The Predictive Accuracy of the CAIDE Score in the U.S. Population

Santiago Porras[1], Zhuo Meng[2]

[1]Biological Sciences, Undergraduate Research Opportunity Program

[2]Center of Population Sciences for Health Equity (CPSHE), College of Nursing, Florida State University

Introduction

- Dementia affects over 50 million people globally, projected to surpass 100 million within a decade (WHO). In the U.S., 6.9 million adults aged 65+ have Alzheimer's, accounting for over 700,000 deaths in the U.S. (Alzheimer's association 37).
- With no cure, prevention is crucial. Early intervention and risk factor identification can help delay or reduce cognitive decline, improving long-term health outcomes (WHO).
- The CAIDE score, developed in Finland, is a common tool for assessing dementia risk in individuals aged 39 to 65, using easily measurable factors like age, sex, education, BMI, blood pressure, cholesterol, and physical activity (Kivipelto et al., 1).
- The predictive accuracy of the CAIDE score may vary due to population differences and changes in risk factors over time, such as education levels and the rising prevalence of hypertension (Zhou et al., 1).
- This study evaluates dementia risk scores in a U.S. population using recent data from the All of Us Research Program, aiming to refine risk prediction and enhance prevention strategies.

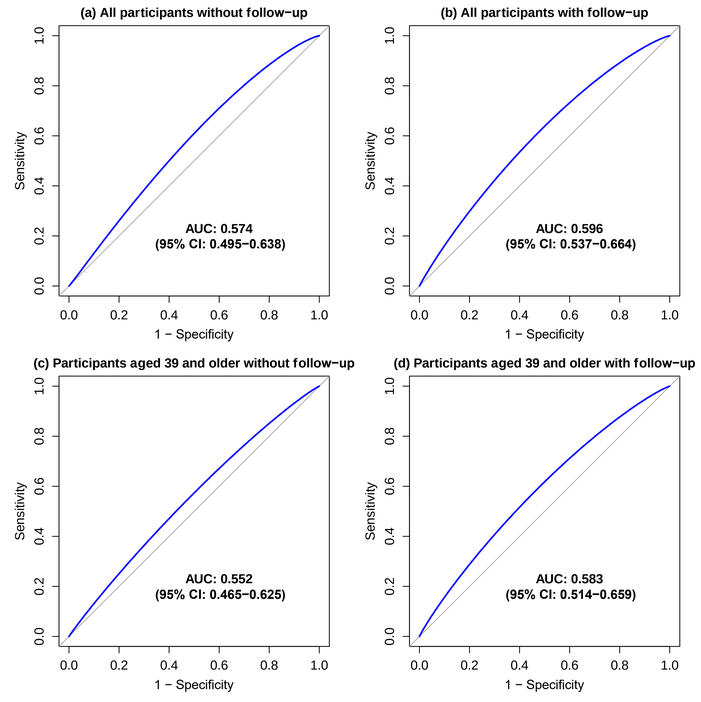
Methodology

- Gather data from the All of Us for participants who consented to share their electronic health records and have available data for CAIDE score calculation prior to 2017 (N = 990).
- CAIDE score: a composite measure of seven risk factors, ranging from 0–15. Cutoffs of 6 and 9 have been suggested for risk classification.
- Dementia diagnoses: extracted from participants' EHR with dementia, Alzheimer's, and cognitive impairment as key words.
- The predictive accuracy was evaluated by
  - The ROC curves and the associated AUCs with their 95% CIs, with and without taking the follow-up time into account.
  - Diagnostic statistics including sensitivity, specificity, accuracy (ACC), and Youden's J index with cutoffs of 6–9.
- The analyses were conducted for all eligible participants and separately for those aged 39 and older to mitigate the influence of younger participants.

Results

- Of the 7 factors, only age and physical activity were associated with dementia.
- Participants with dementia were associated with lower total cholesterol levels.
- The predictive performance of the CAIDE score was limited, as the AUCs ranged 0.522 to 0.596, their CIs covered 0.5, a maximum sensitivity of 0.426, and the Youden's J index close to 0.

	All participants (N = 990)			Participants aged 39 and older (N = 823)		
	No dementia	Dementia		No dementia	Dementia	
Risk factors	(N = 918)	(N = 72)	P	(N = 762)	(N = 61)	P
Age, years	53.5 (13.5)	57.2 (13.1)	.027	58.1 (9.4)	61.2 (9.8)	.022
Education, years	15.8 (1.5)	15.6 (1.6)	.386	15.8 (1.5)	15.9 (1.5)	.705
Men, N (%)	306 (33.3%)	28 (38.9%)	.342	264 (34.6%)	25 (41.0%)	.323
BMI, kg/m^2	29.9 (6.8)	30.6 (7.1)	.436	29.8 (6.4)	29.4 (4.9)	.488
SBP, mmHg	122.3 (13.7)	123.0 (12.8)	.666	123.4 (13.5)	124.7 (11.8)	.413
Total cholesterol, mg/dL	185.9 (36.2)	178.2 (32.7)	.062	187.6 (36.7)	177.9 (31.6)	.025
Physically inactive, N (%)	404 (44.0%)	43 (59.7%)	.010	314 (41.2%)	33 (54.1%)	.051



	All participants (N = 990)				Participants aged 39 and older (N = 823)			
CAIDE score cutoff	6	7	8	9	6	7	8	9
Diagnostic statistics								
Sensitivity	.361	.222	.083	.042	.426	.262	.098	.049
Specificity	.645	.786	.917	.972	.575	.743	.900	.966
Accuracy	.624	.745	.857	.904	.564	.707	.841	.898
Youden's J index	.006	.009	.001	.013	.001	.005	-.001	.015

Discussion

- The predictive accuracy of the CAIDE score appeared to be poor in the U.S. population. The association between dementia and total cholesterol does not align with previous research and theories. The impact of these risk factors should be re-evaluated.
- The study did not consider genetic factors like APOE ε4, which affects dementia, anxiety, and depression (Xu Chun et al. 1), or other risk factors like diabetes included in predictive tools such as ANU-ADRI, CogDrisk, LIBRA, and CAIDE score with a genetic factor. This evaluation could be extended to aforementioned tools.
- Further efforts could focus on refining the CAIDE score as it incorporates with easily accessible risk factors, which makes it more applicable to the general population.
- Future research could develop a predictive tool incorporating proven risk factors like diabetes to enhance prevention and risk identification using larger, more diverse samples (Hussain et al. 1).

Acknowledgements

CRE Leaders: Alicia Batailles & Chris Ryan; UROP Leaders: Natalia Sanchez & Leah Livin

References

Alzheimer's Association. "2024 Alzheimer's Disease Facts and Figures." *Alzheimers Dement*, vol. 20–5, 2024, www.alz.org/media/documents/alzheimers-facts-and-figures.pdf.

Husain, Khaled Hameed, et al. "Dementia in Diabetes: The Role of Hypoglycemia." *International Journal of Molecular Sciences*, edited by Masashi Tanaka, 2023, doi.org/10.3390/ijms24129846.

Kivipelto, M., MD, Ngandu, T., Laatikainen, T., Winblad, B., MD, Soininen, H., MD, & Tuomilehto, J. (n.d.). Risk score for the prediction of dementia risk in 20 years among middle aged people: a longitudinal, population-based study. In *Lancet Neurol* (Vol. 5, pp. 735–741) [Journal-article]. https://doi.org/10.1016/S1474-4422(06)70537-3

WHO: World Health Organization. (2023, March 15). *Dementia*. https://www.who.int/news-room/fact-sheets/detail/dementia

Xu, Chun, et al. "APOE Gene Associated With Dementia-Related Traits, Depression, and Anxiety in the Hispanic Population." *Genes*, vol. 14, no. 7, July 2023, p. 1405. https://doi.org/10.3390/genes14071405.