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INTRODUCTION

- Dementia has a long preclinical phase; pathological changes can start decades before symptoms.¹
- Early detection of high-risk individuals in midlife has great potential for future targeted treatments and prevention but we currently lack non-invasive, low-cost screening tools.
- Sensory (hearing, vision, olfaction) and motor changes are common in aging adults and have been associated with cognitive impairment and dementia.^{2,7}
- Previous risk factors used for prediction of impairment have often been based on cardiovascular-related factors and did not include sensory or motor measures.⁸⁻¹⁰

AIM

We aimed to assess whether midlife sensory and motor function can improve risk prediction models of 10-year cognitive decline and impairment



METHODS

Study Sample

Participants of the Beaver Dam Offspring Study (BOSS), a longitudinal sensory and cognitive aging study. Participants who underwent neurocognitive review using their data from baseline (2005-08), 5-year (2010-13) and 10-year (2015-17) follow-up were included in analysis N=1529

Measurements

Baseline Risk Scores

CAIDE (Cardiovascular Risk Factors, Aging, and Dementia Study) Score₉

- included age, sex, education*, blood pressure, total cholesterol level, physical activity, body mass index

FRS% (Framingham Risk Study) score_{8,10}

- included age, sex, blood pressure, blood pressure medication intake, total cholesterol levels, high-density lipoprotein levels, current smoking status, diabetes

Baseline Sensory and Motor Measures

Hearing:

Pure-tone audiometry (500-4000Hz averaged); Impairment: >25 dB₁₁

Vision:

Contrast sensitivity-Pelli-Robson letter chart; Impairment: <1.55 log units₁₁

Olfaction:

San Diego Odor Identification Test; Impairment: <6 odors correct₁₁

Motor Function:

Grooved Pegboard Test, s, (Lafayette, Instruments, Lafayette, IN)₁₂

Grip strength hand dynamometer, kg, (Lafayette, Instruments, Lafayette, IN)₁₂

36-Item Short Form Survey (SF-36) Physical Function Scale, Score₁₃

Cognitive Outcomes

10-year cognitive decline: Trail-making Test B time, 10% most decline_{12,14}

10-year incidence of cognitive impairment: determined by clinical/neurocognitive expert review panel

METHODS & RESULTS

Statistical Methods

Logistic regression models

Outcomes: 10-yr incidence of cognitive decline or impairment

1. Model: Determinants: CAIDE or FRS%

2. Model: Determinants: CAIDE + sensory and motor or FRS% + sensory and motor

Chi-square test to assess significance in increase in risk prediction models (AUCs), p-value

Table 1. Sample Characteristics (N=1529); n(%)

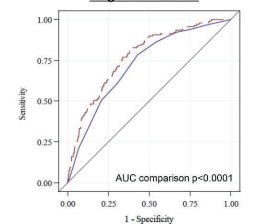
Baseline mean age 49, SD=10 years; range [22-84]
Women 828 (54)
≥Bachelor's degree 521 (34)

Average 9.6 years of follow-up

Incident Cognitive Decline 147 (10)

Incident Cognitive Impairment 248 (16)

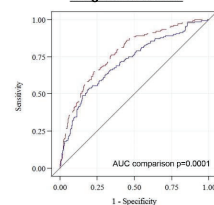
Fig 1. ROC Curves CAIDE & Cognitive Decline



Determinants	AUC (95% CI)
CAIDE	0.72 (0.68, 0.76)
CAIDE+Sensory-Motor	0.77 (0.73, 0.81)

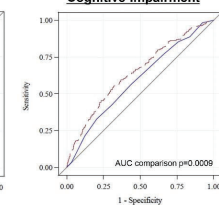
Including midlife hearing, vision, olfactory, and motor function improved the risk prediction of long-term cognitive decline and impairment.

Fig 2. ROC Curves FRS% & Cognitive Decline



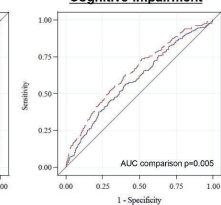
Determinants	AUC (95% CI)
FRS%	0.71 (0.67, 0.76)
FRS%+Sensory-Motor	0.78 (0.74, 0.72)

Fig 3. ROC Curves CAIDE & Cognitive Impairment



Determinants	AUC (95% CI)
CAIDE	0.59 (0.55, 0.63)
CAIDE+Sensory-Motor	0.65 (0.61, 0.68)

Fig 4. ROC Curves FRS% & Cognitive Impairment



Determinants	AUC (95% CI)
FRS%	0.59 (0.55, 0.63)
FRS%+Sensory-Motor	0.65 (0.61, 0.69)

AUC: Area under the receiver operating characteristic curve; CI: Confidence interval; Chi square p-value for statistically significant difference between AUCs.

DISCUSSION

- Adding sensory and motor measures improved AUROCs for predictions of cognitive decline and cognitive impairment as compared to models using only the CAIDE or only the FRS%, two previously used risk factors scores_{8,10}
- This extends previous research to the inclusion of sensory and motor measures assessed in midlife into the long-term prediction of cognitive changes and onset of impairment.

- Sensory and motor assessments could potentially become relevant cost-effective and non-invasive screening tools to identify those at high risk for neurodegeneration and cognitive decline early to target future prevention and intervention strategies.

Limitations

- Rather healthy cohort, with limited impairment/change
- Non-Hispanic White cohort
- Subsample of the BOSS

Strengths

- Large well-characterized sample
- Longitudinal data starting in midlife with 10 years of follow-up
- Large battery of standardized objective assessments

CONCLUSION

Including midlife hearing, vision, olfactory, and motor function improved the risk prediction of long-term cognitive decline and impairment in middle-aged to older adults.



FUTURE DIRECTIONS

- Future studies should follow participants into older ages, with higher incidences of cognitive changes and clinical impairment
- Future research might also explore additional sensory measures to build stronger yet parsimonious prediction models.

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* with adjusted education groups for our cohort

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