Dementia prediction using electrocardiography (ECG)

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Alzheimer's dementia

- Progressive loss of cognitive function
- Alzheimer's is the leading cause of dementia
- 1% of 65-69yr
- 20% of 85-89yr affected
- No cure available → Aim at prevention
- Symptomatic treatment:
  - ACh-esterase-inhibitors, (Memantine)

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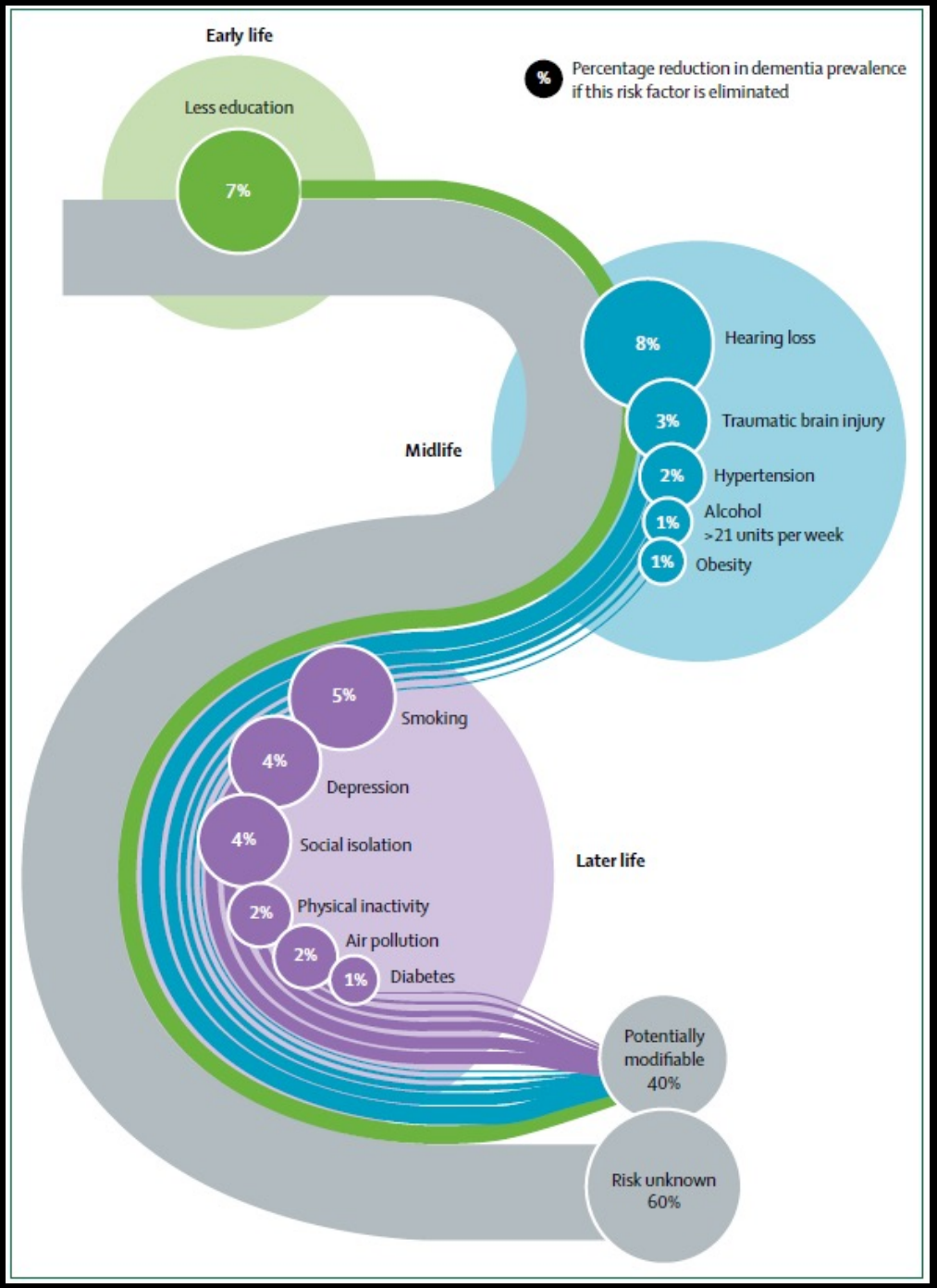
40 % preventable



Livingston 2020

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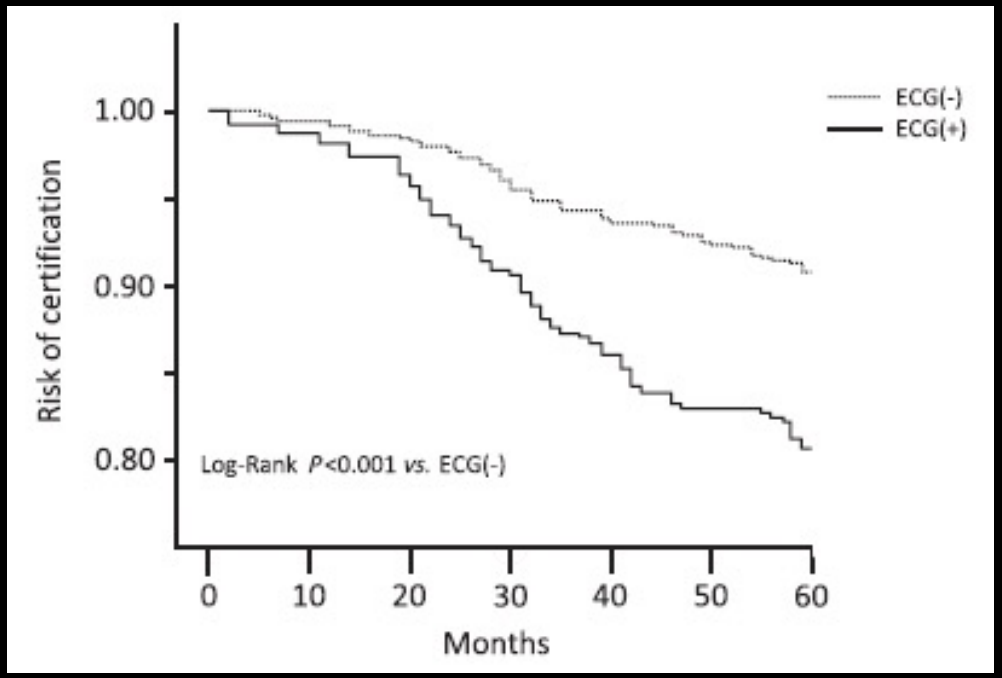
How do we identify those at risk for dementia?

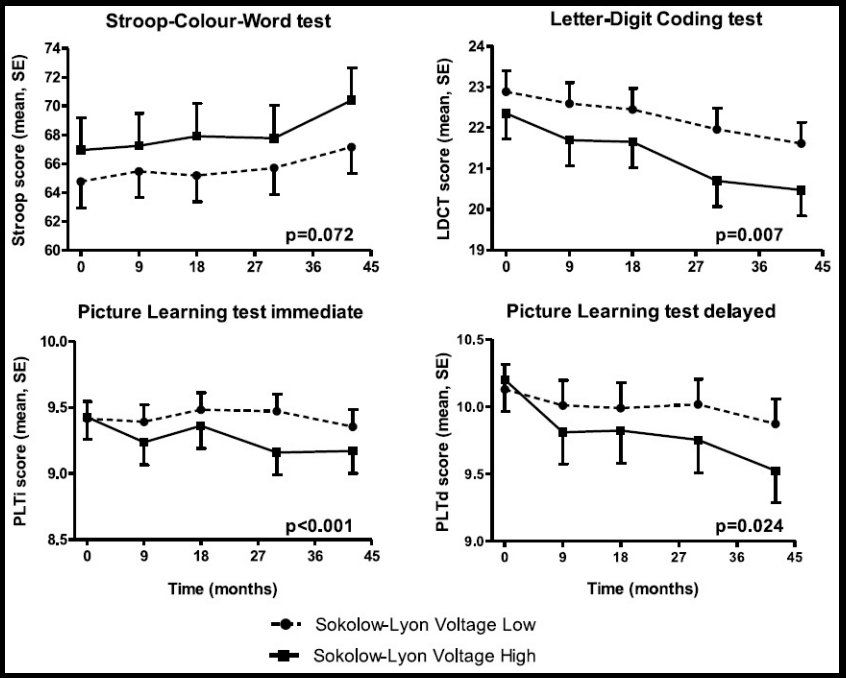
What about the ECG?

Abnormal ECG



Okuno et al., 2017

Left Ventricular Hypertrophy (enlarged heart)



Mahinrad et al., 2017

AIM

To investigate, if the ECG (intervals and amplitudes) is associated with incident Alzheimer's dementia in a large primary care population

The KPLL population

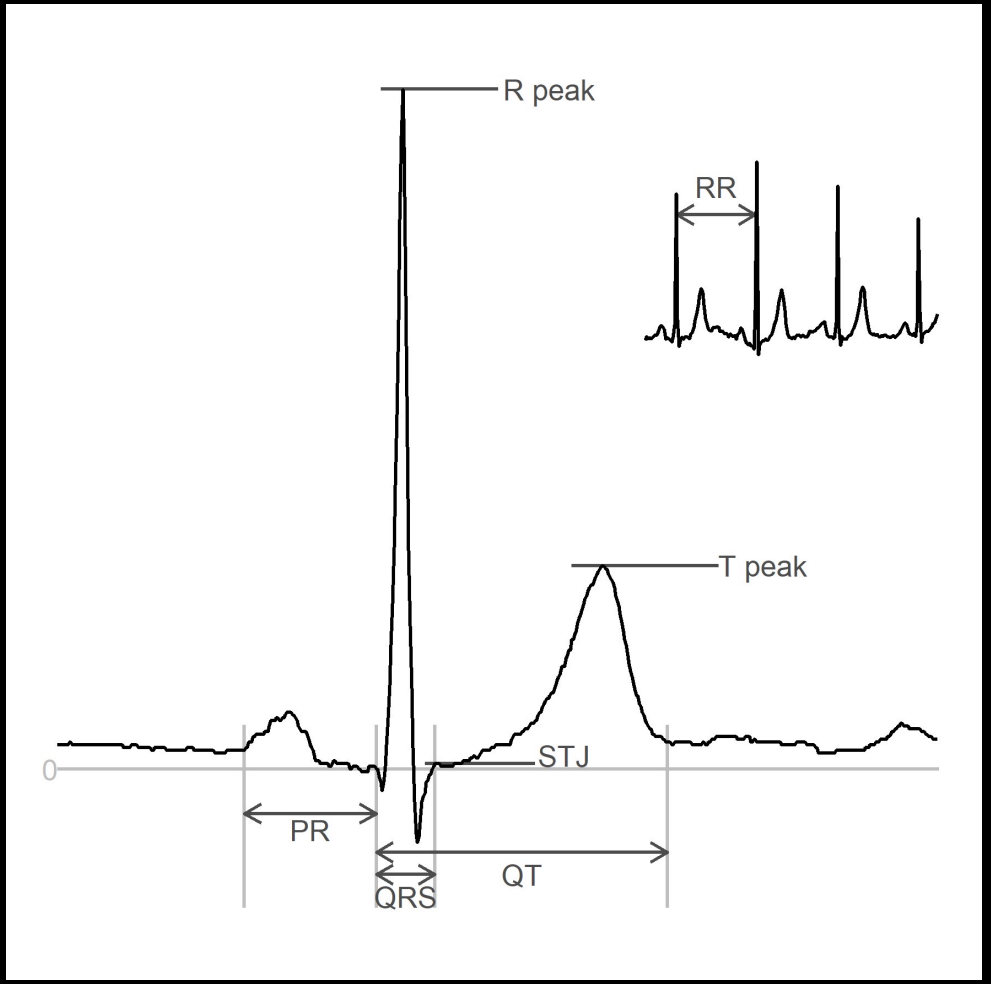
- People referred for sampling (ECG, blood, etc.) by general practitioner 2001-2015
- >1.000.000 ECGs from >450.000 people
- Not particular “sick” population, not completely “healthy” either

Population

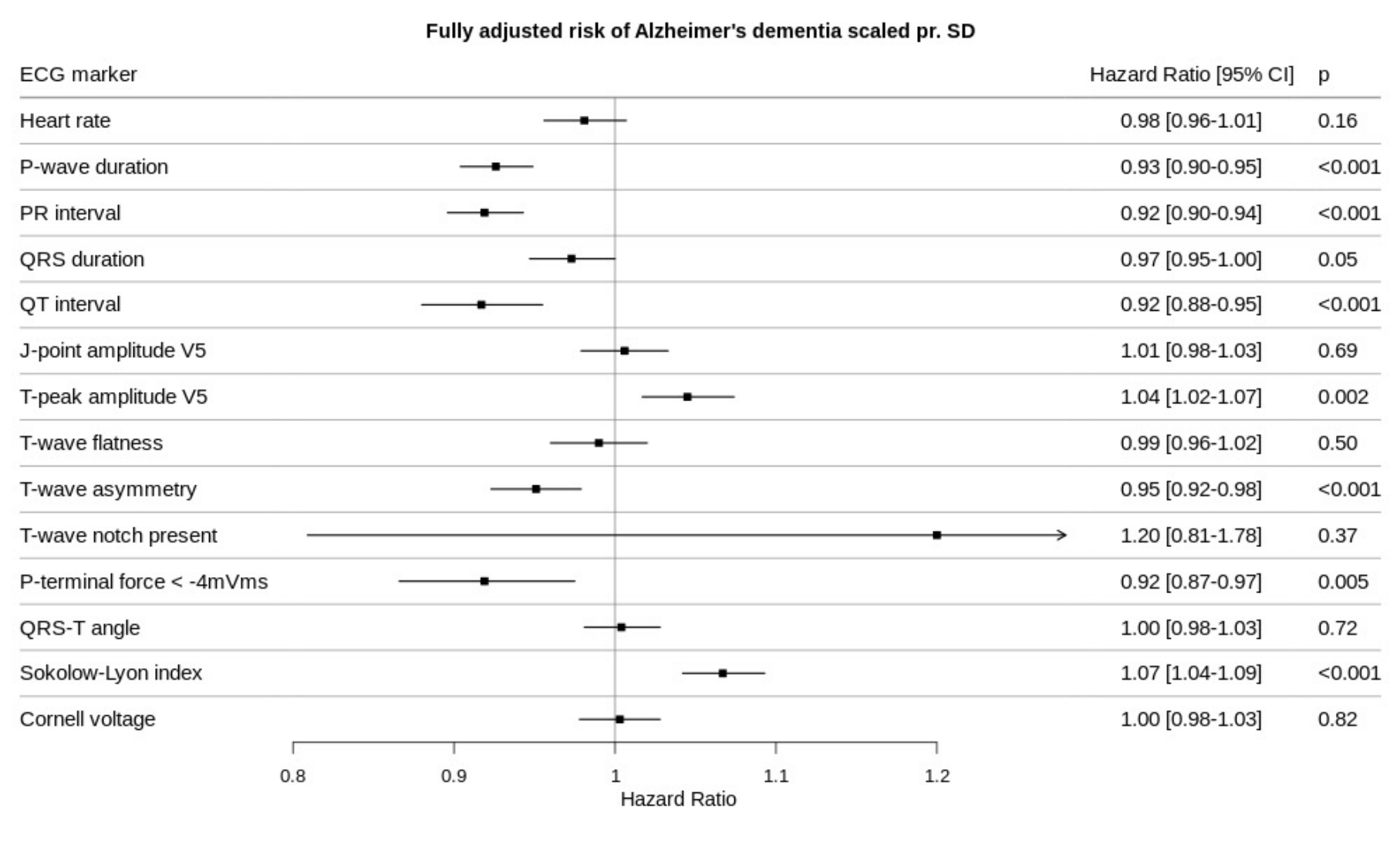
Variable	
n	282,324
Women, % (n)	56% (157,796)
Age, years (median [IQR])	58.5 [49.1-69.2]
Incident Alzheimer's dementia, % (n)	2.1% (6,030)
Follow up, years (median [IQR])	8.3 [4.2-12.2]
Heart rate, bpm (mean (SD))	71.3 (13.1)
QT interval, ms (mean (SD))	397 (30)

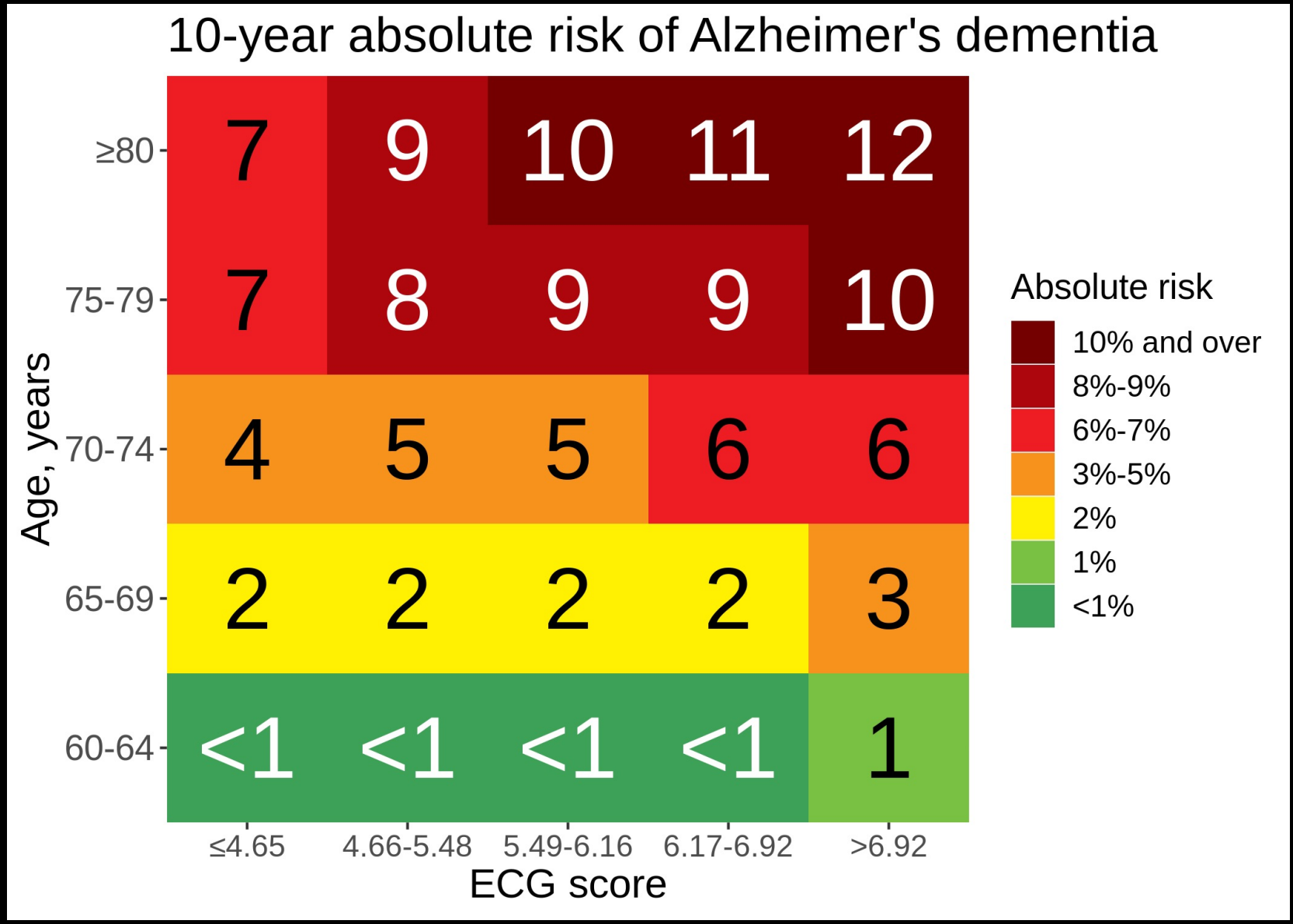
Methods

- ECG amplitudes and intervals
- Cox regression with competing risks
- 30 day blanking
- ECG risk score



Results – Alzheimer's





ECG risk score = 24 –0.05063*heart rate (bpm)–0.03881*P wave duration (ms)–0.02629*PR interval (ms)–0.02026*QT interval (ms)+0.1420*T peak amplitude in V5 (mm)+0.8123*Sokolow-Lyon index (mV) –0.68 if PTF > 4 mVms

Discussion points

- Shortened QT and increased LV mass
  - In contrast and in line with literature, respectively
- Shortened P wave duration and PR (+QRS)
  - ACh – parasympaticus
  - Genetically determined natural ACh reserve?

What's next

- Prediction models: classical approach (Cox) vs. machine learning (SVM)
- Validation in external cohort
- Validation using genetic risk score (GRS) as proxy for ECG markers (estimate of causality, Mendelian Randomization)

Conclusion

ECG intervals and amplitudes were associated with Alzheimer's dementia

T wave morphology