



WORKING FOR A HEALTHIER FUTURE

An assessment of facial dimensions and their impact on mask performance

Winski TA, Mueller W, Graveling RA

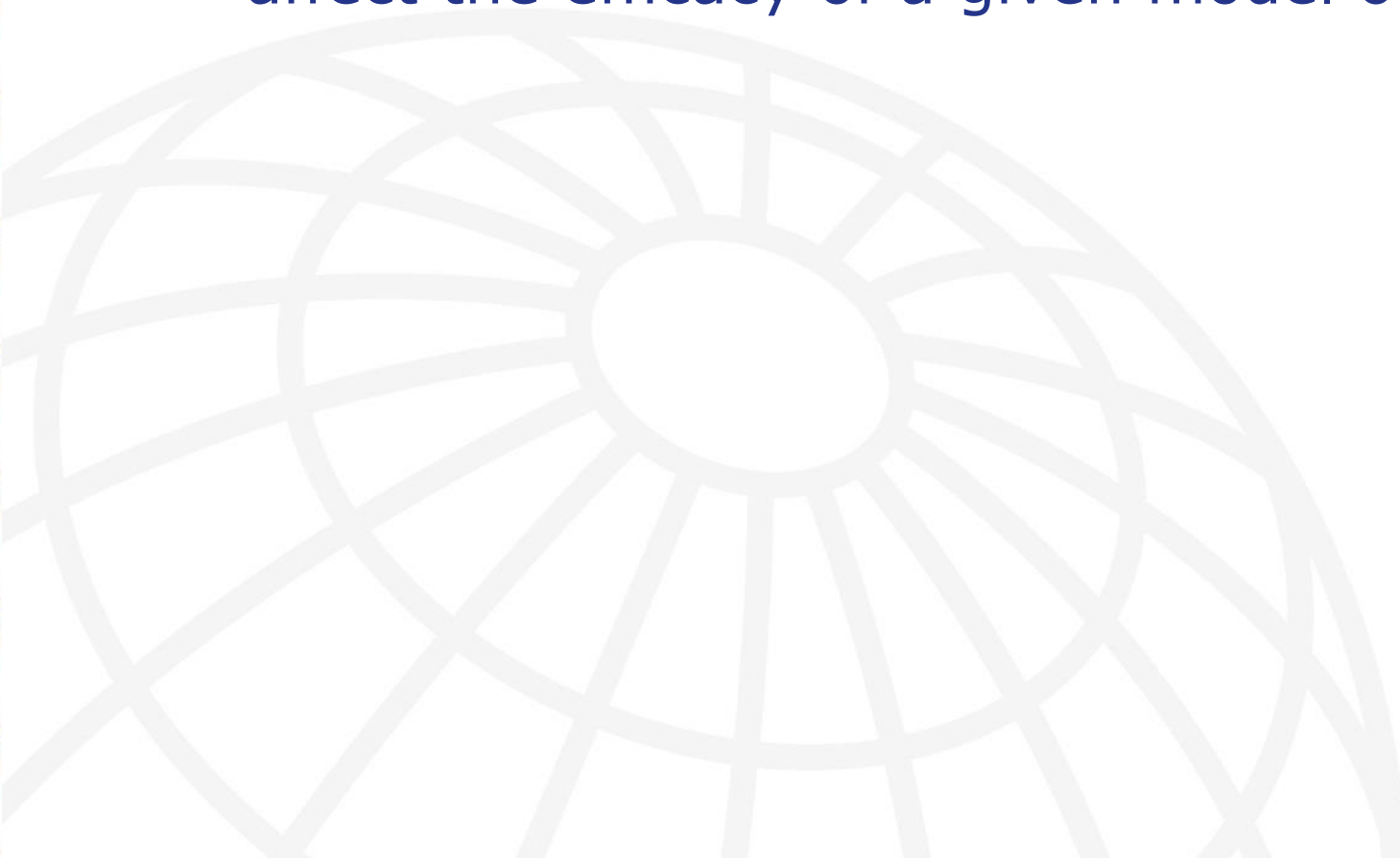
IOM, Research Avenue North, Riccarton,
Edinburgh, EH14 4AP, UK.

Background

- For respiratory protective equipment (RPE) manufacturers, adequacy of facial fit is an important characteristic
- A number of studies have explored the correlation between respirator fit and facial characteristics
- Zhuang et al (2005) explored the relationship between 18 different types of RPE and 12 facial dimensions, as well as considering gender and RPE features

Aims

- Our research aim:
 - This study aims to assess how facial dimensions affect the efficacy of a given model of RPE.



Population fit study

- 3M developed a new design of RPE, the 3M 8835+
- A scientific study was required to establish the proportion of the working population the mask could fit.
- However, there was no intention to carry out any form of comparative study.



Facial measurements

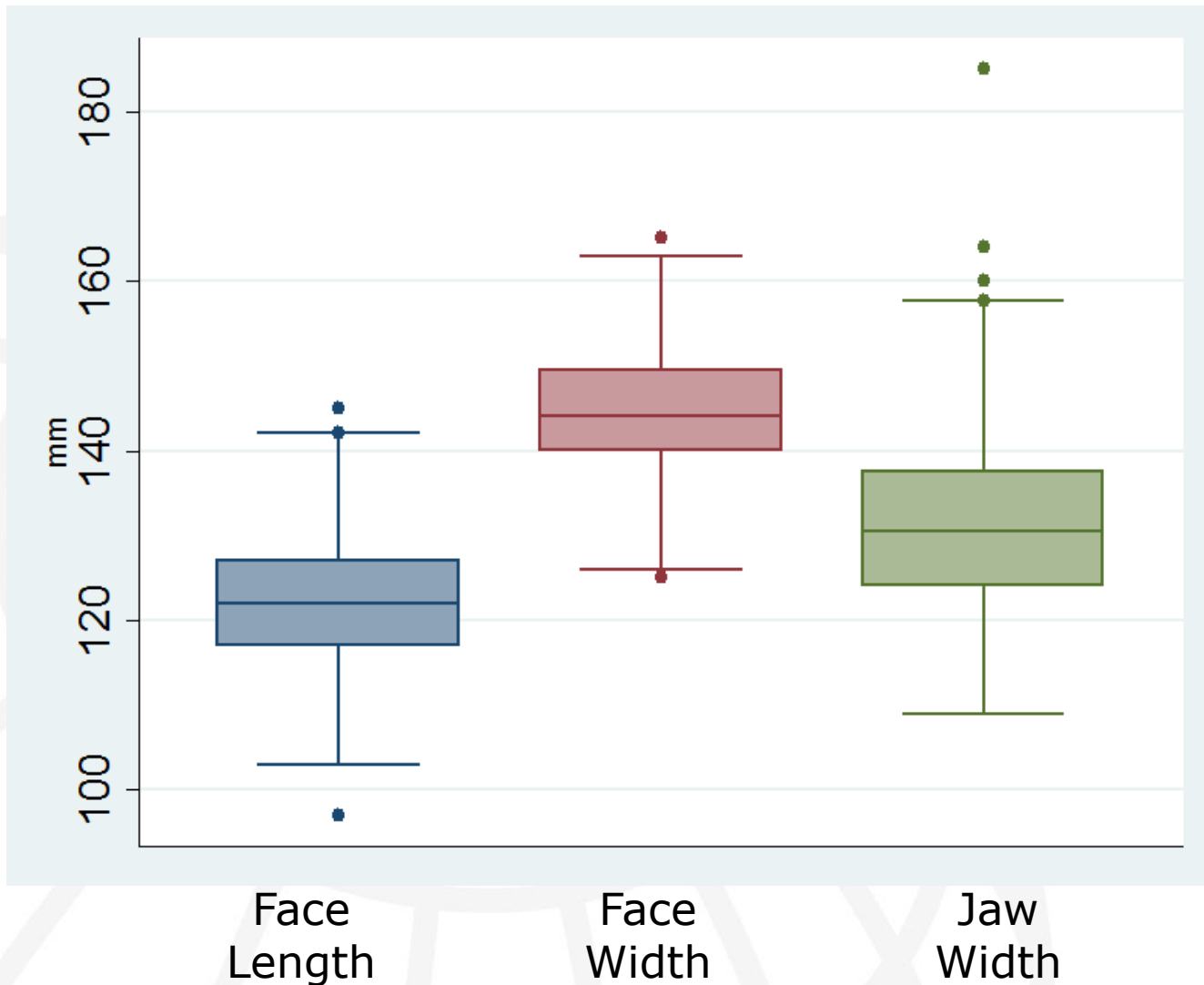
- This gave us the opportunity to take anthropometric measurements
- These were restricted to three measurements to limit the demands placed on the participants
- The three measurements were:
 - **Face Length** (Menton-Sellion Length)
 - **Face Width** (Bizygomatic Breadth)
 - **Jaw Width** (Bigonial Breadth)

The Testing

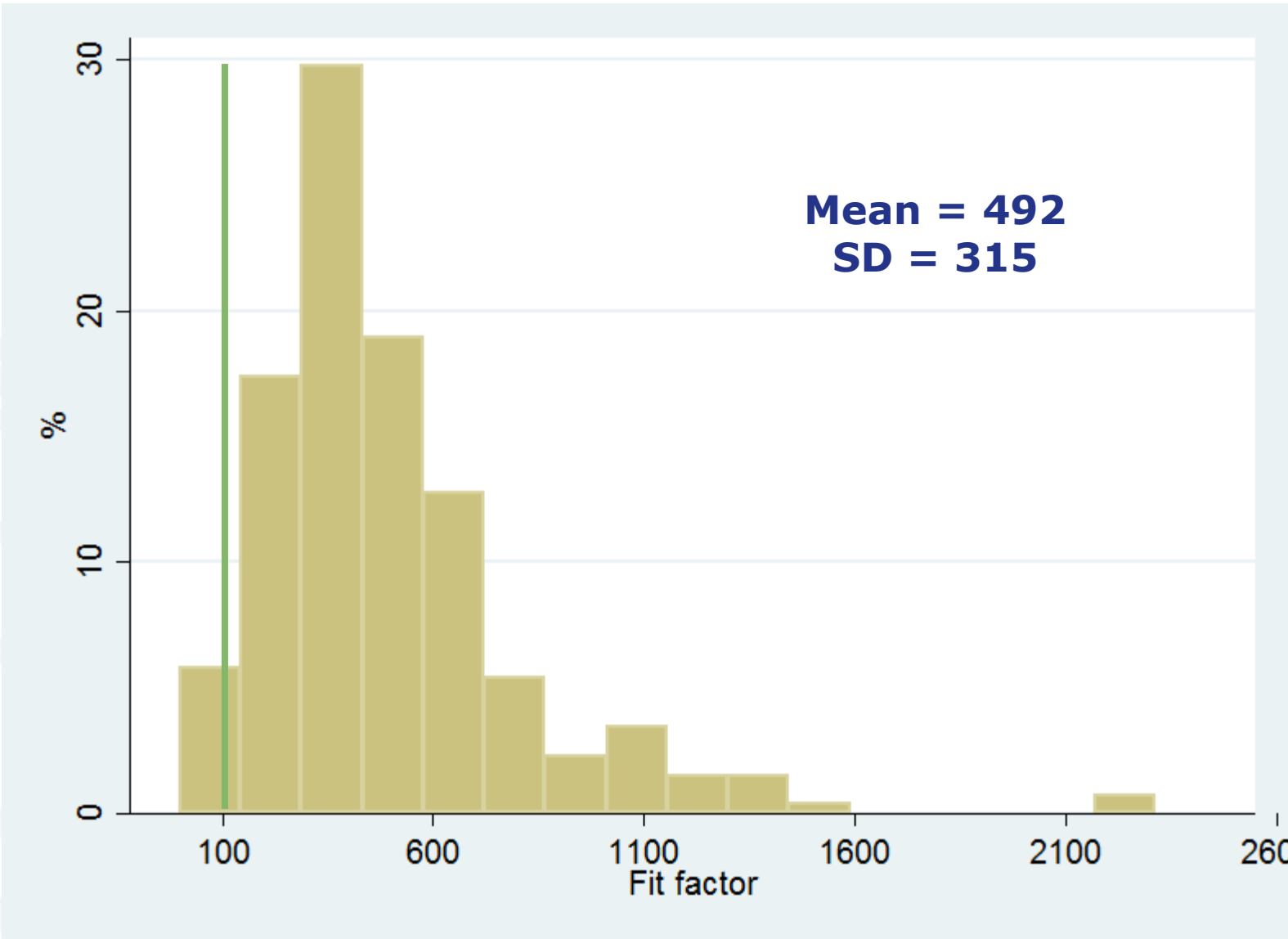
- A single accredited Fit2Fit quantitative fit test provider
 - OC 282/28
- 262 participants who wear RPE for work
 - Test mask plus own mask
- From 22 different industries
- Strengths: One mask, one tester

Results – Facial measurements

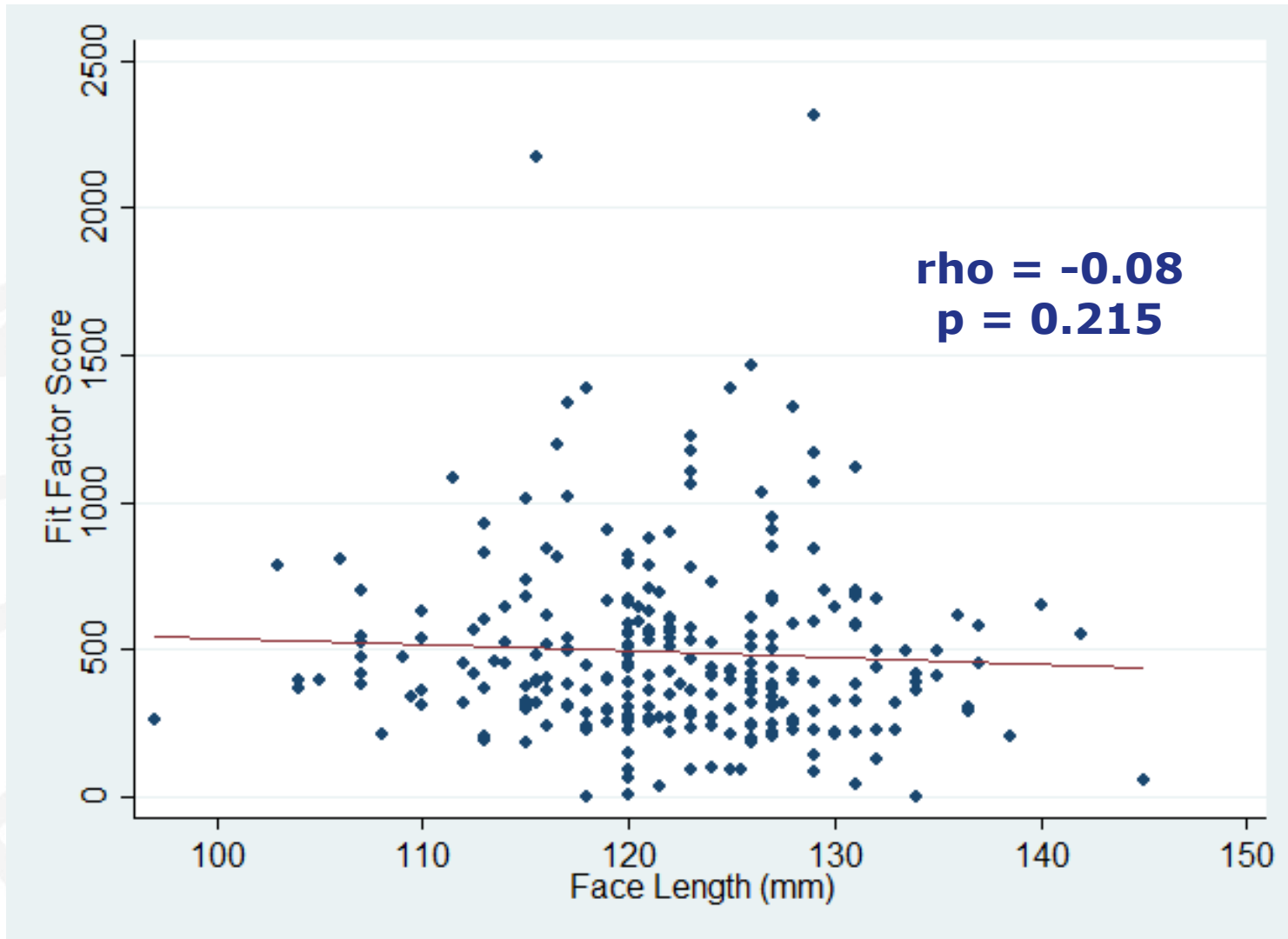
- 259 participants with facial measurements
- >90% male



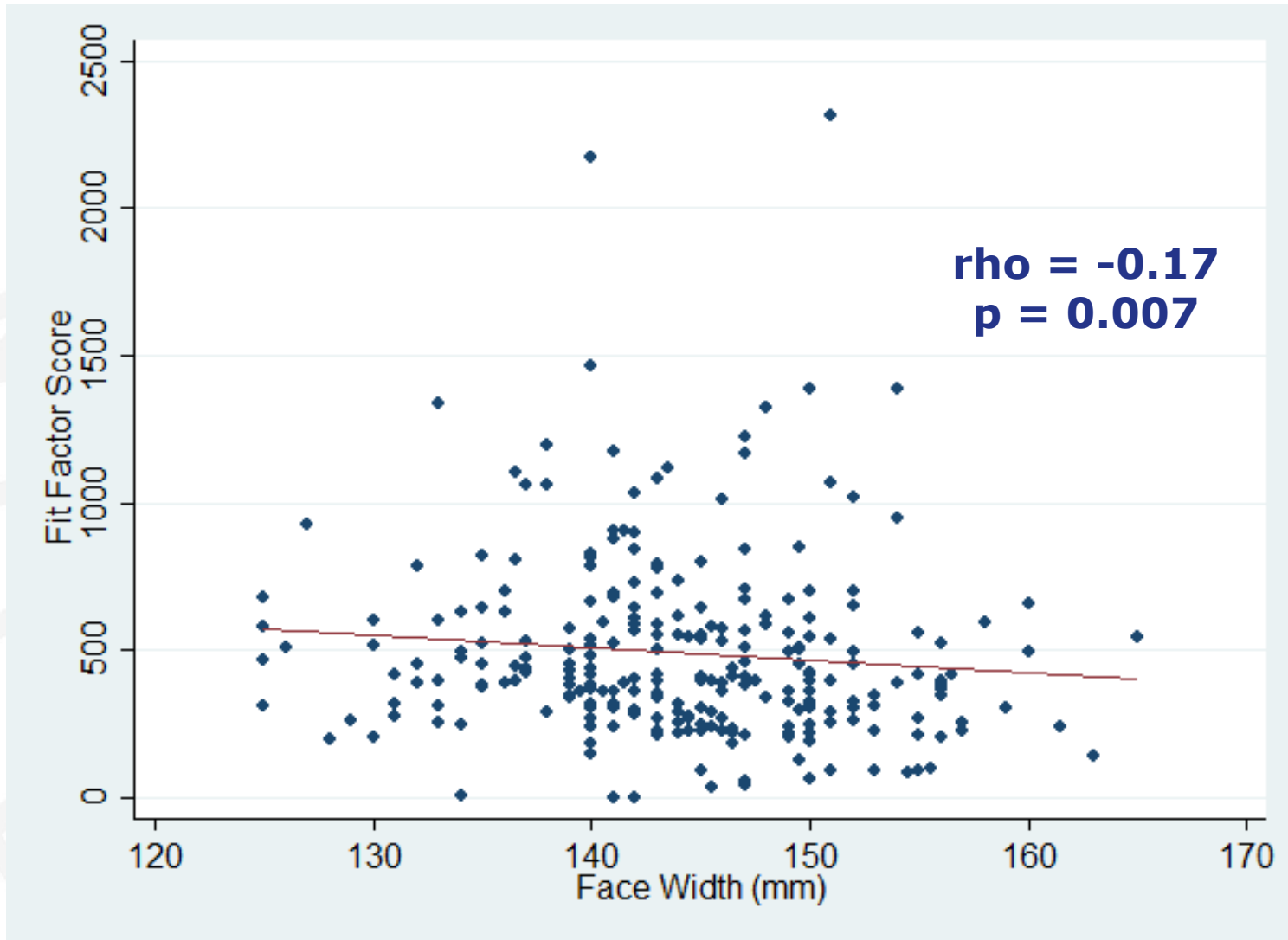
Results – Overall Fit Factor



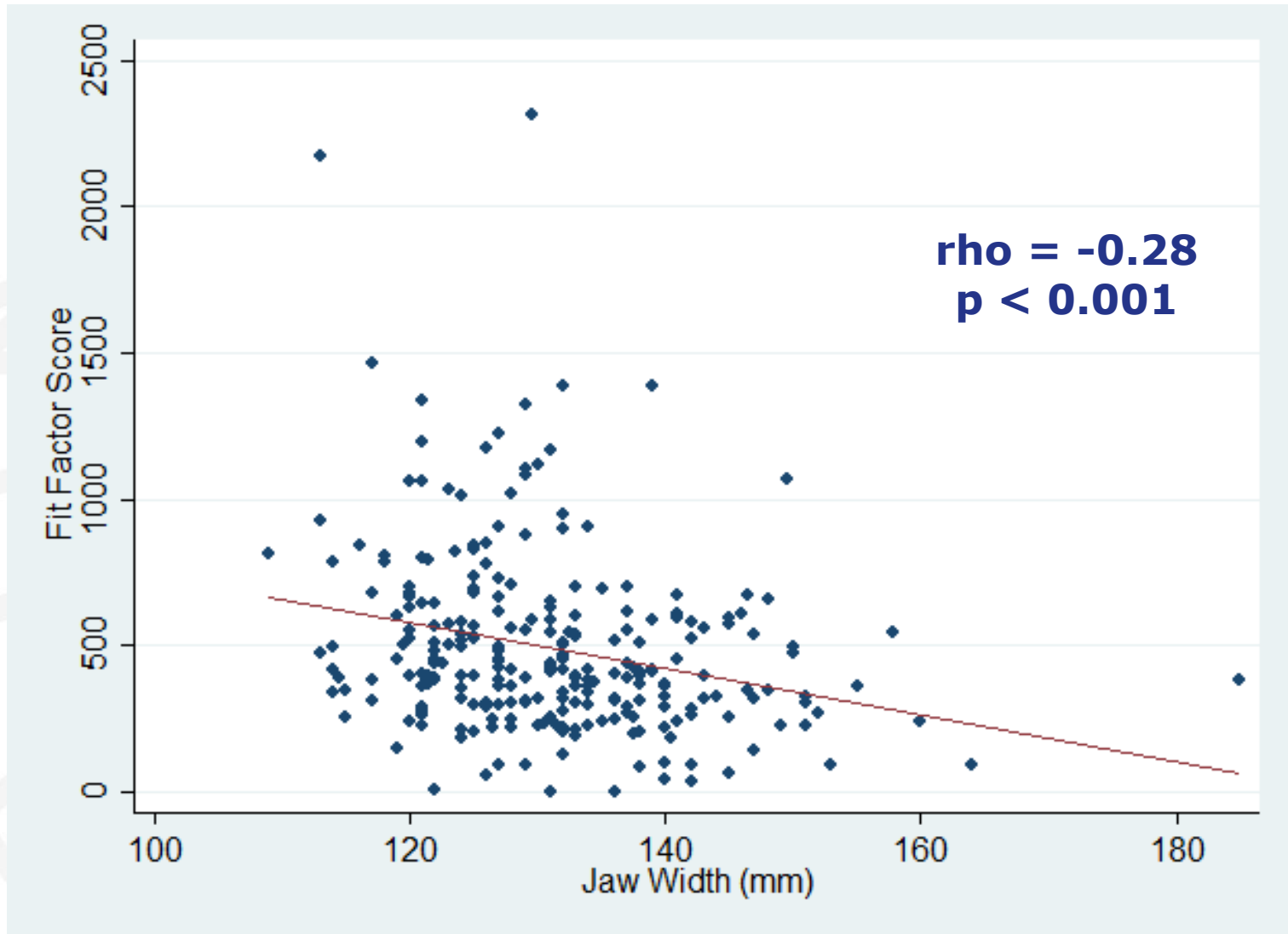
Analysis – Face length & Fit Factor



Analysis – Face width & Fit Factor

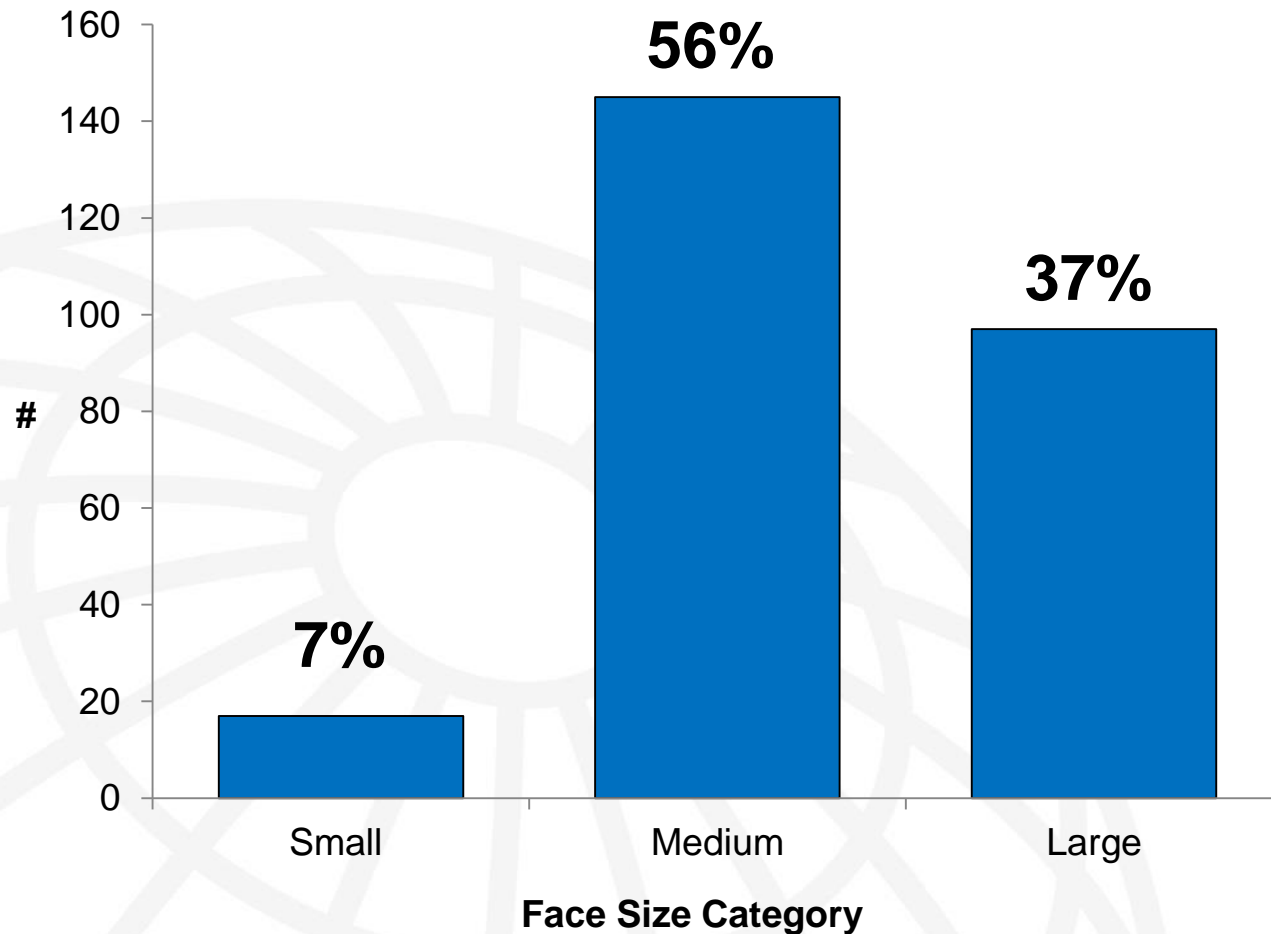


Analysis – Jaw width & Fit Factor

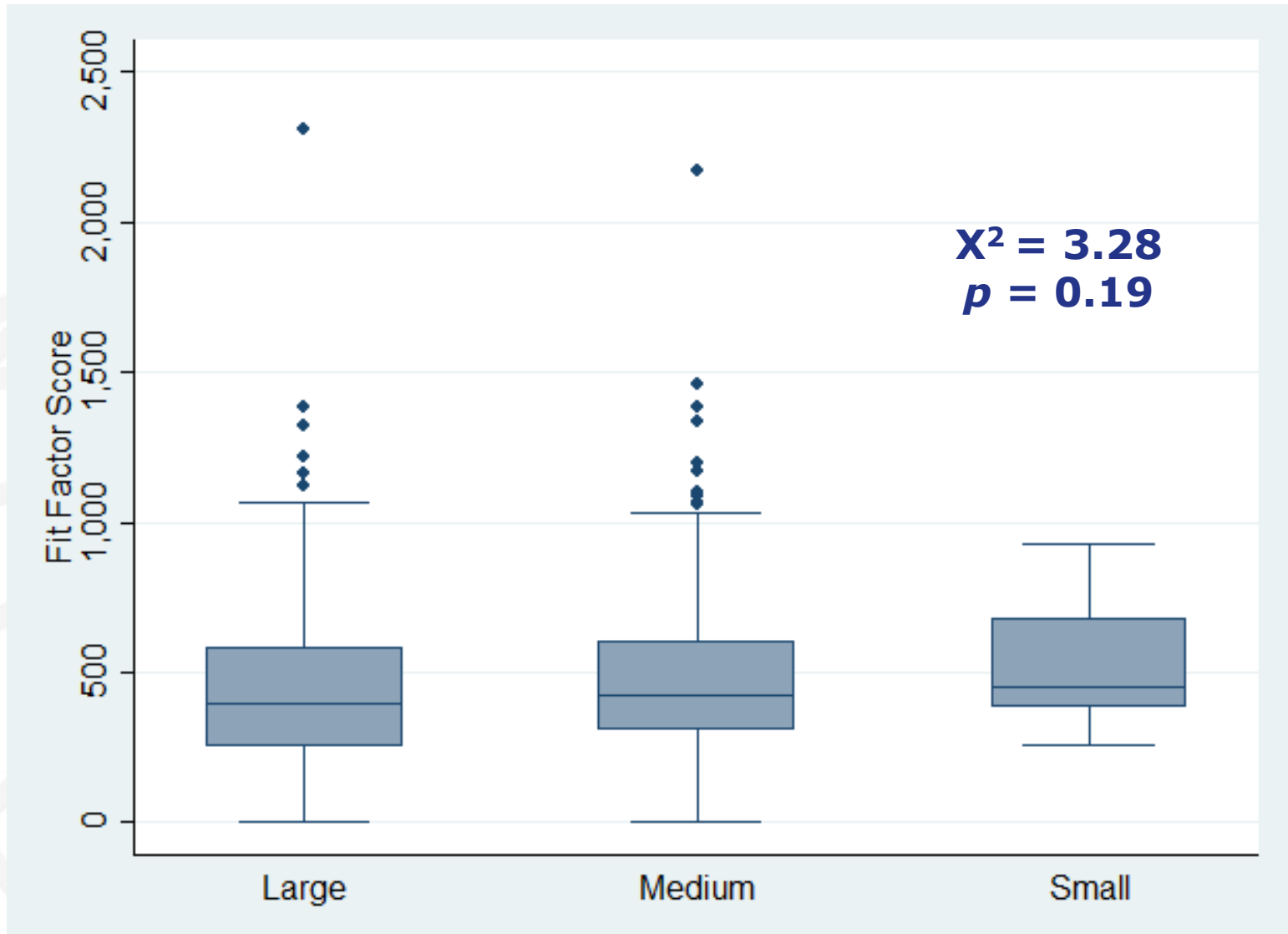


Results – Facial measurements

- Used NIOSH criteria to assign face sizes



Analysis – Face size and Fit Factor



Analysis – Individual Tasks

Task	Face length	Face width	Jaw width
Normal breathing	0.0%	0.0%	-0.9%*
Deep breathing	-0.1%	-1.0%*	-1.2%**
Head side-to-side	-0.3%	-1.1%*	-1.5%***
Head up and down	-0.5%	-0.5%	-1.2%**
Talking	-0.2%	-0.8%*	-1.1%***
Bending forward	-0.6%	-1.0%	-1.3%**

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- Examined ratios of facial features:
↑ Fit Factor with ↓ jaw width

What does this mean?



- There is a clear negative effect of jaw width on fit factor score.
 - What are the implications, if any?
- Is a pass, a pass?
 - A Half Mask pass mark is **100**
 - A Full Face pass mark is **2000**
- Should jaw width be given higher priority in mask design?
- Next steps...



**Thanks for
listening!**

