moderate Alzheimer's disease while memantine is approved for the treatment of moderately severe to severe AD (AIHW, 2019a and 2021).

The approach was to derive an average number of scripts dispensed per person annually in each age-AD dementia severity group to project script volumes and costs over the simulation period under the usual care and DMT intervention scenarios. Data on script numbers (services) and benefits paid by patient category (general or concessional by ordinary or safety net) were downloaded from Medicare Australia's PBS online statistics. The PBS item numbers for the four drugs are given in Appendix C. The number of scripts, expenditure and average price per script in 2020–21 for these four dementia-specific medications are given in Table 22. As shown in Table 22, the unit costs used in the modelling were: $22.14 per script for donepezil; $38.84 galantamine; $83.10 rivastigmine; and $42.28 memantine. The unit costs include both the Government subsidy and out-of-pocket payments (co-payments) made by patients.

The distribution of scripts by age group in 2019-20[12] was used to apportion the total number of scripts for each medication in 2020-21 by age. The number of donepezil, galantamine and rivastigmine scripts in each age group were then divided equally between mild and moderate AD dementia, and the memantine scripts between moderate and severe. Dividing these script volumes by the age-disease severity prevalent population produced

12. Source: Dementia in Australia, Prescriptions dispensed for dementia-specific medications—data tables

an average number of scripts per person per year. These rates are given in Table 23. The approach of averaging the cost of these medications across the entire prevalent AD dementia population is the same as that taken by Standfield et al. 2019.

There is also a range of other medications prescribed by GPs and specialists for the management of AD dementia symptoms, especially behavioural and psychological symptoms (AIHW 2012 and 2019a). These include for example antithrombotic agents, antipsychotics, opioids, anxiolytics and anti-depressants. There is no data on how these medications are prescribed by AD dementia severity. Therefore, the cost of these medications was tied to the expenditure on the four specific AD dementia medicines. It is assumed that 75% of the total expenditure on all other medications prescribed to manage dementia is attributable to patients with AD dementia. In 2019-20 the total cost of all other medications expected to be prescribed to manage AD dementia was equivalent to 15.1% of the total combined expenditure on donepezil, galantamine, rivastigmine and memantine. This ratio is applied across the simulation time horizon.

Table 22 Script numbers, expenditure and average price per script for dementia-specific medications in 2020–21

	Scripts	Expenditure ($)			Average cost per script ($)		
		Out-of-pocket	Government subsidised	Total	Out-of-pocket	Government subsidised	Total
donepezil	366,254	1,801,334	6,307,530	8,108,864	4.92	17.22	22.14
galantamine	64,530	356,957	2,149,314	2,506,271	5.53	33.31	38.84
rivastigmine	75,875	653,029	5,652,204	6,305,233	8.61	74.49	83.10
memantine	69,233	613,523	2,313,867	2,927,390	8.86	33.42	42.28
Total	575,892	3,424,843	16,422,915	19,847,758	5.95	28.52	34.46

Table 23 Average dementia-specific medication scripts per person per year

	Scripts	Expenditure ($)			Average cost per script ($)			
	Mild AD	Mod AD	Mild AD	Mod AD	Mild AD	Mod AD	Mod AD	Sev AD
50–64	4.0	4.5	0.5	0.6	0.9	1.0	1.0	1.4
65–69	1.3	1.5	0.2	0.2	0.3	0.3	0.2	0.3
70–74	2.1	2.3	0.3	0.4	0.5	0.5	0.4	0.5
75–79	3.2	3.6	0.5	0.6	0.7	0.8	0.6	0.8
80–84	4.1	4.6	0.7	0.8	0.8	0.9	0.8	1.1
85+	3.2	3.6	0.6	0.7	0.6	0.7	0.8	1.0
Total	**3.0**	**3.4**	**0.5**	**0.6**	**0.6**	**0.7**	**0.6**	**0.9**

Out of Hospital Diagnostic Imaging and Pathology Services

The use of diagnostic imaging and pathology services by AD dementia severity is also not known. Therefore, the expected cost of these services was estimated as a ratio of the combined expenditure on outpatient hospital care and GP, medical specialist and allied health consultations. Over the simulation period the cost of diagnostic imaging services is assumed to be 8.6% of the expenditure on outpatient hospital care and GP, medical specialist and allied health professional services and pathology services 2.5%. These ratios reflect the health services expenditure patterns for dementia reported by the AIHW (2021).

General Practice, Specialist and Allied Health Services

It was assumed that 75% of the 2018-19 expenditure reported by the AIHW for out of hospital General Practice, Specialist and Allied Health Services for dementia was attributable to AD dementia patients. This expenditure was then uprated to 2020-21 using the average rise in MBS Schedule fees for professional attendances from June 2019 to June 2021. Again, the approach was to benchmark the 2020-21 expenditure on General Practice, Specialist and Allied Health Services to other direct costs and use the ratio to project costs in future years and under both scenarios. In this case the benchmark was the combined total expenditure in 2020-21 on prescribed dementia specific medicines and other medicines used in the management of AD and public hospital outpatient clinics, both of which would be reflective of the underlying activity of GPs, medical specialists and allied health professionals. The ratio of expenditures was 0.244.

5.3 DIRECT COSTS OF CARING

The cost of care provided to persons with AD dementia consists of the direct costs of providing formal care in the community and the cost of residential (institutional) care, and the indirect costs associated with the provision of informal care. There are three steps to estimating the cost of caring. The first step is to breakdown the AD dementia population into those living in the community and those in residential aged care and by dementia severity i.e. persons with mild, moderate and severe AD dementia. The second step is then to estimate of the extent of informal care, the use formal care services in the community, and the likelihood of being in residential aged care. The final step is to identify the average unit costs of informal care, formal home care and residential care and apply these to the overall use of these services and support.

Community-based Formal Aged Care

In terms of formal aged care provided in the community, the Australian Government funds two main aged care programs:

- home care provided through the Home Care Packages Program (HCPP) which helps people with complex care needs to live independently in their own homes. There are four levels of care ranging from low level care needs (Home Care Package Level 1) to high care needs (Home Care Package Level 4). Services provided under these packages might include clinical care such as nursing, allied health and physiotherapy support services such as cleaning and help around the home, visiting the doctor and attending social activities; personal care such as help with showering, dressing and moving around the home; and nutritional care such as assistance with preparing meals, including special diets for health, assistance with using eating utensils and assistance with feeding. In 2019-20, 171,797 older Australians accessed Home Care Packages, equivalent to around 40.4 older clients per 1,000 older people[13] (AIHW, 2020; Productivity Commission, 2021). As at 31 March 2021 167,124 people were recipients of Home Care Packages, 10.5% of whom received a Level 1 package, 40.4% level 2, 24.7% level 3 and 24.4% level 4 (Department of Health, 2021); and
- home support which is provided through the **Commonwealth Home Support Programme (CHSP)** (formerly Home and Community Care (HACC)). CHSP helps older people to access entry-level support services to remain living independently and safely at home and in their community. Services include a wide range of support including nursing, allied health and therapy services; assistance with care and housing; respite care, domestic assistance; goods, equipment and assistive technology; home maintenance; home modifications; meals and other food services; personal care; social support; specialised support services; and transport. In

13. The older person population (the aged care target population) is defined as all people aged 65 years or over and Aboriginal and Torres Strait Islander people aged 50–64 years.

2019-20, there were 829,193 older CHSP clients nationally, equivalent to around 195.2 older clients per 1,000 older persons (AIHW, 2020; Productivity Commission, 2021).

A summary of the cost of these home care packages and home support services is given in Appendix D. Providers of home care packages are able to access a dementia and cognition funding supplement from the Australian Government to provide services for people with moderate to severe cognitive impairment. A diagnosis of dementia alone is not sufficient to access this supplement. A person diagnosed with dementia may not be moderately or severely cognitively impaired. Care recipients with lower levels of cognitive impairment are not eligible for the supplement[14]. The rate of payment for this dementia care supplement is currently set at 11.5% of the Home Care Government subsidy rates.

However, aged care service use data appears to underestimate the number of people with dementia accessing these aged care services (AIHW, 2020). The AIHW reports that at 30 June 2019, providers of home care only received the dementia and cognition supplement for 9% of clients. This means only around 9,700 individuals were receiving home care packages specifically because they had moderate to severe levels of cognitive impairment associated with dementia (i.e. they were receiving the dementia supplement)[15]. It is difficult to identify how many persons with dementia - let alone dementia due to Alzheimer's disease - are actually receiving home care packages or home support, the level and hours of care being provided, and the associated costs of care. In 2019-20, the AIHW report that 18,265 persons with dementia completed a comprehensive aged care assessment and were approved for a home care package (AIHW, 2021). The AIHW estimated that the expenditure on the home care package program and the Commonwealth Home Support Programme in 2018-19 directly attributable to dementia was $397.3 million and $175.6 million respectively.

In this modelling an alternative approach to estimating the cost of formal community-based care provided to people with AD dementia is adopted. The cost of this care principally involves the cost of human resources i.e. the cost of paid care and support workers providing home care and support services to persons with AD dementia living in the community (as opposed to the cost of home modifications, equipment or aids for example). The cost of this care is calculated as the full-time equivalent number of paid care workers multiplied by their average annual wage plus salary on-costs and organisational overheads.

Residential Aged Care

At 30 June 2020, 53% of persons in residential aged care had dementia (AIHW, 2020). It is recommended that both user paid fees and the Aged Care Funding Instrument (ACFI) based Government subsidy are used to estimate residential care costs in Australia (Department of Health, 2016; Gnanamanickam et al., 2018). The usual practice of taking the 85% of the Australian single person age pension that is charged to all users of residential care in Australia as the user fee component of residential care costs is followed in these estimations (Brown et al., 2017; Gnanamanickam et al., 2018).

Government funding to RACFs reflects the levels of funding received by the care providers based on the ACFI. The ACFI considers core individual care needs in the domains of activities of daily living, cognition and behaviour, and complex health care. Persons with dementia living in residential care typically have high care needs. For example, at 30 June 2020, 67% of residents with dementia had high care needs with respect to activities of daily living compared with 54% of residents without dementia and 80% for cognition and behaviour compared with 46%. The proportion of residents with and without dementia who have high complex health care needs is similar at 52% and 55% respectively[16]. The Government subsidy to RACFs for places occupied by residents with dementia based on the ACFI therefore is expected to be on average higher than that for residents without dementia. Gnanamanickam et al. (2018) estimated that the annual per person cost of residential care in Australia in 2016 was 12% higher for residents with dementia compared to residents without dementia.

Parameters for Estimating the Cost of Care: Prevalence of Persons with AD Dementia by Residency, Dementia Severity and Sex

The aim is to estimate the proportion of people with AD dementia living in the community or residential care by disease severity and sex. If the distribution of persons with AD dementia living in RACFs by disease severity and sex can be identified then persons living in the

14. https://www.health.gov.au/health-topics/aged-care/providing-aged-care-services/funding-for-aged-care-serviceproviders/dementia-and-cognition-supplement-for-home-care
15. Dementia in Australia, Aged care services—data tables
16. https://www.gen-agedcaredata.gov.au/Topics/Care-needs-in-aged-care#Residential%20care%20needs%20by%20dementia%20status

community can be estimated by simply subtracting those in residential care from the total numbers.

The number of persons with dementia in permanent residential aged care is rising. Based on trend data from the AIHW over the past 8 years, we estimate there will be 98,817 persons with dementia living in RACFs at 30 June 2021. Assuming AD is the suspected cause of dementia in 75% of these individuals then some 74,113 persons will have dementia suspected to be due to AD. The ratio of male to female residents with dementia is in keeping with the overall gender ratio of persons living in RACFs, with females outnumbering males two to one.

The AIHW estimated the prevalence of people with dementia, by residency, severity and sex (AIHW, 2012). The distribution for people living in cared accommodation, predominantly RACFs, is given in Table 24. These percentages can be applied to the estimated total number of male and female residents with dementia suspected to be due to AD to give counts of residents by dementia severity (Table 25).

Table 24 Proportion of males and females with dementia in cared accommodation by disease severity

Severity	Males (%)	Females (%)	Persons (%)
Mild	7.0	5.8	6.1
Moderate	61.9	62.8	62.6
Severe	31.1	31.4	31.3

Source: AIHW (2012)

Table 25 Estimated number of persons with dementia suspected due to AD in residential care by severity and sex, 30 June 2021

Severity	Males	Females	Persons
Mild	1,738	2,859	4,597
Moderate	15,368	30,951	46,319
Severe	7,721	15,476	23,197
Total	24,827	49,286	74,113

The modelling population is persons with AD dementia who had been clinically diagnosed and AD pathology then confirmed through biomarker testing. Many of the persons with dementia in residential care are diagnosed with dementia through the aged care assessment program (ACAP) that determined these older persons were eligible for government-subsidised residential aged care. The model parameters in Table 10 show that only 36% of patients with mild dementia suspected to be due to AD are assumed to access biomarker testing and 88% of these persons then test positive for Aβ i.e. 31.68% of persons with mild dementia suspected to be due to AD. The proportion of patients with moderate AD dementia was assumed to be 51% of the moderate dementia suspected to be due to AD population and those with severe AD dementia 75%. Applying these percentages to the numbers in Table 25, give a final estimate of the number of persons with AD dementia expected to be in residential care by disease severity and sex, at 30 June 2021. These numbers are given in Table 26.

The results of the simulation modelling provide the total prevalent numbers by AD dementia and sex in 2021, as given in Table 26. The numbers of persons with AD dementia living in the community are the difference between the total and the number in residential care.

In the final step, the data in Table 26 can be used to determine the likelihood that males and females with AD dementia live in the community or in residential care by the severity of their dementia. The results are given in Table 27.

Table 26 Estimated number of persons with AD dementia by residential setting, disease severity and sex, 30 June 2021

Severity AD Dementia	In Residential Care			In the Community			Total		
	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons
Mild	551	906	1,457	26,325	33,194	59,519	26,876	34,100	60,976
Moderate	7,838	15,785	23,623	15,763	14,157	29,920	23,601	29,942	53,543
Severe	5,791	11,607	17,398	11,561	10,410	21,971	17,352	22,017	39,369
Total	14,180	28,298	42,478	53,649	57,761	111,410	67,829	86,059	153,888

Table 27 Probability of persons with AD dementia living in permanent residential care or in the community

Severity AD Dementia	In Residential Care			In the Community		
	Males (%)	Females (%)	Persons (%)	Males (%)	Females (%)	Persons (%)
Mild	2.1	2.7	2.4	97.9	97.3	97.6
Moderate	33.2	52.7	44.1	66.8	47.3	55.9
Severe	33.4	52.7	44.2	66.6	47.3	55.8
Total	20.9	32.9	27.6	79.1	67.1	72.4

Overall, men with AD dementia were more likely to live in the community than women (79.1% and 67.1% respectively). These results are similar to those reported by the AIHW (2012) and by Brown et al. (2017) in the earlier 'Cost of Dementia in Australia 2016-2056' report. While two of every three males with moderate or severe AD dementia are expected to live in community, fewer than one in every two females are expected to.

Use of Formal Care in the Community

The steps taken to estimate the direct costs of formal care provided in the community are summarised below:

- Estimate the proportion of persons with mild, moderate or severe AD dementia living in the community who receive assistance from formal providers;
- Estimate the average number of hours of care received by each person from formal carers;
- Equate hours of care to the full-time equivalent of a paid carer;
- Estimate the average annual wages and salary of a paid carer plus salary on-costs and organisational overheads;
- Calculate costs for all persons with AD dementia receiving care from formal providers under the usual care and the DMT intervention scenarios.

In terms of formal carers providing assistance at home to persons with AD dementia, it is assumed that persons with mild AD dementia are represented in the SDACs by persons with dementia and who have a mild or moderate level of disability, and moderate or severe AD dementia by the more severe levels of disability. Therefore, 50.5% of persons with mild AD dementia living in the community are assumed to receive care in the home from one or more formal providers, and 63.3% of those with moderate or severe AD dementia (Table 31).

It is difficult to estimate from the SDAC data the number of hours of care provided per week by formal carers to persons with dementia living in the community. However, as a guide the Council on the Ageing (COTA) Australia indicates that under the home care package program, an older person could expect to receive approximately 2 hours of care per week (on average) from a level 1 package, 3-4 hours per week for level 2, 7-9 hours per week for level 3 and 10-13 hours per week for level 4[17]. Of the current recipients of home care packages, 10.5% were in a level 1 package, 40.4% level 2, 24.7% level 3 and 24.4% level 4[18] (AIHW, 2021). The CHSP also supports older people to stay at home by providing assistance with everyday tasks that require low-level support. The CHSP aims to give a small amount of help to a large number of people[19].

It is assumed that persons with mild AD dementia who receive formal assistance, receive 3 hours of care per week on average (equivalent to HCP levels 1-2 basic or low level care needs), those with moderate AD dementia 8 hours (level 3 intermediate care needs) and severe AD dementia 12 hours (level 4 high level care needs). These hours of care equate to 0.08 FTE formal paid carer providing care to a person with mild AD dementia, 0.21 FTE for those with moderate AD dementia and 0.32 FTE for those with severe disease.

17. https://www.cota.org.au/information/aged-care-for-consumers/home-care-today-consumers/frequently-asked-questions/faqs-home-care-package-services/
18. As at 31 March 2021 https://gen-agedcaredata.gov.au/www_aihwgen/media/Home_care_report/Home-Care-Data-Report-3rd-Qtr-2020-21.pdf
19. https://www.health.gov.au/initiatives-and-programs/commonwealth-home-support-programme-chsp/about-the-commonwealth-home-support-programme-chsp

Parameters for Estimating the Cost of Care: Unit Costs

The calculations of both the direct and indirect costs of care are based on the unit costs given in Table 29.

The annual replacement value of informal care is calculated as the number of FTE paid care workers multiplied by the estimated average annual wage or salary of care workers in the formal sector. The types of jobs most closely related to informal caring are aged carers and aged care workers including personal carers, personal care workers, personal care assistants, home care workers, home care support workers, nursing support workers, and welfare support workers[20]. Based on the current job market and award rates of pay, the annual gross wages and salary of a formal carer to replace an informal carer was estimated to be $62,400.

There are, however, substantial on-costs associated with employing paid carers. Westpac in its cost of an employee calculator[21] identifies statutory on-costs of superannuation guarantee, workers compensation insurance, payroll tax, annual leave loadings and long service leave provision. For a full or part-time worker these amount to 35% of salary. The majority of aged care workers in home care services are permanent part-time employees. Data from the 2017-18 ABS Survey of Income and Housing shows that 30% of personal care assistants, nursing support workers, and aged or disabled carers were employed full-time. In contrast, the 2016 National Aged Care Workforce Census and Survey (Department of Health, 2017) reports only 11% of aged carer workers in the community were permanent full-time and 14% of workers in home care were employed on a casual or contract basis. The 2018 ABS Employee Earnings and Hours Survey suggests upwards of 33% (of aged and disabled carers and nursing support and personal care workers) are casual employees. The salary on-costs for casual workers are less (around 16.3%) than those for permanent full or part-time employees as casual workers do not get sick leave, holiday pay or long service leave. However, under the Social, Community, Home Care and Disability Services Industry Award [MA000100] casual workers receive a 25% salary loading which offsets the lower on-costs. Therefore the 35% salary on-costs rate is applied to all paid aged care workers simulated in the modelling.

There are also organisational overheads such as training, uniforms and clothing, meal allowances and other amenities, transport, administrative costs that may be incurred by an organisation in employing additional care workers. The rate of 20% used by Diminic et al. (2016) in estimating the cost of informal mental health caring in Australia is also used here.

The offsets to the replacement value of the cost of informal care include the three Government benefits of the Carer Payment, Carer Allowance and Carer Supplement. There are different rates of the Carer Payment for single and partnered people[22]. The 2018 SDAC indicates that around 70% of primary carers of persons with dementia and who are receiving the Carer Payment are partnered and 30% are single. Although these estimates have a large standard error, they will be adopted in the modelling of carer benefits paid by the Government. The carer supplement is attached to each type of payment and is paid on top of the Carer Payment or Carer Allowance to those receiving these two benefits. The supplement is paid in July each year.

The salary costs used in estimating the replacement value of informal care are also used to calculate the cost of formal care provided in the community.

In terms of residential care, as stated earlier the Government subsidy is based on the ACFI. The average Australian Government subsidy per resident in permanent aged care in 2019-20 in Western Australia is used as a starting point to calculate the 2021 unit cost for Australia's aged care residents with AD dementia. This is because the care need ratings of people in permanent residential care in WA closely match those of all aged care residents with dementia, as shown in Table 1.7. The average Australian Government ACFI subsidy per aged care resident in 2019-20 in WA was $71,424, as reported by the Productivity Commission in Section 14 Aged care services of the Report on Government Services 2021[23].

20. These include occupations in the 4117, 4231 and 4233 codes in the Australian and New Zealand Standard Classification of Occupations (ANZSCO).
21. https://www.westpac.com.au/content/dam/public/wbc/documents/excel/business/Cost-of-an-employee-calculator.xlsx
22. https://www.servicesaustralia.gov.au/individuals/services/centrelink/carer-payment
23. https://www.pc.gov.au/research/ongoing/report-on-government-services/2021/community-services/aged-care-services

Table 28 Care need ratings of people with dementia and living in WA in permanent residential care by care domain

	Activities of daily living		Cognition and behaviour		Complex health care	
	Dementia	WA	Dementia	WA	Dementia	WA
Nil (%)	0.2	0.2	0.6	1.9	0.3	0.4
Low (%)	5.4	4.2	4.5	5.4	15.6	16.2
Medium (%)	27.6	25.6	14.5	17.3	32.2	32.4
High (%)	66.8	70.0	80.4	75.3	51.9	50.9

Source: AIHW (2021)[24], Productivity Commission (2021)[25]

The Department of Health's ACFI Monitoring Report for March 2021 indicated the actual national growth rate in the ACFI subsidy between July 2019 to March 2020 and July 2020 to March 2021 was 4.1%. Applying this growth rate to the 2019-20 WA average annual Government subsidy gives a unit cost of $74,352 which is used in the modelling.

The basic daily fee is set at 85% of the single person rate of the basic age pension. The Department of Health lists the basic daily fee at $52.71 per day, or $19,239.15 per year in the Schedule of Fees and Charges for Residential and Home Care from 1 July 2021.[26]

Table 29 Unit costs for estimating direct and indirect costs of caring (2021 prices)

Cost Item	Unit Cost per year ($)	Source
Paid carer in the community	per FTE carer	
Annual gross wages and salary	$62,400.00	Fair Work Ombudsman Pay Guides Payscale Australia, Seek and Indeed job searches Department of Jobs and Small Business Job Outlook initiative
Salary on-costs	35%	Westpac cost of an employee calculator
Organisational overheads	20%	Diminic et al (2016)
Total	***$96,720.00***	
Government benefits+	per recipient	
Carer Payment#	$24,770.20 single $37,341.20 couple combined	Service Australia Department of Social Services
Carer Allowance	$3,429.40	Service Australia Department of Social Services
Carer Supplement	$600 per payment type	Service Australia Department of Social Services
Disability Support Pension	$24,770.20 single $37,341.20 couple combined	Service Australia Department of Social Services
Residential Care	per resident	
Government subsidy	$74,352.00	Productivity Commission Department of Health ACFI Monitoring Report – March 2021
Basic daily fee	$19,239.15	Department of Health Services Australia MyAgedCare website[27]
Total	***$93,591.15***	

+ as at 20 March 2021

these rates include the maximum basic rate plus the pension and energy supplements.

24. https://www.gen-agedcaredata.gov.au/Topics/Care-needs-in-aged-care#Residential%20care%20needs%20by%20dementia%20status
25. https://www.pc.gov.au/research/ongoing/report-on-government-services/2021/community-services/aged-care-services
26. https://www.health.gov.au/resources/publications/schedule-of-fees-and-charges-for-residential-and-home-care
27. https://www.myagedcare.gov.au/aged-care-home-costs-and-fees

5.4 INDIRECT COSTS

Informal Care

The replacement cost method, also known as the proxy good method, of valuing informal care is adopted in this Report. Unpaid informal care is not a free resource in an economic sense. There is an opportunity cost of the time spent in caregiving, including the lost productivity from the reduced attachment of informal carers to the labour force. The replacement method uses a shadow price approach where the time spent on informal caregiving is valued at the (labour) market price of a close market substitute (Koopmanschap et al., 2008; Oliva-Moreno et al., 2019) such as a home support worker or personal care assistant. This measures the cost of care if the formal paid carer workforce had to provide this care in the absence of informal carers i.e. the cost of 'buying' an equivalent amount of care from the formal sector if the informal care were not supplied (Goodrich et al., 2012; Deloitte Access Economics, 2020).

There is no clear consensus on the best approach to measure carer costs. The replacement method and the opportunity cost method are the two most widely used approaches in the economic assessment of informal care (see for example van den Berg et al., 2006; Oliva-Moreno et al., 2019; Urwin et al., 2021). The replacement method was used in two recent studies of the cost of informal care in Australia - by Deloitte Access Economics to estimate the value of informal care in Australia in 2020 for Carers Australia, and Diminic et al. (2016) to estimate the economic value of informal mental health caring in Australia, a study commissioned by Mind Australia. It has also been used to measure the cost of informal dementia care (see Trepel, 2011). Deb et al. (2017) used both the replacement and opportunity cost methods to estimate the direct and indirect cost of managing Alzheimer's disease and related dementias in the United States. Robinson et al. (2020) similarly used these two methods to examine, also in the US, costs of caregiving time in early-stage Alzheimer's disease.

The Australian Government does provide income support that can be accessed by carers of people with dementia. This includes:

- the **Carer Payment** - an income support payment to someone who gives constant care to a person with dementia in a private home and isn't apart from the recipient of care for more than 25 hours a week to work, study or train. The Carer Payment is subject to income and assets tests. Older carers can choose between staying on the Carer Payment or transferring to the age pension[28];
- the **Carer Allowance** - a fortnightly supplement if the carer provides additional daily care and attention to a person with dementia. The income test for the Carer Allowance is the carer and carer's partner's combined adjusted taxable income must be under $250,000 a year. This means the majority of primary carers will qualify for this supplement even if they work or study.[29]; and
- the **Carer Supplement** - an annual lump sum to assist with the cost of caring for a person. A carer can get the Carer Supplement if they receive the Carer Payment or Carer Allowance.[30]

The payment rates for these benefits are given in Table 27. If all informal care was replaced with paid formal care, as under the replacement valuation method, then the annual Government expenditure on these payments would not be incurred. The 'savings' represent a cost-offset to the replacement value (Diminic et al., 2016).

Use of Informal Care in the Community

Based on what data are available, the steps used to estimate the indirect costs of informal care are summarised below:

1. Estimate the average number of informal carers providing care to a person with mild, moderate or severe AD dementia who lives in the community;

2. Estimate the average number of hours of care provided by each informal carer;

3. Equate hours of care to the full-time equivalent of a paid carer;

4. Using the replacement value method, estimate the average annual wages and salary of a paid carer plus salary on-costs and organisational overheads; and

5. Calculate costs for all persons with AD dementia receiving care from informal providers under the usual care and the DMT intervention scenarios.

28. https://www.servicesaustralia.gov.au/individuals/services/centrelink/carer-payment
29. https://www.servicesaustralia.gov.au/individuals/services/centrelink/carer-allowance
30. https://www.servicesaustralia.gov.au/individuals/services/centrelink/carer-supplement

It is assumed that people with AD dementia have the same patterns of use of informal care and formal home care services as those reported for all people with dementia. As the AIHW notes the number of people using home care has tripled over the last 10 years[31]. The ABS 2018 Survey of Disability, Ageing and Carers (SDAC) showed that 91% of persons with dementia living in the community received assistance in at least one broad area of activity[32] from one or more informal or formal carers (Table 30). This level of assistance was unchanged from the 2012 SDAC data used in 2017 'Economics of Dementia' report. However, the proportion of individuals reporting receiving assistance from both formal providers in addition to informal carers increased noticeably from around 29% of individuals with dementia in 2012 to over 50% by 2018, with fewer receiving only informal care.

While there is little difference in the proportion of men and women living in the community with dementia receiving informal care (Table 30), there are major differences in whom they are receiving this assistance from. The 2018 SDAC indicates that 75% of men with dementia receive care in the home from their spouse or partner compared to only 20% of women with dementia. In contrast, daughters and/or sons provide assistance to 76% of female parents with dementia compared to 40% of male parents. Also 28% of women living in the community with dementia get help from other family members such as daughters in-law, sons in-law, grandchildren, sisters and brothers compared to only 7% of men. Friends or neighbours provide care to around 14% of persons living in the community with dementia (12% of men and 15% of women) (ABS, 2018).

Table 30 Type of assistance received by people with dementia living in the community

	Males (%)	Females (%)	Persons* (%)
Informal assistance only	34.8	36.3	35.5
Informal and formal assistance	51.0	51.0	51.0
Formal assistance only	3.5	5.7	4.5
No assistance	10.7	7.0	9.0

Source: 2018 SDAC

* Because of small cell sizes the estimates in the SDAC have high relative standard errors.

The type of assistance received in at least one broad area of activity does vary significantly by level of disability as shown in Table 31. Data were pooled from the 2015 and 2018 SDACs to give more reliable estimates. Those with mild or moderate disability were combined as their distributions were similar as were those with severe or profound levels of disability. These data suggest that all persons with dementia living in the community who are severely or profoundly limited in core activities receive some type of assistance, with nearly two-thirds getting care from both informal and formal carers. In contrast, nearly 20% of people with mild or moderate disability receive no assistance, with only 40% getting help from both informal and formal providers of care.

Table 31 Type of assistance received by people with dementia living in the community by disability status

	Mild/ Moderate (%)	Severe/ Profound (%)
Informal assistance only	30.4	35.8
Informal and formal assistance	39.6	63.3
Formal assistance only	10.9	0.9
No assistance	19.2	0.0

Source: 2015 and 2018 SDAC

The approach to calculating the number of carers used by the AIHW (2012) is also used here. The average number of informal and formal carers providing assistance to people living in the community with mild, moderate and severe forms of AD dementia was estimated by combining data from the 2015 and 2018 SDACs (as the estimates in each year had large relative standard errors). The average number of carers per person with dementia was identified by disability status. The 2015 and 2018 SDAC data showed that people with dementia with a mild level of disability had an average of 0.9 informal carers per person, those moderately limited in core activities 1.0 informal carer per person and those with severe or profound disability 1.3 informal carers[33]. The AIHW (2012) thought that the derived average number of carers of people with milder forms of dementia using this approach may be too high because the SDAC significantly under-represents those in the earlier stages of dementia. Therefore, a figure of 0.6 informal carers per person is used for those with mild AD dementia.

31. https://www.gen-agedcaredata.gov.au//Topics/People-using-aged-care
32. The SDAC includes 10 broad areas where assistance is required, or difficulties experienced: Mobility, Self-care, Communication, Health care, Cognitive or emotional tasks, Household chores, Property maintenance, Meal preparation, Reading or writing, and Transport.
33. The AIHW (2012) used data from the 2009 SDAC which showed people with milder forms of dementia had an average of 0.7 carers, while those with severe forms had an average of 1.6 carers

Virtually all informal carers of persons with dementia living in the community are primary carers and the vast majority (93%) of these carers provide continuous rather than episodic care. Combined data from the 2015 and 2018 SDACs indicate that two thirds (63%) of primary carers of persons with more severe dementia[34] provide 60 hours or more of care per week, a further 19% provide 30-59 hours of care per week, 16% 10-29 hours with only 3% providing less than 10 hours (ABS, 2015, 2018). The weighted average number of hours of care provided per week by these carers is 55 hours if it is assumed those providing 60 hours or more of care per week, provide on average 10 hours of care each day. This carer workload is equivalent to 1.38 times the full-time ordinary hours per week of work (38 hours[35]) of a paid caregiver. Therefore, the replacement value of each informal carer providing care to a person with severe AD dementia is calculated at the cost of 1.447 FTE paid formal carer. For those with more moderate forms of dementia[36] the hours of informal care are less but still average 42 hours of care per week or 1.105 FTEs and those with mild dementia[37] 31 hours or 0.816 FTE. While 56% and 26% of primary carers of persons with moderate or mild dementia respectively provide 40 hours or more of care per week, another 25% and 32% respectively provide 1-19 hours per week. The FTEs of 1.105 and 0.816 are used to estimate the costs of informal care for persons with moderate or mild AD dementia.

Pooled data from the 2015 and 2018 SDACs indicate that 29% of primary carers of people with dementia with profound disability and 18% with severe disability receive the Carer Payment[38], and 50% and 42% respectively the Carer Allowance. The number of recipients of the Carer Allowance is typically double that receiving the Carer Payment. This is the case for all carers[39] and carers providing assistance to persons with dementia (AIHW, 2012). These proportions are used to estimate the offset costs of informal care for persons with severe and moderate AD dementia. Based on the SDAC data it is assumed carers of persons with mild AD dementia do not get the Carer Payment or Carer Allowance and therefore are not eligible for the Carer Supplement. As stated earlier it is assumed that 70% of carers for people with AD dementia are their husband, wife or partner and therefore get the partner rates, and 30% are single.

Lost Productivity

The lost productivity of persons with AD dementia is valued in terms of the foregone earnings of a person with AD dementia. A person with dementia may no longer be able to work and retire early from the workforce or are only able to participate in paid work on a restricted basis, and thus have to forego earnings. A growing concern for employers in the medium-term is the increasing number of workers developing dementia while still in employment, and how best to manage early cognitive decline among their older workers or even employees presenting with dementia in their 40s or 50s (Bevan, 2017; Dementia Australia, 2020). Some people especially those with early-onset dementia are able to continue working in the early years of the disease and choose to do so, especially if their employer has created a 'dementia-friendly' workplace (Bevan, 2017; Thomson et al., 2019; Silvaggi et al., 2020); Some of the changes in work behaviour and problems that may become apparent at work with the onset of dementia are listed in Appendix D.

Unfortunately, there is a lack of data indicating employment patterns of persons with dementia and AD in particular. Several qualitative studies recount the experiences of people with dementia and their work experiences. Workers with dementia often feel unsupported at work, report negative reactions from colleagues when they disclose their diagnosis, including being bullied and discriminated against, and being redeployed and moved into lesser roles (Chaplin and Davison, 2016; Evans 2019; Dementia Australia, 2020). Some workers retire immediately following diagnosis, some are dismissed, some go on sick leave and eventually leave paid work, and some reduce their hours and workloads (Chaplin and Davison, 2016; Evans 2019). Quoting Dementia Australia (2020) "Too often, a diagnosis of dementia brings about the end of employment". In the UK, the Alzheimer's Society (2015) report that only 18 per cent of people with dementia under the age of 65 in the UK continue to work after their dementia is diagnosed.

The potential loss of earnings was estimated using data from wave 19 of the Household, Income and Labour Dynamics in Australia (HILDA) Survey. HILDA is a nationally representative longitudinal study of Australian

34. Severe dementia is represented by persons with dementia receiving care who have a profound level of disability
35. According to the Fair Work Commission Pay Guide Social, Community, Home Care and Disability Services Industry Award [MA000100]
36. Moderate dementia is represented by persons with dementia receiving care who have a severe level of disability
37. Mild dementia is represented by persons with dementia receiving care who have mild or moderate disability status
38. The AIHW (2021) report a slightly higher percentage (31.4%) of primary carers of people with dementia receiving the carer payment but the 95% confidence interval around this estimate is 21.9%-40.8% which includes the NATSEM calculation (Dementia in Australia, Carers of people with dementia—data tables)
39. Department of Social Services DSS Payment Demographic Data DSS Demographics - March 2021 https://data.gov.au/data/dataset/cff2ae8a-55e4-47db-a66d-e177fe0ac6a0/resource/e9de2352-c21b-4c5f-bb5b-02020227f1eb/download/dss-demographics-march-2021-final.xlsx

households. The data in Wave 19 was collected in 2019, and this was used in the modelling to avoid the impact of COVID 19 on labour force participation and income. Age-sex employment rates for full-time and part-time workers and the respective average annual incomes from wages and salaries were obtained. The cost of lost productivity is the difference in earnings between 'observed' employment rates and what would be expected if persons with AD dementia had the same employment patterns as the general population. As shown in Table 32, it is assumed that all persons with AD dementia aged 65 years and above are out of the paid workforce, irrespective of disease severity. For persons with younger onset AD dementia, it is assumed, using the UK employment rate, that 18% of persons with mild younger onset AD dementia are employed, while those with moderate or severe disease have left the workforce. Based on the employment patterns in the general Australia population, rates of full and part-time employment were constructed for males and females with mild AD dementia aged 50-64 years such that the overall rate of employment in this group was 18% (Table 32).

Government Income Support – the Disability Support Pension

As Dementia Australia comments in its submission[40] to the 2021 Inquiry into the purpose, intent and adequacy of the Disability Support Pension, the DSP can provide much needed financial support for people living with younger onset dementia. The DSP is a means-tested income support payment for people who are aged 16 and over but under Age Pension age (at claim) and who have reduced capacity to work because of their disability. Not everyone with a disability or a medical condition can get the DSP. The key medical eligibility rules are that the individual

- Has a condition that will last more than 2 years;
- the condition is fully diagnosed, treated and stabilised;
- has an impairment rating of 20 points or more;
- meets Program of Support rules, if these apply to them; and
- has a condition that will stop them working at least 15 hours a week in the next 2 years.[41]

Table 32 Employment rates, annual wages and lost productivity

Age Groups	EMPLOYMENT GENERAL POPULATION				EMPLOYMENT PERSONS WITH AD DEMENTIA						DIFFERENCE IN EMPLOYMENT RATES (LOST PRODUCTIVITY)					
					MILD		MODERATE		SEVERE		MILD		MODERATE		SEVERE	
	Full-time (%)	Annual full-time wage ($)	Part-time (%)	Annual part-time wage ($)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)	Full-time (%)	Part-time (%)
Male																
50 - 64	63.1	90,552	10.7	36,194	16.4	2.8	0	0	0	0	46.7	7.9	63.1	10.7	63.1	10.7
65 - 74	11	65,393	11.6	27,479	0	0	0	0	0	0	11	11.6	11	11.6	11	11.6
75+	0	0	3.8	11,710	0	0	0	0	0	0	0	3.8	0	3.8	0	3.8
Female																
50 - 64	36.3	77,043	29	37,665	9.4	7.5	0	0	0	0	26.9	21.5	36.3	29	36.3	29
65 - 74	4.3	73,445	11.6	29,320	0	0	0	0	0	0	4.3	11.6	4.3	11.6	4.3	11.6
75+	0	0	0.7	8,079	0	0	0	0	0	0	0	0.7	0	0.7	0	0.7

Derived from Wave 19 HILDA data

40. https://www.dementia.org.au/sites/default/files/2021-07/Dementia-Australia-submission-DSP-inquiry.pdf
41. https://www.servicesaustralia.gov.au/individuals/services/centrelink/disability-support-pension/how-much-you-can-get/payment-rates

An impairment rating, based on various Impairment Tables, is used to assess if people meet the general medical rules for DSP[42]. This essentially assesses how a person's disability or medical condition affects their ability to function each day, and their capacity to work.

However, few people with younger onset dementia receive the DSP. Dementia Australia states that the assessment and determination process can be overwhelming, confusing and distressing for people living with younger onset dementia, their families and carers. DSP claims of people with a confirmed diagnosis of YOD can be fast-tracked to ensure they are not unnecessarily referred for a job capacity assessment and can receive timely financial assistance. However, despite having a permanent, progressive and terminal disability which has required them to cease employment, some people living with younger onset dementia still must unnecessarily undergo Job Capacity Assessments. The functional capacity of a person living with dementia can fluctuate from day to day and within a day. An assessment conducted over short period of time may not adequately capture the extent of disability and functional impairment. A person with dementia could be deemed ineligible for the DSP if the assessor does not have a thorough understanding of dementia[43].

On becoming qualified for the Age Pension, those already on the DSP may remain on it or transfer to the Age Pension. The number and proportion of those aged 65 years and over receiving the DSP has increased over the past 15 years, the vast majority (67%) of those aged 65 and over receiving the DSP being aged 65–69 years (AIHW, 2020). The payment rates for DSP are given in Table 28.

Administrative data on the number of DSP recipients with dementia listed as a medical condition was obtained from the Department of Social Services. Based on the general prevalence of dementia, it was assumed that 75% of the recipients aged ≥ 65 years with dementia had AD dementia and 27% of persons aged < 65 years. It was assumed that AD dementia recipients of the DSP had moderate or severe dementia and that those aged <65 years were aged 50-64 years and those aged ≥65 years were aged 65-74 years. Trend data from 2012-2019 was used to project recipient numbers by age and sex over the simulation period to 2041. The number of recipients of the DSP in the DMT scenario were calculated based on the ratio of the number of cases aged 50-74 years with moderate or severe AD dementia in the DMT scenario relative to the number on the usual care scenario. To estimate the costs of the DSP, based on administrative data it was assumed that 72% of female AD dementia DSP recipients aged 50-64 years were partnered; 66% of females aged 65-74; 78% of males aged 50-64 years and 65-74 years.

42. https://www.servicesaustralia.gov.au/individuals/services/centrelink/disability-support-pension/how-we-assess-your-claim/impairment-rating
43. https://www.dementia.org.au/sites/default/files/2021-07/Dementia-Australia-submission-DSP-inquiry.pdf

6. RESULTS – PREVALENCE, INCIDENCE AND MORTALITY

6.1 PREVALENCE

Under present circumstances (usual care scenario) the number of Australians aged 50 years and above who have MCI due to AD is expected to increase 1.40 fold over the next 20 years from a total of 15,448 persons in 2021 to 21,631 in 2041 and those with AD dementia 1.73 fold (this is the same for mild, moderate and severe AD dementia) from 153,888 persons in 2021 to 266,114 in 2041 (Table 33, Figure 5). In 2021, those with MCI due to AD represented 9.1% of persons with AD, mild AD dementia 36.6%, moderate AD 31.0% and severe AD 23.2%. By 2041, there was a relative reduction in those with MCI due to AD (7.5%) and very small relative increase in those with AD dementia (mild 36.6%, moderate 32.2% and severe 23.7%).

Under the DMT scenario, the number of persons with MCI due to AD increases from 15,448 persons in 2021 to 25,458 in 2041 (65% increase); the number of persons with mild AD dementia nearly doubles (94% increase from 60,976 persons to 118,546; the prevalence of persons with moderate AD dementia increases by 63% from 53,543 persons to 87,146; and for severe AD dementia numbers increase over the 20 years from 39,369 persons in 2021 to 62,552 in 2041(a 59% increase in prevalent cases) (Table 33, Figure 5).

Figure 5 Prevalence of AD dementia by severity under usual care and DMT intervention, 2021-2041

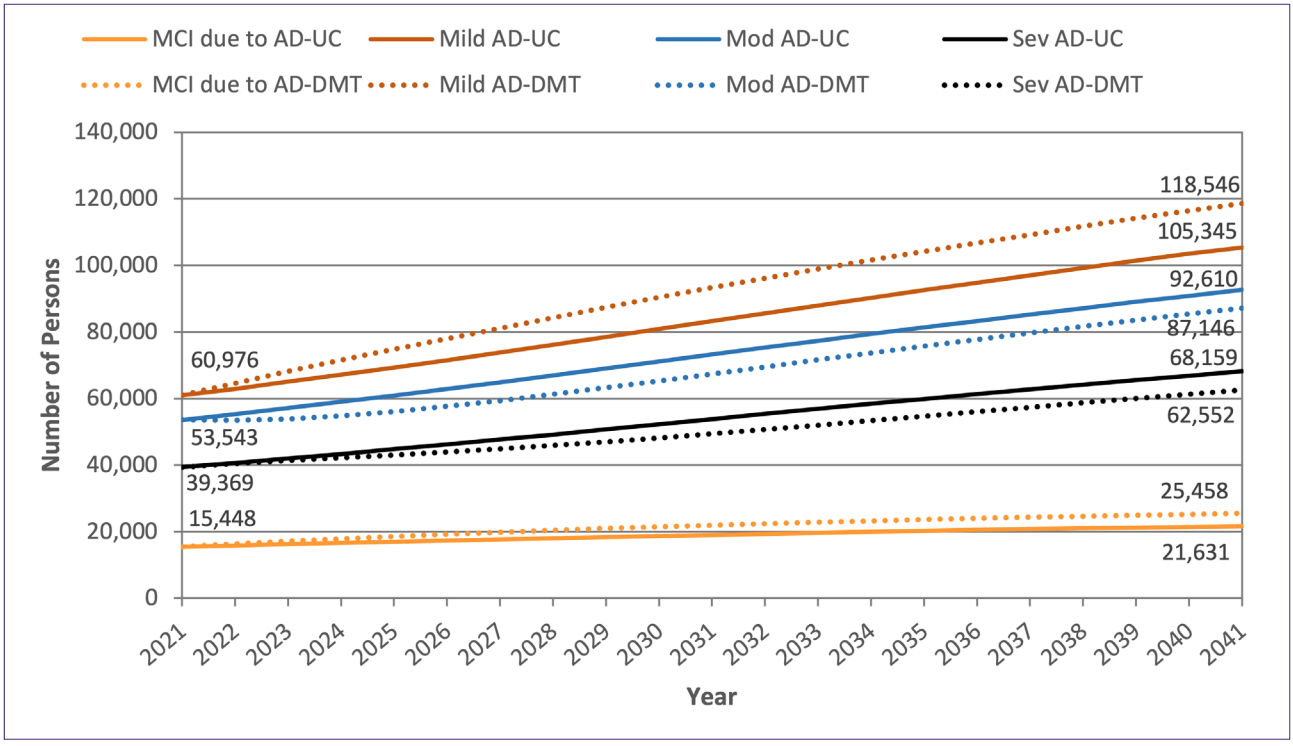


Table 33 Prevalence of AD dementia by severity under usual care and DMT intervention, 2021-2041

Year	USUAL CARE					DMT					DIFFERENCE				
	MCI due to AD	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total	MCI due to AD	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total	MCI due to AD	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total
2021	15,448	60,976	53,543	39,369	169,336	15,448	60,976	53,543	39,369	169,336	0	0	0	0	0
2022	15,833	62,887	55,314	40,658	174,692	16,309	64,539	53,411	40,434	174,693	476	1,652	-1,903	-224	1
2023	16,223	65,012	57,121	41,982	180,338	17,122	68,103	53,869	41,329	180,423	899	3,091	-3,252	-653	85
2024	16,615	67,138	58,994	43,347	186,094	17,880	71,492	54,802	42,162	186,336	1,265	4,354	-4,192	-1,185	242
2025	17,001	69,293	60,916	44,752	191,962	18,592	74,757	56,083	43,003	192,435	1,591	5,464	-4,833	-1,749	473
2026	17,369	71,493	62,881	46,197	197,940	19,253	77,939	57,624	43,891	198,707	1,884	6,446	-5,257	-2,306	767
2027	17,718	73,764	64,883	47,675	204,040	19,862	81,082	59,357	44,842	205,143	2,144	7,318	-5,526	-2,833	1,103
2028	18,050	76,130	66,920	49,171	210,271	20,421	84,227	61,233	45,866	211,747	2,371	8,097	-5,687	-3,305	1,476
2029	18,371	78,520	69,000	50,696	216,587	20,943	87,324	63,220	46,973	218,460	2,572	8,804	-5,780	-3,723	1,873
2030	18,683	80,911	71,099	52,242	222,935	21,435	90,352	65,281	48,155	225,223	2,752	9,441	-5,818	-4,087	2,288
2031	18,994	83,271	73,200	53,800	229,265	21,906	93,286	67,384	49,401	231,977	2,912	10,015	-5,816	-4,399	2,712
2032	19,316	85,611	75,287	55,355	235,569	22,372	96,132	69,494	50,697	238,695	3,056	10,521	-5,793	-4,658	3,126
2033	19,638	87,942	77,331	56,880	241,791	22,819	98,887	71,598	52,012	245,316	3,181	10,945	-5,733	-4,868	3,525
2034	19,951	90,229	79,348	58,381	247,909	23,242	101,541	73,686	53,343	251,812	3,291	11,312	-5,662	-5,038	3,903
2035	20,248	92,502	81,334	59,855	253,939	23,641	104,146	75,736	54,683	258,206	3,393	11,644	-5,598	-5,172	4,267
2036	20,524	94,741	83,292	61,308	259,865	24,010	106,684	77,749	56,028	264,471	3,486	11,943	-5,543	-5,280	4,606
2037	20,773	96,976	85,232	62,735	265,716	24,343	109,198	79,732	57,364	270,637	3,570	12,222	-5,500	-5,371	4,921
2038	20,999	99,255	87,137	64,126	271,517	24,645	111,739	81,663	58,684	276,731	3,646	12,484	-5,474	-5,442	5,214
2039	21,211	101,423	89,019	65,493	277,146	24,924	114,157	83,557	59,991	282,629	3,713	12,734	-5,462	-5,502	5,483
2040	21,419	103,452	90,852	66,840	282,563	25,193	116,425	85,392	61,284	288,294	3,774	12,973	-5,460	-5,556	5,731
2041	21,631	105,345	92,610	68,159	287,745	25,458	118,546	87,146	62,552	293,702	3,827	13,201	-5,464	-5,607	5,957

As disease progression is reduced in those aged 50-84 years under the DMT, the number of persons in 2041 with early-stage AD dementia increases compared with prevalent case numbers under the usual care scenario (a 17.7% increase in those with MCI due to AD and 12.5% in persons with mild AD dementia) and those with moderate or severe disease declines (reduction in the prevalence of moderate and severe AD dementia of 5.9% and 8.2% respectively compared with numbers under the usual care scenario). The total AD dementia population is expected to increase with the DMT intervention as the reduction in the prevalence of moderate and severe disease is outnumbered by the growth in the number of persons with early-stage AD dementia.

Prevalence estimates for 2021-2041 by age, sex and disease severity for the two scenarios are provided in the detailed Data Tables accompanying the Report.

6.2 MORTALITY

The age-sex rates of mortality are provided in the transition matrices in Tables 14 and 15 for the usual care (Base Case) simulation, which are unchanged under the DMT scenario (transition probabilities are given in Appendix A). Since the risk of death is a function of disease severity, the DMT leads to a significant overall reduction in deaths in all persons with AD over the simulation period (Table 34, Figure 6).

Figure 6 Number of deaths in persons with AD dementia by severity under usual care and DMT intervention, 2021-2041

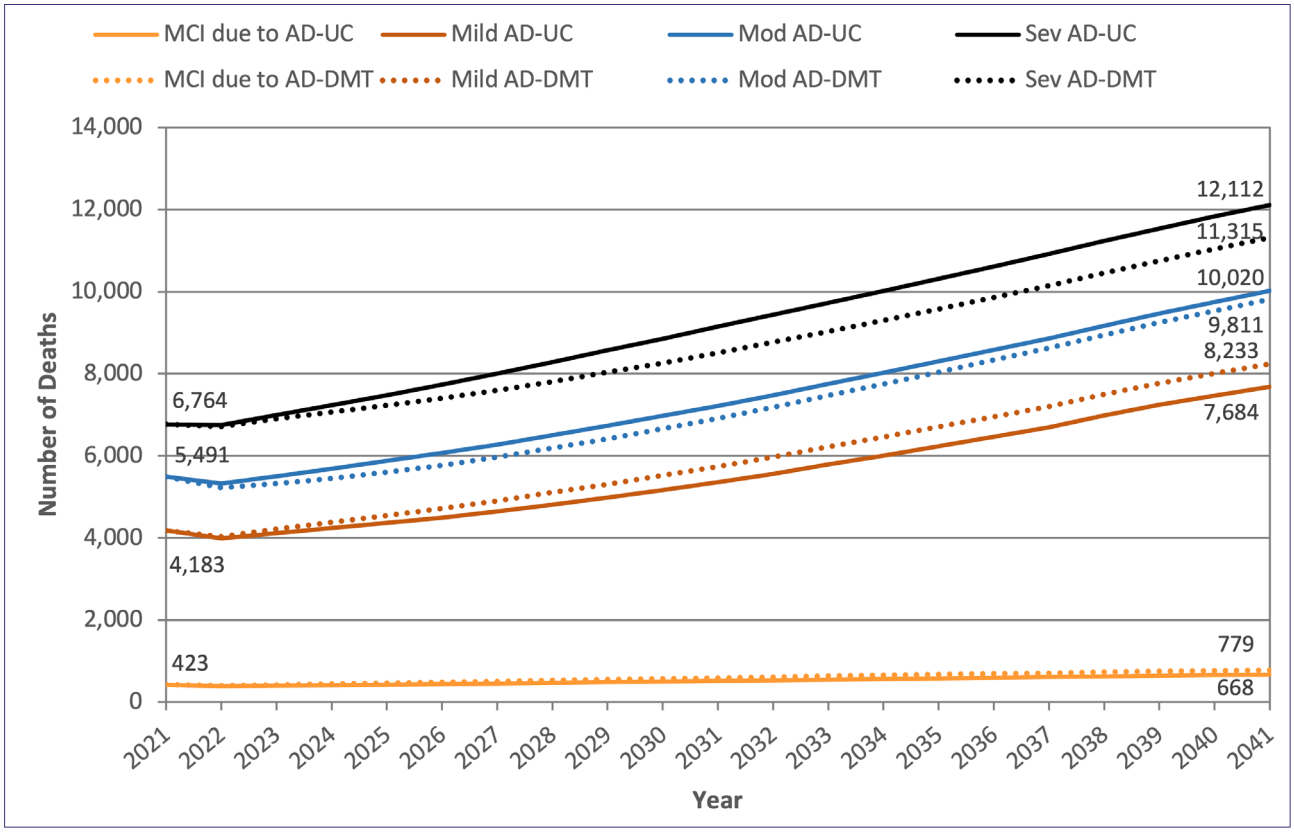


Table 34 Number of deaths in persons with AD dementia by severity under usual care and DMT intervention, 2021-2041

Year	USUAL CARE					DMT					DIFFERENCE				
	MCI due to AD	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total	MCI due to AD	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total	MCI due to AD	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total
2021	423	4,183	5,491	6,764	16,861	423	4,183	5,491	6,764	16,861	0	0	0	0	0
2022	388	3,984	5,328	6,750	16,450	402	4,033	5,223	6,718	16,376	14	49	-105	-32	-74
2023	404	4,120	5,507	6,993	17,024	422	4,215	5,326	6,899	16,862	18	95	-181	-94	-162
2024	415	4,240	5,686	7,231	17,572	445	4,381	5,448	7,062	17,336	30	141	-238	-169	-236
2025	427	4,365	5,875	7,480	18,147	464	4,548	5,600	7,228	17,840	37	183	-275	-252	-307
2026	444	4,497	6,068	7,735	18,744	486	4,719	5,769	7,406	18,380	42	222	-299	-329	-364
2027	455	4,642	6,273	8,004	19,374	508	4,900	5,965	7,600	18,973	53	258	-308	-404	-401
2028	470	4,812	6,506	8,287	20,075	531	5,109	6,187	7,810	19,637	61	297	-319	-477	-438
2029	485	4,982	6,732	8,569	20,768	550	5,307	6,416	8,035	20,308	65	325	-316	-534	-460
2030	500	5,167	6,971	8,855	21,493	572	5,523	6,661	8,263	21,019	72	356	-310	-592	-474
2031	517	5,356	7,220	9,146	22,239	593	5,741	6,912	8,512	21,758	76	385	-308	-634	-481
2032	529	5,556	7,475	9,437	22,997	614	5,967	7,179	8,767	22,527	85	411	-296	-670	-470
2033	547	5,789	7,755	9,730	23,821	635	6,223	7,471	9,031	23,360	88	434	-284	-699	-461
2034	562	6,004	8,024	10,019	24,609	655	6,457	7,752	9,295	24,159	93	453	-272	-724	-450
2035	577	6,233	8,300	10,316	25,426	673	6,707	8,040	9,573	24,993	96	474	-260	-743	-433
2036	594	6,465	8,579	10,612	26,250	694	6,950	8,333	9,856	25,833	100	485	-246	-756	-417
2037	610	6,700	8,862	10,916	27,088	710	7,203	8,627	10,148	26,688	100	503	-235	-768	-400
2038	629	6,986	9,172	11,233	28,020	732	7,499	8,946	10,458	27,635	103	513	-226	-775	-385
2039	643	7,242	9,467	11,539	28,891	750	7,768	9,248	10,752	28,518	107	526	-219	-787	-373
2040	659	7,467	9,749	11,830	29,705	764	8,007	9,534	11,038	29,343	105	540	-215	-792	-362
2041	668	7,684	10,020	12,112	30,484	779	8,233	9,811	11,315	30,138	111	549	-209	-797	-346
2021-2041	**10,946**	**116,474**	**155,060**	**193,558**	**476,038**	**12,402**	**123,673**	**149,939**	**182,530**	**468,544**	**1,456**	**7,199**	**-5,121**	**-11,028**	**-7,494**

Introducing the DMT leads to 7,494 fewer deaths over the 20 years. The substantial reduction in deaths per year for those with moderate or severe AD dementia is however partially offset by the increase in the number of deaths in those with early-stage AD dementia as the prevalence of MCI due to AD and mild AD dementia in the population increases.

The estimated number of deaths for 2021-2041 by age, sex and disease severity for the two scenarios are provided in the detailed Data Tables accompanying the Report.

6.3 INCIDENCE

The incidence of new cases in the modelling is the number of people in the non-dementia 'normal' population who are diagnosed with MCI due to AD, mild or moderate AD dementia each year. It is assumed that there are no incidence cases of severe AD dementia from the general population, rather people progress to severe AD dementia from mild or moderate AD dementia states. The age-sex incidence rates are the transition probabilities from normal to the AD dementia states in Tables 14 and 15. The incidence rates are the same for both the base case usual care and the DMT intervention.

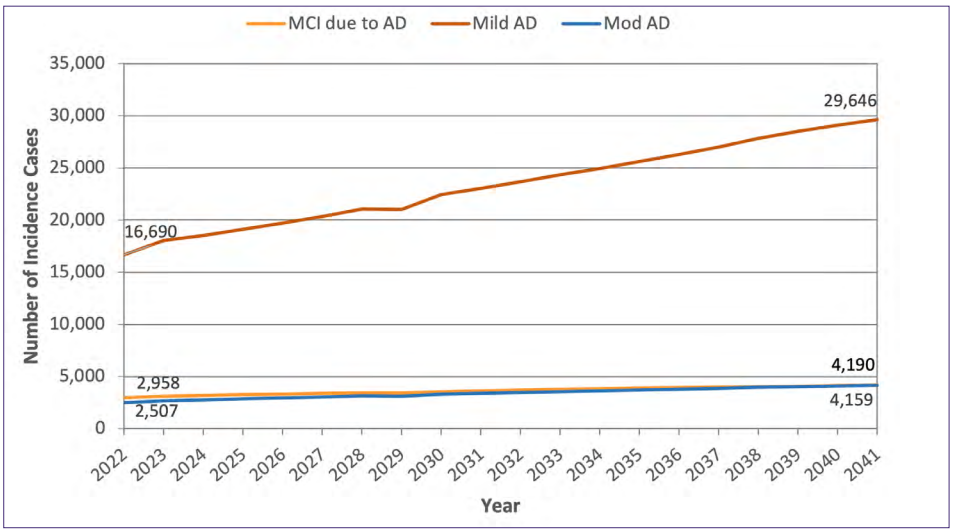
The results of the modelling for the usual care scenario are given in Table 35 and Figure 7. These represent the number of incidence cases over the previous 12 months. Between 11% and 13% of new cases are diagnosed at the early MCI prodromal stage of AD with the majority of new cases (75-78%) having mild AD dementia. However, AD dementia has already progressed to a moderate disease severity in 11% of new cases.

There are very slight differences in the number of new cases diagnosed each year under the DMT scenario compared with usual care. For example, there were 4 fewer new cases of MCI due to AD, 37 fewer new cases of mild AD dementia and 3 fewer new cases with moderate AD dementia under the DMT in 2041 compared with the numbers given in Table 35. These differences reflect the small changes in the size of the 'normal' population because of the changing prevalence of MCI due to AD and AD dementia within the population.

Table 35 Annual incidence of AD dementia by disease severity, usual care scenario, 2022-2041

Year	MCI due to AD	Mild AD Dem	Mod AD Dem	Total
2022	2,958	16,690	2,507	22,155
2023	3,108	18,042	2,699	23,849
2024	3,183	18,544	2,775	24,502
2025	3,256	19,115	2,861	25,232
2026	3,318	19,713	2,949	25,980
2027	3,376	20,360	3,042	26,778
2028	3,432	21,078	3,138	27,648
2029	3,427	21,006	3,118	27,551
2030	3,554	22,432	3,319	29,305
2031	3,622	23,052	3,394	30,068
2032	3,704	23,690	3,471	30,865
2033	3,778	24,343	3,552	31,673
2034	3,843	24,962	3,628	32,433
2035	3,900	25,633	3,707	33,240
2036	3,949	26,301	3,788	34,038
2037	3,991	27,021	3,881	34,893
2038	4,038	27,847	3,969	35,854
2039	4,085	28,526	4,043	36,654
2040	4,134	29,112	4,106	37,352
2041	4,190	29,646	4,159	37,995

Figure 7 Annual incidence of AD dementia by disease severity, Usual Care, 2022-2041



7. RESULTS – DIRECT COSTS

7.1 COST OF THE DMT

The cost of the intervention comprises the costs associated with:

- biomarker testing patients aged 50-84 years who are clinically diagnosed with MCI or mild dementia suspected to be due to AD;
- patient follow-up with a dementia specialist; and
- administering the DMT infusion to eligible patients.

The cost is calculated as the number of persons accessing biomarker testing and then who are Aβ positive and treated with the DMT by the relevant unit costs given in Table 18. The estimated number of persons aged 50-84 years who would be biomarker tested and then commence the DMT each year are given in Table 36. As noted in the methods, it is assumed that all persons in the prevalent population is tested and eligible patients treated in the first year. From 2022 onwards only new incidence cases aged 50-84 years are tested and treated with the DMT.

The cost of the DMT (expressed in $ millions at 2021 prices) is given in Table 37. As explained previously a cost for the DMT drug is not included. In the absence of a price for the DMT drug, the cost of administering the is expected to account for around 86% of the DMT costs. The cost of $554m in 2021 is 4 times higher than expected in 2022 reflecting the 'start-up' approach assumed in the modelling where all patients in the population who would be eligible for the DMT would be able to commence treatment as soon as the DMT was introduced. The annual costs then rise from $137.1m in 2022 to $207.1m in 2041.

Table 36 DMT populations aged 50-84 years, 2021-2041

Year	Accessing Biomarker Testing			Biomarker +ve DMT treated		
	MCI suspected AD	Mild dem suspected AD	Total	MCI due to AD	Mild AD dem	Total
2021	27,433	45,516	72,949	13,991	40,054	54,045
2022	5,249	12,526	17,775	2,677	11,023	13,700
2023	5,480	13,344	18,824	2,795	11,743	14,538
2024	5,620	13,790	19,410	2,866	12,135	15,001
2025	5,747	14,259	20,006	2,931	12,548	15,479
2026	5,845	14,734	20,579	2,981	12,966	15,947
2027	5,937	15,223	21,160	3,028	13,396	16,424
2028	6,022	15,742	21,764	3,071	13,853	16,924
2029	6,029	15,863	21,892	3,075	13,959	17,034
2030	6,204	16,618	22,822	3,164	14,624	17,788
2031	6,302	16,947	23,249	3,214	14,913	18,127
2032	6,431	17,263	23,694	3,280	15,191	18,471
2033	6,520	17,398	23,918	3,325	15,310	18,635
2034	6,604	17,622	24,226	3,368	15,507	18,875
2035	6,673	17,884	24,557	3,403	15,738	19,141
2036	6,725	18,153	24,878	3,430	15,975	19,405
2037	6,771	18,482	25,253	3,453	16,264	19,717
2038	6,812	18,798	25,610	3,474	16,542	20,016
2039	6,867	19,070	25,937	3,502	16,782	20,284
2040	6,933	19,322	26,255	3,536	17,003	20,539
2041	7,006	19,511	26,517	3,573	17,170	20,743

Table 37 Cost of the DMT intervention, 2021-2041 ($millions)

Year	AD biomarker testing	Follow-up visit Dementia specialists	Administering DMT	DMT Drug Cost	Total Annual Cost	Cumulative Cost
2021	72.6	9.7	461.7	-	**544.0**	**544.0**
2022	17.7	2.4	117.0	-	**137.1**	**681.1**
2023	18.7	2.5	124.2	-	**145.4**	**826.5**
2024	19.3	2.6	128.2	-	**150.0**	**976.5**
2025	19.9	2.7	132.2	-	**154.8**	**1,131.3**
2026	20.5	2.7	136.2	-	**159.4**	**1,290.8**
2027	21.0	2.8	140.3	-	**164.2**	**1,455.0**
2028	21.7	2.9	144.6	-	**169.1**	**1,624.1**
2029	21.8	2.9	145.5	-	**170.2**	**1,794.3**
2030	22.7	3.0	152.0	-	**177.7**	**1,972.0**
2031	23.1	3.1	154.9	-	**181.1**	**2,153.1**
2032	23.6	3.2	157.8	-	**184.5**	**2,337.6**
2033	23.8	3.2	159.2	-	**186.2**	**2,523.8**
2034	24.1	3.2	161.2	-	**188.6**	**2,712.4**
2035	24.4	3.3	163.5	-	**191.2**	**2,903.6**
2036	24.7	3.3	165.8	-	**193.8**	**3,097.4**
2037	25.1	3.4	168.4	-	**196.9**	**3,294.4**
2038	25.5	3.4	171.0	-	**199.9**	**3,494.2**
2039	25.8	3.5	173.3	-	**202.5**	**3,696.8**
2040	26.1	3.5	175.5	-	**205.1**	**3,901.9**
2041	26.4	3.5	177.2	-	**207.1**	**4,109.0**
2021-2041	**528.5**	**70.7**	**3,509.7**	**-**	**4,109.0**	

The cumulative cost of the DMT over the 20 years 2021-2041 is $4.11bn (excluding the cost of the DMT drug).

7.2 HOSPITAL CARE

These direct costs include costs for

- admitted hospitalisations where AD dementia is the primary diagnosis or associated diagnosis;
- attendance at public hospital outpatient clinics, and;
- public hospital emergency department presentations.

Admitted Patient Care

The projected number of admitted hospitalisation with AD dementia as the principal diagnosis for those with mild, moderate and severe AD, 2021-2041, is given in Table 38. Under usual care, the number of these hospitalisations are expected to increase by 76% from 7,342 in 2021 to 12,924 by 2041. As expected, the number of hospitalisations in those with moderate or severe AD dementia are significantly reduced under the DMT with 5,081 and 3,700 fewer separations respectively over the 20 years.

Table 38 Number of admitted hospitalisations with AD dementia as the principal diagnosis by disease severity, 2021-2041

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE			
	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total
2021	2,909	2,555	1,878	7,342	2,909	2,555	1,878	7,342	0	0	0	0
2022	3,006	2,643	1,944	7,593	3,083	2,553	1,932	7,568	77	-90	-12	-25
2023	3,111	2,734	2,011	7,856	3,258	2,576	1,979	7,813	147	-158	-32	-43
2024	3,218	2,828	2,078	8,124	3,424	2,622	2,021	8,067	206	-206	-57	-57
2025	3,324	2,923	2,147	8,394	3,583	2,687	2,063	8,333	259	-236	-84	-61
2026	3,435	3,020	2,219	8,674	3,742	2,764	2,108	8,614	307	-256	-111	-60
2027	3,548	3,120	2,293	8,961	3,898	2,852	2,157	8,907	350	-268	-136	-54
2028	3,666	3,222	2,369	9,257	4,057	2,946	2,209	9,212	391	-276	-160	-45
2029	3,784	3,323	2,443	9,550	4,207	3,042	2,264	9,513	423	-281	-179	-37
2030	3,902	3,429	2,519	9,850	4,357	3,144	2,324	9,825	455	-285	-195	-25
2031	4,021	3,533	2,598	10,152	4,505	3,249	2,385	10,139	484	-284	-213	-13
2032	4,134	3,633	2,673	10,440	4,645	3,350	2,449	10,444	511	-283	-224	4
2033	4,251	3,735	2,747	10,733	4,782	3,454	2,515	10,751	531	-281	-232	18
2034	4,366	3,837	2,822	11,025	4,916	3,559	2,581	11,056	550	-278	-241	31
2035	4,480	3,936	2,897	11,313	5,046	3,661	2,648	11,355	566	-275	-249	42
2036	4,589	4,035	2,969	11,593	5,172	3,761	2,716	11,649	583	-274	-253	56
2037	4,701	4,130	3,040	11,871	5,297	3,859	2,784	11,940	596	-271	-256	69
2038	4,813	4,225	3,111	12,149	5,425	3,955	2,848	12,228	612	-270	-263	79
2039	4,921	4,316	3,179	12,416	5,544	4,049	2,913	12,506	623	-267	-266	90
2040	5,020	4,408	3,246	12,674	5,658	4,138	2,979	12,775	638	-270	-267	101
2041	5,116	4,496	3,312	12,924	5,764	4,224	3,042	13,030	648	-272	-270	106
2021-2041	**84,315**	**74,081**	**54,495**	**212,891**	**93,272**	**69,000**	**50,795**	**213,067**	**8,957**	**-5,081**	**-3,700**	**176**

In contrast, annual hospitalisations with mild AD dementia as the primary diagnosis are 10.6% higher on average over this time. However, the ALOS for those with mild AD dementia was estimated to be 10.1 days compared with 13.7 days for moderate AD dementia and 18.4 for severe AD dementia.

Differences in ALOS by age and disease severity means there is a net savings in the cost of public and private admitted hospitalisations for AD dementia (Table 39). Total expenditure on hospitalisations for AD dementia over the period 2021-2041 was estimated to be $2,573.8m under usual care compared with $2,529.9m with the DMT intervention, a savings of $44.0m.

However, expenditure on admitted patient care for other principal diagnoses with AD dementia as an associated diagnosis is 3.6-fold higher. The cumulative cost of these hospitalisations is $9,265.8m over the simulation period under usual care with the DMT generating a savings of $158.3m.

The total cost of admitted hospitalisations is expected to be reduced by over $200m over the 20 years with the introduction of the DMT in 2021.

Detailed information on the number of hospitalisations with AD dementia as the principal diagnosis by age and AD dementia severity, by year 2021-2041, and costs is provided in the Report's data tables.

The cumulative total cost of hospital care over the 20 years 2021-2041 is $16.1bn under the base case of usual care and $15.9bn with the introduction of the DMT, an overall savings of $241.0m.

Public hospital outpatient clinics and public hospital emergency departments

The costs associated with the use of public hospital outpatient clinics and public hospital emergency department care by persons with AD dementia under the base case and intervention scenarios are given in Table 40. Over the period 2021-2041, under usual care, some $4,226.5m is attributable to persons with AD dementia for their use of public hospital outpatient clinics and $78.2m for presentations to public hospital emergency departments. Under the DMT intervention scenario, expenditure on both services decreases, by $37.6m and $1.1m respectively.

Table 39 Cost of public and private admitted hospitalisations with AD dementia as the principal diagnosis and associated diagnosis, 2021-2041 ($millions)

Year	USUAL CARE						DMT INTERVENTION						DIFFERENCE						
	PRIMARY DIAGNOSIS				ASSOC. DIAG.	TOTAL	PRIMARY DIAGNOSIS				ASSOC. DIAG	TOTAL	PRIMARY DIAGNOSIS				ASSOC DIAG	TOTAL	CUMUL DIFF
	Mild AD Dem	Mod AD Dem	Sev AD Dem	Total			Mild AD Dem	Mod AD Dem	Sev AD Dem	Total			Mild AD Dem	Mod AD Dem	Sev AD Dem	Total			
2021	27.5	31.2	30.9	89.5	322.3	411.9	27.5	31.2	30.9	89.5	322.3	411.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2022	28.4	32.2	32.0	92.6	333.3	425.9	29.1	31.0	31.8	92.0	331.0	423.0	0.7	-1.2	-0.2	-0.6	-2.3	-2.9	-2.9
2023	29.4	33.3	33.1	95.8	344.8	440.6	30.8	31.3	32.5	94.6	340.5	435.1	1.4	-2.0	-0.6	-1.2	-4.3	-5.5	-8.4
2024	30.4	34.5	34.2	99.0	356.4	455.4	32.4	31.8	33.2	97.3	350.4	447.7	2.0	-2.7	-1.0	-1.7	-6.0	-7.7	-16.1
2025	31.4	35.6	35.3	102.3	368.1	470.4	33.9	32.5	33.8	100.2	360.9	461.1	2.5	-3.0	-1.5	-2.0	-7.3	-9.3	-25.4
2026	32.4	36.8	36.5	105.6	380.2	485.8	35.3	33.5	34.5	103.3	372.0	475.4	3.0	-3.3	-1.9	-2.3	-8.2	-10.5	-35.8
2027	33.4	37.9	37.6	109.0	392.4	501.4	36.8	34.5	35.3	106.6	383.6	490.2	3.4	-3.5	-2.3	-2.4	-8.8	-11.3	-47.1
2028	34.5	39.2	38.9	112.5	405.1	517.6	38.3	35.6	36.1	110.0	395.9	505.8	3.8	-3.6	-2.8	-2.6	-9.2	-11.8	-58.9
2029	35.6	40.3	40.0	116.0	417.5	533.4	39.6	36.7	37.0	113.3	407.9	521.2	4.1	-3.6	-3.1	-2.7	-9.6	-12.2	-71.1
2030	36.6	41.6	41.2	119.5	430.1	549.6	41.0	37.9	37.9	116.8	420.5	537.3	4.4	-3.7	-3.3	-2.7	-9.6	-12.3	-83.4
2031	37.7	42.8	42.5	123.0	442.9	565.9	42.3	39.1	38.8	120.3	433.2	553.5	4.6	-3.7	-3.7	-2.7	-9.7	-12.5	-95.9
2032	38.7	43.9	43.7	126.3	454.7	581.1	43.6	40.3	39.8	123.7	445.3	568.9	4.9	-3.7	-3.8	-2.6	-9.5	-12.1	-108.0
2033	39.8	45.1	44.8	129.7	466.8	596.5	44.8	41.5	40.8	127.1	457.6	584.7	5.1	-3.6	-4.0	-2.6	-9.2	-11.8	-119.8
2034	40.8	46.3	46.0	133.0	478.9	685.0	46.0	42.7	41.8	130.5	469.9	675.2	5.2	-3.6	-4.1	-2.5	-9.0	-9.8	-129.5
2035	41.8	47.4	47.1	136.4	490.9	627.2	47.2	43.8	42.9	133.9	482.0	615.9	5.4	-3.6	-4.3	-2.5	-8.8	-11.3	-140.8
2036	42.7	48.6	48.2	139.5	502.3	641.9	48.3	45.0	43.9	137.2	493.9	631.1	5.5	-3.6	-4.3	-2.4	-8.5	-10.8	-151.7
2037	43.7	49.6	49.3	142.7	513.7	656.4	49.4	46.1	45.0	140.5	505.6	646.1	5.7	-3.5	-4.4	-2.3	-8.1	-10.4	-162.0
2038	44.7	50.7	50.4	145.9	525.1	671.0	50.5	47.2	45.9	143.7	517.2	660.9	5.8	-3.5	-4.5	-2.2	-7.9	-10.1	-172.1
2039	45.7	51.8	52.8	148.9	536.1	685.0	51.6	48.3	49.3	146.8	528.4	675.2	5.9	-3.5	-3.5	-2.1	-7.6	-9.8	-181.9
2040	46.5	52.8	53.8	151.9	546.8	698.7	52.6	49.3	50.2	149.9	539.5	689.3	6.1	-3.5	-3.6	-2.0	-7.3	-9.3	-191.2
2041	47.4	53.8	53.5	154.7	557.1	711.8	53.6	50.2	48.9	152.7	549.8	702.6	6.2	-3.6	-4.6	-2.0	-7.2	-9.3	-200.5
2021-2041	789.0	895.4	892.0	2,573.8	9,265.8	11,912.6	874.5	829.4	830.6	2,529.9	9,107.5	11,712.1	85.5	-66.1	-61.4	-44.0	-158.3	-200.5	

Table 40 Cost of public hospital outpatient clinics and hospital emergency departments by persons with AD dementia, 2021-2041 ($millions)

Year	USUAL CARE		DMT		DIFFERENCE			
	Outpatient Clinics	Emerg Dept	Outpatient Clinics	Emerg Dept	Outpatient Clinics	Emerg Dept	Total	Cumul Diff
2021	141.9	2.7	141.9	2.7	0.0	0.0	0.0	0.0
2022	147.0	2.8	146.4	2.8	-0.6	0.0	-0.7	-0.7
2023	152.3	2.9	151.1	2.8	-1.2	0.0	-1.2	-1.9
2024	157.6	3.0	155.9	2.9	-1.7	0.0	-1.8	-3.7
2025	163.1	3.1	160.9	3.0	-2.1	-0.1	-2.2	-5.8
2026	168.7	3.2	166.3	3.1	-2.4	-0.1	-2.4	-8.3
2027	174.6	3.3	172.0	3.2	-2.5	-0.1	-2.6	-10.9
2028	180.5	3.4	177.8	3.3	-2.6	-0.1	-2.7	-13.6
2029	186.6	3.5	184.0	3.4	-2.7	-0.1	-2.7	-16.4
2030	193.0	3.6	190.4	3.5	-2.6	-0.1	-2.7	-19.1
2031	199.6	3.7	197.0	3.6	-2.6	-0.1	-2.7	-21.7
2032	206.5	3.8	204.1	3.8	-2.4	-0.1	-2.5	-24.2
2033	213.4	3.9	211.1	3.9	-2.3	-0.1	-2.3	-26.6
2034	220.1	4.1	218.0	4.0	-2.1	-0.1	-2.1	-28.7
2035	226.8	4.2	224.9	4.1	-1.9	-0.1	-1.9	-30.6
2036	233.4	4.3	231.7	4.2	-1.7	-0.1	-1.8	-32.4
2037	239.9	4.4	238.4	4.3	-1.5	-0.1	-1.6	-34.0
2038	246.4	4.5	245.0	4.4	-1.4	0.0	-1.5	-35.4
2039	252.6	4.6	251.4	4.5	-1.2	0.0	-1.3	-36.7
2040	258.4	4.7	257.4	4.6	-1.0	0.0	-1.0	-37.7
2041	264.2	4.8	263.2	4.7	-1.0	0.0	-1.0	-38.7
2021-2041	**4,226.5**	**78.2**	**4,188.9**	**77.1**	**-37.6**	**-1.1**	**-38.7**	

7.3 OUT OF HOSPITAL MEDICAL SERVICES

These direct costs include the expenditure on

- prescribed dementia specific medications;
- other prescribed drugs used in the management of AD dementia;
- diagnostic imaging and pathology services; and
- consultations with GPs, specialists, and allied health professionals.

Prescribed Medicines

The projected annual script volumes of the four prescribed dementia specific medications – donepezil, galantamine, rivastigmine and memantine – over the 20 years under the two scenarios are shown in Table 41. Over the first 3 years after the DMT commences, there is a reduction in the number of all of the prescribed dementia specific medications as an outcome of fewer persons having moderate AD dementia.

Table 41 Estimated number of scripts for dementia specific medications, 2021-2041

Year	USUAL CARE					DMT INTERVENTION					DIFFERENCE				
	D	G	R	M	Total	D	G	R	M	Total	D	G	R	M	Total
2021	365,145	64,381	75,635	68,974	**574,135**	365,145	64,381	75,635	68,974	**574,135**	0	0	0	0	0
2022	377,956	66,623	78,288	71,426	**594,293**	376,392	66,373	77,952	70,068	**590,785**	-1,564	-250	-336	-1,358	-3,508
2023	391,309	68,963	81,067	73,870	**615,209**	389,500	68,684	80,672	71,316	**610,172**	-1,809	-279	-395	-2,554	-5,037
2024	404,988	71,377	83,883	76,429	**636,677**	403,841	71,221	83,619	72,838	**631,519**	-1,147	-156	-264	-3,591	-5,158
2025	419,034	73,860	86,764	79,076	**658,734**	419,146	73,931	86,756	74,606	**654,439**	112	71	-8	-4,470	-4,295
2026	433,485	76,427	89,716	81,812	**681,440**	435,230	76,787	90,041	76,600	**678,658**	1,745	360	325	-5,212	-2,782
2027	448,778	79,191	92,761	84,727	**705,457**	452,380	79,881	93,467	78,887	**704,615**	3,602	690	706	-5,840	-842
2028	464,490	82,015	95,910	87,655	**730,070**	470,053	83,053	97,015	81,304	**731,425**	5,563	1,038	1,105	-6,351	1,355
2029	479,960	84,810	99,026	90,583	**754,379**	487,504	86,201	100,536	83,819	**758,060**	7,544	1,391	1,510	-6,764	3,681
2030	495,591	87,642	102,172	93,579	**778,984**	505,075	89,379	104,077	86,477	**785,008**	9,484	1,737	1,905	-7,102	6,024
2031	511,297	90,496	105,334	96,627	**803,754**	522,673	92,570	107,624	89,256	**812,123**	11,376	2,074	2,290	-7,371	8,369
2032	526,129	93,235	108,331	99,608	**827,303**	539,206	95,616	110,967	92,035	**837,824**	13,077	2,381	2,636	-7,573	10,521
2033	541,229	96,010	111,376	102,591	**851,206**	555,898	98,676	114,335	94,878	**863,787**	14,669	2,666	2,959	-7,713	12,581
2034	556,213	98,751	114,399	105,543	**874,906**	572,337	101,682	117,653	97,734	**889,406**	16,124	2,931	3,254	-7,809	14,500
2035	570,948	101,448	117,361	108,449	**898,206**	588,398	104,617	120,884	100,571	**914,470**	17,450	3,169	3,523	-7,878	16,264
2036	585,567	104,130	120,283	111,334	**921,314**	604,225	107,518	124,051	103,403	**939,197**	18,658	3,388	3,768	-7,931	17,883
2037	600,009	106,773	123,169	114,161	**944,112**	619,770	110,358	127,160	106,189	**963,477**	19,761	3,585	3,991	-7,972	19,365
2038	614,485	109,427	126,053	116,938	**966,903**	635,228	113,188	130,245	108,926	**987,587**	20,743	3,761	4,192	-8,012	20,684
2039	628,621	112,021	128,870	119,677	**989,189**	650,256	115,942	133,242	111,624	**1,011,064**	21,635	3,921	4,372	-8,053	21,875
2040	642,058	114,499	131,536	122,345	**1,010,438**	664,499	118,564	136,072	114,252	**1,033,387**	22,441	4,065	4,536	-8,093	22,949
2041	655,049	116,916	134,107	124,993	**1,031,065**	678,242	121,119	138,791	116,849	**1,055,001**	23,193	4,203	4,684	-8,144	23,936

D donepezil, G galantamine, R rivastigmine and M memantine

However, with the use of the DMT, more people stay in the mild AD dementia state for longer, and with no changes in the prescribing patterns of specialists, the volume of scripts for donepezil, galantamine, rivastigmine increases (3.5% higher in 2041 under the DMT). Meanwhile by 2041, it is expected that there would more than 8,100 fewer memantine scripts being dispensed each year (a 6.5% reduction in annual script volume when compared to the continuation of usual care).

The change in costs associated with the changes in script numbers for these 4 dementia specific medications under the DMT scenario is shown in Table 42, along with the annual expenditure on other medications used in the management of AD dementia symptoms. The total annual cost of dementia specific medications and other medications used in the management of AD dementia was projected to reach $40.8m by 2041 in the base case of usual care, increasing by 2% to $41.7m under the DMT intervention. Small savings were made in the first 6 years after the introduction of the DMT after which any savings from the reduced use of memantine were offset by the increased cost of the other 3 drugs.

An age breakdown of script use and cost can be found in the Report data tables.

Diagnostic Imaging and Pathology Services

Using the methods outlined in section 5.2, the costs attached to diagnostic imaging services and pathology services used by persons with AD dementia are given Table 43. The introduction of the DMT resulted in relatively small annual savings in the cost of these two services, with a cumulative reduction in costs over the 20 years of only $5m. The cost of diagnostic imaging and pathology services grew by 85.9% under usual care from 2021-2041 and very slightly lower by 85.4% under the DMT.

GPs, Specialists, and Allied Health Professionals

There is a small impact of the DMT intervention on the cost of medical practitioner and allied health services with a combined savings in costs of care of $7.9m over the 20 years (Table 44). By 2040 the annual expenditure on GPs, specialists, and allied health professionals was the same under usual care and the hypothetical DMT intervention.

The cumulative total cost of out-of-hospital health services over the 20 years 2021-2041 was similar under the base case of usual care and with the introduction of the DMT at $2.46bn with the DMT generating an overall savings of $7.4m.

Table 42 Estimated cost of scripts for dementia specific medications and other medications used to manage AD dementia, 2021-2041 ($millions)

Year	USUAL CARE							DMT INTERVENTION							DIFFERENCE						
	Dementia Specific Medications					Other Meds	TOTAL Meds	Dementia Specific Medications					Other Meds	TOTAL Meds	Dementia Specific Medications					Other Meds	TOTAL Meds
	D	G	R	M	Total			D	G	R	M	Total			D	G	R	M	Total		
2021	8.1	2.5	6.3	2.9	19.8	3.0	**22.8**	8.1	2.5	6.3	2.9	19.8	3.0	**22.8**	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
2022	8.4	2.6	6.5	3.0	20.5	3.1	**23.6**	8.3	2.6	6.5	3.0	20.4	3.1	**23.4**	0.0	0.0	0.0	-0.1	0.0	0.0	**-0.1**
2023	8.7	2.7	6.7	3.1	21.2	3.2	**24.4**	8.6	2.7	6.7	3.0	21.0	3.2	**24.2**	0.0	0.0	0.0	-0.1	0.0	0.0	**-0.2**
2024	9.0	2.8	7.0	3.2	21.9	3.3	**25.3**	8.9	2.8	6.9	3.1	21.7	3.3	**25.0**	0.0	0.0	0.0	-0.2	0.0	0.0	**-0.2**
2025	9.3	2.9	7.2	3.3	22.7	3.4	**26.1**	9.3	2.9	7.2	3.2	22.5	3.4	**25.9**	0.0	0.0	0.0	-0.2	0.0	0.0	**-0.2**
2026	9.6	3.0	7.5	3.5	23.5	3.5	**27.0**	9.6	3.0	7.5	3.2	23.3	3.5	**26.9**	0.0	0.0	0.0	-0.2	0.0	0.0	**-0.2**
2027	9.9	3.1	7.7	3.6	24.3	3.7	**28.0**	10.0	3.1	7.8	3.3	24.2	3.7	**27.9**	0.1	0.0	0.1	-0.2	0.1	0.0	**-0.1**
2028	10.3	3.2	8.0	3.7	25.1	3.8	**28.9**	10.4	3.2	8.1	3.4	25.1	3.8	**28.9**	0.1	0.0	0.1	-0.3	0.1	0.0	**0.0**
2029	10.6	3.3	8.2	3.8	26.0	3.9	**29.9**	10.8	3.3	8.4	3.5	26.0	3.9	**30.0**	0.2	0.1	0.1	-0.3	0.2	0.0	**0.1**
2030	11.0	3.4	8.5	4.0	26.8	4.0	**30.9**	11.2	3.5	8.6	3.7	27.0	4.1	**31.0**	0.2	0.1	0.2	-0.3	0.2	0.0	**0.2**
2031	11.3	3.5	8.8	4.1	27.7	4.2	**31.9**	11.6	3.6	8.9	3.8	27.9	4.2	**32.1**	0.3	0.1	0.2	-0.3	0.3	0.0	**0.2**
2032	11.6	3.6	9.0	4.2	28.5	4.3	**32.8**	11.9	3.7	9.2	3.9	28.8	4.3	**33.1**	0.3	0.1	0.2	-0.3	0.3	0.0	**0.3**
2033	12.0	3.7	9.3	4.3	29.3	4.4	**33.7**	12.3	3.8	9.5	4.0	29.7	4.5	**34.1**	0.3	0.1	0.2	-0.3	0.3	0.1	**0.4**
2034	12.3	3.8	9.5	4.5	30.1	4.5	**34.7**	12.7	3.9	9.8	4.1	30.5	4.6	**35.1**	0.4	0.1	0.3	-0.3	0.4	0.1	**0.5**
2035	12.6	3.9	9.8	4.6	30.9	4.7	**35.6**	13.0	4.1	10.0	4.3	31.4	4.7	**36.1**	0.4	0.1	0.3	-0.3	0.4	0.1	**0.5**
2036	13.0	4.0	10.0	4.7	31.7	4.8	**36.5**	13.4	4.2	10.3	4.4	32.2	4.9	**37.1**	0.4	0.1	0.3	-0.3	0.4	0.1	**0.6**
2037	13.3	4.1	10.2	4.8	32.5	4.9	**37.4**	13.7	4.3	10.6	4.5	33.1	5.0	**38.1**	0.4	0.1	0.3	-0.3	0.4	0.1	**0.7**
2038	13.6	4.3	10.5	4.9	33.3	5.0	**38.3**	14.1	4.4	10.8	4.6	33.9	5.1	**39.0**	0.5	0.1	0.3	-0.3	0.5	0.1	**0.7**
2039	13.9	4.4	10.7	5.1	34.0	5.1	**39.2**	14.4	4.5	11.1	4.7	34.7	5.2	**39.9**	0.5	0.2	0.4	-0.3	0.5	0.1	**0.8**
2040	14.2	4.4	10.9	5.2	34.8	5.2	**40.0**	14.7	4.6	11.3	4.8	35.5	5.4	**40.8**	0.5	0.2	0.4	-0.3	0.5	0.1	**0.8**
2041	14.5	4.5	11.1	5.3	35.5	5.4	**40.8**	15.0	4.7	11.5	4.9	36.2	5.5	**41.7**	0.5	0.2	0.4	-0.3	0.5	0.1	**0.8**
2021-2041	237.2	73.8	183.3	85.9	580.1	87.6	**667.7**	242.1	75.3	187.0	80.4	584.8	88.3	**673.1**	4.9	1.6	3.7	-5.5	4.7	0.7	**5.5**

D donepezil, G galantamine, R rivastigmine and M memantine

Table 43 Cost of the use of diagnostic imaging and pathology services by persons with AD dementia, 2021-2041 ($millions)

Year	USUAL CARE		DMT		DIFFERENCE			
	Diagnostic Imaging	Pathology	Diagnostic Imaging	Pathology	Diagnostic Imaging	Pathology	Total	Cumul Diff
2021	15.7	4.5	15.7	4.5	0.0	0.0	0.0	0.0
2022	16.3	4.7	16.2	4.6	-0.1	0.0	-0.1	-0.1
2023	16.8	4.8	16.7	4.8	-0.1	0.0	-0.2	-0.3
2024	17.4	5.0	17.2	4.9	-0.2	-0.1	-0.2	-0.5
2025	18.0	5.2	17.8	5.1	-0.2	-0.1	-0.3	-0.8
2026	18.7	5.3	18.4	5.3	-0.3	-0.1	-0.3	-1.1
2027	19.3	5.5	19.0	5.5	-0.3	-0.1	-0.4	-1.5
2028	20.0	5.7	19.7	5.6	-0.3	-0.1	-0.4	-1.9
2029	20.7	5.9	20.4	5.8	-0.3	-0.1	-0.4	-2.2
2030	21.4	6.1	21.1	6.0	-0.3	-0.1	-0.4	-2.6
2031	22.1	6.3	21.8	6.2	-0.3	-0.1	-0.4	-2.9
2032	22.8	6.5	22.6	6.5	-0.3	-0.1	-0.3	-3.3
2033	23.6	6.8	23.4	6.7	-0.2	-0.1	-0.3	-3.6
2034	24.3	7.0	24.1	6.9	-0.2	-0.1	-0.3	-3.8
2035	25.1	7.2	24.9	7.1	-0.2	-0.1	-0.2	-4.1
2036	25.8	7.4	25.6	7.3	-0.2	0.0	-0.2	-4.3
2037	26.5	7.6	26.4	7.6	-0.1	0.0	-0.2	-4.5
2038	27.2	7.8	27.1	7.8	-0.1	0.0	-0.2	-4.7
2039	27.9	8.0	27.8	8.0	-0.1	0.0	-0.1	-4.8
2040	28.6	8.2	28.5	8.2	-0.1	0.0	-0.1	-4.9
2041	29.2	8.4	29.1	8.3	-0.1	0.0	-0.1	-5.0
2021-2041	**467.4**	**134.0**	**463.5**	**132.8**	**-3.9**	**-1.1**	**-5.0**	

Table 44 Estimated cost of visits to GPs, specialists and allied health professionals by persons with AD dementia, 2021-2041 ($millions)

	USUAL CARE	DMT	DIFF.	CUMUL DIFF
2021	40.2	40.2	0.0	0.0
2022	41.7	41.5	-0.2	-0.2
2023	43.2	42.8	-0.4	-0.5
2024	44.7	44.2	-0.5	-1.0
2025	46.2	45.7	-0.6	-1.6
2026	47.8	47.2	-0.6	-2.2
2027	49.5	48.8	-0.6	-2.9
2028	51.2	50.5	-0.6	-3.5
2029	52.9	52.3	-0.6	-4.1
2030	54.7	54.1	-0.6	-4.8
2031	56.5	56.0	-0.6	-5.3
2032	58.5	58.0	-0.5	-5.8
2033	60.4	59.9	-0.5	-6.3
2034	62.2	61.9	-0.4	-6.7
2035	64.1	63.8	-0.3	-7.0
2036	66.0	65.7	-0.3	-7.3
2037	67.8	67.6	-0.2	-7.5
2038	69.6	69.4	-0.2	-7.7
2039	71.3	71.2	-0.1	-7.8
2040	72.9	72.9	0.0	-7.8
2041	74.5	74.5	0.0	-7.9
2021-2041	**1.195.9**	**1,188.0**	**-7.9**	

7.4 COST OF FORMAL AGED CARE SERVICES

Residential Aged Care

The increase in the projected number of the study AD dementia population who would be living in permanent residential aged care by disease severity over the period 2021-2041 under usual care and the DMT scenario is shown in Figure 8 and Table 45. Under usual care, there is a 72.3% expected increase over the next 20 years in the number of RACF residents with AD dementia (a growth rate consistent across mild, moderate and severe dementia) with the numbers increasing from 42,478 persons in 2021 to 73,172 in 2041. However, with the introduction of the DMT in 2021, the number of persons with AD dementia (with an existing diagnosis of confirmed dementia due to AD before assessment and entry into permanent residential care) increases by only 61.4%. Although the number of residents with mild AD dementia increases by 94.0% (from 1,457 persons in 2021 to 2,827), rate of increase for those with moderate disease severity is only 61.9% and severe dementia 58.0%. By 2041 under the DMT scenario compared with usual care, there is expected to be 2,427 fewer residents with moderate AD dementia and 2,490 with severe AD dementia living in permanent residential aged care, with only an increase of 315 residents with mild disease. This will change the mix of care needs of persons with AD dementia in permanent care.

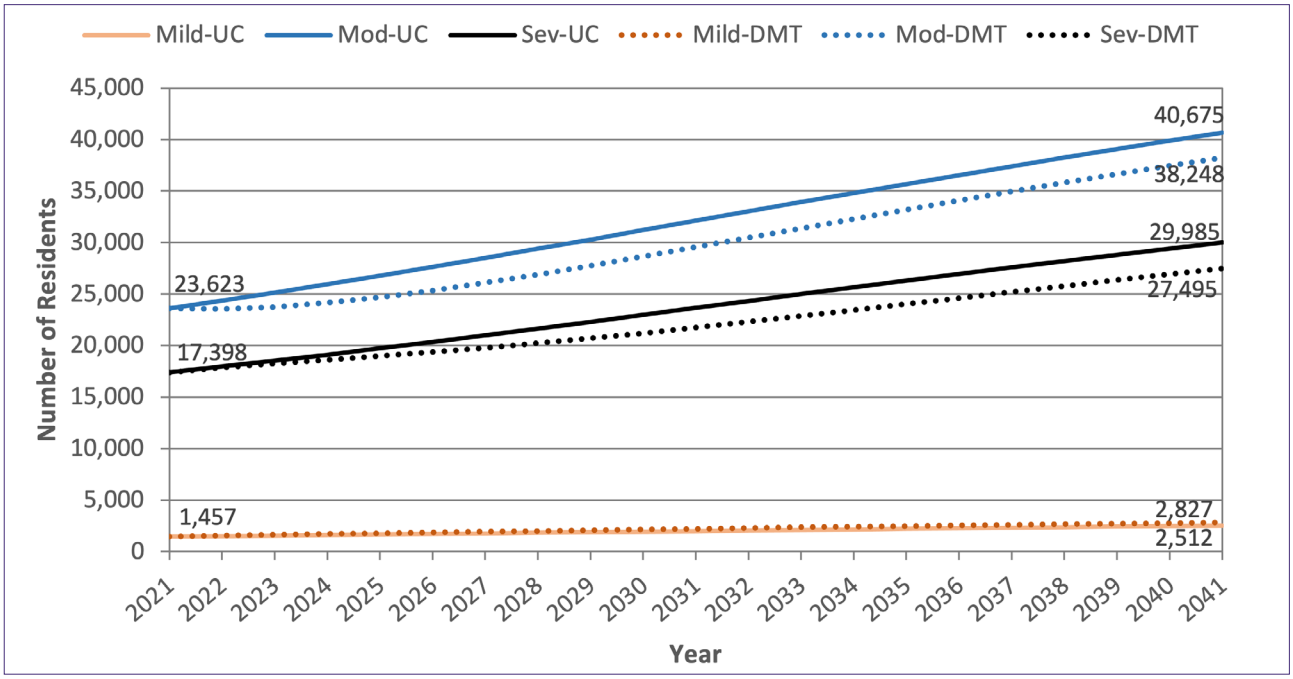
As identified in Table 29, the unit cost of residential aged care in 2021 was estimated to be $93,591.15 per person p.a. Thus, the relative reduction in numbers of residential aged care residents under the DMT scenario equates to a substantial annual and cumulative savings in the costs of residential care (Table 46). If usual care continues the cost of residential care for the study population is projected to increase from nearly $4.0bn in 2021 to $6.8bn by 2041 and with the introduction of the DMT to $6.4bn. Over the 20-year simulation period the DMT produces a $7.0bn savings.

Formal Community Care Services

The cost of formal care in the community reflects the number of persons with AD dementia living in the community, their level of dementia severity and their need for care. The number of community dwelling persons with AD dementia is projected to rise from 111,410 persons in 2021 to 192,942 by 2041 under the base case of usual care, and to 199,674 persons under the DMT (Table 47). By 2041, the number of persons with mild AD dementia is 12.5% higher under the DMT scenario compared with usual care but there is a projected 5.8% reduction in those with moderate severity and 8.2% for those with severe AD dementia.

As a consequence of this changing profile there is a change in the number of formal carers (Table 48).

Figure 8 Number of persons with AD dementia[1] living in residential care by disease severity, 2021-2041



1. This only refers to the study population i.e. persons with an existing diagnosis of confirmed dementia due to AD before assessment and entry into permanent residential care and is not the whole population of persons with clinically diagnosed AD in permanent residential care who may have received a diagnosis in the process of entering residential care.

Table 45 Number of persons with AD dementia[1] living in residential care by disease severity, 2021-2041

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE			
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total
2021	1,457	23,623	17,398	**42,478**	1,457	23,623	17,398	**42,478**	0	0	0	**0**
2022	1,502	24,380	17,954	**43,836**	1,541	23,565	17,861	**42,967**	39	-815	-93	**-869**
2023	1,552	25,156	18,526	**45,234**	1,625	23,755	18,253	**43,633**	73	-1,401	-273	**-1,601**
2024	1,602	25,962	19,116	**46,680**	1,706	24,148	18,618	**44,472**	104	-1,814	-498	**-2,208**
2025	1,654	26,791	19,723	**48,168**	1,783	24,691	18,983	**45,457**	129	-2,100	-740	**-2,711**
2026	1,705	27,639	20,348	**49,692**	1,858	25,346	19,368	**46,572**	153	-2,293	-980	**-3,120**
2027	1,759	28,506	20,989	**51,254**	1,932	26,088	19,778	**47,798**	173	-2,418	-1,211	**-3,456**
2028	1,815	29,390	21,639	**52,844**	2,007	26,893	20,220	**49,120**	192	-2,497	-1,419	**-3,724**
2029	1,872	30,294	22,302	**54,468**	2,081	27,750	20,696	**50,527**	209	-2,544	-1,606	**-3,941**
2030	1,929	31,208	22,976	**56,113**	2,153	28,641	21,206	**52,000**	224	-2,567	-1,770	**-4,113**
2031	1,985	32,125	23,656	**57,766**	2,222	29,553	21,744	**53,519**	237	-2,572	-1,912	**-4,247**
2032	2,040	33,036	24,336	**59,412**	2,291	30,472	22,304	**55,067**	251	-2,564	-2,032	**-4,345**
2033	2,097	33,930	25,003	**61,030**	2,356	31,388	22,873	**56,617**	259	-2,542	-2,130	**-4,413**
2034	2,151	34,813	25,661	**62,625**	2,420	32,299	23,450	**58,169**	269	-2,514	-2,211	**-4,456**
2035	2,205	35,684	26,308	**64,197**	2,482	33,196	24,032	**59,710**	277	-2,488	-2,276	**-4,487**
2036	2,258	36,545	26,947	**65,750**	2,543	34,080	24,618	**61,241**	285	-2,465	-2,329	**-4,509**
2037	2,312	37,400	27,576	**67,288**	2,603	34,954	25,203	**62,760**	291	-2,446	-2,373	**-4,528**
2038	2,367	38,243	28,192	**68,802**	2,664	35,808	25,783	**64,255**	297	-2,435	-2,409	**-4,547**
2039	2,418	39,078	28,799	**70,295**	2,722	36,650	26,360	**65,732**	304	-2,428	-2,439	**-4,563**
2040	2,467	39,894	29,397	**71,758**	2,776	37,466	26,932	**67,174**	309	-2,428	-2,465	**-4,584**
2041	2,512	40,675	29,985	**73,172**	2,827	38,248	27,495	**68,570**	315	-2,427	-2,490	**-4,602**

1. This only refers to the study population i.e. persons with an existing diagnosis of confirmed dementia due to AD before assessment and entry into permanent residential care and is not the whole population of persons with clinically diagnosed AD in permanent residential care who may have received a diagnosis in the process of entering residential care.

Table 46 Cost of residential care for persons with AD dementia[1] by disease severity, 2021-2041 ($millions)

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE				
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Cumul
2021	136.4	2,210.9	1,628.3	3,975.6	136.4	2,210.9	1,628.3	3,975.6	0.0	0.0	0.0	0.0	0.0
2022	140.6	2,281.8	1,680.3	4,102.7	144.2	2,205.5	1,671.6	4,021.3	3.7	-76.3	-8.7	-81.3	-81.3
2023	145.3	2,354.4	1,733.9	4,233.5	152.1	2,223.3	1,708.3	4,083.7	6.8	-131.1	-25.6	-149.8	-231.2
2024	149.9	2,429.8	1,789.1	4,368.8	159.7	2,260.0	1,742.5	4,162.2	9.7	-169.8	-46.6	-206.6	-437.8
2025	154.8	2,507.4	1,845.9	4,508.1	166.9	2,310.9	1,776.6	4,254.4	12.1	-196.5	-69.3	-253.7	-691.5
2026	159.6	2,586.8	1,904.4	4,650.7	173.9	2,372.2	1,812.7	4,358.7	14.3	-214.6	-91.7	-292.0	-983.5
2027	164.6	2,667.9	1,964.4	4,796.9	180.8	2,441.6	1,851.0	4,473.5	16.2	-226.3	-113.3	-323.5	-1,307.0
2028	169.9	2,750.6	2,025.2	4,945.7	187.8	2,516.9	1,892.4	4,597.2	18.0	-233.7	-132.8	-348.5	-1,655.5
2029	175.2	2,835.3	2,087.3	5,097.7	194.8	2,597.2	1,937.0	4,728.9	19.6	-238.1	-150.3	-368.8	-2,024.4
2030	180.5	2,920.8	2,150.4	5,251.7	201.5	2,680.5	1,984.7	4,866.7	21.0	-240.2	-165.7	-384.9	-2,409.3
2031	185.8	3,006.6	2,214.0	5,406.4	208.0	2,765.9	2,035.0	5,008.9	22.2	-240.7	-178.9	-397.5	-2,806.8
2032	190.9	3,091.9	2,277.6	5,560.4	214.4	2,851.9	2,087.5	5,153.8	23.5	-240.0	-190.2	-406.7	-3,213.5
2033	196.3	3,175.5	2,340.1	5,711.9	220.5	2,937.6	2,140.7	5,298.9	24.2	-237.9	-199.3	-413.0	-3,626.5
2034	201.3	3,258.2	2,401.6	5,861.1	226.5	3,022.9	2,194.7	5,444.1	25.2	-235.3	-206.9	-417.0	-4,043.5
2035	206.4	3,339.7	2,462.2	6,008.3	232.3	3,106.9	2,249.2	5,588.3	25.9	-232.9	-213.0	-419.9	-4,463.5
2036	211.3	3,420.3	2,522.0	6,153.6	238.0	3,189.6	2,304.0	5,731.6	26.7	-230.7	-218.0	-422.0	-4,885.5
2037	216.4	3,500.3	2,580.9	6,297.6	243.6	3,271.4	2,358.8	5,873.8	27.2	-228.9	-222.1	-423.8	-5,309.2
2038	221.5	3,579.2	2,638.5	6,439.3	249.3	3,351.3	2,413.1	6,013.7	27.8	-227.9	-225.5	-425.6	-5,734.8
2039	226.3	3,657.4	2,695.3	6,579.0	254.8	3,430.1	2,467.1	6,151.9	28.5	-227.2	-228.3	-427.1	-6,161.9
2040	230.9	3,733.7	2,751.3	6,715.9	259.8	3,506.5	2,520.6	6,286.9	28.9	-227.2	-230.7	-429.0	-6,590.9
2041	235.1	3,806.8	2,806.3	6,848.3	264.6	3,579.7	2,573.3	6,417.5	29.5	-227.1	-233.0	-430.7	-7,021.6
2021-2041	**3,898.9**	**63,115.3**	**46,499.0**	**113,513.1**	**4,309.8**	**58,832.7**	**43,349.1**	**106,491.6**	**410.9**	**-4,282.5**	**-3,149.9**	**-7,021.6**	

1. This only refers to the study population i.e. persons with an existing diagnosis of confirmed dementia due to AD before assessment and entry into permanent residential care and is not the whole population of persons with clinically diagnosed AD in permanent residential care who may have received a diagnosis in the process of entering residential care.

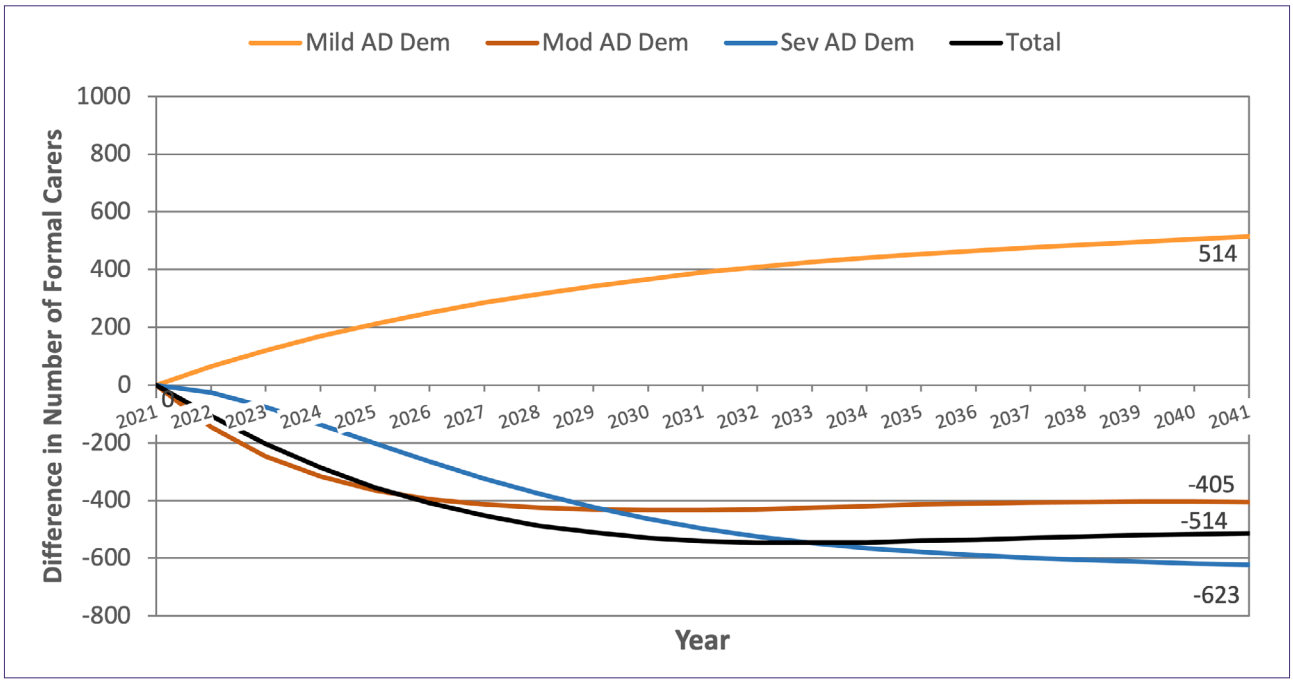
Table 47 Estimated number of persons with AD dementia living in the community by disease severity, 2021-2041

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE			
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total
2021	59,519	29,920	21,971	111,410	59,519	29,920	21,971	111,410	0	0	0	**0**
2022	61,385	30,934	22,704	115,023	62,998	29,846	22,573	115,417	1,613	-1,088	-131	**394**
2023	63,460	31,965	23,456	118,881	66,478	30,114	23,076	119,668	3,018	-1,851	-380	**787**
2024	65,536	33,032	24,231	122,799	69,786	30,654	23,544	123,984	4,250	-2,378	-687	**1,185**
2025	67,639	34,125	25,029	126,793	72,974	31,392	24,020	128,386	5,335	-2,733	-1,009	**1,593**
2026	69,788	35,242	25,849	130,879	76,081	32,278	24,523	132,882	6,293	-2,964	-1,326	**2,003**
2027	72,005	36,377	26,686	135,068	79,150	33,269	25,064	137,483	7,145	-3,108	-1,622	**2,415**
2028	74,315	37,530	27,532	139,377	82,220	34,340	25,646	142,206	7,905	-3,190	-1,886	**2,829**
2029	76,648	38,706	28,394	143,748	85,243	35,470	26,277	146,990	8,595	-3,236	-2,117	**3,242**
2030	78,982	39,891	29,266	148,139	88,199	36,640	26,949	151,788	9,217	-3,251	-2,317	**3,649**
2031	81,286	41,075	30,144	152,505	91,064	37,831	27,657	156,552	9,778	-3,244	-2,487	**4,047**
2032	83,571	42,251	31,019	156,841	93,841	39,022	28,393	161,256	10,270	-3,229	-2,626	**4,415**
2033	85,845	43,401	31,877	161,123	96,531	40,210	29,139	165,880	10,686	-3,191	-2,738	**4,757**
2034	88,078	44,535	32,720	165,333	99,121	41,387	29,893	170,401	11,043	-3,148	-2,827	**5,068**
2035	90,297	45,650	33,547	169,494	101,664	42,540	30,651	174,855	11,367	-3,110	-2,896	**5,361**
2036	92,483	46,747	34,361	173,591	104,141	43,669	31,410	179,220	11,658	-3,078	-2,951	**5,629**
2037	94,664	47,832	35,159	177,655	106,595	44,778	32,161	183,534	11,931	-3,054	-2,998	**5,879**
2038	96,888	48,894	35,934	181,716	109,075	45,855	32,901	187,831	12,187	-3,039	-3,033	**6,115**
2039	99,005	49,941	36,694	185,640	111,435	46,907	33,631	191,973	12,430	-3,034	-3,063	**6,333**
2040	100,985	50,958	37,443	189,386	113,649	47,926	34,352	195,927	12,664	-3,032	-3,091	**6,541**
2041	102,833	51,935	38,174	192,942	115,719	48,898	35,057	199,674	12,886	-3,037	-3,117	**6,732**

Table 48 Estimated number of full-time equivalent formal carers providing assistance to persons with AD dementia in the community by disease severity, 2021-2041

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE			
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total
2021	2,373	3,987	4,392	**10,752**	2,373	3,987	4,392	**10,752**	0	0	0	0
2022	2,447	4,122	4,538	**11,107**	2,512	3,977	4,512	**11,001**	65	-145	-26	-106
2023	2,530	4,260	4,689	**11,479**	2,650	4,013	4,613	**11,276**	120	-247	-76	-203
2024	2,613	4,402	4,844	**11,859**	2,782	4,085	4,706	**11,573**	169	-317	-138	-286
2025	2,697	4,548	5,003	**12,248**	2,909	4,183	4,801	**11,893**	212	-365	-202	-355
2026	2,782	4,696	5,167	**12,645**	3,033	4,301	4,902	**12,236**	251	-395	-265	-409
2027	2,871	4,848	5,334	**13,053**	3,156	4,434	5,010	**12,600**	285	-414	-324	-453
2028	2,963	5,001	5,504	**13,468**	3,278	4,576	5,127	**12,981**	315	-425	-377	-487
2029	3,056	5,158	5,676	**13,890**	3,399	4,727	5,253	**13,379**	343	-431	-423	-511
2030	3,149	5,316	5,850	**14,315**	3,516	4,883	5,387	**13,786**	367	-433	-463	-529
2031	3,241	5,474	6,026	**14,741**	3,631	5,041	5,528	**14,200**	390	-433	-498	-541
2032	3,332	5,631	6,201	**15,164**	3,741	5,200	5,676	**14,617**	409	-431	-525	-547
2033	3,423	5,784	6,372	**15,579**	3,849	5,359	5,825	**15,033**	426	-425	-547	-546
2034	3,512	5,935	6,541	**15,988**	3,952	5,515	5,975	**15,442**	440	-420	-566	-546
2035	3,600	6,083	6,706	**16,389**	4,053	5,669	6,127	**15,849**	453	-414	-579	-540
2036	3,687	6,230	6,869	**16,786**	4,152	5,819	6,279	**16,250**	465	-411	-590	-536
2037	3,774	6,374	7,028	**17,176**	4,250	5,967	6,429	**16,646**	476	-407	-599	-530
2038	3,863	6,516	7,183	**17,562**	4,349	6,111	6,577	**17,037**	486	-405	-606	-525
2039	3,947	6,655	7,335	**17,937**	4,443	6,251	6,723	**17,417**	496	-404	-612	-520
2040	4,026	6,791	7,485	**18,302**	4,531	6,387	6,867	**17,785**	505	-404	-618	-517
2041	4,100	6,921	7,631	**18,652**	4,614	6,516	7,008	**18,138**	514	-405	-623	-514

Figure 9 Difference in full-time equivalent number of formal carers between usual care and DMT scenarios, 2021-2041.



The impact of the DMT on the FTE number of formal carers compared with the usual care base case is very different for the three disease severity states over the 20 years (Figure 9). The reduction in the total FTE number of formal carers in the community plateaued in 2032-34, with the increase in carers providing assistance to persons with mild AD dementia thereafter increasingly off-setting the reduced need for care provided to persons with moderate or severe AD dementia.

The associated cost of formal care in the community is given in Table 49. Over the 20 year simulation period, the DMT intervention would be expected to lead to an overall savings of $889.5m. While the cost of care for persons with mild AD dementia increases with a cumulative gain of $695.2m by 2041, the total expenditure 2021-2041 on formal community care for persons with moderate AD dementia would have decreased by $747.5m and severe AD dementia by $837.2m.

The cumulative total cost of formal aged care over the 20 years 2021-2041 under the base case of usual care was $143.4bn and with the DMT $135.5bn generating an overall savings of $7.9bn.

Table 49 Cost of formal care provided in the community to persons with AD dementia by disease severity, 2021-2041 ($millions)

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE				
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Cumul
2021	229.5	385.6	424.8	1,039.9	229.5	385.6	424.8	1,039.9	0.0	0.0	0.0	0.0	0.0
2022	236.7	398.7	439.0	1,074.4	242.9	384.7	436.4	1,064.0	6.2	-14.0	-2.5	-10.3	-10.3
2023	244.7	412.0	453.5	1,110.2	256.4	388.1	446.1	1,090.6	11.6	-23.9	-7.3	-19.6	-29.9
2024	252.7	425.8	468.5	1,146.9	269.1	395.1	455.2	1,119.4	16.4	-30.7	-13.3	-27.5	-57.4
2025	260.8	439.8	483.9	1,184.6	281.4	404.6	464.4	1,150.4	20.6	-35.2	-19.5	-34.2	-91.6
2026	269.1	454.2	499.8	1,223.1	293.4	416.0	474.1	1,183.5	24.3	-38.2	-25.6	-39.6	-131.2
2027	277.7	468.9	515.9	1,262.5	305.2	428.8	484.6	1,218.6	27.6	-40.1	-31.4	-43.9	-175.0
2028	286.6	483.7	532.3	1,302.6	317.1	442.6	495.8	1,255.5	30.5	-41.1	-36.5	-47.1	-222.1
2029	295.6	498.9	549.0	1,343.4	328.7	457.2	508.0	1,293.9	33.1	-41.7	-40.9	-49.5	-271.6
2030	304.6	514.2	565.8	1,384.6	340.1	472.3	521.0	1,333.4	35.5	-41.9	-44.8	-51.2	-322.8
2031	313.5	529.4	582.8	1,425.7	351.2	487.6	534.7	1,373.5	37.7	-41.8	-48.1	-52.2	-375.0
2032	322.3	544.6	599.7	1,466.6	361.9	503.0	548.9	1,413.8	39.6	-41.6	-50.8	-52.8	-427.8
2033	331.0	559.4	616.3	1,506.7	372.2	518.3	563.4	1,453.9	41.2	-41.1	-52.9	-52.9	-480.6
2034	339.6	574.0	632.6	1,546.3	382.2	533.4	577.9	1,493.6	42.6	-40.6	-54.7	-52.6	-533.3
2035	348.2	588.4	648.6	1,585.2	392.0	548.3	592.6	1,532.9	43.8	-40.1	-56.0	-52.2	-585.5
2036	356.6	602.5	664.3	1,623.5	401.6	562.9	607.3	1,571.7	45.0	-39.7	-57.1	-51.8	-637.3
2037	365.0	616.5	679.8	1,661.3	411.0	577.2	621.8	1,610.0	46.0	-39.4	-58.0	-51.3	-688.6
2038	373.6	630.2	694.7	1,698.6	420.6	591.0	636.1	1,647.7	47.0	-39.2	-58.6	-50.8	-739.4
2039	381.8	643.7	709.4	1,734.9	429.7	604.6	650.2	1,684.5	47.9	-39.1	-59.2	-50.4	-789.8
2040	389.4	656.8	723.9	1,770.1	438.3	617.7	664.2	1,720.1	48.8	-39.1	-59.8	-50.0	-839.8
2041	396.5	669.4	738.0	1,804.0	446.2	630.3	677.8	1,754.3	49.7	-39.1	-60.3	-49.7	-889.5
2021-2041	**6,575.6**	**11,096.8**	**12,222.6**	**29,895.0**	**7,270.8**	**10,349.3**	**11,385.4**	**29,005.4**	**695.2**	**-747.5**	**-837.2**	**-889.5**	

7.5 SUMMARY OF DIRECT COSTS

A summary of the direct costs under the usual care and DMT intervention scenarios over the 20 year simulation period 2021-2041 is provided in Table 50. Total direct costs over the 20 years summed to $162.017bn under the base case of usual care compared with $157.967bn under the DMT scenario. The cumulative direct costs of biomarker testing, follow-up with a dementia specialist and administering the DMT infusion over the 20 years was estimated to be $4.109bn. In the absence of a price on the DMT drug, this represented 2.6% of total direct costs, the cost of implementing the DMT having contributed to 8.8% of total direct costs in year 1 when it was first introduced falling to 2.2% of direct costs estimated in 2041.

These treatment costs were offset by the $8.159bn generated in savings with the DMT compared with the direct costs estimated to occur under usual care. The DMT produced an overall reduction of $4.051bn in direct costs over the 20 years when the costs of implementing the DMT are taken into account.

The cost of formal aged care dominates the direct costs of AD dementia as shown in Table 50. Costs of residential care contributed to 69-70% of the non-DMT direct costs. Formal care in the community accounted for a further 18-19% of the other direct costs in both scenarios and hospital care around 10%. The reduction in the number of persons with AD dementia in permanent residential care under the DMT scenario contributed to 86.1% of the reduction in direct costs over the simulation period.

Table 50 Summary of direct costs under usual care and DMT intervention, 2021-2041 ($millions)

Direct Cost Component	2021			2041			2021-2041		
	Usual Care	DMT	Diff	Usual Care	DMT	Diff	Usual Care	DMT	Diff
DIRECT COSTS – DMT INTERVENTION									
Biomarker testing	0.0	72.6	72.6	0.0	26.4	26.4		528.5	528.5
Specialist follow-up	0.0	9.7	9.7	0.0	3.5	3.5		70.7	70.7
Administering infusion	0.0	461.7	461.7	0.0	177.2	177.2		3,509.7	3,509.7
DMT drug	-	-	-	-	-	-	-	-	-
Total	**0.0**	**544.0**	**544.0**	**0.0**	**207.1**	**207.1**		**4,109.0**	**4,109.0**
DIRECT COSTS - OTHER									
Hospital Care									
Admitted principal diagnosis	89.5	89.5	0.0	154.7	152.7	-2.0	2,573.8	2,529.9	-44.0
Admitted associated diagnosis	322.3	322.3	0.0	557.1	549.8	-7.2	9,265.8	9,107.5	-158.3
Public hospital outpatient clinics	141.9	141.9	0.0	264.2	263.2	-1.0	4,226.5	4,188.9	-37.6
Public hospital emergency departments	2.7	2.7	0.0	4.8	4.7	0.0	78.2	77.1	-1.1
Total	*556.5*	*556.5*	*0.0*	*980.8*	*970.5*	*-10.3*	*16,144.3*	*15,903.4*	*-241.0*
Out-of-Hospital Health Services									
Dementia specific medications	19.8	19.8	0.0	35.5	36.2	0.7	580.1	584.8	4.7
Other drugs	3.0	3.0	0.0	5.4	5.5	0.1	87.6	88.3	0.7
Diagnostic imaging services	15.7	15.7	0.0	29.2	29.1	-0.1	467.4	463.5	-3.9
Pathology services	4.5	4.5	0.0	8.4	8.3	0.0	134.0	132.8	-1.1
GPs, specialists, allied health	40.2	40.2	0.0	74.5	74.5	0.0	1,195.9	1,188.0	-7.9
Total	*83.2*	*83.2*	*0.0*	*152.9*	*153.6*	*0.7*	*2,464.9*	*2,457.4*	*-7.4*
Formal Aged Care									
Residential care	3,975.6	3,975.6	0.0	6,848.3	6,417.5	-430.7	113,513.1	106,491.6	-7,021.6
Community care	1,039.9	1,039.9	0.0	1,804.0	1,754.3	-49.7	29,895.0	29,005.4	-889.5
Total	*5,015.5*	*5,015.5*	*0.0*	*8,652.2*	*8,171.8*	*-480.4*	*143,408.1*	*135,497.0*	*-7,911.1*
Total	**5,655.2**	**5,655.2**	**0.0**	**9,786.0**	**9,296.0**	**-490.0**	**162,017.3**	**153,857.8**	**-8,159.5**
GRAND TOTAL	**5,655.2**	**6,199.2**	**544.0**	**9,786.0**	**9,503.1**	**-282.9**	**162,017.3**	**157,966.8**	**-4,050.6**

8. RESULTS - INDIRECT COSTS

8.1 INFORMAL CARE

The first step in the replacement method for valuing informal care is to establish the caregiving workload of informal carers to which the unit cost is applied. In this Report, the number of FTE carers was estimated under each of the two scenarios to represent carer 'hours' of work. The number of persons providing informal care to persons with AD dementia under usual care and the DMT intervention is provided in Table 51 and the number of FTE carers in Table 52. The FTE takes into account the different number of hours of care provided per week by informal carers to persons with mild, moderate or severe AD dementia.

While numerically there is expected to be a very small increase in the number of informal carers under the DMT scenario compared with usual care by 2041 (642 carers or 0.4% increase) (Table 51), there is an overall reduction in the amount of care provided (2,916 fewer FTEs or a 1.6% reduction in FTE carers). This occurs because while there is a rise in the number of informal carers (12.5% in 2041 compared with usual care) of persons with mild AD dementia, the hours of care provided per week averages 0.816FTE (31 hours of care per week). By 2041 the number of informal carers needed to assist persons with moderate AD dementia is expected to fall by 5.8% compared with the usual care scenario and for persons with severe AD dementia by 8.2%. Even though the relative increase in the number of carers of persons with mild AD dementia (7,732 carers) outnumbers the reduction in carers for those with moderate or severe AD dementia (3,037 and 4,053 carers respectively), the reduction in caregiving workload is much higher as the hours of care provided to persons moderate AD dementia averages 1.105 FTE and severe AD dementia 1.447 FTE.

Gross Value of Informal Care

The gross replacement value of the FTE informal carer workforce is given in Table 53. This is the replacement value of informal care before the offset of Government benefits paid to carers for caregiving are taken into account. The gross annual costs of informal care increase from $10.015bn in 2021 to $17.367bn (73.4% increase) in 2041 under the base case and to $17.085bn (70.6% increase) under the DMT intervention. In the usual care scenario, care of persons with mild AD dementia contributes to 28.0% of the gross costs of informal care, persons with moderate AD dementia 32.0% and persons with severe disease 40.0%. In contrast, under the DMT scenario, the respective percentages are 31.6%, 30.4% and 38.0%. In terms of the gross replacement value of care provided by informal carers, the DMT produces a cumulative savings of $5.545bn over the 20 years.

Government Payments to Carers Offset

Government payments of the carer payment, carer allowance and supplement are treated as offsets against the gross replacement value of informal care. If all informal care was replaced with paid formal care then the annual Government expenditure on carers wouldn't be required (Diminic et al., 2016).

The estimated numbers of carer payment and carer allowance recipients under the two scenarios over the period 2021-2041 are reported in Tables 54 and 55. The yearly difference in the number of carer payment and carer allowance recipients between usual care and DMT intervention is shown in Figure 10.

Table 51 Estimated number of informal carers of persons with AD dementia in the community by disease severity, 2021-2041.

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE			
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total
2021	35,711	29,920	28,562	94,193	35,711	29,920	28,562	94,193	0	0	0	0
2022	36,831	30,934	29,515	97,280	37,799	29,846	29,345	96,990	968	-1,088	-170	-290
2023	38,076	31,965	30,493	100,534	39,887	30,114	29,999	100,000	1,811	-1,851	-494	-534
2024	39,322	33,032	31,500	103,854	41,872	30,654	30,608	103,134	2,550	-2,378	-892	-720
2025	40,584	34,125	32,538	107,247	43,784	31,392	31,226	106,402	3,200	-2,733	-1,312	-845
2026	41,872	35,242	33,604	110,718	45,649	32,278	31,880	109,807	3,777	-2,964	-1,724	-911
2027	43,203	36,377	34,692	114,272	47,490	33,269	32,583	113,342	4,287	-3,108	-2,109	-930
2028	44,589	37,530	35,792	117,911	49,332	34,340	33,340	117,012	4,743	-3,190	-2,452	-899
2029	45,989	38,706	36,912	121,607	51,145	35,470	34,160	120,775	5,156	-3,236	-2,752	-832
2030	47,390	39,891	38,046	125,327	52,920	36,640	35,034	124,594	5,530	-3,251	-3,012	-733
2031	48,772	41,075	39,187	129,034	54,638	37,831	35,954	128,423	5,866	-3,244	-3,233	-611
2032	50,142	42,251	40,325	132,718	56,305	39,022	36,911	132,238	6,163	-3,229	-3,414	-480
2033	51,507	43,401	41,441	136,349	57,918	40,210	37,881	136,009	6,411	-3,191	-3,560	-340
2034	52,846	44,535	42,536	139,917	59,472	41,387	38,861	139,720	6,626	-3,148	-3,675	-197
2035	54,178	45,650	43,611	143,439	60,999	42,540	39,846	143,385	6,821	-3,110	-3,765	-54
2036	55,489	46,747	44,669	146,905	62,485	43,669	40,833	146,987	6,996	-3,078	-3,836	82
2037	56,799	47,832	45,706	150,337	63,957	44,778	41,809	150,544	7,158	-3,054	-3,897	207
2038	58,133	48,894	46,714	153,741	65,445	45,855	42,771	154,071	7,312	-3,039	-3,943	330
2039	59,403	49,941	47,703	157,047	66,861	46,907	43,720	157,488	7,458	-3,034	-3,983	441
2040	60,591	50,958	48,676	160,225	68,189	47,926	44,658	160,773	7,598	-3,032	-4,018	548
2041	61,699	51,935	49,627	163,261	69,431	48,898	45,574	163,903	7,732	-3,037	-4,053	642

Table 52 Estimated number of full-time equivalent informal carers of persons with AD dementia in the community by disease severity, 2021-2041.

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE			
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total
2021	29,133	33,069	41,340	103,542	29,133	33,069	41,340	103,542	0	0	0	0
2022	30,046	34,190	42,719	106,955	30,836	32,988	42,473	106,297	790	-1,202	-246	-658
2023	31,062	35,330	44,135	110,527	32,539	33,284	43,420	109,243	1,477	-2,046	-715	-1,284
2024	32,078	36,509	45,592	114,179	34,159	33,881	44,301	112,341	2,081	-2,628	-1,291	-1,838
2025	33,108	37,717	47,094	117,919	35,719	34,696	45,196	115,611	2,611	-3,021	-1,898	-2,308
2026	34,159	38,952	48,637	121,748	37,240	35,676	46,142	119,058	3,081	-3,276	-2,495	-2,690
2027	35,245	40,206	50,212	125,663	38,742	36,771	47,160	122,673	3,497	-3,435	-3,052	-2,990
2028	36,375	41,481	51,804	129,660	40,245	37,955	48,255	126,455	3,870	-3,526	-3,549	-3,205
2029	37,517	42,780	53,425	133,722	41,724	39,204	49,442	130,370	4,207	-3,576	-3,983	-3,352
2030	38,660	44,090	55,067	137,817	43,172	40,497	50,707	134,376	4,512	-3,593	-4,360	-3,441
2031	39,788	45,399	56,718	141,905	44,573	41,813	52,039	138,425	4,785	-3,586	-4,679	-3,480
2032	40,905	46,698	58,365	145,968	45,933	43,130	53,424	142,487	5,028	-3,568	-4,941	-3,481
2033	42,019	47,970	59,980	149,969	47,249	44,443	54,828	146,520	5,230	-3,527	-5,152	-3,449
2034	43,111	49,223	61,565	153,899	48,517	45,744	56,246	150,507	5,406	-3,479	-5,319	-3,392
2035	44,198	50,455	63,121	157,774	49,762	47,018	57,672	154,452	5,564	-3,437	-5,449	-3,322
2036	45,267	51,668	64,653	161,588	50,975	48,266	59,100	158,341	5,708	-3,402	-5,553	-3,247
2037	46,336	52,867	66,153	165,356	52,175	49,491	60,513	162,179	5,839	-3,376	-5,640	-3,177
2038	47,424	54,041	67,612	169,077	53,389	50,682	61,905	165,976	5,965	-3,359	-5,707	-3,101
2039	48,460	55,198	69,044	172,702	54,545	51,845	63,279	169,669	6,085	-3,353	-5,765	-3,033
2040	49,430	56,322	70,452	176,204	55,628	52,971	64,637	173,236	6,198	-3,351	-5,815	-2,968
2041	50,333	57,402	71,829	179,564	56,641	54,045	65,962	176,648	6,308	-3,357	-5,867	-2,916

Table 53 Estimated gross value of informal care in the community by AD disease severity, 2021-2041 ($millions)

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE				
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Cumul Diff
2021	2,817.7	3,198.43	3,998.4	10,014.6	2,817.7	3,198.4	3,998.4	10,014.6	0.0	0.0	0.0	0.0	0.0
2022	2,906.0	3,306.9	4,131.8	10,344.7	2,982.5	3,190.6	4,108.0	10,281.0	76.4	-116.3	-23.8	-63.6	-63.6
2023	3,004.3	3,417.1	4,268.7	10,690.2	3,147.2	3,219.2	4,199.6	10,566.0	142.9	-197.9	-69.2	-124.2	-187.8
2024	3,102.6	3,531.2	4,409.7	11,043.4	3,303.9	3,277.0	4,284.8	10,865.6	201.3	-254.2	-124.9	-177.8	-365.6
2025	3,202.2	3,648.0	4,554.9	11,405.1	3,454.7	3,355.8	4,371.4	11,181.9	252.5	-292.2	-183.6	-223.2	-588.8
2026	3,303.9	3,767.4	4,704.2	11,775.5	3,601.9	3,450.6	4,462.9	11,515.3	298.0	-316.9	-241.3	-260.2	-849.0
2027	3,408.9	3,888.7	4,856.5	12,154.1	3,747.1	3,556.5	4,561.3	11,864.9	338.2	-332.2	-295.2	-289.2	-1,138.2
2028	3,518.2	4,012.0	5,010.5	12,540.7	3,892.5	3,671.0	4,667.2	12,230.7	374.3	-341.0	-343.3	-310.0	-1,448.2
2029	3,628.6	4,137.7	5,167.3	12,933.6	4,035.5	3,791.8	4,782.0	12,609.4	406.9	-345.9	-385.2	-324.2	-1,772.4
2030	3,739.2	4,264.4	5,326.1	13,329.7	4,175.6	3,916.9	4,904.4	12,996.8	436.4	-347.5	-421.7	-332.8	-2,105.2
2031	3,848.3	4,391.0	5,485.8	13,725.1	4,311.1	4,044.2	5,033.2	13,388.5	462.8	-346.8	-452.6	-336.6	-2,441.8
2032	3,956.3	4,516.6	5,645.1	14,118.0	4,442.6	4,171.5	5,167.2	13,781.3	486.3	-345.1	-477.9	-336.7	-2,778.5
2033	4,064.1	4,639.7	5,801.3	14,505.0	4,569.9	4,298.5	5,303.0	14,171.4	505.8	-341.1	-498.3	-333.6	-3,112.1
2034	4,169.7	4,760.8	5,954.6	14,885.1	4,692.6	4,424.4	5,440.1	14,557.0	522.9	-336.5	-514.5	-328.1	-3,440.1
2035	4,274.8	4,880.0	6,105.1	15,259.9	4,813.0	4,547.6	5,578.0	14,938.6	538.2	-332.4	-527.0	-321.3	-3,761.4
2036	4,378.2	4,997.3	6,253.2	15,628.8	4,930.3	4,668.3	5,716.2	15,314.7	552.1	-329.0	-537.1	-314.0	-4,075.5
2037	4,481.6	5,113.3	6,398.3	15,993.2	5,046.4	4,786.8	5,852.8	15,686.0	564.7	-326.5	-545.5	-307.3	-4,382.8
2038	4,586.8	5,226.8	6,539.4	16,353.1	5,163.8	4,902.0	5,987.5	16,053.2	576.9	-324.9	-552.0	-299.9	-4,682.7
2039	4,687.1	5,338.8	6,677.9	16,703.7	5,275.6	5,014.4	6,120.3	16,410.4	588.5	-324.3	-557.6	-293.4	-4,976.1
2040	4,780.9	5,447.5	6,814.1	17,042.5	5,380.3	5,123.4	6,251.7	16,755.4	599.5	-324.1	-562.4	-287.1	-5,263.1
2041	4,868.2	5,551.9	6,947.3	17,367.4	5,478.3	5,227.2	6,379.8	17,085.4	610.1	-324.7	-567.5	-282.0	-5,545.2
2021-2041	**80,727.7**	**92,035.6**	**115,050.1**	**287,813.4**	**89,262.5**	**85,836.0**	**107,169.7**	**282,268.2**	**8,534.8**	**-6,199.6**	**-7,880.4**	**-5,545.2**	

Table 54 Estimated number of carer payment recipients by AD dementia severity, 2021-2041.

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE			
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total
2021	0	5,386	8,283	13,669	0	5,386	8,283	13,669	0	0	0	0
2022	0	5,568	8,559	14,127	0	5,372	8,510	13,882	0	-196	-49	-245
2023	0	5,754	8,843	14,597	0	5,421	8,700	14,120	0	-333	-143	-477
2024	0	5,946	9,135	15,081	0	5,518	8,876	14,394	0	-428	-259	-687
2025	0	6,143	9,436	15,579	0	5,651	9,056	14,706	0	-492	-380	-873
2026	0	6,344	9,745	16,089	0	5,810	9,245	15,055	0	-534	-500	-1,034
2027	0	6,548	10,061	16,609	0	5,988	9,449	15,437	0	-560	-612	-1,172
2028	0	6,755	10,380	17,135	0	6,181	9,669	15,850	0	-574	-711	-1,285
2029	0	6,967	10,704	17,672	0	6,385	9,906	16,291	0	-582	-798	-1,381
2030	0	7,180	11,033	18,214	0	6,595	10,160	16,755	0	-585	-873	-1,459
2031	0	7,394	11,364	18,758	0	6,810	10,427	17,236	0	-584	-937	-1,522
2032	0	7,605	11,694	19,299	0	7,024	10,704	17,728	0	-581	-990	-1,571
2033	0	7,812	12,018	19,830	0	7,238	10,985	18,223	0	-574	-1,033	-1,607
2034	0	8,016	12,335	20,352	0	7,450	11,270	18,719	0	-566	-1,065	-1,633
2035	0	8,217	12,647	20,864	0	7,657	11,555	19,213	0	-560	-1,092	-1,651
2036	0	8,414	12,954	21,368	0	7,860	11,842	19,702	0	-554	-1,112	-1,666
2037	0	8,610	13,255	21,865	0	8,060	12,125	20,185	0	-550	-1,130	-1,680
2038	0	8,801	13,547	22,348	0	8,254	12,404	20,657	0	-547	-1,143	-1,691
2039	0	8,989	13,834	22,823	0	8,443	12,679	21,122	0	-546	-1,155	-1,701
2040	0	9,172	14,116	23,288	0	8,627	12,951	21,578	0	-545	-1,165	-1,710
2041	0	9,348	14,392	23,740	0	8,802	13,216	22,018	0	-546	-1,176	-1,722

Table 55 Estimated number of carer allowance recipients by AD dementia severity, 2021-2041.

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE			
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total
2021	0	12,566	14,281	26,847	0	12,566	14,281	26,847	0	0	0	0
2022	0	12,992	14,758	27,750	0	12,535	14,673	27,208	0	-457	-85	-542
2023	0	13,425	15,247	28,672	0	12,648	15,000	27,647	0	-777	-247	-1,025
2024	0	13,873	15,750	29,623	0	12,875	15,304	28,179	0	-998	-446	-1,444
2025	0	14,333	16,269	30,602	0	13,185	15,613	28,798	0	-1,148	-656	-1,804
2026	0	14,802	16,802	31,604	0	13,557	15,940	29,497	0	-1,245	-862	-2,107
2027	0	15,278	17,346	32,624	0	13,973	16,292	30,264	0	-1,305	-1,054	-2,360
2028	0	15,763	17,896	33,659	0	14,423	16,670	31,093	0	-1,340	-1,226	-2,566
2029	0	16,257	18,456	34,713	0	14,897	17,080	31,977	0	-1,360	-1,376	-2,736
2030	0	16,754	19,023	35,777	0	15,389	17,517	32,906	0	-1,365	-1,506	-2,871
2031	0	17,252	19,594	36,845	0	15,889	17,977	33,866	0	-1,363	-1,617	-2,979
2032	0	17,745	20,163	37,908	0	16,389	18,456	34,845	0	-1,356	-1,707	-3,063
2033	0	18,228	20,721	38,949	0	16,888	18,941	35,829	0	-1,340	-1,780	-3,120
2034	0	18,705	21,268	39,973	0	17,383	19,431	36,813	0	-1,322	-1,837	-3,160
2035	0	19,173	21,806	40,979	0	17,867	19,923	37,790	0	-1,306	-1,883	-3,189
2036	0	19,634	22,335	41,968	0	18,341	20,417	38,757	0	-1,293	-1,918	-3,211
2037	0	20,089	22,853	42,942	0	18,807	20,905	39,711	0	-1,282	-1,948	-3,231
2038	0	20,535	23,357	43,892	0	19,259	21,386	40,645	0	-1,276	-1,971	-3,247
2039	0	20,975	23,852	44,827	0	19,701	21,860	41,561	0	-1,274	-1,992	-3,266
2040	0	21,402	24,338	45,740	0	20,129	22,329	42,458	0	-1,273	-2,009	-3,282
2041	0	21,813	24,814	46,626	0	20,537	22,787	43,324	0	-1,276	-2,027	-3,302

Figure 10 Yearly difference in number of carer payment and carer allowance recipients between usual care and DMT intervention, 2021-2041

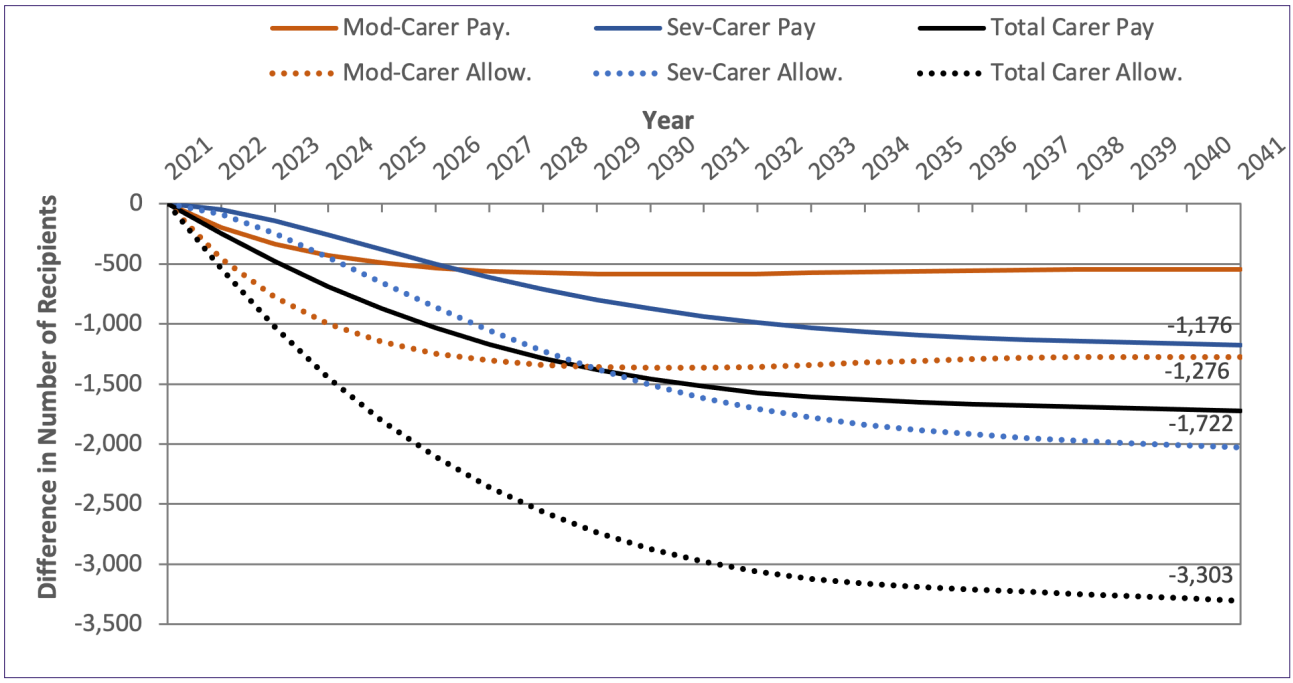


Figure 11 Projected Government expenditure on Carer Payment, Carer Allowance and Carer Supplement, 2021-2041 ($millions) under usual care and DMT intervention scenarios

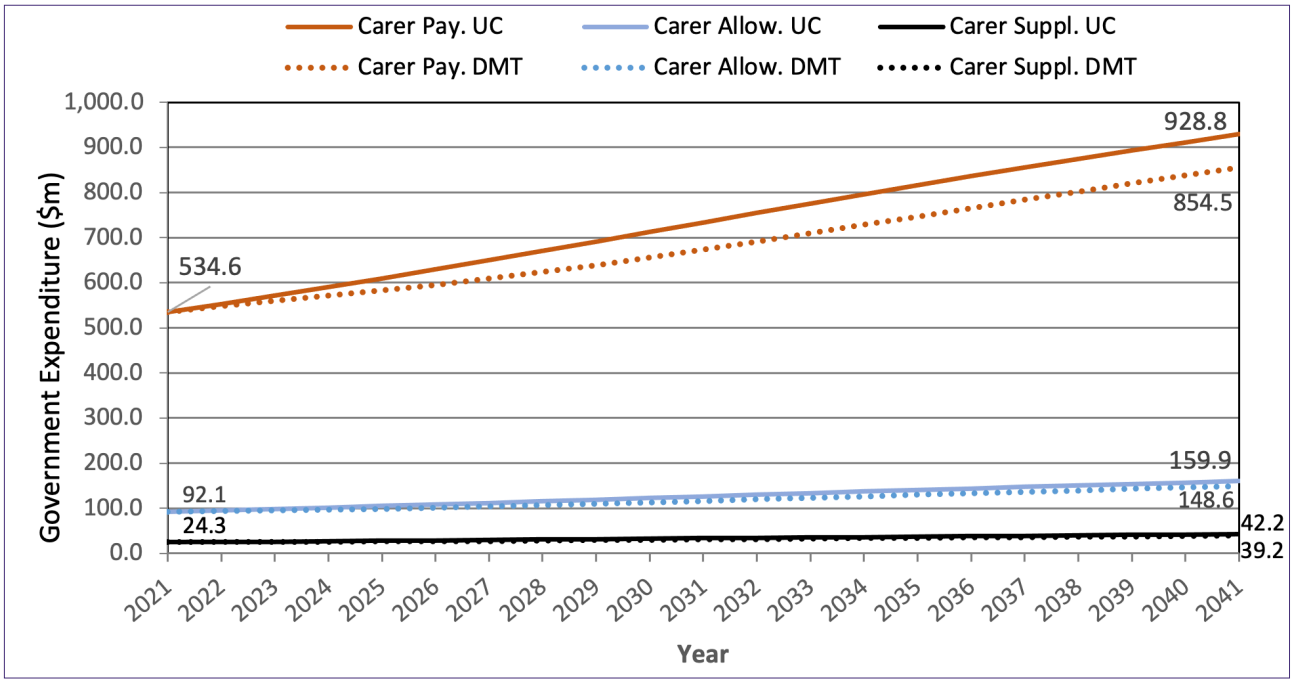


Table 56 Estimated cost of Government payments[1] to carers by AD disease severity, 2021-2041 ($millions)

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE				
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Cumul Diff
2021	0.0	310.4	340.6	651.0	0.0	310.4	340.6	651.0	0.0	0.0	0.0	0.0	0.0
2022	0.0	320.8	351.9	672.7	0.0	316.1	349.9	666.0	0.0	-4.7	-2.0	-6.7	-6.7
2023	0.0	331.4	363.6	695.0	0.0	321.9	357.7	679.6	0.0	-9.6	-5.9	-15.4	-22.2
2024	0.0	342.4	375.6	718.0	0.0	328.2	365.0	693.2	0.0	-14.2	-10.6	-24.9	-47.0
2025	0.0	353.7	388.0	741.7	0.0	335.2	372.3	707.5	0.0	-18.5	-15.6	-34.2	-81.2
2026	0.0	365.3	400.7	766.0	0.0	342.9	380.1	723.1	0.0	-22.4	-20.6	-42.9	-124.1
2027	0.0	377.1	413.7	790.8	0.0	351.4	388.5	739.9	0.0	-25.7	-25.1	-50.9	-175.0
2028	0.0	389.1	426.8	815.9	0.0	360.5	397.5	758.0	0.0	-28.6	-29.2	-57.8	-232.8
2029	0.0	401.3	440.1	841.4	0.0	370.2	407.3	777.6	0.0	-31.0	-32.8	-63.8	-296.7
2030	0.0	413.6	453.7	867.2	0.0	380.5	417.7	798.3	0.0	-33.0	-35.9	-68.9	-365.6
2031	0.0	425.9	467.3	893.2	0.0	391.3	428.7	820.0	0.0	-34.7	-38.6	-73.2	-438.9
2032	0.0	438.3	480.8	919.1	0.0	402.2	440.1	842.4	0.0	-36.0	-40.7	-76.7	-515.6
2033	0.0	450.3	494.1	944.5	0.0	413.3	451.7	865.0	0.0	-37.0	-42.4	-79.4	-595.0
2034	0.0	462.2	507.2	969.4	0.0	424.4	463.4	887.8	0.0	-37.7	-43.8	-81.6	-676.6
2035	0.0	473.8	520.0	993.8	0.0	435.5	475.1	910.7	0.0	-38.3	-44.9	-83.2	-759.8
2036	0.0	485.3	532.6	1,017.9	0.0	446.6	486.9	933.4	0.0	-38.7	-45.7	-84.5	-844.3
2037	0.0	496.6	545.0	1,041.6	0.0	457.4	498.5	956.0	0.0	-39.1	-46.5	-85.6	-929.8
2038	0.0	507.5	557.0	1,064.5	0.0	468.1	510.0	978.1	0.0	-39.4	-47.0	-86.4	-1,016.3
2039	0.0	518.3	568.8	1,087.1	0.0	478.6	521.3	999.9	0.0	-39.7	-47.5	-87.2	-1,103.5
2040	0.0	528.9	580.4	1,109.3	0.0	488.9	532.5	1,021.4	0.0	-40.0	-47.9	-87.9	-1,191.4
2041	0.0	539.2	591.8	1,130.9	0.0	498.9	543.4	1,042.3	0.0	-40.3	-48.3	-88.6	-1,280.0
2021-2041	**0.0**	**8,931.4**	**9,799.7**	**18,731.1**	**0.0**	**8,322.7**	**9,128.5**	**17,451.2**	**0.0**	**-608.7**	**-671.2**	**-1,280.0**	

1. Includes carer payment, carer allowance and carer supplement

Table 57 Estimated replacement value of informal care in the community by AD disease severity, 2021-2041 ($millions)

Year	USUAL CARE				DMT INTERVENTION				DIFFERENCE				
	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Mild AD Dem	Moderate AD Dem	Severe AD Dem	Total	Cumul Diff
2021	2,817.7	2,888.0	3,657.8	9,363.6	2,817.7	2,888.0	3,657.8	9,363.6	0.0	0.0	0.0	0.0	0.0
2022	2,906.0	2,986.1	3,779.8	9,672.0	2,982.5	2,874.5	3,758.1	9,615.0	76.4	-111.6	-21.8	-56.9	-56.9
2023	3,004.3	3,085.7	3,905.1	9,995.1	3,147.2	2,897.3	3,841.9	9,886.4	142.9	-188.3	-63.3	-108.7	-165.7
2024	3,102.6	3,188.7	4,034.1	10,325.4	3,303.9	2,948.8	3,919.8	10,172.4	201.3	-240.0	-114.2	-152.9	-318.6
2025	3,202.2	3,294.3	4,166.9	10,663.4	3,454.7	3,020.6	3,999.0	10,474.4	252.5	-273.7	-167.9	-189.1	-507.6
2026	3,303.9	3,402.1	4,303.5	11,009.5	3,601.9	3,107.6	4,082.7	10,792.2	298.0	-294.5	-220.8	-217.3	-724.9
2027	3,408.9	3,511.6	4,442.8	11,363.3	3,747.1	3,205.1	4,172.8	11,125.0	338.2	-306.5	-270.0	-238.3	-963.2
2028	3,518.2	3,623.0	4,583.7	11,724.9	3,892.5	3,310.5	4,269.7	11,472.7	374.3	-312.4	-314.0	-252.2	-1,215.3
2029	3,628.6	3,736.4	4,727.1	12,092.2	4,035.5	3,421.6	4,374.7	11,831.8	406.9	-314.9	-352.4	-260.4	-1,475.7
2030	3,739.2	3,850.8	4,872.4	12,462.4	4,175.6	3,536.3	4,486.6	12,198.6	436.4	-314.5	-385.8	-263.9	-1,739.6
2031	3,848.3	3,965.1	5,018.5	12,831.8	4,311.1	3,652.9	4,604.5	12,568.5	462.8	-312.2	-414.0	-263.3	-2,002.9
2032	3,956.3	4,078.4	5,164.2	13,198.9	4,442.6	3,769.3	4,727.0	12,939.0	486.3	-309.1	-437.2	-260.0	-2,262.9
2033	4,064.1	4,189.3	5,307.1	13,560.5	4,569.9	3,885.2	4,851.3	13,306.4	505.8	-304.1	-455.9	-254.1	-2,517.0
2034	4,169.7	4,298.7	5,447.4	13,915.7	4,692.6	3,999.9	4,976.7	13,669.2	522.9	-298.8	-470.6	-246.5	-2,763.6
2035	4,274.8	4,406.2	5,585.0	14,266.1	4,813.0	4,112.0	5,102.9	14,027.9	538.2	-294.1	-482.1	-238.1	-3,001.7
2036	4,378.2	4,512.0	5,720.6	14,610.9	4,930.3	4,221.7	5,229.3	14,381.3	552.1	-290.3	-491.3	-229.6	-3,231.2
2037	4,481.6	4,616.7	5,853.3	14,951.7	5,046.4	4,329.3	5,354.3	14,730.0	564.7	-287.4	-499.0	-221.7	-3,452.9
2038	4,586.8	4,719.3	5,982.4	15,288.6	5,163.8	4,433.9	5,477.5	15,075.1	576.9	-285.5	-505.0	-213.5	-3,666.4
2039	4,687.1	4,820.4	6,109.1	15,616.6	5,275.6	4,535.8	5,599.0	15,410.5	588.5	-284.6	-510.1	-206.1	-3,872.6
2040	4,780.9	4,918.6	6,233.7	15,933.2	5,380.3	4,634.4	5,719.2	15,734.0	599.5	-284.1	-514.5	-199.2	-4,071.7
2041	4,868.2	5,012.8	6,355.5	16,236.5	5,478.3	4,728.3	5,836.4	16,043.1	610.1	-284.4	-519.1	-193.5	-4,265.2
2021-2041	**80,727.7**	**83,104.1**	**105,250.4**	**269,082.3**	**89,262.5**	**77,513.3**	**98,041.3**	**264,817.1**	**8,534.8**	**-5,590.9**	**-7,209.1**	**-4,265.2**	

The projected Government expenditure on each of the Carer Payment, Carer Allowance and Carer Supplement, over the 20-year simulation period for the usual care and DMT intervention scenarios is given in Figure 11 and the total cost of these payments by disease severity in Table 56. Because it is assumed carers of persons with mild AD dementia are not eligible for these payments, the DMT intervention leads to reductions in the cost of all three payments. By 2041 the cost of the carer payment is reduced by 8.0% and the carer allowance and supplement by 7.1%. In 2021 dollar terms these are savings of $74.2m, $11.3m and $3.0m, respectively. The cumulative savings over the 20 years is estimated to be $1.28bn.

Net Replacement Value of Informal Care

The income support provided by the Government payments to carers of persons with moderate or mild AD dementia (Table 56) was subtracted from the gross replacement value of informal care (Table 53) to give the final cost of informal care (Table 57).

It would cost the Australian Government $269.1bn to replace informal care with paid carers over the next 20 years if the diagnosis and treatment of AD dementia remains unchanged. This cost is expected to reduce to $264.8bn if the DMT were to be introduced into the treatment mix.

Under the DMT the net replacement cost (having taken into account the potential savings from no longer needing Government payments to carers) of informal care over the 20 years 2021-2041 decreases by 1.6%, compared with usual care, representing a total savings in 2021 dollars of $4,265.2m.

8.2 LOST PRODUCTIVITY

Lost productivity was measured in terms of the loss of earnings from wages and salary from full and part-time employment. The results are presented in Tables 57 and 58. In 2021, there were 10,402 persons with AD dementia who were expected to have left full or part-time employment because of their dementia, 65.8% of these individuals being male and 41.2% of whom would have been in full-time employment. Over 3,500 females would also have left the paid workforce, 42.1% of whom would have left full-time employment.

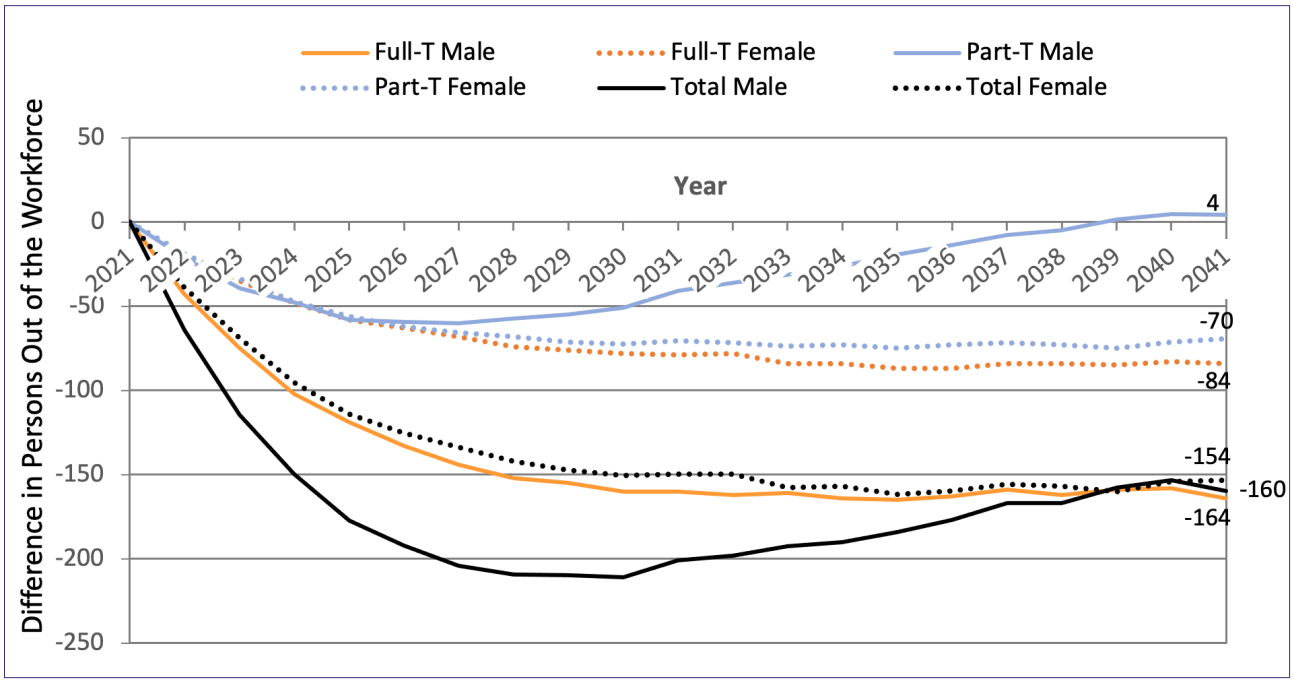
Under usual care, numbers 'missing' from the workforce are expected to rise by 20.9% for males and 23.8% for females in terms of full-time employment and 57.4% for males and 38.4% for females with respect to part-time employment. Under the DMT scenario the percentage growth in those out-of-work from 2021 to 2041 was lower at 15.1% and 18.2%, for males and females respectively in terms of full-time employment, and 35.0% for females in part-time employment. However, for males who would be working part-time the increase in numbers was similar at 57.5%. The difference in the number of persons out-of-the workforce because of AD dementia between usual care and the modelled DMT intervention is shown in Figure 12 for males and females by employment status over the period 2021-2041. The impact of the DMT over time is very different for males and females and by employment status. This reflects the change in the underlying disease severity profile of the AD dementia population and differences in the employment rates by age, sex and AD dementia severity.

The cost of the lost productivity associated with these numbers of persons being out-of-the workforce is shown in Table 59. The total cost of lost productivity was $456.4m in 2021, rising to $575.6m (an increase of 26.1%) under usual care by 2041 compared with $551.6m (20.8%) under the DMT intervention.

Table 58 Number of persons expected to have left full or part-time employment because of AD dementia by gender, 2021-2041

	USUAL CARE					DMT INTERVENTION					DIFFERENCE				
	FULL-TIME		PART-TIME		TOTAL	FULL-TIME		PART-TIME		TOTAL	FULL-TIME		PART-TIME		TOTAL
	Male	Female	Male	Female		Male	Female	Male	Female		Male	Female	Male	Female	
2021	2,820	1,498	4,024	2,059	10,402	2,820	1,498	4,024	2,059	10,402	0	0	0	0	0
2022	2,841	1,516	4,126	2,109	10,591	2,798	1,496	4,104	2,090	10,488	-43	-20	-21	-19	-103
2023	2,870	1,540	4,242	2,156	10,808	2,795	1,505	4,203	2,122	10,625	-75	-35	-39	-34	-183
2024	2,909	1,566	4,361	2,206	11,042	2,807	1,518	4,313	2,159	10,797	-102	-48	-48	-47	-245
2025	2,944	1,591	4,487	2,256	11,278	2,825	1,533	4,429	2,200	10,987	-119	-58	-58	-56	-291
2026	2,978	1,612	4,611	2,304	11,505	2,845	1,549	4,552	2,242	11,187	-133	-63	-59	-62	-317
2027	3,012	1,634	4,742	2,349	11,737	2,868	1,566	4,682	2,283	11,399	-144	-68	-60	-66	-338
2028	3,048	1,656	4,877	2,390	11,971	2,896	1,582	4,820	2,322	11,620	-152	-74	-57	-68	-352
2029	3,087	1,678	5,016	2,434	12,214	2,932	1,602	4,961	2,362	11,857	-155	-76	-55	-71	-357
2030	3,137	1,703	5,152	2,473	12,465	2,977	1,625	5,101	2,400	12,104	-160	-78	-51	-73	-362
2031	3,172	1,726	5,278	2,501	12,676	3,012	1,647	5,237	2,430	12,325	-160	-79	-41	-71	-351
2032	3,216	1,748	5,406	2,528	12,898	3,054	1,670	5,370	2,456	12,550	-162	-78	-36	-72	-348
2033	3,255	1,771	5,526	2,553	13,104	3,094	1,687	5,494	2,479	12,754	-161	-84	-32	-74	-350
2034	3,286	1,788	5,641	2,577	13,293	3,122	1,704	5,615	2,505	12,945	-164	-84	-26	-73	-347
2035	3,310	1,801	5,750	2,622	13,483	3,145	1,714	5,730	2,547	13,137	-165	-87	-19	-75	-346
2036	3,313	1,801	5,846	2,665	13,625	3,150	1,714	5,833	2,592	13,289	-163	-87	-14	-73	-337
2037	3,313	1,801	5,943	2,718	13,775	3,154	1,717	5,935	2,646	13,453	-159	-84	-8	-72	-323
2038	3,323	1,807	6,037	2,771	13,938	3,161	1,723	6,032	2,698	13,614	-162	-84	-5	-73	-324
2039	3,333	1,817	6,131	2,815	14,096	3,174	1,732	6,132	2,740	13,779	-159	-85	1	-75	-318
2040	3,366	1,835	6,232	2,845	14,279	3,208	1,752	6,237	2,774	13,971	-158	-83	5	-71	-308
2041	3,410	1,855	6,335	2,849	14,449	3,246	1,771	6,339	2,780	14,136	-164	-84	4	-70	-313

Figure 12 Difference in the number of persons out of the workforce due to AD dementia between usual care and the DMT intervention, 2021-2041



Over the 20 years 2021-2041 under usual care, 44.1% and 24.3% of the cost of lost productivity on average was due to the reduction in the number of males with AD dementia and females respectively in full-time employment. Fewer males and females with AD dementia in part-time work contributed to 19.4% and 12.2%, respectively, of the total cost of lost productivity. The percentage contribution to the cost of lost productivity was similar under the DMT scenario (43.6%, 24.3%, 19.9% and 12.2% respectively).

The cumulative cost of lost productivity over the 20-years simulation period was estimated to be $10.953bn under the usual care scenario and $10.528bn under the DMT.

The DMT intervention is expected to reduce the cost of lost productivity over the 20 years by $424.9m, 56.3% and 25.9% of these savings coming from the expected improved number of males and females with AD dementia in full-time employment respectively.

8.3 INCOME SUPPORT FOR PEOPLE WITH AD DEMENTIA

The disability support pension provides income support to people with AD dementia under 65 years of age when they applied for the DSP. However, there are very few people with AD dementia in receipt of this pension (Table 59), especially given the number of persons who are out of the workforce (Table 57). There were only an estimated 157 persons with AD dementia in 2021 on the DSP, rising to 382 individuals in 2041 under the usual care scenario and 318 under the DMT. In 2021 the number of male and female recipients was similar with a slight increase in the number of females relative to males over time under both scenarios (54% of recipients were female in 2041). In terms of age, 30% of the recipients with AD dementia in 2021 were aged 65-74 years. Under both scenarios the DSP AD dementia population ages, with 35% being 65-74 years of age in 2041 under usual care and 37.4% under the DMT.

Relative to the other indirect costs, expenditure on the DSP for AD dementia is small, rising from a current cost of $5.4m p.a. to an estimated $13.1m in 2041 with the continuation of usual care and $10.9m with the DMT intervention.

Table 59 Estimated cost of lost productivity from full and part-time employment by gender, 2021-2041 ($millions)

	USUAL CARE					DMT INTERVENTION					DIFFERENCE					
	FULL-TIME		PART-TIME		TOTAL	FULL-TIME		PART-TIME		TOTAL	FULL-TIME		PART-TIME		TOTAL	CUMUL DIFF
	Male	Female	Male	Female		Male	Female	Male	Female		Male	Female	Male	Female		
2021	207.3	111.9	82.7	54.6	456.4	207.3	111.9	82.7	54.6	456.4	0.0	0.0	0.0	0.0	0.0	0.0
2022	208.9	113.2	84.0	55.8	461.9	205.3	111.7	83.5	55.1	455.6	-3.6	-1.5	-0.6	-0.7	-6.3	-6.3
2023	211.1	115.0	85.8	56.9	468.8	204.8	112.3	84.8	55.7	457.6	-6.3	-2.7	-1.1	-1.2	-11.2	-17.5
2024	213.9	116.9	87.7	58.0	476.5	205.3	113.2	86.4	56.4	461.4	-8.5	-3.7	-1.3	-1.6	-15.1	-32.6
2025	216.3	118.8	89.7	59.2	484.0	206.4	114.3	88.1	57.3	466.0	-9.9	-4.4	-1.7	-2.0	-18.0	-50.6
2026	218.6	120.3	91.7	60.3	490.8	207.5	115.5	89.9	58.1	471.0	-11.1	-4.8	-1.7	-2.2	-19.8	-70.4
2027	220.7	121.9	93.8	61.2	497.7	208.7	116.7	92.0	58.9	476.4	-12.0	-5.2	-1.8	-2.3	-21.3	-91.7
2028	223.0	123.5	96.0	62.0	504.6	210.4	117.9	94.2	59.6	482.1	-12.6	-5.7	-1.8	-2.4	-22.5	-114.2
2029	225.4	125.1	98.4	62.9	511.8	212.6	119.3	96.5	60.4	488.8	-12.9	-5.8	-1.9	-2.5	-23.0	-137.2
2030	228.9	127.0	100.7	63.7	520.3	215.6	121.0	98.8	61.1	496.6	-13.3	-6.0	-1.9	-2.6	-23.7	-160.9
2031	231.4	128.7	102.6	64.1	526.8	218.1	122.7	101.0	61.6	503.3	-13.3	-6.0	-1.7	-2.5	-23.5	-184.4
2032	234.7	130.3	104.7	64.5	534.3	221.2	124.4	103.1	62.0	510.6	-13.5	-6.0	-1.6	-2.6	-23.7	-208.1
2033	237.7	132.1	106.5	64.9	541.2	224.2	125.7	104.9	62.2	517.0	-13.5	-6.4	-1.6	-2.7	-24.2	-232.3
2034	240.0	133.4	108.2	65.2	546.9	226.3	126.9	106.7	62.6	522.5	-13.7	-6.4	-1.5	-2.7	-24.4	-256.7
2035	241.9	134.3	109.8	66.2	552.1	228.1	127.7	108.3	63.4	527.4	-13.8	-6.7	-1.4	-2.8	-24.7	-281.4
2036	242.1	134.3	110.9	66.9	554.3	228.4	127.7	109.6	64.2	529.9	-13.7	-6.6	-1.4	-2.7	-24.4	-305.8
2037	242.1	134.3	112.1	68.0	556.5	228.7	127.9	110.9	65.3	532.7	-13.4	-6.4	-1.2	-2.7	-23.8	-329.5
2038	242.8	134.7	113.3	69.1	559.9	229.2	128.3	112.0	66.3	535.9	-13.6	-6.4	-1.2	-2.8	-24.0	-353.6
2039	243.5	135.5	114.5	70.0	563.5	230.1	129.0	113.4	67.1	539.6	-13.4	-6.5	-1.1	-2.9	-23.8	-377.4
2040	245.9	136.8	116.2	70.5	569.3	232.6	130.5	115.1	67.7	545.9	-13.3	-6.3	-1.1	-2.8	-23.5	-400.9
2041	249.2	138.3	117.9	70.3	575.6	235.4	131.9	116.8	67.6	551.6	-13.8	-6.4	-1.1	-2.7	-24.1	-424.9
2021-2041	**4,825.2**	**2,666.3**	**2,127.2**	**1,334.4**	**10,953.1**	**4,586.0**	**2,556.3**	**2,098.5**	**1,287.3**	**10,528.2**	**-239.2**	**-110.0**	**-28.7**	**-47.0**	**-424.9**	

Table 60 Number of Disability Support Pension recipients with AD dementia and cost ($millions), 2021-2041

Year	DSP RECIPIENTS			EXPENDITURE ($millions)			
	Usual Care	DMT	Diff.	Usual Care	DMT	Diff.	Cumul. Diff.
2021	157	157	0	5.4	5.4	0.0	0.0
2022	167	159	-8	5.7	5.4	-0.3	-0.3
2023	178	166	-12	6.1	5.7	-0.4	-0.7
2024	188	169	-19	6.4	5.8	-0.6	-1.3
2025	201	176	-25	6.9	6.0	-0.9	-2.2
2026	212	184	-28	7.3	6.3	-1.0	-3.1
2027	224	192	-32	7.7	6.6	-1.1	-4.2
2028	236	201	-35	8.1	6.9	-1.2	-5.4
2029	245	207	-38	8.4	7.1	-1.3	-6.7
2030	257	217	-40	8.8	7.4	-1.4	-8.1
2031	269	225	-44	9.2	7.7	-1.5	-9.6
2032	279	233	-46	9.5	8.0	-1.6	-11.2
2033	291	243	-48	10.0	8.3	-1.6	-12.8
2034	302	252	-50	10.3	8.6	-1.7	-14.5
2035	313	261	-52	10.7	8.9	-1.8	-16.3
2036	324	270	-54	11.1	9.2	-1.8	-18.2
2037	336	279	-57	11.5	9.5	-1.9	-20.1
2038	348	290	-58	11.9	9.9	-2.0	-22.1
2039	358	299	-59	12.2	10.2	-2.0	-24.1
2040	370	308	-62	12.7	10.5	-2.1	-26.2
2041	382	318	-64	13.1	10.9	-2.2	-28.4

The DMT intervention is expected to reduce the cost of income support through the disability support pension over the 20 years by $28.4m.

8.4 SUMMARY OF INDIRECT COSTS

A summary of the indirect costs under the usual care and DMT intervention scenarios over the 20-year simulation period 2021-2041 is provided in Table 61. Total indirect costs amounted to $280.227bn from 2021 to 2041 under the usual care scenario and $275.509bn under the DMT. Thus, the DMT intervention generated an expected accumulated savings of $4.718bn.

The cost of informal care, under both scenarios, accounted for a staggering 96% of the indirect costs incurred over the 20 years. This is after off-setting Government payments to carers.

Table 61 Summary of indirect costs under usual care and DMT intervention scenarios, 2021-2041 ($millions)

Indirect Cost Component	2021			2041			2021-2041		
	Usual Care	DMT	Diff	Usual Care	DMT	Diff	Usual Care	DMT	Diff
Informal Care									
Gross replacement value	10,014.6	10,014.6	0.0	17,367.4	17,085.4	-282.0	287,813.4	282,268.2	-5,545.2
Government carer payment offsets	-651.0	-651.0	0.0	-1,130.9	-1,042.3	88.6	-18,731.1	-17,451.2	1,280.0
Total (net cost)	9,363.6	9,363.6	0.0	16,236.5	16,043.1	-193.5	269,082.3	264,817.1	-4,265.2
Lost Productivity									
Loss of earnings from wages & salary	456.4	456.4	0.0	575.6	551.6	-24.1	10,953.1	10,528.2	-424.9
Income Support									
Disability support pension	5.4	5.4	0.0	13.0	10.8	2.2	191.8	163.5	-28.3
TOTAL	**9,825.4**	**9,825.4**	**0.0**	**16,825.2**	**16,605.5**	**-215.3**	**280,227.2**	**275,508.8**	**-4,718.4**

Table 62 Summary of direct and indirect costs under usual care and DMT intervention scenarios, 2021-2041 ($millions)

Cost Component	2021			2041			2021-2041		
	Usual Care	DMT	Diff	Usual Care	DMT	Diff	Usual Care	DMT	Diff
Direct Costs - DMT	0.0	544.0	544.0	0.0	207.1	207.1	0.0	4,109.0	4,109.0
Direct Costs - Other									
Hospital Care	556.5	556.5	0.0	980.8	970.5	-10.3	16,144.3	15,903.4	-241.0
Out-of-Hospital Health Services	83.2	83.2	0.0	152.9	153.6	0.7	2,464.9	2,457.4	-7.4
Formal Aged Care	5,015.5	5,015.5	0.0	8,652.2	8,171.8	-480.4	143,408.1	135,497.0	-7,911.1
Total	*5,655.2*	*5,655.2*	*0.0*	*9,786.0*	*9,296.0*	*-490.0*	*162,017.3*	*153,857.8*	*-8,159.5*
Indirect Costs									
Informal Care	9,363.6	9,363.6	0.0	16,236.5	16,043.1	-193.5	269,082.3	264,817.1	-4,265.2
Lost Productivity	456.4	456.4	0.0	575.6	551.6	-24.1	10,953.1	10,528.2	-424.9
DSP Income Support	5.4	5.4	0.0	13.0	10.8	2.2	191.8	163.5	-28.3
Total	*9,825.4*	*9,825.4*	*0.0*	*16,825.2*	*16,605.5*	*-215.3*	*280,227.2*	*275,508.8*	*-4,718.4*
TOTAL	**15,480.6**	**16,024.6**	**544.0**	**26,611.1**	**26,108.5**	**-498.2**	**442,244.6**	**433,475.6**	**-8,769.0**

9. SUMMARY OF DIRECT AND INDIRECT COSTS

A summary of the direct and indirect costs of AD dementia over the period 2021-2041 under the base case of usual care and the DMT intervention is provided in Table 62. Indirect costs accounted for 63% of total costs under both scenarios, and direct costs 37%. The cost of aged care dominated both direct and indirect costs. Informal care accounted for 60-62% of total non-DMT costs and formal aged care another 32%.

The DMT produced estimated cumulative savings over the 20 years of $8.159bn in direct costs and $4.718bn in indirect costs. These represented a 5% and 1.7% reduction in costs compared to usual care. The estimated cumulative expenditure on the DMT, excluding an indicative drug cost, was $4.109bn, giving an overall net reduction in the cost of AD dementia of $8.769bn over the period 2021-2041.

10. DISCUSSION AND CONCLUSIONS

The annual societal costs in Australia of dementia due to Alzheimer's disease are enormous. Under existing health and aged care i.e. usual care, the cost of AD dementia in 2021 is estimated to be nearly $15.5bn and this is expected to rise by more than 70% over the next 20 years to around $26.6bn in 2041 in today's dollars. Such costs pose a major challenge not only to the Government through pressure on Government health and aged care systems but also to individuals with AD dementia, their families and the community at large. There are currently an estimated 15,448 persons aged 50 years and above living in Australia who have MCI due to AD, a prodromal stage of AD dementia. Some 153,888 persons are expected to have dementia due to AD, 40% of whom will have mild AD dementia and 60% more severe disease. By 2041, the AD dementia population including those with MCI due to dementia is expected to increase to 287,745 persons. Without any new intervention to slow the progression of AD dementia, 14% of persons with MCI due to AD will transition to mild or moderate AD dementia each year and one in five persons' mild AD dementia will progress to a more severe and costly state. It is therefore of utmost importance that new cost-effective treatments that slow disease progression are developed.

The aim of this study was to build an economic dynamic simulation model to examine the impact of an effective hypothetical Disease Modifying Treatment (DMT) in AD relative to usual care. The model framework is based on the screening of persons with early-stage AD involving biomarker testing of brain amyloid in persons with MCI or mild dementia suspected to be due to AD to confirm AD as the underlying pathology and the introduction of the use of a DMT to slow disease progression in those individuals testing positive to Aβ. The model captures changes in population level patient outcomes such as the prevalence of AD dementia by disease state, incidence, disease progression and mortality, as well as residential setting - persons living in a home setting in the community versus those living in permanent residential aged care as well as a range of direct and indirect societal level costs across mild, moderate and severe AD dementia. The modelling aims to estimate the potential savings that could be realised or additional costs that might be incurred in the event that a DMT become available in Australia.

The DMT intervention scenario is hypothetical but it is grounded in the clinical findings of trials for the drug aducanumab as well as parameters used in modelling studies in the literature of the cost-effectiveness of DMTs for Alzheimer's disease (Budd et al., 2011; Sköldunger et al., 2013; Anderson et al., 2018; Green et al., 2019; Wimo et al., 2020). The modelling assumed a 25% reduction in the annual transition probabilities for persons aged 50-84 years with MCI due to AD or mild AD dementia. According to Budd et al. (2011) a 25% reduction in the risk of progression is only assuming a 'modest' impact on the course of disease progression. A longer-term time horizon of 20 years (2021-2041) was used to capture the necessary epidemiological and economic consequences of continuing with care as usual versus the potential effects of the DMT intervention. The simulation used 1-year cycles for disease progression, resource use, costs and effects. This is the typical cycle length for budget impact analyses and is used in the majority studies of the potential impacts of DMTs in AD.

All data came from publicly available secondary data sources, accessed online or from published data sources, including data extracts from the literature. It was difficult to directly populate the model with data that fully reflected the definition of MCI due to AD and AD dementia. Data inputs for broader categories of dementia and dementia severity had to be applied. Preference was, however, given to Australian data and data specific to AD. The societal direct and indirect costs were derived by applying standardised unit costs to formal and informal resources. Although much of the cost data was based on people with dementia, and not specifically AD dementia, these are likely to be representative of the costs of AD dementia. Sköldunger et al. (2013) report that a Swedish bottom-up database showed there was an overall agreement of 0.97 when costs for dementia and AD were compared.

The starting transition probabilities and relative mortality figures were also based on data in the literature for dementia and not specifically AD dementia. However, an iterative process was used to derive final progression rates that replicated age-sex prevalence estimates of MCI due to AD and mild, moderate and severe AD dementia over the simulation period. Therefore, these are considered to be representative of people with AD. The mortality rates were based on relative risk ratios derived from the literature being applied to Australian age-sex specific deaths rates.

The patterns and growth in the costs of AD dementia are consistent with other reports of direct health and related costs in Australia (Brown et al., 2017; Gnanamanickam 2017; Standfield et al., 2019). Indirect costs accounted for 63% of total costs under both scenarios, and direct costs 37%. The cost of aged care dominated both direct and indirect costs with informal care accounting for 60-62% of total non-DMT costs and formal aged care another 32%.

Given the same data sources were often used, the costs presented in the Report are also consistent with those reported by the AIHW (2021). Differences arise because of the different study populations – all cause dementia vs. AD dementia - and the manner in which costs are attributed. For example, the cost of residential aged care was estimated to be early $4.0bn in 2021 for persons with AD dementia under the usual care scenario. The AIHW reports that in 2018-19, $1.7bn was spent on residential aged care services directly for dementia. This cost only includes dementia-specific costs of permanent residential care i.e. expenditure directly related to dementia with no costs associated with other co-existing conditions in residents with dementia being included. In contrast a whole-of-system approach was taken in this Report where costs were estimated for residents with dementia, not for dementia per se. The AIHW (2021) does, however, note that the total cost of care for permanent residents with dementia was almost $6.8bn in 2018–19. This is in keeping with the modelling estimate of $4.0bn in the current report for persons diagnosed with AD dementia prior to entry into residential care. Under the usual care scenario, formal aged care accounted for most (88%) of the total direct health and aged care system expenditure for people with AD dementia which compares with the 82% reported by AIHW (2021) for dementia.

The estimated number of carers and hours of care is consistent with the estimates produced by AIHW (2021) largely because both NATSEM and the AIHW used data from the ABS Survey of Disability, Ageing and Carers 2018 to derive their estimates. The modelling in this Report indicated there were 94,193 informal carers of persons with AD dementia living in the community in 2021. Given the high number of hours of informal care provided per week, this number of carers was equivalent to 103,542 full-time formal carers. The AIHW minimum estimate of the number of carers of people with dementia in Australia in 2021 was 134,900.

The cost of informal care was substantial, contributing to 96% of indirect costs and 63% of all non-DMT related costs. While informal care is widely reported as the major component of the total costs of dementia, annual figures increasing from $9.4bn in 2021 to over $16bn by 2041 are high. This reflects the use of the replacement method in valuing informal care. The replacement method is a very commonly used approach to estimating the cost of informal care, but it tends to provide cost estimates higher than other methods. For example, in the previous 2017 report on the costs of dementia in Australia (Brown et al., 2017) the cost of informal care was very conservatively estimated by valuing the cost of lost productivity of carers leaving or reducing their participation in the workforce i.e. the costs of wages and salary forgone through caregiving. While still significant, the cost of informal care in 2016 was valued at only $3.2bn. A key difference is this latter cost did not include any cost for carers who were not attached to the labour force and therefore did not forgo earnings.

The DMT produced estimated cumulative savings over the 20 years of $8.159bn in direct costs and $4.718bn in indirect costs. These represented a 5.0% and 1.7% reduction in costs respectively compared to usual care. The estimated cumulative expenditure on the DMT, excluding an indicative drug cost, was $4.109bn giving an overall net reduction in the cost of AD dementia of $8.769bn over the period 2021-2041.

Over the 20-year simulation period, 410,833 persons with MCI due to AD or mild AD dementia are expected to be treated by the DMT. If the cost of the DMT drug was to be cost neutral over the 20 years then its price would have to be around $21,344 per person per year in 2021 dollars. However, as Wimo et al. (2020) comment, it is unrealistic to assume a hypothetical future DMT for AD would result in absolute cost savings because of the cost associated with the treatment and the prolonged survival of treated patients. Treated persons are expected to live longer through the reduced exposure to higher mortality rates by spending less time in more severe AD dementia stages and more time in the early stages of AD dementia where the risk of death is similar to the general population. This effect of the DMT results in higher care costs over the long-term. While savings were still occurring in the cost of formal and informal care after 20 years under the DMT scenario, annual savings in community-based formal and

informal care had started to reduce by the early 2030s (Tables 49 and 57) and while savings were still growing in terms of the cost of residential care, the rate of change had also slowed.

The results presented here are for a budget impact analysis of a hypothetical DMT intervention in early AD dementia undertaken from a societal perspective. This is not a cost-effectiveness study. However, when comparing a DMT with usual care, Green et al. (2019) found their cost-effectiveness estimates to be in the region of what may be considered value for money when applying relatively modest base case assumptions on treatment effectiveness (a 20% reduction in the risk). Sköldunger et al. (2013) similarly reported their model indicated cost-effectiveness with a DMT even if costs increase with the DMT – as stated above the main reasons for potentially higher costs with the DMT being the costs of the DMT, itself and the prolonged survival with DMT. Wimo et al. (2020) also reported that most of the scenarios they modelled illustrated hypothetical cost-effectiveness but not necessarily cost savings. They found that at least 25-50% slowing of disease progression would result in favourable epidemiological and health-economic outcomes.

In the absence of a price on the hypothetical DMT drug, the modelling shows significant cost savings over the 20 years. However, what is of interest is not simply potential cost savings but other important outcomes such as decreased mortality and extended life expectancy, greater time persons with AD dementia are able to live in the community rather than in institutional care, or the reduction in intangible costs in terms of the social and emotional burden associated with a family member having dementia. As noted by Wimo et al. (2020) comment, an appropriate approach to assessing the economic value of a DMT for slowing the progression of AD is the societal willingness to pay (WTP) for these specific outcomes.

The number of people that may be eligible for the DMT is relatively large. For modelling purposes, it was assumed there were no resource constraints in screening of persons suspected of having early-stage AD, biomarker testing, follow-up and treatment with the DMT infusion. In the first year it was assumed all persons in the population meeting eligibility criteria for the DMT (54,045 persons) could access treatment, and thereafter new incidence cases of MCI or mild dementia due to AD would become the treated population. However, the uptake could be staggered, and ways found to identify persons that may benefit the most from the DMT treatment.

Due to limitations around availability of specific data inputs the model employs a number of assumptions. However, it is clear that the modelled efficacy of the hypothetical DMT will affect its ability to demonstrate budget impact and potential cost-effectiveness. Treatment options for AD dementia are limited. Currently, one DMT - aducanumab (ADUHELM) - has been approved in the US for the treatment of AD. Early biomarker screening and the use of potential DMTs will have significant implications for the treatment strategies adopted for persons suspected of having early-stage AD and the resultant societal costs of the disease. Models, such as the one developed for this Report, are urgently needed to provide policy-makers with tools to help inform their decisions regarding future treatment options for AD dementia. They also prompt broad-based public discussions around the community's willingness to pay for these interventions and the additional resources (i.e. screening, testing/ scans) required to identify those who are more like to benefit from these interventions.

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APPENDIX A: TRANSITION PROBABILITIES USED IN THE DMT SIMULATION

Annual Age-specific Transition Probabilities, Males, DMT Simulation

		Time t+1					
Time t	**50-54 years**	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.996599	0.000001	0.0000	0.0000	0.0000	0.0034
	MCI due to AD	0.0000	0.98835	0.0075	0.00075	0.0000	0.0034
	Mild AD Dem	0.0000	0.0000	0.97185	0.0240	0.00075	0.0034
	Mod AD Dem	0.0000	0.0000	0.0000	0.9538	0.0190	0.0272
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9660	0.0340
	55-59 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.994694	0.000096	0.0000097	0.0000	0.0000	0.0052
	MCI due to AD	0.0000	0.90855	0.06375	0.0225	0.0000	0.0052
	Mild AD Dem	0.0000	0.0000	0.8553	0.1245	0.0150	0.0052
	Mod AD Dem	0.0000	0.0000	0.0000	0.8498	0.1190	0.0312
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9480	0.0520
	60-64 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.991050	0.000740	0.00011	0.0000	0.0000	0.0081
	MCI due to AD	0.0000	0.88465	0.0750	0.03225	0.0000	0.0081
	Mild AD Dem	0.0000	0.0000	0.8104	0.1500	0.0315	0.0081
	Mod AD Dem	0.0000	0.0000	0.0000	0.8287	0.1470	0.0243
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9352	0.0648
	65-69 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.985880	0.000410	0.00151	0.00050	0.0000	0.0117
	MCI due to AD	0.0000	0.89605	0.06750	0.02475	0.0000	0.0117
	Mild AD Dem	0.0000	0.0000	0.81355	0.1500	0.02475	0.0117
	Mod AD Dem	0.0000	0.0000	0.0000	0.8016	0.1750	0.0234
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9064	0.0936
	70-74 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.978790	0.000430	0.0021	0.00048	0.0000	0.0182
	MCI due to AD	0.0000	0.8663	0.0930	0.0225	0.0000	0.0182
	Mild AD Dem	0.0000	0.0000	0.8468	0.1200	0.0150	0.0182
	Mod AD Dem	0.0000	0.0000	0.0000	0.8376	0.1260	0.0364
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8908	0.1092

		Time t+1					
Time t	**75-79 years**	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.962850	0.000650	0.0044	0.0007	0.0000	0.0314
	MCI due to AD	0.0000	0.79985	0.13875	0.0300	0.0000	0.0314
	Mild AD Dem	0.0000	0.0000	0.7961	0.1500	0.0225	0.0314
	Mod AD Dem	0.0000	0.0000	0.0000	0.7832	0.1540	0.0628
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8116	0.1884
	80-84 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.933050	0.000700	0.0076	0.00105	0.0000	0.0576
	MCI due to AD	0.0000	0.76990	0.1425	0.0300	0.0000	0.0576
	Mild AD Dem	0.0000	0.0000	0.7549	0.1650	0.0225	0.0576
	Mod AD Dem	0.0000	0.0000	0.0000	0.7248	0.1600	0.1152
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.7696	0.2304
	85-89 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.879640	0.000560	0.0101	0.0017	0.0000	0.1080
	MCI due to AD	0.0000	0.71200	0.1500	0.0300	0.0000	0.1080
	Mild AD Dem	0.0000	0.0000	0.6920	0.1850	0.0150	0.1080
	Mod AD Dem	0.0000	0.0000	0.0000	0.7130	0.1250	0.1620
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.7840	0.2160
	90+ years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.769660	0.000840	0.0203	0.0024	0.0000	0.2068
	MCI due to AD	0.0000	0.54320	0.2000	0.0500	0.0000	0.2068
	Mild AD Dem	0.0000	0.0000	0.5772	0.2000	0.0160	0.2068
	Mod AD Dem	0.0000	0.0000	0.0000	0.6165	0.1250	0.2585
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.6898	0.3102

Annual Age-specific Transition Probabilities, Females, DMT Simulation

Time t	Time t+1					
50-54 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
Normal	0.9979998	0.0000002	0.0000	0.0000	0.0000	0.0020
MCI due to AD	0.0000	0.99275	0.0045	0.00075	0.0000	0.0020
Mild AD Dem	0.0000	0.0000	0.9815	0.01575	0.00075	0.0020
Mod AD Dem	0.0000	0.0000	0.0000	0.9668	0.0172	0.0160
Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9800	0.0200
55-59 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
Normal	0.996846	0.000047	0.000007	0.0000	0.0000	0.0031
MCI due to AD	0.0000	0.9144	0.0600	0.0225	0.0000	0.0031
Mild AD Dem	0.0000	0.0000	0.8544	0.1275	0.0150	0.0031
Mod AD Dem	0.0000	0.0000	0.0000	0.8614	0.1200	0.0186
Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9690	0.0310
60-64 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
Normal	0.994420	0.000820	0.000160	0.0000	0.0000	0.0046
MCI due to AD	0.0000	0.8904	0.0750	0.0300	0.0000	0.0046
Mild AD Dem	0.0000	0.0000	0.8004	0.1650	0.0300	0.0046
Mod AD Dem	0.0000	0.0000	0.0000	0.8362	0.1500	0.0138
Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9632	0.0368
65-69 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
Normal	0.989490	0.000210	0.0027	0.0007	0.0000	0.0069
MCI due to AD	0.0000	0.9436	0.0195	0.0300	0.0000	0.0069
Mild AD Dem	0.0000	0.0000	0.8131	0.1500	0.0300	0.0069
Mod AD Dem	0.0000	0.0000	0.0000	0.8342	0.1520	0.0138
Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9448	0.0552
70-74 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
Normal	0.986350	0.000070	0.0015	0.00028	0.0000	0.0118
MCI due to AD	0.0000	0.9657	0.0150	0.0075	0.0000	0.0118
Mild AD Dem	0.0000	0.0000	0.91095	0.0750	0.00225	0.0118
Mod AD Dem	0.0000	0.0000	0.0000	0.8944	0.0820	0.0236
Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.9292	0.0708
75-79 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
Normal	0.975020	0.000580	0.0033	0.0004	0.0000	0.0207
MCI due to AD	0.0000	0.8293	0.1275	0.0225	0.0000	0.0207
Mild AD Dem	0.0000	0.0000	0.84805	0.12375	0.0075	0.0207
Mod AD Dem	0.0000	0.0000	0.0000	0.8336	0.1250	0.0414
Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8758	0.1242

		Time t+1					
Time t	**80-84 years**	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.952970	0.000630	0.0060	0.0005	0.0000	0.0399
	MCI due to AD	0.0000	0.8026	0.1350	0.0225	0.0000	0.0399
	Mild AD Dem	0.0000	0.0000	0.8026	0.1425	0.0150	0.0399
	Mod AD Dem	0.0000	0.0000	0.0000	0.7932	0.1270	0.0798
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8404	0.1596
	85-89 years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.911950	0.000370	0.0057	0.00078	0.0000	0.0812
	MCI due to AD	0.0000	0.7938	0.1050	0.0200	0.0000	0.0812
	Mild AD Dem	0.0000	0.0000	0.7758	0.1380	0.0050	0.0812
	Mod AD Dem	0.0000	0.0000	0.0000	0.7852	0.0930	0.1218
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.8376	0.1624
	90+ years	**Normal**	**MCI due to AD**	**Mild AD Dem**	**Mod AD Dem**	**Sev AD Dem**	**Death**
	Normal	0.786540	0.000960	0.0215	0.0009	0.0000	0.1901
	MCI due to AD	0.0000	0.5229	0.2630	0.0240	0.0000	0.1901
	Mild AD Dem	0.0000	0.0000	0.5699	0.2200	0.0200	0.1901
	Mod AD Dem	0.0000	0.0000	0.0000	0.6424	0.1200	0.2376
	Sev AD Dem	0.0000	0.0000	0.0000	0.0000	0.71485	0.28515

APPENDIX B: MBS ITEMS USED IN THE DMT COSTINGS

MBS Item Number	Description	Medicare Benefits Schedule Fee (July 2021)
61559	FDG PET study of the brain, performed for the evaluation of refractory epilepsy which is being evaluated for surgery	$918.00
61505	CT scan performed at the same time and covering the same body area as single photon emission tomography or positron emission tomography for the purpose of anatomic localisation or attenuation correction if no separate diagnostic CT report is issued and performed in association with a service to which an item in Subgroup 1 or 2 of Group I4 applies	$100.00
21945	INITIATION OF MANAGEMENT OF ANAESTHESIA for lumbar puncture, cisternal puncture, or epidural injection	$103.00
23010	ANAESTHESIA, PERFUSION OR ASSISTANCE AT ANAESTHESIA (a) administration of anaesthesia performed in association with an item in the range 20100 to 21997 or 22900 to 22905; or (b) perfusion performed in association with item 22060; or (c) for assistance at anaesthesia performed in association with items 25200 to 25205.For a period of: (FIFTEEN MINUTES OR LESS)	$20.60
39000	LUMBAR PUNCTURE	$78.35
14245	IMMUNOMODULATING AGENT, administration of, by intravenous infusion for at least 2 hours duration - payable once only on the same day and where the agent is provided under section 100 of the Pharmaceutical Benefits Scheme	$101.90
13950 (replaced items 13915 to 13948)	Parenteral administration of one or more antineoplastic agents, including agents used in cytotoxic chemotherapy or monoclonal antibody therapy but not agents used in anti-resorptive bone therapy or hormonal therapy, by or on behalf of a specialist or consultant physician—attendance for one or more episodes of administration. (13915- An injection of a medicine into a vein to treat cancer (cytotoxic chemotherapy). Treatment may be given as push technique or as an infusion, lasting up to 1 hour.)	$112.40

APPENDIX C: PBS ITEM NUMBERS FOR ALZHEIMER'S DISEASE MEDICATIONS

N06D - ANTI-DEMENTIA DRUGS		
	N06DA - Anticholinesterases	
	DONEPEZIL	11922L, 11924N, 2479L, 2532G, 8495D, 8496E
	GALANTAMINE	11899G, 11917F, 11918G, 2463P, 2531F, 2537M, 8770N, 8771P, 8772Q
	RIVASTIGMINE	10538P, 10541T, 11901J, 11903L, 11904M, 11912Y, 11916E, 11923M, 11925P, 2475G, 2477J, 2493F, 2494G, 2526Y, 2551G, 8497F, 8498G, 8499H, 8500J, 9161E, 9162F
	N06DX - Other anti-dementia drugs	
	MEMANTINE	11902K, 11905N, 1956Y, 2492E, 2513G, 9306T

APPENDIX D: COST OF HOME CARE PACKAGES AND COMMONWEALTH HOME SUPPORT PROGRAM

In 2019-20, the average cost to the Australian Government of providing level 1 and 2 home care packages was $9,442 per client and level 3 and 4 services $29,127 per client (Productivity Commission, 2021). This reflects that many clients did not receive services for the full 12 months. Further, the total cost of a Home Care Package not only comprises the Australian Government's contribution (subsidy and any eligible supplements) but also a user-pay basic daily fee (which everyone receiving a Home Care Package can be asked to pay), a client income-tested care fee and any additional fees a client may agree to pay for additional care and services that wouldn't otherwise be covered by their Home Care Package budget[44]. The basic daily fee is set by the Government at a percentage of the single basic age pension, and changes in March and September each year in line with the pension. Most providers will require payment of the basic daily fee to increase the funds available from the Government subsidy in the Home Care Package budget to pay for care[45]. The yearly Government contribution and client basic daily fees for the different packages are given in the Table below. For those individuals and families paying the income-tested care fee for home care, there are annual and lifetime caps on expenditure.

Providers of home care packages are able to access a dementia and cognition funding supplement from the Australian Government to provide services for people with moderate to severe cognitive impairment associated with dementia or other conditions. The annual payment of this supplement for the four home care package levels is also provided in the Table.

Home Care Package Level	Yearly government contribution+	Dementia and Cognition Government Supplement+	Annual basic (daily) feex
Level 1	$9,026.45	$1,036.60	$3,547.80
Level 2	$15,877.50	$1,825.00	$3,752.20
Level 3	$34,550.90	$3,974.85	$3,858.05
Level 4	$52,377.50	$6,022.50	$3,960.25

Source: https://www.health.gov.au/resources/publications/schedule-of-subsidies-and-supplements-for-aged-care ; https://www.health.gov.au/resources/publications/schedule-of-fees-and-charges-for-residential-and-home-care

+ These rates are applicable from 1 July 2021 to 30 June 2022

x from 20 March 2021

The Australian Government pays the subsidy for the CHSP directly to service providers. In 2019-20, the average cost to the Australian Government of providing CHSP services was $3,335 per client (AIHW, 2020; Productivity Commission, 2021). Recipients of these services are also expected to contribute to the cost of care. The cost depends on client's capacity to pay, the type of support and the provider. Simple services like house cleaning and meals might cost the recipient of care a few dollars, while more complex services like home renovation work may require a much higher contribution. Each provider sets their own prices[46]. Client contributions total around 10% of the total CHSP funding.

44. https://www.myagedcare.gov.au/home-care-package-costs-and-fees
45. ibid
46. https://www.myagedcare.gov.au/help-at-home/commonwealth-home-support-programme, https://www.myagedcare.gov.au/commonwealth-home-support-programme-costs

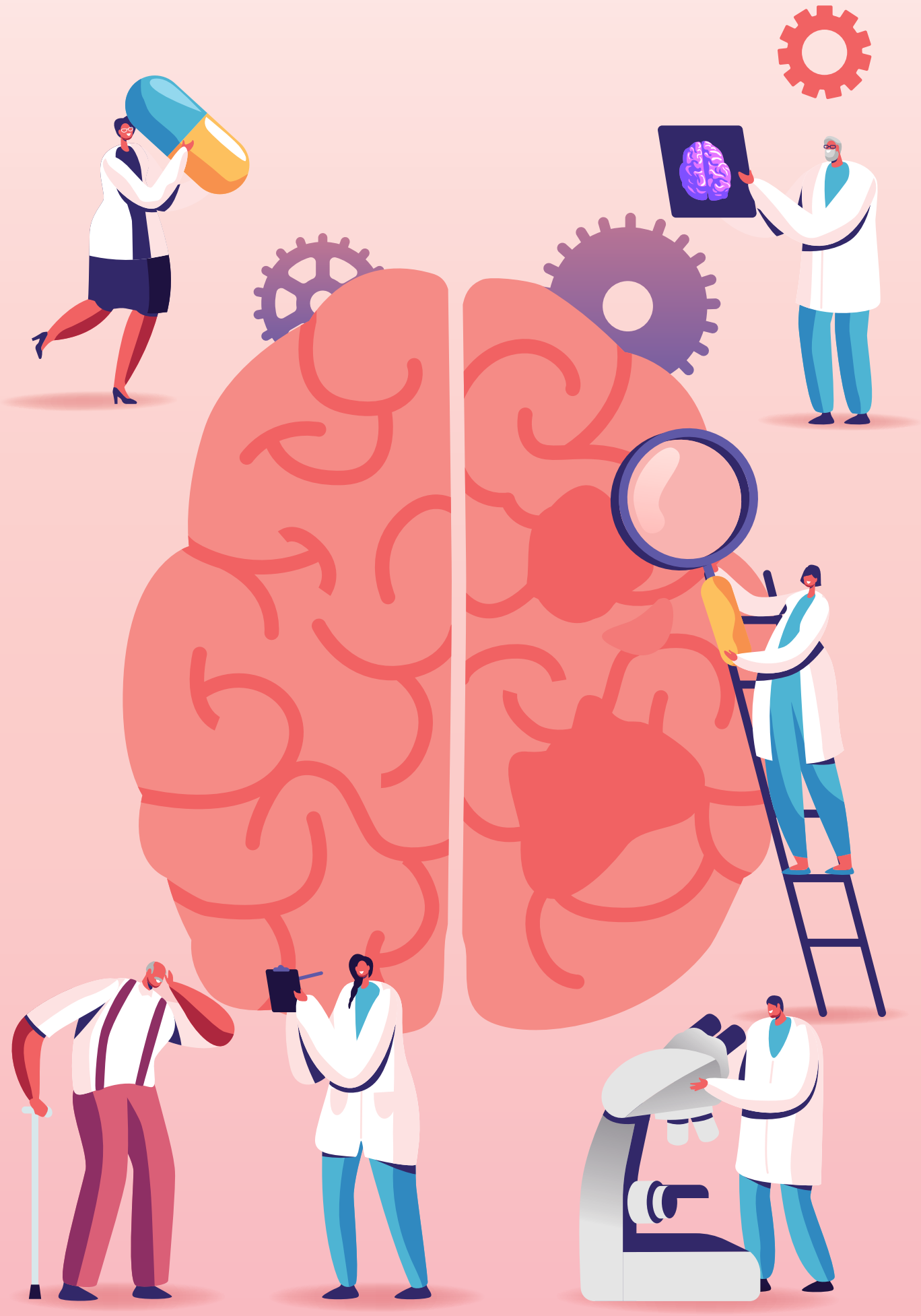
APPENDIX E: WORKPLACE PROBLEMS WITH ONSET OF DEMENTIA

Changes in work behaviour and problems that may become apparent at work with the onset of dementia include:

- difficulty in communicating with colleagues or clients
- trouble with concentration, reduced attention and distractibility
- issues with short-term memory such as forgetting important meetings or appointments
- confusion about time and place
- having problems with larger groups and possibly preferring to work alone
- struggling to complete routine tasks, difficulty managing several tasks at one time, difficulty adjusting to new tasks and deficits in dexterity for complex tasks
- poor or diminished judgment and feeling uncertain about making important decisions
- changes in personality or behaviour including depression, aggressive behaviour, rapid mood swings, becoming confused and withdrawn
- losing confidence

Sources: Chaplin and Davidson, 2016; and Dementia Australia

https://www.dementia.org.au/about-dementia/i-have-dementia/employment-and-dementia;



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