

Supplementary Material

Mortality Risk Models for Persons with Dementia: A Systematic Review

Supplementary Table 1. Search strategy

Medline (via Pubmed)

((predict* OR risk) AND (((mortality) OR death) OR dying) OR dead) OR die)) AND ((dementia[Title]) OR cognitive[Title]))

PsycInfo:

- 1 dementia.m_titl. (28507)
- 2 cognitive.m_titl. (111264)
- 3 1 or 2 (137355)
- 4 exp Prediction/ (24757)
- 5 exp Mortality Risk/ (547)
- 6 4 or 5 (25298)
- 7 mortality.mp. or exp "Death and Dying"/ (62868)
- 8 3 and 6 and 7 (60)

Supplementary Table 2. PROBAST [1] signaling questions for risk of bias

	Participants		Predictors			Outcome					
	Data Source	Inclusion criteria	Assessed similar	Blinded	Available intended time	Assessed appropriately	Definition	Predictors excluded	Defined same	Without predictor knowledge	Interval appropriate
Carlson, 2001 [2]	Y	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y
Cheng, 2019 [3]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Delva, 2013 [4]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Haaksma, 2019 [5]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Haaksma, 2020 [6]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mitchell, 2004 [7]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mitchell, 2010 [8]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mitchell, 2010 [9]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Newcomer, 2003 [10]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Paradise, 2009 [11]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pilotto, 2009 [12]	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Stern, 1997 [13]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sultana, 2018 [14]	N	Y	Y	Y	PN	Y	Y	Y	Y	Y	Y
van der Steen, 2007 [15]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
van der Vorst, 2020 [16]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
van Dijk, 1996 [17]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Wang, 2010 [18]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Wang, 2019 [19]	Y	N	PN	PN	N	Y	Y	Y	Y	Y	Y

Author	Analysis								
	Number outcomes	Continuous versus categorical	All included	Missing data	Not selected on univ.	Complexities	Calib / discrim	Internal valid	Predictors weights correspond
Carlson, 2001 [2]	Y	Y	Y	PN	N	NI	N	N	Y
Cheng, 2019 [3]	Y	N	Y	Y	N	NI	N	N	Y
Delva, 2013 [4]	Y	Y	Y	N	N	NI	N	N	Y
Haaksma, 2019 [5]	Y	Y	Y	N	Y	NI	N	N	Y
Haaksma, 2020 [6]	Y	Y	Y	PY	N	NI	Y	Y	Y
Mitchell, 2004 [7]	PY	N	Y	N	N	NI	N	N	Y
Mitchell, 2010 [8]	Y	N	Y	PY	Y	NI	Y	Y	Y
Mitchell, 2010 [9]	Y	N	Y	Y	Y	NI	Y	N/A	N/A
Newcomer, 2003 [10]	PY	N	Y	Y	N	NI	Y	PN	PY
Paradise, 2009 [11]	N	N	Y	N	N	NI	N	N	Y
Pilotto, 2009 [12]	N	Y	Y	N	Y	NI	N	N	Y
Stern, 1997 [13]	N	PN	Y	N	N	NI	N	N	Y
Sultana, 2018 [14]	N	PY	Y	N	Y	NI	PY	N	NI
van der Steen, 2007 [15]	N	N	Y	N	Y	NI	Y	N/A	N/A
van der Vorst, 2020 [16]	Y	PN	Y	N	N	NI	N	Y	PY
van Dijk, 1996 [17]	Y	Y	Y	N	N	NI	N	N	PY
Wang, 2010 [18]	N	N	Y	N	NI	NI	N	N	Y
Wang, 2019 [19]	Y	N/A	Y	N	NI	NI	N	Y	N/A

Y, yes; PY, probably yes; N, No; PN, probably no; NI, no information; N/A, not applicable.

REFERENCES

- [1] Moons KGM, Wolff RF, Riley RD, Whiting PF, Westwood M, Collins GS, Reitsma JB, Kleijnen J, Mallett S (2019) PROBAST: A tool to assess risk of bias and applicability of prediction model studies: explanation and elaboration. *Ann Intern Med* **170**, W1-W33.
- [2] Carlson MC, Brandt J, Steele C, Baker A, Stern Y, Lyketsos CG (2001) Predictor index of mortality in dementia patients upon entry into long-term care. *J Gerontol A Biol Sci Med Sci* **56**, M567-570.
- [3] Cheng CM, Chang WH, Chiu YC, Chen MH, Liao WT, Yang CH, Hwang JP, Li CT, Bai YM, Tsai SJ, Chen TJ, Tsai CF (2019) Risk score for predicting mortality in people with dementia: a nationwide, population-based cohort study in Taiwan with 11 years of follow-up. *J Clin Psychiatry* **80**, 18m12629.
- [4] Delva F, Pimouguet C, Helmer C, Peres K, Brechat B, Le Goff M, Jacqmin-Gadda H, Amieva H, Orgogozo JM, Auriacombe S, Berr C, Tzourio C, Barberger-Gateau P, Dartigues JF (2013) A simple score to predict survival with dementia in the general population. *Neuroepidemiology* **41**, 20-28.
- [5] Haaksma ML, Rizzuto D, Ramakers I, Garcia-Ptacek S, Marengoni A, van der Flier WM, Verhey FRJ, Olde Rikkert MGM, Melis RJF (2019) The impact of frailty and comorbidity on institutionalization and mortality in persons with dementia: a prospective cohort study. *J Am Med Dir Assoc* **20**, 165-170 e162.
- [6] Haaksma ML, Eriksdotter M, Rizzuto D, Leoutsakos JS, Olde Rikkert MGM, Melis RJF, Garcia-Ptacek S (2020) Survival time tool to guide care planning in people with dementia. *Neurology* **94**, e538-e548.

- [7] Mitchell SL, Kiely DK, Hamel MB, Park PS, Morris JN, Fries BE (2004) Estimating prognosis for nursing home residents with advanced dementia. *JAMA* **291**, 2734-2740.
- [8] Mitchell SL, Miller SC, Teno JM, Davis RB, Shaffer ML (2010) The advanced dementia prognostic tool: a risk score to estimate survival in nursing home residents with advanced dementia. *J Pain Symptom Manage* **40**, 639-651.
- [9] Mitchell SL, Miller SC, Teno JM, Kiely DK, Davis RB, Shaffer ML (2010) Prediction of 6-month survival of nursing home residents with advanced dementia using ADEPT vs hospice eligibility guidelines. *JAMA* **304**, 1929-1935.
- [10] Newcomer R, Covinsky KE, Clay T, Yaffe K (2003) Predicting 12-month mortality for persons with dementia. *J Gerontol B Psychol Sci Soc Sci* **58**, S187-198.
- [11] Paradise M, Walker Z, Cooper C, Blizzard R, Regan C, Katona C, Livingston G (2009) Prediction of survival in Alzheimer's disease--the LASER-AD longitudinal study. *Int J Geriatr Psychiatry* **24**, 739-747.
- [12] Pilotto A, Sancarlo D, Panza F, Paris F, D'Onofrio G, Cascavilla L, Addante F, Seripa D, Solfrizzi V, Dallapiccola B, Franceschi M, Ferrucci L (2009) The Multidimensional Prognostic Index (MPI), based on a comprehensive geriatric assessment predicts short- and long-term mortality in hospitalized older patients with dementia. *J Alzheimers Dis* **18**, 191-199.
- [13] Stern Y, Tang MX, Albert MS, Brandt J, Jacobs DM, Bell K, Marder K, Sano M, Devanand D, Albert SM, Bylsma F, Tsai WY (1997) Predicting time to nursing home care and death in individuals with Alzheimer disease. *JAMA* **277**, 806-812.
- [14] Sultana J, Fontana A, Giorgianni F, Basile G, Patorno E, Pilotto A, Molokhia M, Stewart R, Sturkenboom M, Trifiro G (2018) Can information on functional and cognitive status

improve short-term mortality risk prediction among community-dwelling older people? A cohort study using a UK primary care database. *Clin Epidemiol* **10**, 31-39.

- [15] van der Steen JT, Mitchell SL, Frijters DH, Kruse RL, Ribbe MW (2007) Prediction of 6-month mortality in nursing home residents with advanced dementia: validity of a risk score. *J Am Med Dir Assoc* **8**, 464-468.
- [16] van de Vorst IE, Goluke NMS, Vaartjes I, Bots ML, Koek HL (2020) A prediction model for one- and three-year mortality in dementia: results from a nationwide hospital-based cohort of 50,993 patients in the Netherlands. *Age Ageing* **49**, 361-367.
- [17] Van Dijk PT, Dippel DW, Van Der Meulen JH, Habbema JD (1996) Comorbidity and its effect on mortality in nursing home patients with dementia. *J Nerv Ment Dis* **184**, 180-187.
- [18] Wang Y, Huang Y, Liu Z, Zhuo C, Li S, Prince M (2010) A five-year community-based longitudinal survival study of dementia in Beijing, China: a 10/66 Dementia Research Group population-based study. *Int Psychogeriatr* **22**, 761-768.
- [19] Wang L, Sha L, Lakin JR, Bynum J, Bates DW, Hong P, Zhou L (2019) Development and validation of a deep learning algorithm for mortality prediction in selecting patients with dementia for earlier palliative care interventions. *JAMA Netw Open* **2**, e196972.