

Mind and Machine: AI-Driven Health Psychology for Disease Prevention

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Neurodegenerative disease burden



- Age as strongest risk factor of neurodegenerative diseases.¹
- Annual societal costs of dementia estimated at US \$1313.4 billion for 55.2 million people with dementia in 2019 globally.²
- Modifiable factors in dementia estimated to contribute 40%, while genetic risk contributes ca. 7%.³

¹ Hou et al. 2019. doi: 10.1038/s41582-019-0244-7

² Wimo et al. 2023. doi: 10.1002/alz.12901

³ Livingston et al. 2020. doi: 10.1016/S0140-6736(20)30367-6

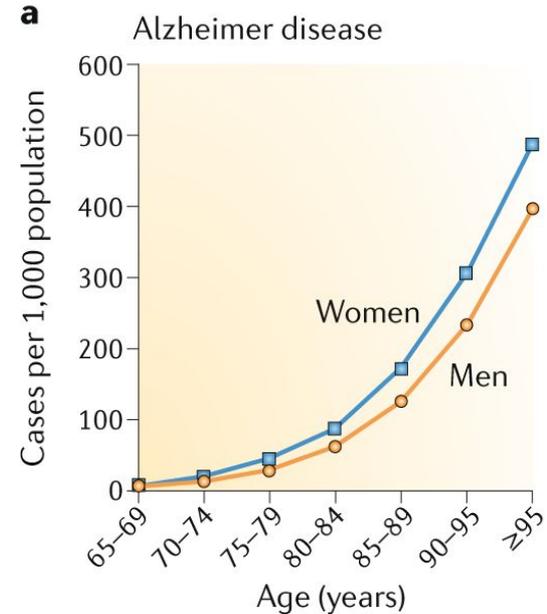


Figure: Hou et al. 2019. doi: 10.1038/s41582-019-0244-7

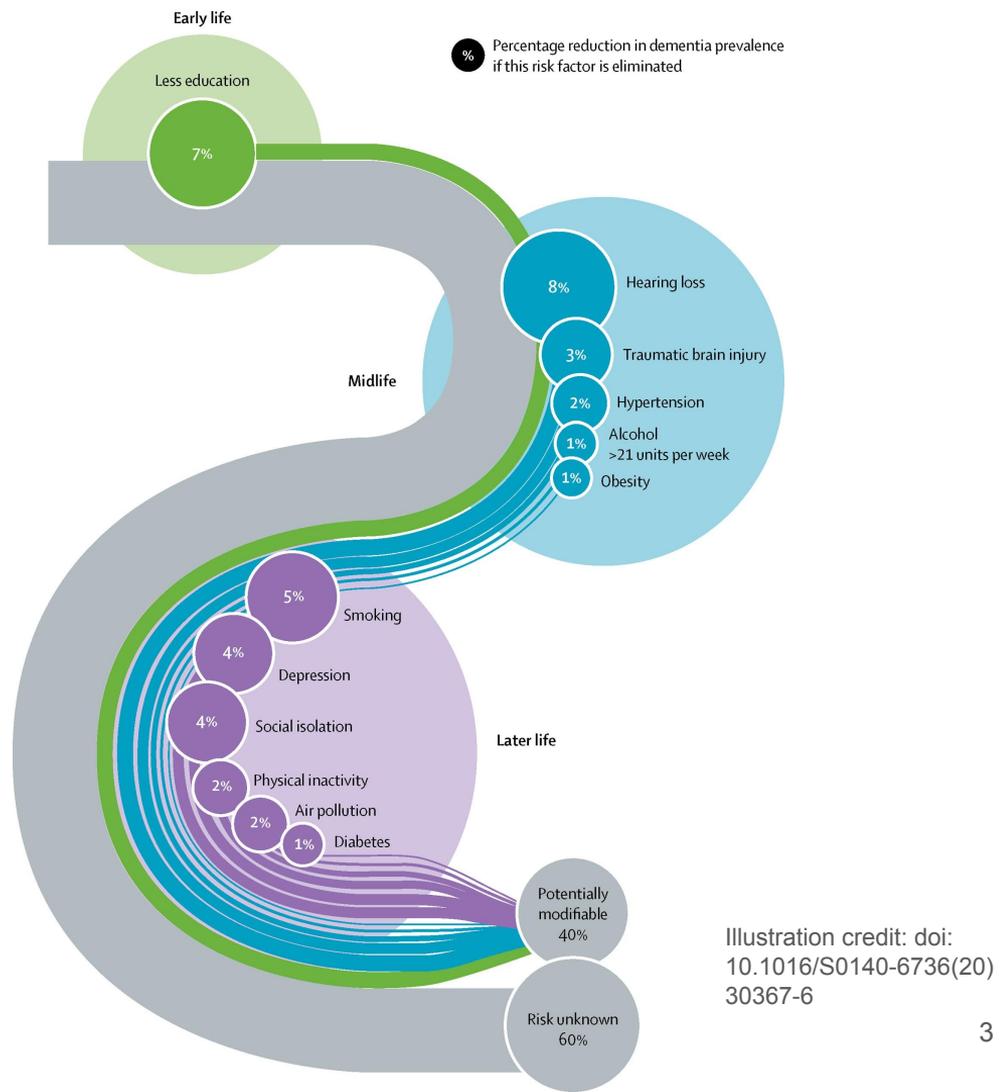
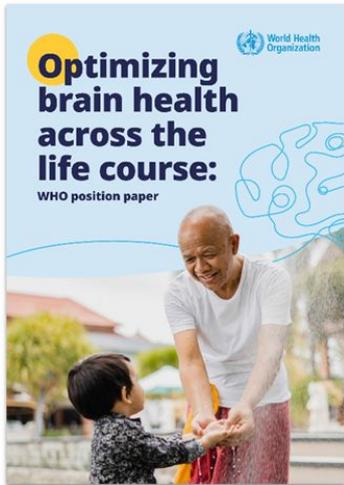
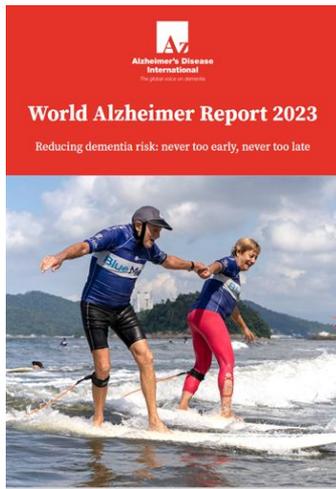
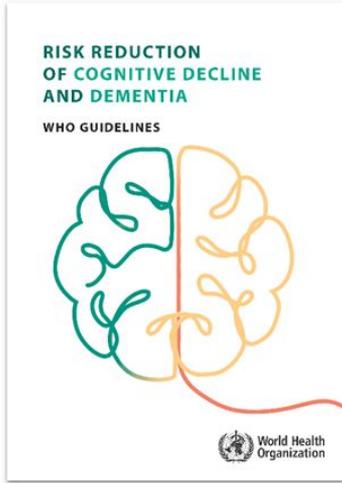
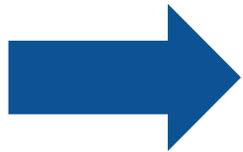


Illustration credit: doi:
10.1016/S0140-6736(20)
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AI-driven disease prevention: Targeting modifiable risk factors

- Cardiometabolic risk factors
- Chronic stress
- Excessive caloric intake
- Physical inactivity
- Harmful substance consumption
- ...



Detection of risk factors



Education, Counseling, Personalised Advice



Decision-making support



Use of AI in disease prevention



Selected applications

- **Detection of risk factor(s):** unobtrusive, possibly innovative - current assessments less than optimal.¹
- **Personalised advice:** adapt to idiosyncrasies of users
- **Monitoring and feedback of health data** to end-users and healthcare professionals
- **Decision-making support** for healthcare professionals.²



¹ Bramich et al., 2023. doi: 10.3399/bjgp23X731721

² SURGE-Ahead: NKG Stockholm 2024; doi: 10.1371/journal.pone.0287230



Views on AI in healthcare

- Discourses on AI: Overoptimism against hypercriticism? ¹
- Strong end-user and healthcare professionals' wishes to enrich decision-making based on AI ²
- Risks and necessary regulation ³

¹ Arbelaez Ossa, ... Leist et al. 2024. doi: 10.1007/s11948-024-00486-0

² <https://apolitical.co/solution-articles/en/top-5-trends-to-watch-as-ai-transforms-healthcare>

³ Ethics and governance of artificial intelligence for health. Guidance on large multi-modal models. Geneva: World Health Organization; 2024.

Science and Engineering Ethics (2024) 30:24
<https://doi.org/10.1007/s11948-024-00486-0>

ORIGINAL RESEARCH/SCHOLARSHIP

AI Through Ethical Lenses: A Discourse Analysis of Guidelines for AI in Healthcare

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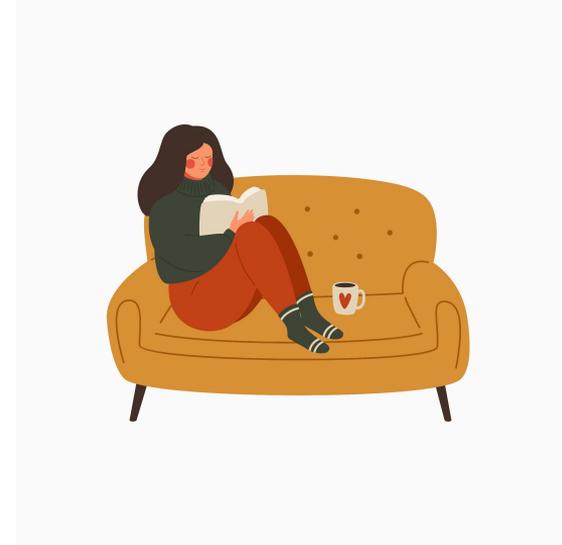
Ethics and governance of artificial intelligence for health

Guidance on large multi-modal models



Benefits of LLMs in disease prevention

- In high-knowledge contexts: increased efficiency and accuracy of care
- Preference for AI psychotherapists for mental health issues for 55% of users, particularly for remote and socially challenging contexts ¹
- Psychoeducation for low-literacy users ²
- Disease management ³



¹ Aktan et al. 2022. doi: 10.1016/j.chb.2022.107273

² Maurya et al. 2024. doi: 10.1002/capr.12759

³ Al-Anezi 2024. doi: 10.1002/lrh2.10406

Considerations on LLMs in disease prevention

- Quality of input acceptable? ¹
- Validation of AI recommendations subject to confirmation bias ²
- Systematic inequalities possibly exacerbated in AI-based healthcare ³
- AI-based detection errors at whose cost? ⁴



A Simplified Ethical Matrix

Each cell of the matrix represents how a certain concern applies to a particular stakeholder group. Cells that indicate where a stakeholder could be gravely harmed or the algorithm violates a hard constraint are shaded red. Cells that raise some ethical worries for the stakeholder are highlighted yellow, and cells that satisfy the stakeholder's objectives and raise no worries are highlighted green.

		CONCERNS	
		False positive (transaction gets flagged but isn't truly fraud)	False negative (transaction is truly fraud but does not get flagged)
STAKEHOLDERS	Company	Moderate Concern	Serious Concern
	Nonfraudulent customers	Serious Concern	Minimal/No Concern
	Fraudsters	Minimal/No Concern	Benefit

■ SERIOUS CONCERN ■ MODERATE CONCERN □ MINIMAL/NO CONCERN ■ BENEFIT

¹ SURGE-Ahead: NKG Stockholm 2024; DOI: 10.1371/journal.pone.0287230

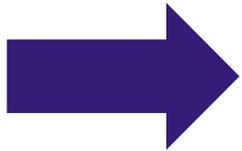
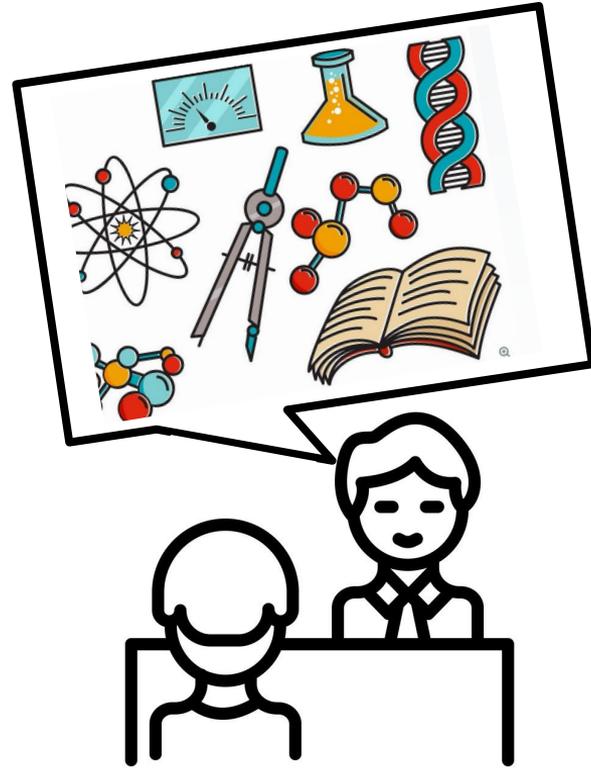
² Bashkirova & Krpan 2024. doi: <https://doi.org/10.1016/j.chbah.2024.100066>

³ Chen et al. 2021. doi: 10.1146/annurev-biodatasci-092820-114757

⁴ MIT Sloan Review 11 June 2024, <https://sloanreview.mit.edu/article/auditing-algorithmic-risk/>

Why health psychology in AI-driven disease prevention?

- Beyond insights on risk factors: Insights on goal setting and habit formation to bridge the knowledge-implementation gap
- Personalised recommendations on healthy lifestyle to adapt to cultural, socioeconomic, sex/gender differences



Conservative LLM text generation

Validated scientific knowledge grounding the LLM

Examples of health psychology insights for disease prevention

- Define a purpose
- Set realistic, achievable, measurable goals
- Use self-regulation capacities wisely
- Reframe unpleasant sensations, emotions
- Increase accountability



Visit us for brain health
advice:



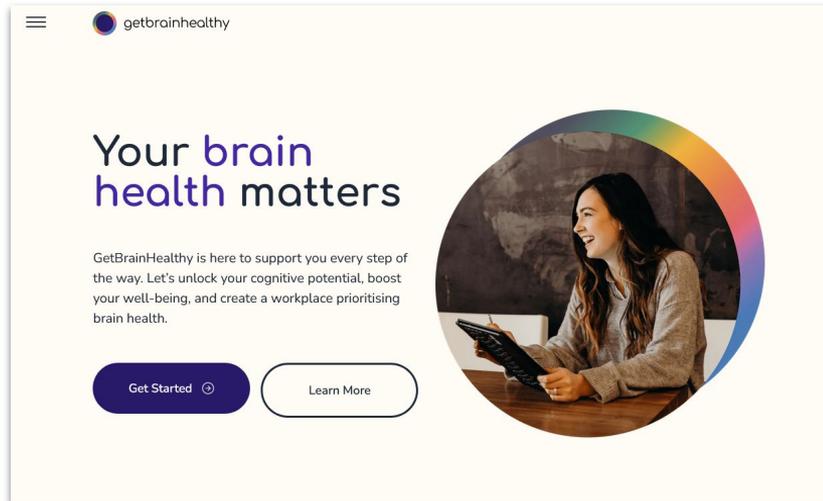


Get Brain Healthy: A platform to promote brain health at the workplace

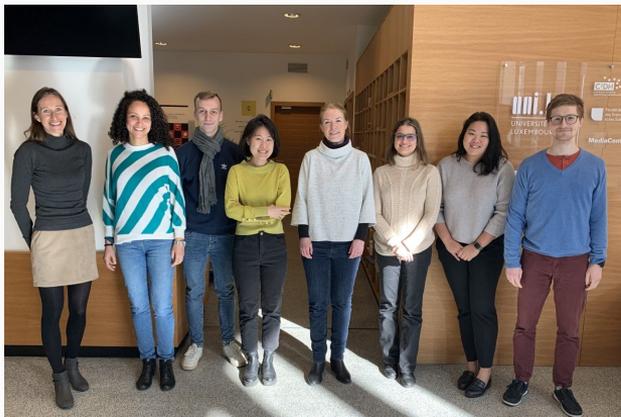
Partner with us: hello@getbrainhealthy.org



Joint work with Melissa Chan, knowledge translation expert, and 6+ scientific contributors



175+ employee actions
35+ manager actions
5+ pilot businesses
200+ scientific studies



Team

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Affiliated projects



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