Large-scale predictive modelling of confound-prone motor targets with neuroimaging features from UKB

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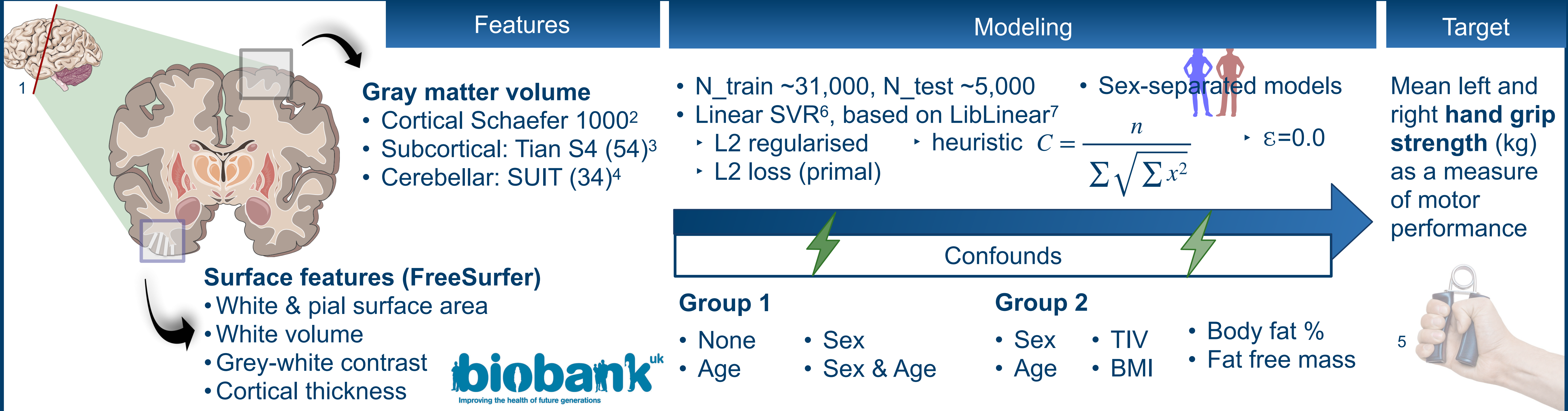## Introduction

Individual motor performance

- Driving factors of individual motor performance are unclear and could help to understand motor recovery from brain lesions
- Hand grip strength may be represented by brain structure

Large scale predictive modelling

Predictive modelling of brain-behaviour relationships can benefit from large samples
➡ require heavy computational infrastructure
➡ tempt to blindly trust data-driven results

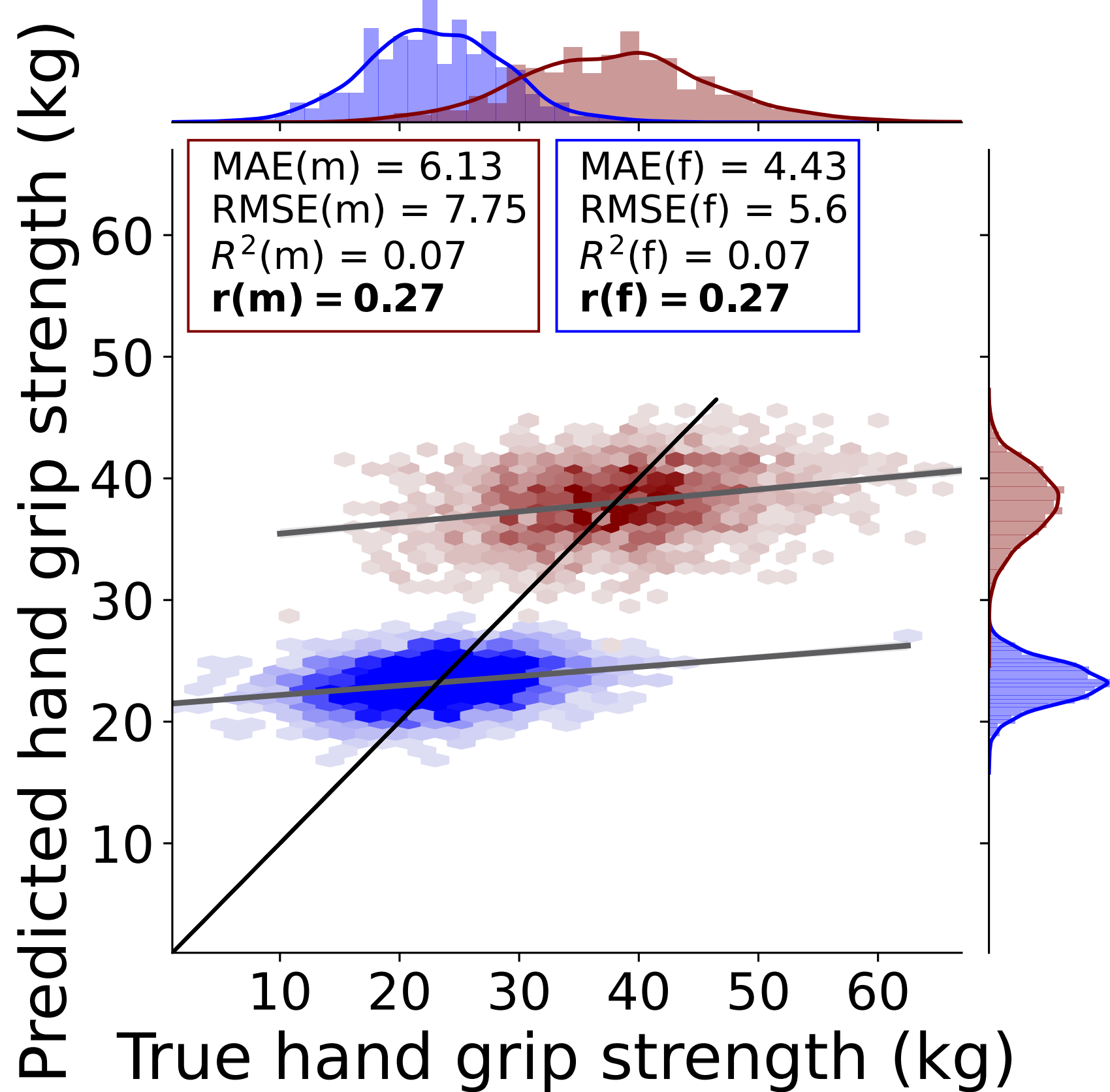## Methods

Features

Gray matter volume
- Cortical Schaefer 1000[2]
- Subcortical: Tian S4 (54)[3]
- Cerebellar: SUIT (34)[4]

Surface features (FreeSurfer)
- White & pial surface area
- White volume
- Grey-white contrast
- Cortical thickness

Modeling

- N_train ~31,000, N_test ~5,000
- Linear SVR[6], based on LibLinear[7]
  - L2 regularised
  - L2 loss (primal)
  - heuristic $C = \dfrac{n}{\sum \sqrt{\sum x^2}}$
- Sex-separated models
- ε=0.0

Confounds

Group 1
- None
- Age
- Sex
- Sex & Age

Group 2
- Sex
- Age
- TIV
- BMI
- Body fat %
- Fat free mass

Target

Mean left and right **hand grip strength** (kg) as a measure of motor performance

Results

Gray matter volume without confound removal decently predicts HGS.

MAE = 6.63
RMSE = 8.41
R^2 = 0.33
r = 0.57
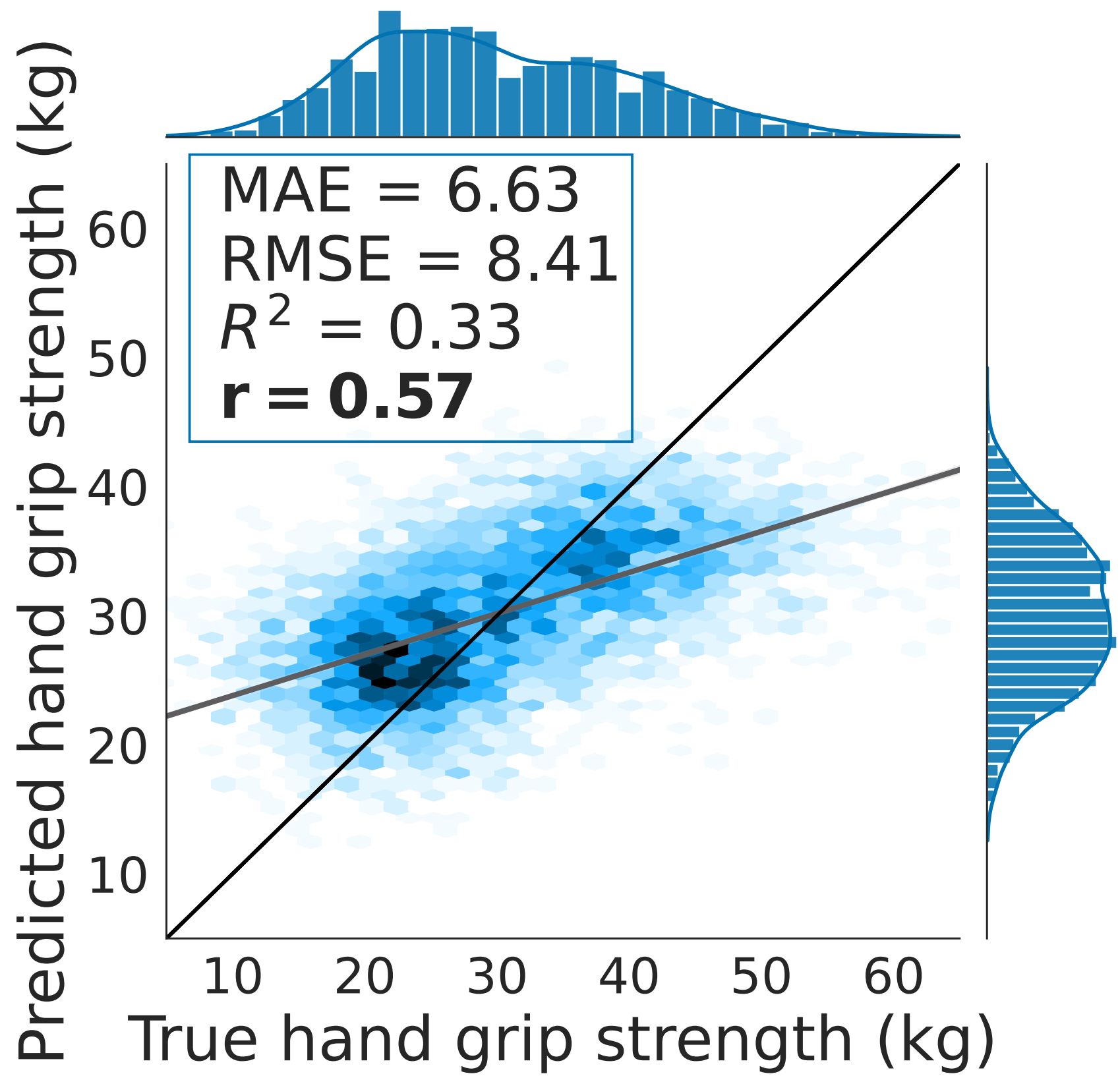
Gray matter volume with confound removal only predicts the mean.

MAE = 8.45
RMSE = 10.22
R^2 = -0.00
r = 0.04
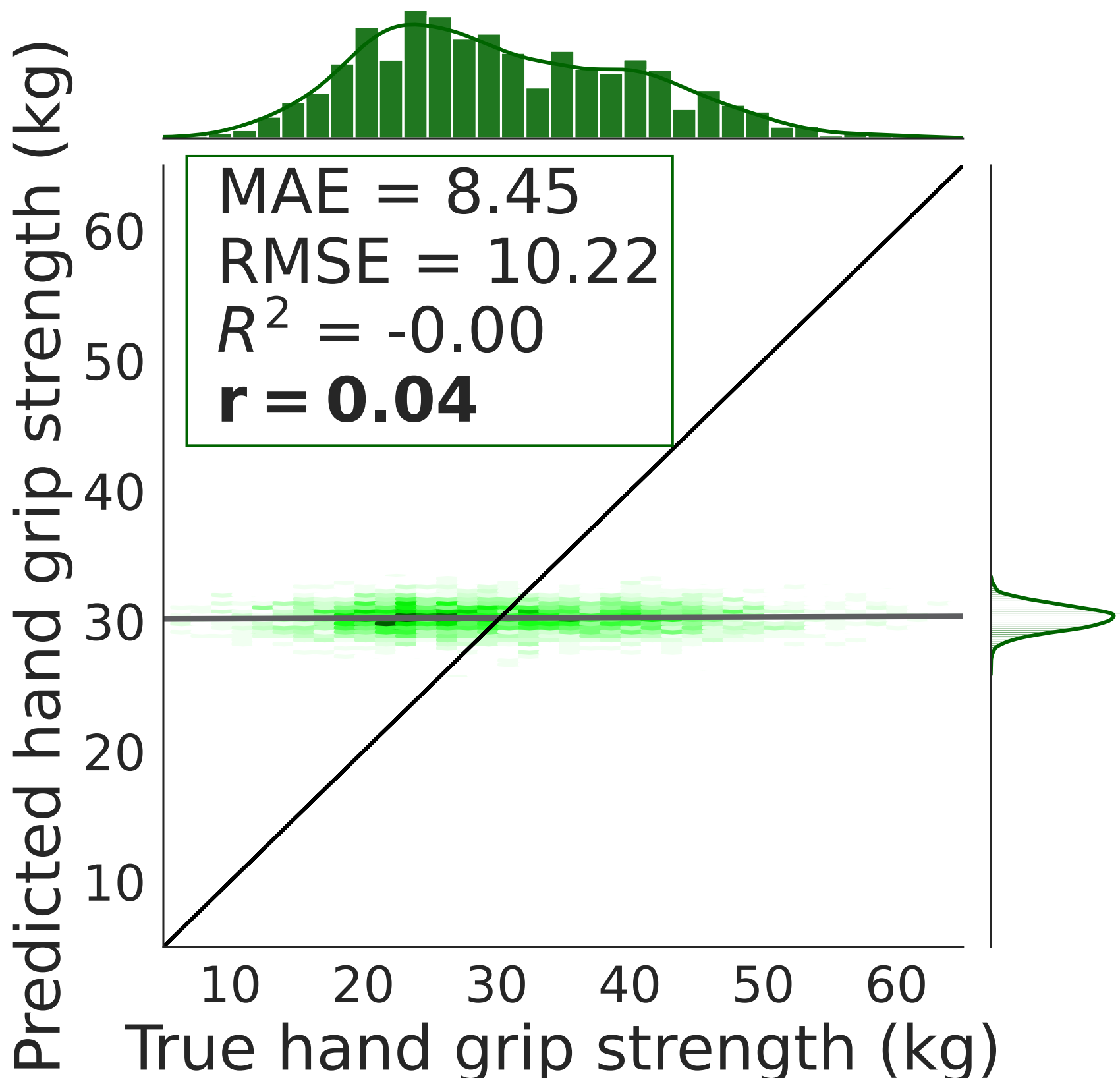
Sex-separated models show that HGS predictability is mostly driven by sex.

MAE(m) = 6.13
RMSE(m) = 7.75
R^2(m) = 0.07
r(m) = 0.27

MAE(f) = 4.43
RMSE(f) = 5.6
R^2(f) = 0.07
r(f) = 0.27

Surface brain features (with and without confound removal) reveal the same pattern.

MAE = 6.20
RMSE = 7.91
R^2 = 0.40
r = 0.64

MAE = 8.29
RMSE = 10.06
R^2 = 0.00
r = 0.07
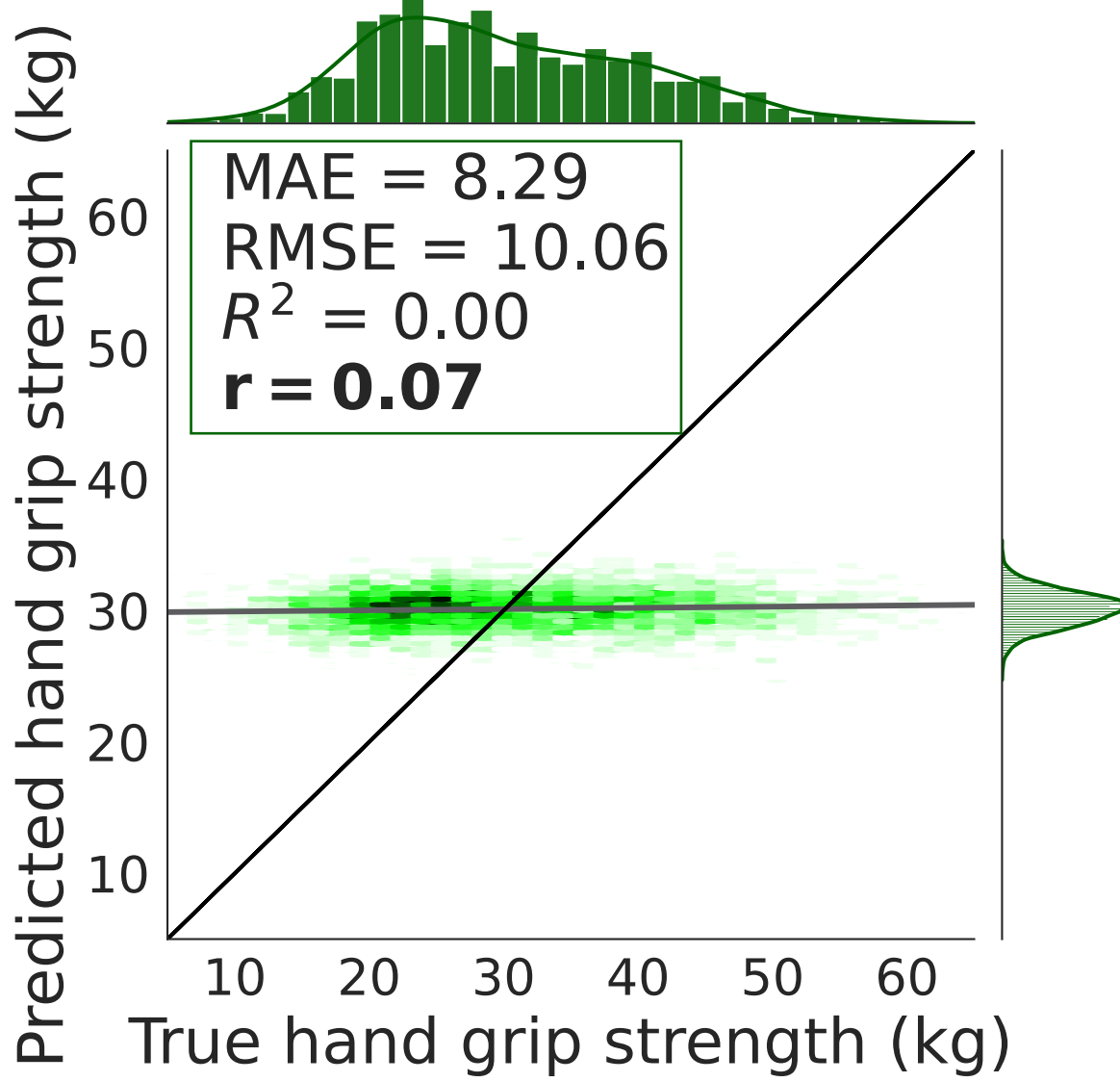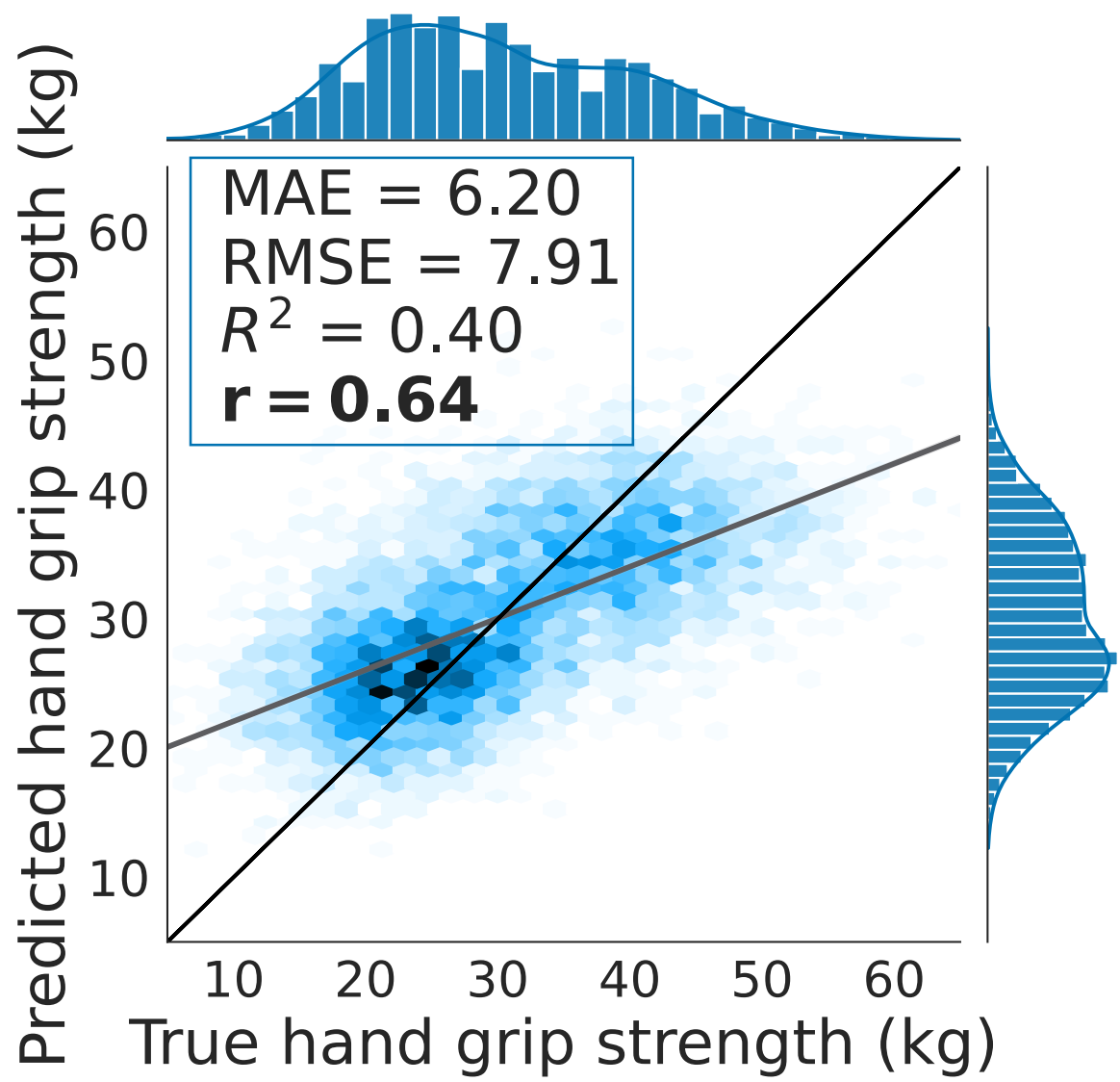
Want to know more?

https://files.inm7.de/vkomeyer/2022_INMIBIRetreat_Poster_supplements.pdf

Structural brain imaging features <u>alone</u> cannot predict hand grip strength. → **Watch your confounds**

References:
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