NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

Division of the National Herlath Laboratory Service





Overview of Respirator Fit– Limitations & Challenges by Jeanneth Manganyi

Occupational Health Dialogue

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Healthy, Safe, Happy & Sustainable Workplaces

PROMOTING DECENT WORK THROUGH CUTTING EDGE RESEARCH, SPECIALISED SERVICES, INFORMATION, TEACHING AND TRAINING

Examples of tight fitting respirators

Respirator fit testing determines if a tight fitting respirator type or size can fits a specific individual

Respirator Performance Depends On…

Efficiency of the filter - How well does the filter collect airborne particles?

Fit - How well does the facepiece prevent inward leakage of particles?

Proper use - Proper donning and checking the seal may influence performance

Acknowledgement: Prof L. Brosseau

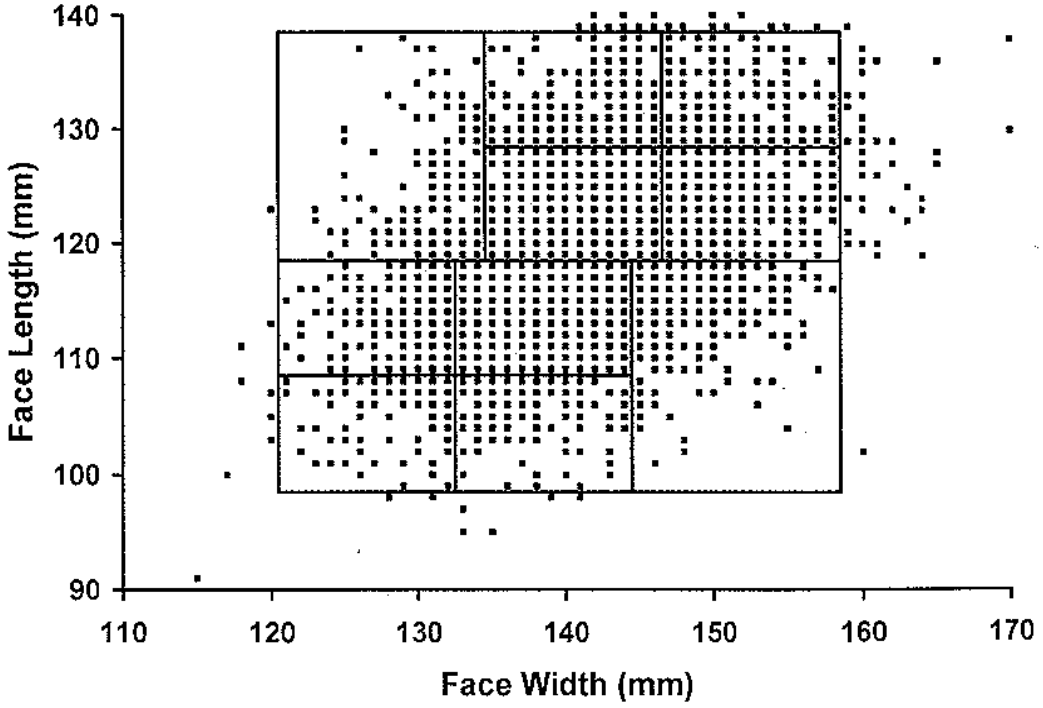
Background

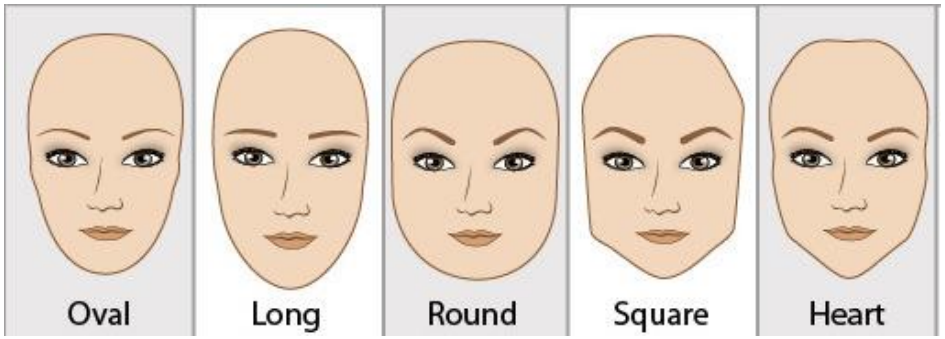
- Respirators (mainly FFRs) are predominantly used in many workplaces
- Respirators are made and tested to fit many individuals as possible.
- Variability in physical facial features of individuals and respirator designs
- Perception of “one size does fit all” still exists

Background (cont)

NIOSH bivariate respirator fit test panel

Respirator design is tested to meet a specific respirator fit test panel which is applicable to the user population





Background (cont)

China

- For years China was basing their respirator design on LANL fit test panel
- In 2007, the difference of facial anthropometric dimensions between Chinese (451 participants) and Americans was investigated
- 12-35 % of the Chinese subjects fell outside the ranges derived from American panels NB small sample size
- In 2006 a nationwide anthropometric survey (3000 participants)
- Chinese survey data was plotted against the NIOSH bivariate panel
- Overall, 95 % of the workers fell within the NIOSH bivariate panel but not uniformly distributed across the cells.
- New panels were constructed using data containing only workers from the Chinese population
- Almost 97% of the Chinese subjects are within the boundary of the panel

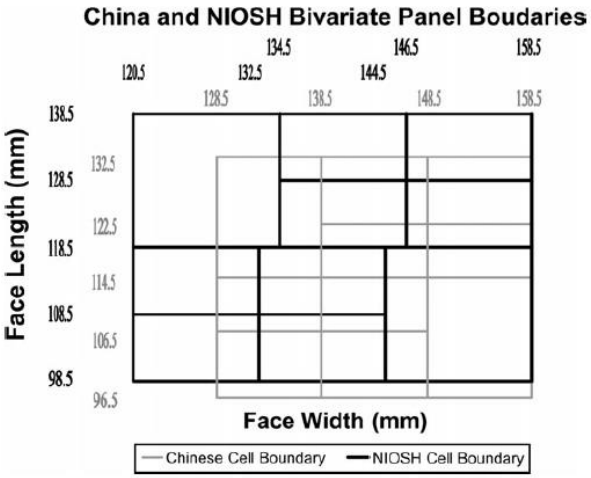


Fig 5. Boundary of Chinese bivariate panel in relation to the NIOSH bivariate panel.

Background (cont)

South Africa

- No RFTPs
- No confirmation if currently used respirator fit test panel are representative of the SA user population (PhD study question)
- No similar anthropometric data to develop SA panels
- Call by Ergonomics Engineering - Proposed Anthropometry Survey of the South African Civilian Population

Publications (cont)

Original Article

Quantitative Respirator Fit, Face Sizes, and Determinants of Fit in South African Diagnostic Laboratory Respirator Users

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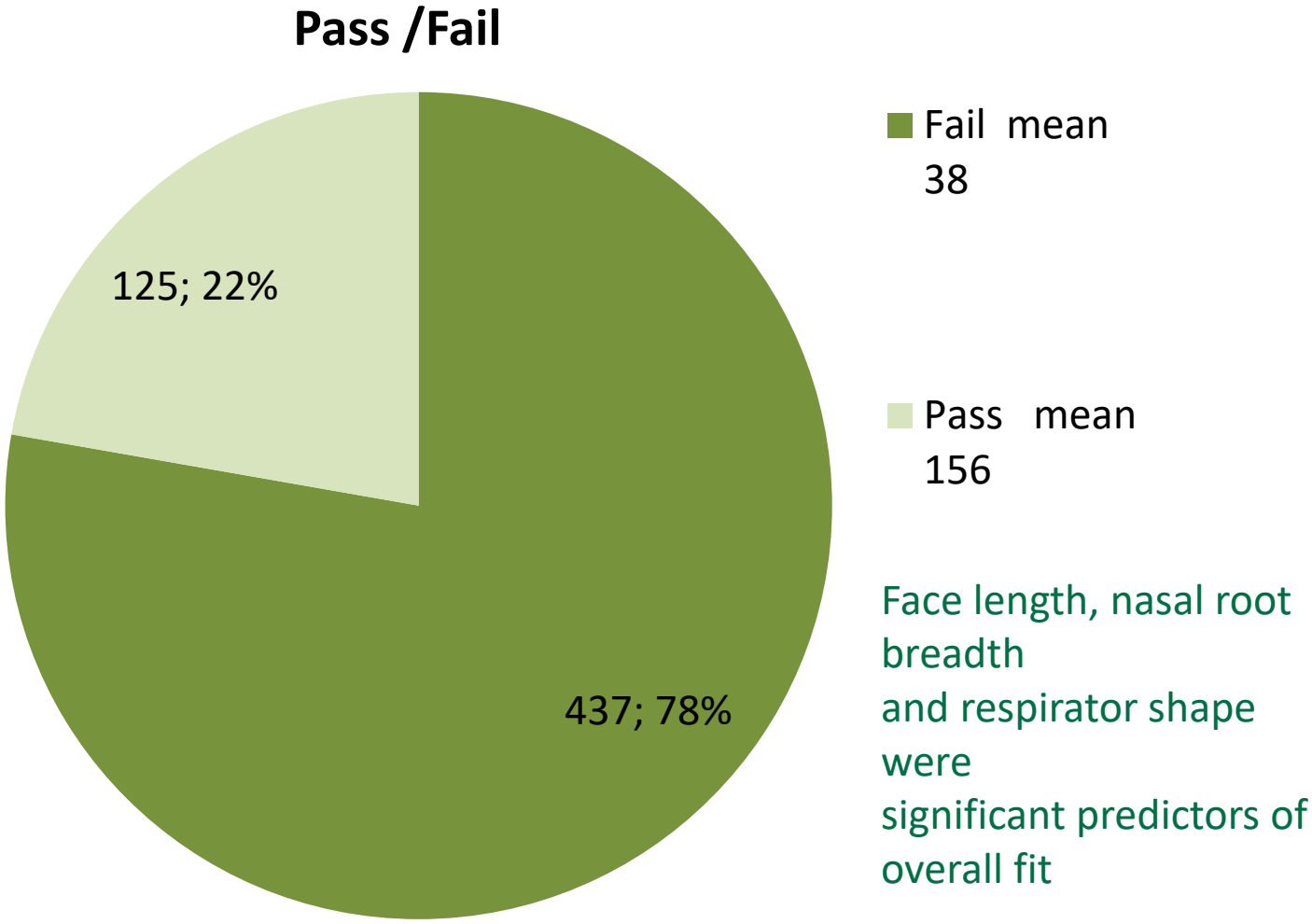
Submitted 21 November 2016; revised 7 June 2017; editorial decision 13 June 2017; revised version accepted 25 August 2017.

- 562 participants, 4 SA race groups, male and female
  - Quantitative respirator fit test – TSI Portacount
  - 4 Facial Characteristics (face length, face width, nasal root breadth & head circumference)

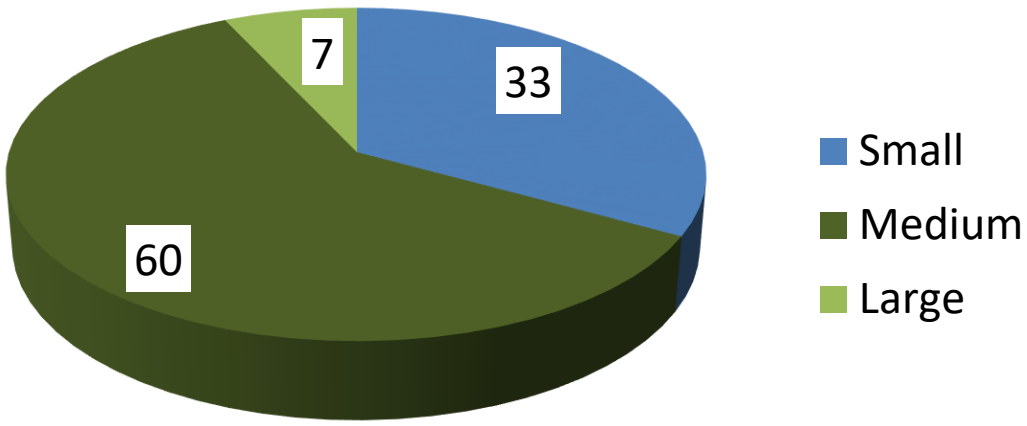
Results



Face length, nasal root breadth
and respirator shape were
significant predictors of overall fit

Results (cont)

- 91% of respirator supplied were medium-sized



Distribution of face sizes

Aim & Objectives

Title: Facial characteristics and determinants of respirator fit among industrial workers in Gauteng

Aim : To improve the protection of workers using respirators….

Objectives

- To determine the facial characteristics of South African respirator users using the 13 facial dimensions Description of facial dimensions.docx
- To conduct respirator fit testing on a sub- sample (a random selection from all of the participants) of participants
- To use selected facial characteristics to evaluate the suitability of the USA and Chinese respirator fit test panels in designing and testing respirators for South African respirator users
- To develop a South African respirator fit test panel informed by the findings from the third objective.
- To identify the facial characteristics that contribute significantly to respirator fit in men and in women using disposable respirators

Methods

Study design

- Cross sectional study with an analytical component (Sample size **1992**)
- > 800 enrolled to date

Study population

- Industries known to be employers of RPE users (e.g. Health Care, Manufacturing , Railway, Power Utility, Mining & Iron and Steel)

Inclusion criteria

- Consenting participants within the working age population of 18-65 years.
- Participants should be respirator users
- Both experienced and inexperienced respirator users

Exclusion criteria

- Consenting participants having beard (fit testing only)

Equipment

Envisaged study impact

- The applicability of currently used panels for designing and testing RPE supplied to South Africans will be confirmed
- New panels made of South African facial characteristics will be developed
- Manufacturers will have access to a relevant anthropometric database for designing and testing RPE for the South African workforce
- More respirator styles and sizes which afford better fit will become available
- Control of exposure to hazardous agents will be possible
- Significant facial characteristics contributing to acceptable respirator fit will be identified

Challenges

- Respirator fit testing as part of respiratory protection programme is not a statutory requirement in SA
- Many countries (USA, UK, Canada etc) have mandated RFT
- Opinions that clean shaving policy by men is a form of discrimination (personal preference & fashion than culture or religion)
- The misconception is that conducting respirator fit testing may initiate possible industrial action and /or litigation
- Access to industries for research (viewed as sensitive) is often denied

Recommendations

- Employers should aim for best practice and view legislation as minimum requirements
- Employers to provide and maintain a safe work environment "as far as is reasonably practicable"
- Recommendation on the use of respirators should always include respirator fit testing as part of the RPP
- Research conducted should aim to contribute to legislation
- All stakeholders (regulators, employers, employees and organised labour) to accept and embrace change through new knowledge

Thank You

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