

Appendix

This appendix provides an overview of the model, sources for our model parameters, and details on the capacity projections.

The simulation model has two parts. First, a Markov model simulates transitions between the following disease states: normal cognition (no mild cognitive impairment [MCI] and no Alzheimer's dementia) to MCI to Alzheimer's dementia. People move through the disease states based on annual transition probabilities from the literature (Table A-1).

Second, within the MCI state, a systems dynamic model simulates three health care system capacity constraints within the diagnosis and treatment phases. The systems dynamic model uses stocks and flows to allow people to move through the phases and to delay people in phases when there is not enough capacity. For example, in the diagnosis phase, the initial constraint is the first dementia specialist visit. Based on the specialists' capacity for visits, people move to the biomarker testing step; if the number of people exceeds the specialists' capacity, then those people remain at the specialist visit step until the following year (i.e., they queue for the next year). The model uses a one-year time step for the entire diagnosis and treatment phases, i.e., if a person is delayed at any step due to inadequate capacity, they remain at that step until the following year. After exiting each capacity step, a subset of people may exit the model at each "decision point" (see the diamonds in the conceptual framework in Figure 1 in the main report) if the next step is not indicated. For example, at the first dementia specialist visit, specialists would determine whether biomarker testing is indicated for a given patient. See Table A-1 for the assumptions for the share of patients that proceed at each decision point.

Table A-1. Model parameters, values, and sources

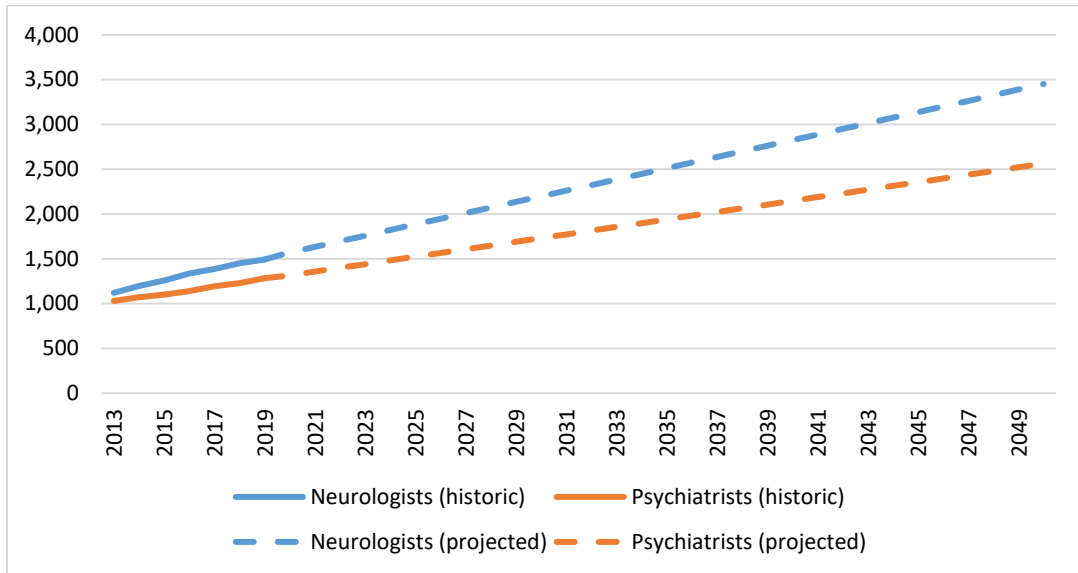
Parameter	Description	Value	Source
Population in 2017 (millions)			
Age 50+ without mild cognitive impairment (MCI) and Alzheimer's dementia	Population estimate of people 50 years and older, minus those with MCI and Alzheimer's dementia	15.967	KOSTAT (2020), Petersen et al. (2018)
MCI	Estimated number of people with MCI based on a meta-analysis of MCI prevalence	1.593	Petersen et al. (2018)
Alzheimer's dementia	Estimated number of Alzheimer's dementia patients based on dementia prevalence and AD etiology estimates	0.981	Montgomery et al. (2018)
Dead	Estimated mortality among the age 50+ population	0.263	KOSTAT (2020)
Annual mortality rates			
Age 50+ without cognitive impairment and Alzheimer's dementia	Derived from all-cause mortality rate among those without cognitive impairment, adjusted to the average age each year from 2017–2050	1.6 – 2.6%	KOSTAT (2020), Vassilaki et al. (2015), Rossetti et al. (2010), Spackman et al. (2012)
MCI	Derived from all-cause mortality rate, adjusted to the average age each year from 2017–2050, and adjusted for increased mortality in MCI cohorts	5.2%	KOSTAT (2020), Vassilaki et al. (2015)
Alzheimer's dementia	Derived from weighted average of mortality rate for patients in mild, moderate, and severe stages of Alzheimer's disease, adjusted to the average age each year from 2017–2050	14.9%	Rossetti et al. (2010), Spackman et al. (2012)
Annual disease state transition probabilities			
Probability of transitioning to MCI	Interpolated from Yesavage et al. (2002) based on the average age of the 50+ cohort for each year between 2017–2050	2.3-3.2%	Yesavage et al. (2002)
Probability of transitioning from MCI due to AD to Alzheimer's dementia <i>without</i> treatment	Derived from a meta-analysis	6.5%	Mitchell and Shiri-Feshki (2009)
Probability of transitioning from MCI due to AD to Alzheimer's dementia <i>with</i> treatment	Calculated as a product of a transitioning from MCI due to AD to Alzheimer's dementia and an assumed relative risk reduction of 30%	4.55%	—

Parameter	Description	Value	Source
Patient uptake and epidemiological parameters			
Share of the population who receive cognitive screening each year	Assumption based on expert input	50%	Liu et al. (2017)
Share of the MCI population who receive further evaluation by a dementia specialist each year	Assumption based on expert input	50%	Liu et al. (2017)
Share of MCI patients eligible for biomarker test	Assumption based on expert input	90%	Liu et al. (2017)
Share of MCI patients who have clinically relevant amyloid burden	Average of two estimates by Ong et al. (2015) and Doraiswamy et al. (2014)	45%	Ong et al. (2015); Doraiswamy et al. (2014)
Share of MCI patients with amyloid who have no contradictions for treatment	Assumption based on expert input	80%	Liu et al. (2017)
Capacity parameters			
Dementia specialists	Estimated total number of neurologists and psychiatrists able to diagnose MCI due to AD; 80% of neurologists and 35% of psychiatrists based on expert input from Korean subject-matter experts	2,886 in 2020 See Figure A-1 for the projected number of specialists	HIRA (2019)
Average visits by a dementia specialist per year	Estimated annual number of ambulatory visits by a full-time clinical neurologist	2,860	Dall et al. (2013)
Dementia specialists fraction of excess capacity	Assumption based on expert input	5%	Liu et al. (2017)
PET scanners	Number of scanners; estimated growth in PET scanners based on projecting historical trends forward	170 in 2018 See Figure A-2 for the projected number of PET scanners	OECD (2018a), HIRA (2019)
CSF testing fraction of total biomarker testing by CSF and PET	Assumption based on expert input from Korea	Base case scenario: 5% Alternative scenarios 2 and 3: 15%	–
Current PET scanners fraction of excess capacity	Assumption based on expert input	50%	Liu et al. (2017)

Parameter	Description	Value	Source
New PET scanners fraction of excess capacity	Assumption based on expert input	80%	Liu et al. (2017)
Infusions	Estimated based on the historical number of infusions of therapeutic or prophylactic substances, excluding chemotherapy and biologic response modifiers, in the U.S., and scaled to Korea based on population size and relative health care system capacity; growth rates from the U.S. analysis	See Figure A-3 for the projected infusion capacity in Korea, which is based on U.S. scaled to the Korean population and relative health care system capacity (Table A-2)	NAMCS and NHAMCS 2011 and 2013 data from Centers for Disease Control and Prevention (last updated 2017); OECD (2018a and 2018b); Liu et al. (2017)
Current infusion centers fraction of excess capacity	Assumption based on expert input	10%	Liu et al. (2017)
New infusion centers fraction of excess capacity	Assumption based on expert input	80%	Liu et al. (2017)

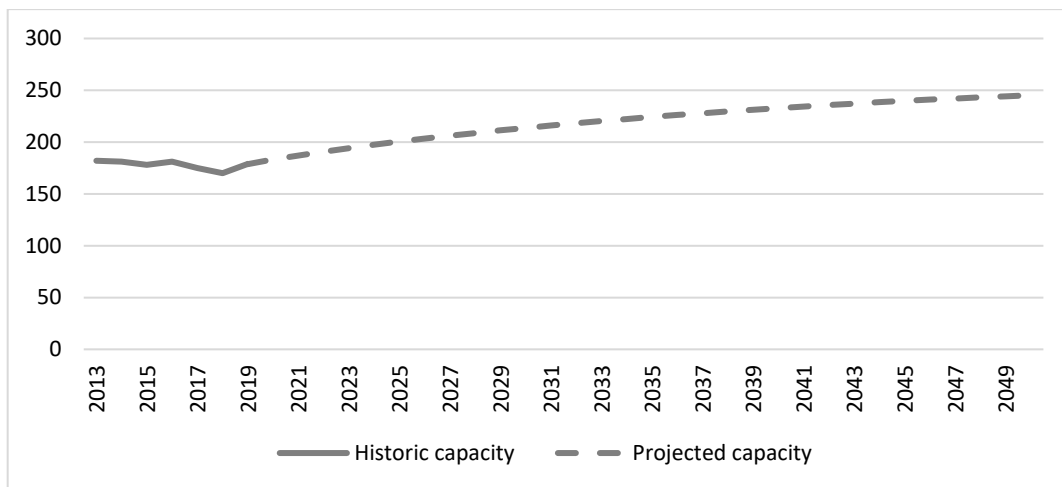
NOTE: MCI = mild cognitive impairment, AD = Alzheimer's disease, CSF = cerebrospinal fluid.

Figure A-1. Projected number of specialists in Korea



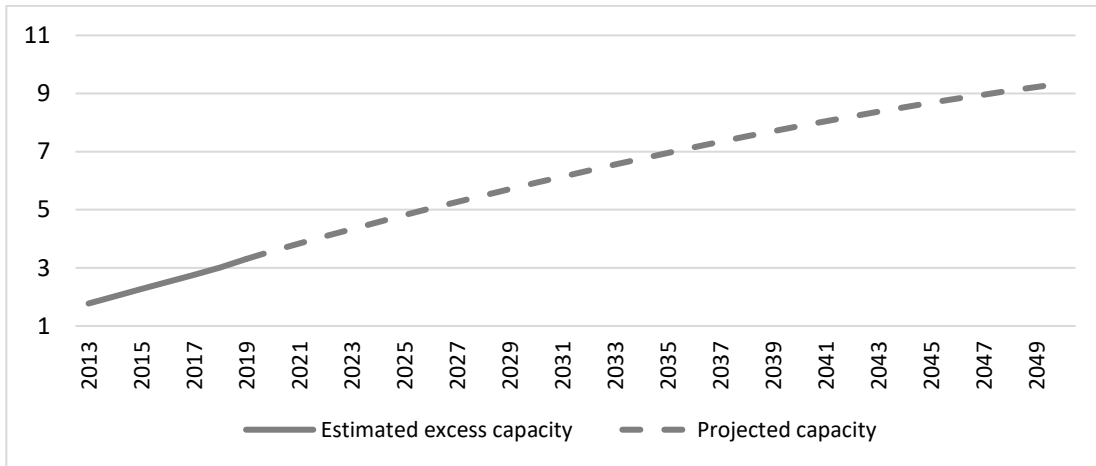
NOTES: The data shown reflect projections based on historical counts of specialists between 2013 and 2019 (HIRA 2019), and our projection shows a 4% increase in 2020 to a 2.1% increase in 2040 and a 1.8% increase in 2050.

Figure A-2. Projected number of PET scanners in Korea



NOTES: The solid line reflects historical data on the number of PET scanners in Korea from 2013 to 2018 (OECD, 2018a; HIRA 2019). The dotted line is our projection assuming the historical trend continues with an initial 3 percent annual growth rate and decreasing to a 0.7 percent growth rate in 2050.

Figure A-3. Projected excess capacity for infusions in Korea (millions)



NOTES: The solid line reflects historical data on the number of infusions in Korea based on our health care system capacity index relative to the number of infusions administered in the U.S. (see Table A-2), and our assumption of 10 percent excess capacity for additional infusions. The dotted line is our projection assuming the historical trend continues with a 10 percent annual growth rate initially and decreasing to a 2.3 percent growth rate in 2050, and that new infusion services could dedicate 80 percent of their capacity to an Alzheimer’s disease-modifying therapy.

Table A-2. Health care system capacity index

	Hospital beds	Active nurses	MRI scanners	PET scanners	Health care system capacity index
Japan	432%	77%	72%	53%	158.6%

NOTES: Each component of the index is a relative value on per-capita basis between Korea and the United States based on OECD data (OECD, 2018a and 2018b). We average the four component values to calculate the health care system capacity index for Korea, relative to the United States at 100 percent.

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