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Estimating costs of health care for neurological conditions in Canada in 2031

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Plan of presentation

- **Project Background**
- **Description of POHEM-Neurological**
- **Examining the costs**
- **Results**
- **Discussion**



Project Background

- June 2009
 - Health Minister announces 4-year \$15 million National Population Health Study of Neurological Conditions (NPHSNC)
 - Co-managed by Public Health Agency of Canada and Neurological Health Charities Canada
- Several projects funded by NPHSNC to examine various aspects of neurological conditions
 - Prevalence, risk factors, institutionalization, caregivers
- Microsimulation project to examine future burden of neurological conditions



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NPHSNC Microsimulation project

- **Purpose:**
 - To examine the future health and economic impacts of neurological conditions over the next 20 years
 - Bring together findings from many of the other NPHSNC-funded studies
 - Incidence, prevalence, institutionalization, caregivers
 - (But not the risk factors)
- **The microsimulation team included**
 - Analysts from Health Analysis Division of Statistics Canada
 - and members of the Public Health Agency of Canada
- **Model developed in consultation with clinical experts in neurological conditions, individuals with neurological conditions, their caregivers and other researchers**



Microsimulation

- Simulation of individuals (“micro”) in a population and the way that their characteristics change over time
- POHEM (**P**opulation **H**ealth **M**odel) is a dynamic continuous time, Monte Carlo microsimulation tool developed in the Health Analysis Division of Statistics Canada
 - Individuals are simulated from birth to death, one at a time
 - Birth and death rates calculated by Demographic Division of Statistics Canada
 - Open population (includes birth and migration)
 - Used to simulate and project several risk factors and health conditions for the Canadian population
- The purpose is to
 - Recreate the Canadian population at a given point in time
 - Project future trends
 - *Under existing conditions (base case)*
 - *Under specified scenarios*



POHEM-Neurological: General Framework

- Objective: Create one general framework to examine the impacts of each of the seven priority neurological conditions
 - Models run separately for each priority neurological condition
- Competing priorities
 - Sufficiently complex to encompass the major life, health and economic impacts of each neurological condition
 - Not so detailed that we can't find adequate data, or that the framework won't be suitable for each priority neurological condition



POHEM-Neurological: Conditions modeled

- From the list of 15 neurological conditions identified by NPHSNC, the following 7 were modeled:
 - Alzheimer's and other dementias
 - Cerebral palsy
 - Epilepsy
 - Multiple sclerosis
 - Parkinson's disease and Parkinsonism
 - Traumatic brain injuries
 - Traumatic spinal cord injuries

- Excluded conditions:
 - Amyotrophic lateral sclerosis (ALS), Brain tumours, Dystonia, Huntington's disease, Hydrocephalus, Muscular dystrophy, Spina bifida, Tourette syndrome



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Assigning Health Care Costs

- An objective of the models was to examine the economic impact of neurological conditions (NCs)
- Health care direct costs
 - Physician visits
 - Pharmaceutical costs
 - Hospitalizations
 - Home care
 - Rehabilitation hospitals
 - Long-term care institutions
 - Assistive devices
- Indirect costs were not included



Assigning Health Care Costs

- Costs were estimated from administrative data in Ontario and British Columbia,
 - By condition
 - By state (Incidence and Prevalence)
 - By sex and age group
- Base case considered
 - No inflation
 - No discount
 - 2010 Canadian \$



Assigning Health Care Costs



- Out-of-pocket expenditures were included in the Direct costs

Out-of-pocket from the patient	Out-of-pocket from the caregiver
Only for the persons with the NC	For all persons with or without the NC, but only when they have a caregiver
Typical expenditures	
<ul style="list-style-type: none"> • Prescription and non-prescription (over-the-counter) medications • Assistive devices such as mobility aids, agility aids or specialized equipment • Rehabilitation therapy such as physical, occupational, speech or massage therapy • Home care services such as health care, homemaker, or other support services 	<ul style="list-style-type: none"> • Home modifications to accommodate a care receiver's needs • Professional services for a care receiver's healthcare or rehabilitation • Hiring people to help with a care receiver's daily activities • Transportation, travel or accommodation because of care giving responsibilities • Specialized aids or devices for a care receiver's use • Prescription or non-prescription drugs for a care receiver's use • Any other out-of-pocket expenses because of care giving responsibilities



Assigning Health Care Costs

- Problem of co-morbidities
 - People may have more than one health condition that sends them to a doctor or to hospital
 - How to disentangle co-morbidity-related costs from those due to the neurological condition?
- Solution: Use of a counter-factual population
 - “No neurological” population against which we compare costs
 - Net economic impact of a specific neurological condition

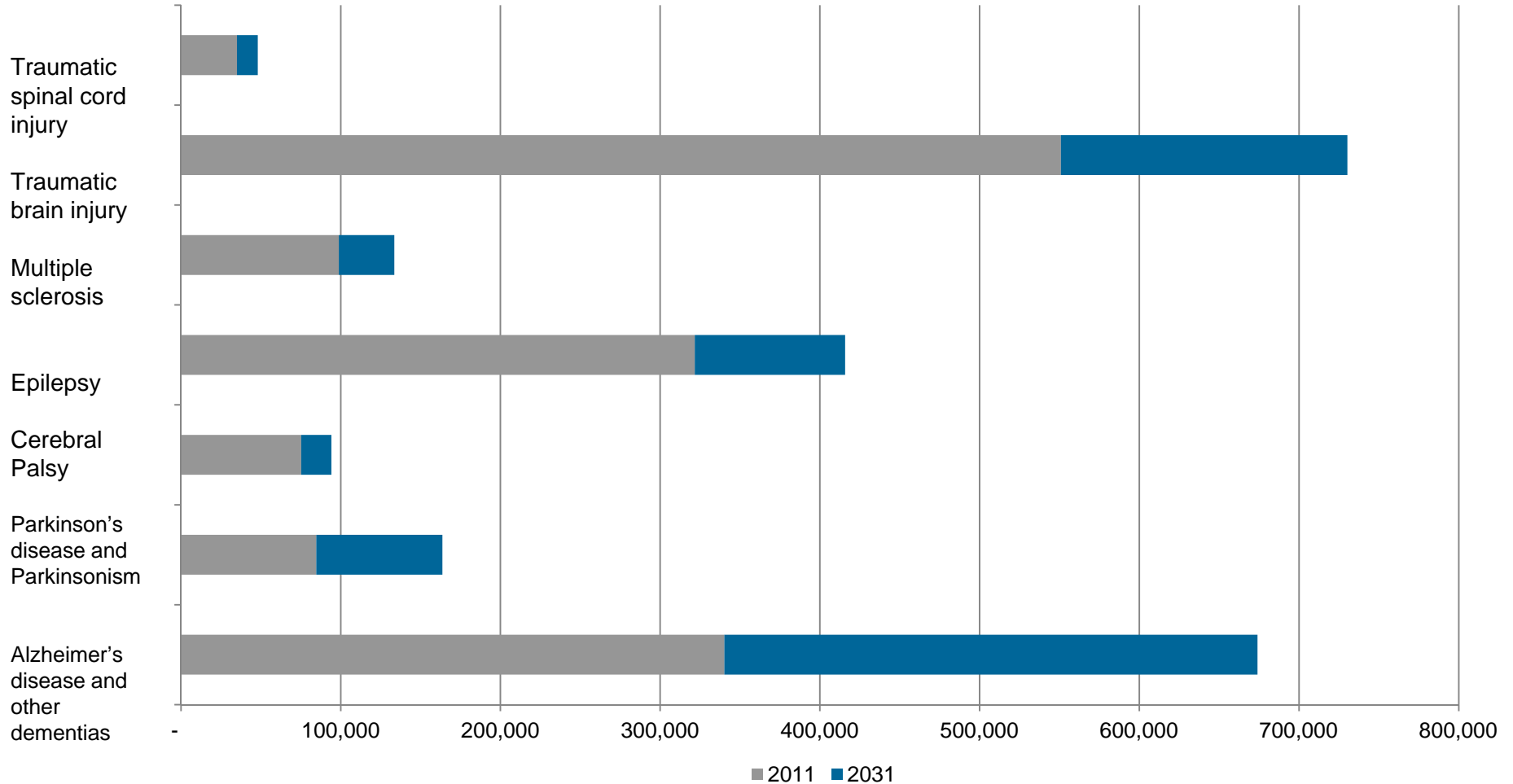


Plan of presentation

- **Background**
- **Description of POHEM-Neurological**
- **Examining the costs**
- **Results:**
 - **All the modeled Neurological Conditions**
- **Discussion**

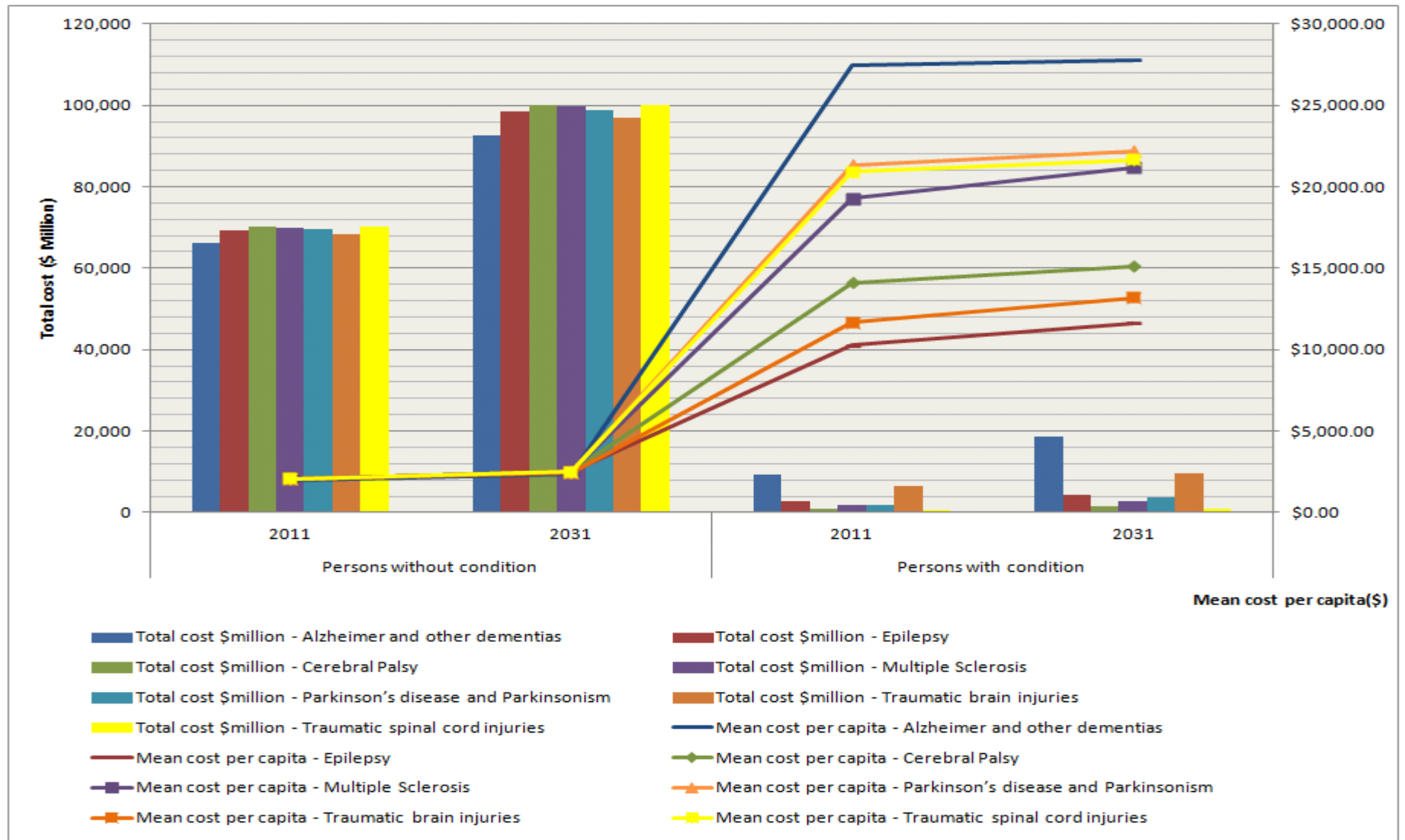


Projected Prevalence Counts, All the modeled Neurological Conditions, Canada, 2011 and 2031





Total and mean per capita costs – All the Modeled Neurological conditions





Plan of presentation

- **Background**
- **Description of POHEM-Neurological**
- **Examining the costs**
- **Results:**
 - **Alzheimer and other dementias**
 - **Prevalence of persons diagnosed with the Neurological condition (based on hospital data)**
 - **Costs**
 - Total costs
 - Mean costs (per capita)
- **Discussion**



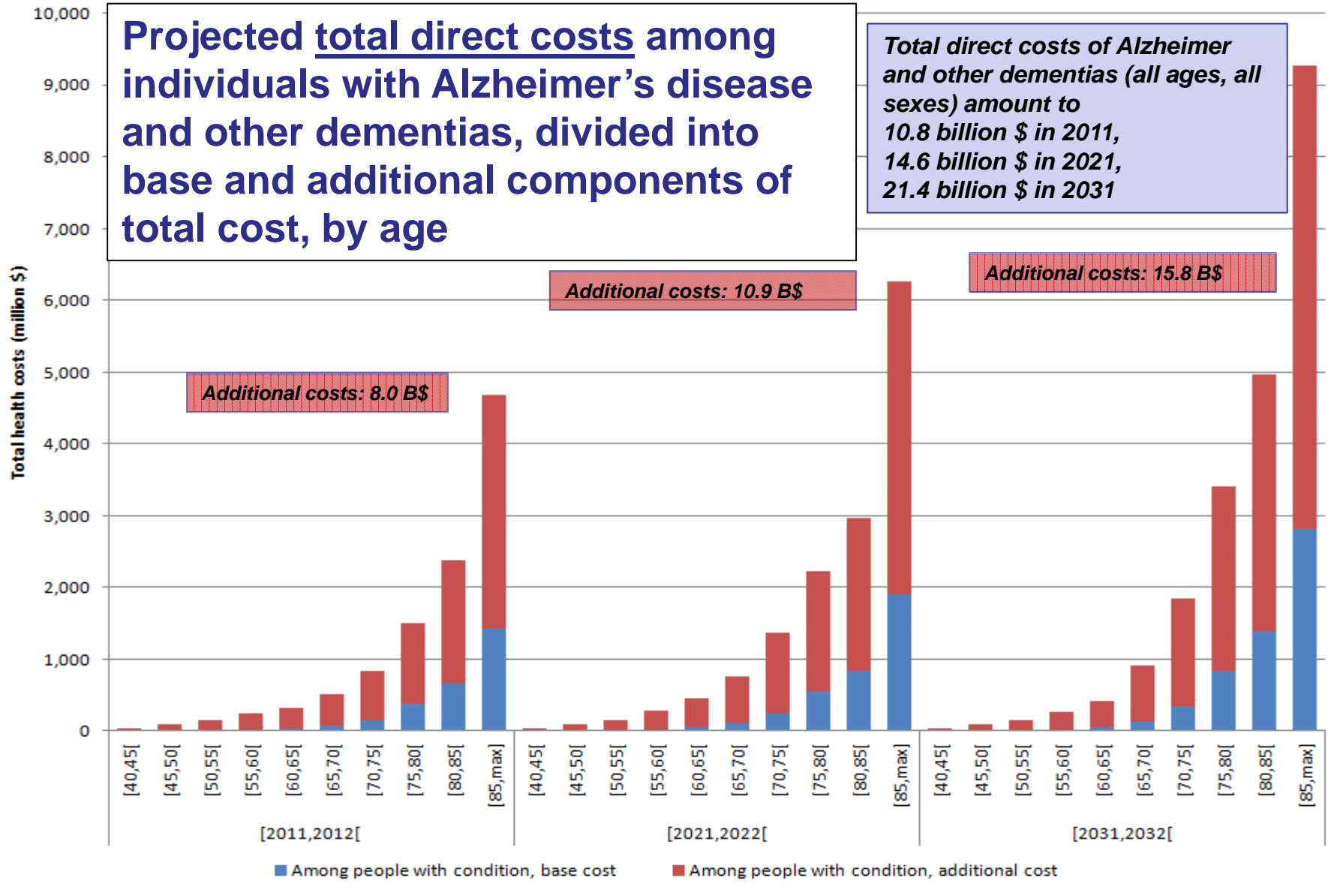
Estimated and projected prevalence of diagnosed Alzheimer's disease and other dementias, both sexes combined





Projected total direct costs among individuals with Alzheimer's disease and other dementias, divided into base and additional components of total cost, by age

Total direct costs of Alzheimer and other dementias (all ages, all sexes) amount to 10.8 billion \$ in 2011, 14.6 billion \$ in 2021, 21.4 billion \$ in 2031

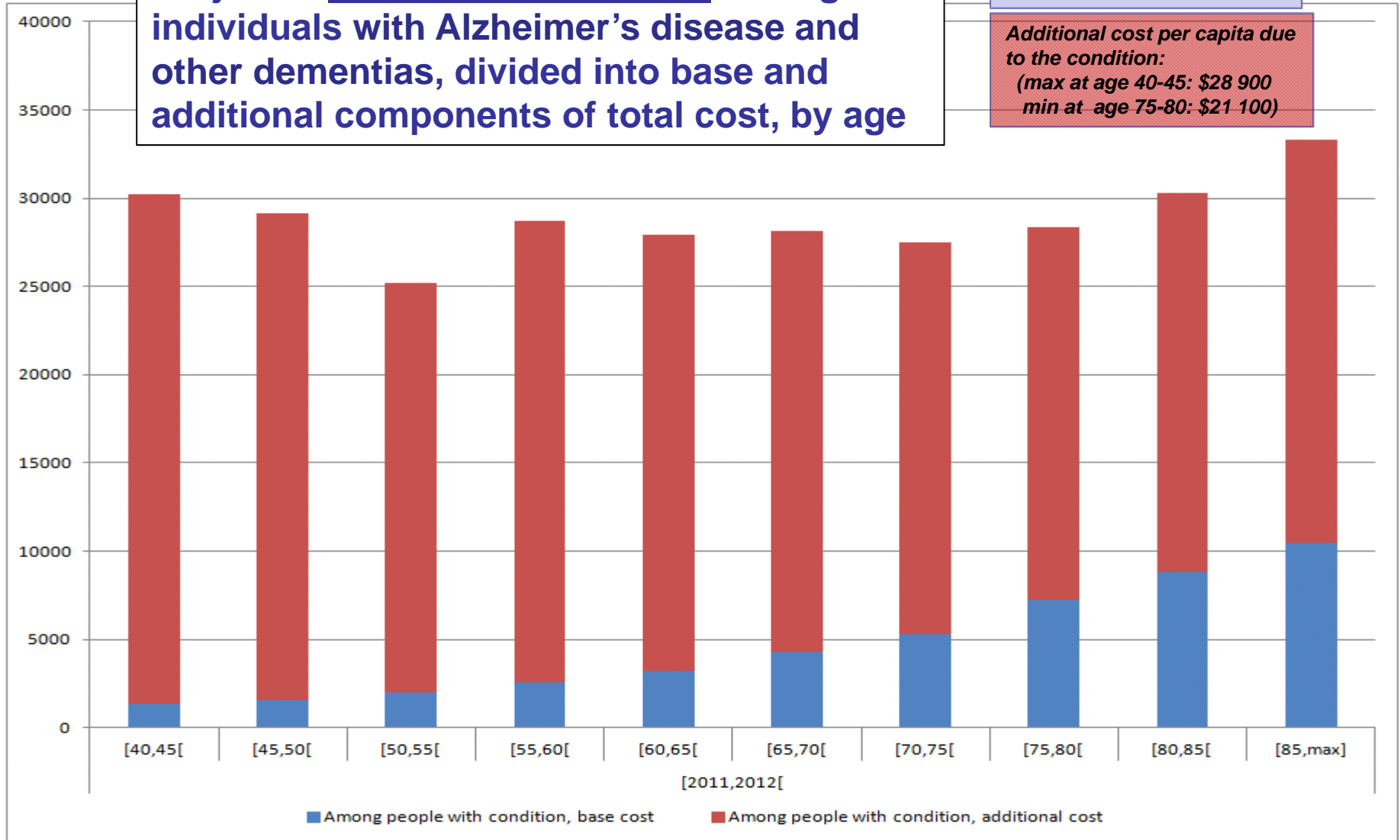




Projected Mean costs per capita among individuals with Alzheimer's disease and other dementias, divided into base and additional components of total cost, by age

Average cost per capita (all ages): \$31 700

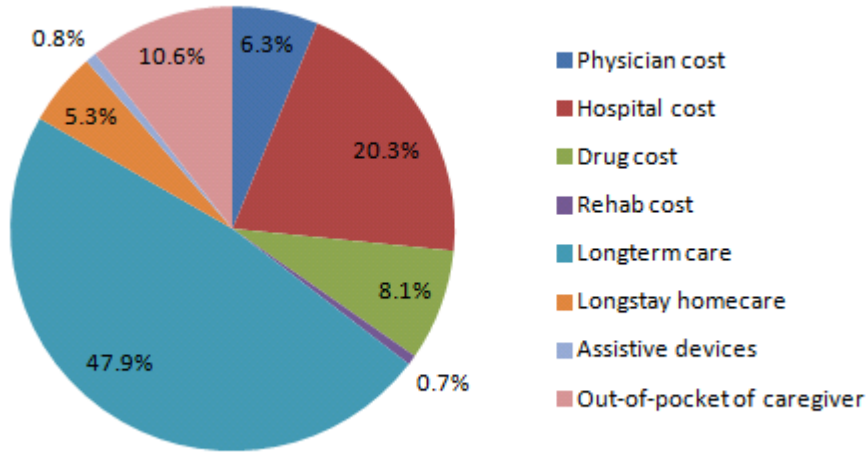
Additional cost per capita due to the condition:
(max at age 40-45: \$28 900
min at age 75-80: \$21 100)



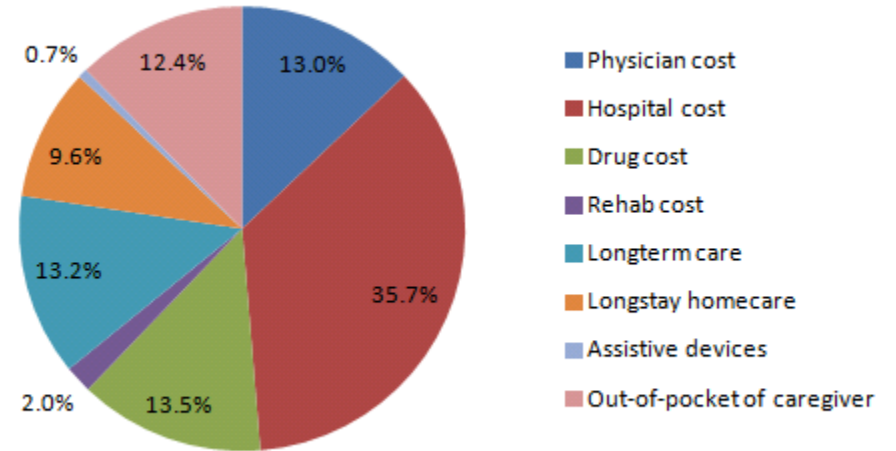


Main drivers for mean costs per capita in 2031, age 85+, sexes combined

**Persons with Alzheimer disease and other dementias:
Mean cost per capita in 2031= \$33,272**



**Persons without Neurological conditions:
Mean cost per capita in 2031= \$10,463**





What have we learned?

- Total direct health care costs (population level)
 - Are higher among persons without Neurological conditions
 - Because prevalence of neurological condition is relatively small
 - Vary according to sex and age group
 - Increase with time
 - Because population increases and ages
 - and there is a shift towards older ages

- Mean costs per capita
 - Are higher among persons with the Neurological condition
 - Vary according to sex and age group
 - Are stable with time within the sex and age group
 - Because we assumed no change in costs per year



What have we learned?

The highest <u>total costs</u>	of Alzheimer and other dementias are observed among	the oldest age group (85+)
The highest <u>total <i>additional</i> costs</u>		the oldest age group (85+)
The highest <u>mean costs per capita</u>		the oldest age group (85+)
The highest <u>mean <i>additional</i> costs per capita</u>		the youngest age group with that Neurological condition (40-44)



What have we learned?

- Main drivers for mean costs per capita vary according to the presence or absence of the neurological condition

Persons with Alzheimer or other dementias	Persons without Neurological conditions
1. Long term care	1. Hospital
2. Hospital	2. Physician
3. Out-of-pocket of the caregiver	3. Drugs



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Discussion

- POHEM-Neurological is a family of microsimulation models (i.e. a “tool”) that allows for the estimation and projection of health costs for 7 priority neurological conditions

- Results produced on a specific neurological condition show that examining
 - total costs or mean costs per capita,
 - base or additional costslead to different stories



Discussion

- Results produced so far are based on base case (status quo)
 - No variation on costs in future years
 - Future demography of Canada based on most probable hypotheses
 - Assessment of costs based on comparison of neurological condition and counterfactual
- However, it is possible to run the models with specific scenarios
 - Discounting on costs
 - Other demographic hypotheses (high and low hypotheses from Demographic division of Statistics Canada)
 - Variation in incidence or mortality rates



References

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 - Alzheimer's and other dementias in Canada 2011 to 2031: a POHEM microsimulation modelling study of projected prevalence, health burden, health services and caregiving use, *Forthcoming*
- Public Health Agency of Canada
 - Mapping Connections – An understanding of Neurological Conditions in Canada, September 2014
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The team

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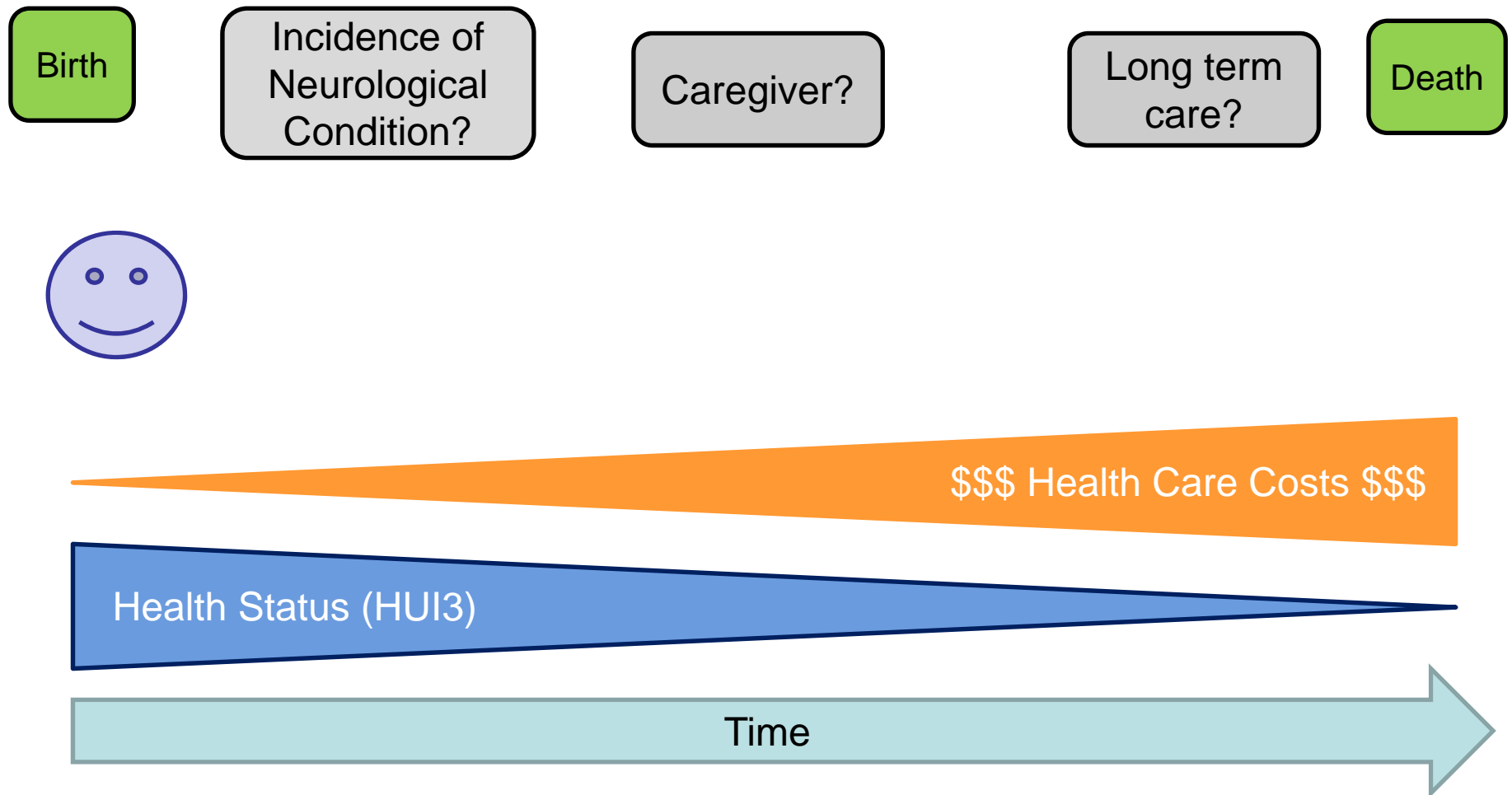
Merci – Thank you!



(APPENDICES)



POHEM-Neurological: General Framework





Parameters: Data Integration

Module	Statistics Canada Data Sources	External Data Sources
Demographics	Historical births, deaths, and future population projections	
Neurological: Incidence, mortality		Administrative health data (BC Ministry of Health)
Health status: General population	National Population Health Survey (NPHS)	
Health status: Neurological population	- 2011 Survey on Living with Neurological Conditions in Canada (SLNCC) - 2006 Participation and Activity Limitations Survey (PALS)	
Caregiving & care receiving	2012 General Social Survey (GSS) – Caregiving and Care Receiving	
Long term care		Continuing Care Reporting System -- Ontario (University of Waterloo)
Health care costs		Administrative health data from Ontario (ICES) & BC



CAREGIVING – Total out-of-pocket costs from caregivers

Condition	2011	2016	2021	2026	2031
Alzheimer's disease and other dementias	\$1,212.1 M	\$1,400.1 M	\$1,631.3 M	\$1,947.5 M	\$2,369.2 M
Parkinson's /Parkinsonism	\$ 214.2 M	\$ 249.0 M	\$ 291.9 M	\$ 348.4 M	\$ 408.4 M
Cerebral Palsy	\$ 204.5 M	\$ 216.1 M	\$ 231.7 M	\$ 249.5 M	\$ 264.6 M
Epilepsy	\$ 145.5 M	\$ 158.7 M	\$ 172.7 M	\$ 185.1 M	\$ 205.5 M
Multiple Sclerosis	\$ 162.1 M	\$ 186.1 M	\$ 205.4 M	\$ 223.8 M	\$ 239.2 M
Hospitalized Traumatic Brain Injury	\$1,001.5 M	\$1,099.3 M	\$1,201.1 M	\$1,302.8 M	\$1,415.6 M
Hospitalized Spinal Cord Injury	\$ 86.6 M	\$ 96.7 M	\$ 106.6M	\$ 116.9 M	\$ 125.2 M



Total direct costs (million \$) by year and age group

Total costs of Alzheimer and other dementias (all ages, all sexes) amount to 10.8 billion \$ in 2011, 14.6 billion \$ in 2021, 21.4 billion \$ in 2031

