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Is The Navy Five-year Periodicity To Size And Fit Chemical Biological Radiological Defense Protective Masks Sufficient?

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The purpose of this study was to determine how often sailors should be quantitatively fit tested for their chemical protective masks. The objective was to determine if the current five-year mask size and fit periodicity is satisfactory or if standard size and fit checks should be performed more frequently. This study assessed mask fit over time for a U.S. Navy population in terms of demographic and anthropometric test variables to be used as a proxy to assess the physical determinants of mask fit. The tests events were performed over a three-year period at multiple U.S. Navy Commands. Multiple mask fit assessments were conducted on each sailor over time to provide measures for statistical modeling. Statistical modeling was performed to correlate mask fit with underlying structural anthropometry and to support recommendations on the frequency of mask fit assessments.

The participants in this study were similar in age and ethnicity to the Navy population as a whole, making the data a good representation of expected changes. Additionally, the anthropometric measurements taken in this study were roughly the same as the measurements taken for the ANSUR II study conducted by the U.S. Army, providing confidence that the random sample of subjects accurately represents the general Navy population.

This study found that changes in mask fit were well represented by a statistical model that included subject changes in principal anthropometric parameters such as mass and facial anthropometry ($R2 = 0.69$). Given the good fit of the model for the subject population, the mask fit is only weakly sensitive to changes in measured facial and body anthropometric parameters, including weight. For example, a one standard deviation change in weight (33 lbs. in this data) changes mask fit by 0.1 sizes across all participants (i.e., one-tenth of a size change). Similarly, a one standard deviation change in bizygomatic breadth, or the maximum width of the face between the zygomatic arches located on the cheek bones (0.7 cm in this data), changes fit by 0.2 sizes (i.e., two-tenths of a size change). Other measured variables are not significant and have small effect sizes in this study.

Based on these observations and findings, weight and facial bizygomatic breadth may be used as a proxies for periodic assessments without performing mask fit tests. Alternatively, it is important to note that weight and bizygomatic breadth are somewhat correlated. So, weight alone may be used as a single, easily assessed anthropometric proxy for mask fit.

Though, the results showed that a sailor's mask size can change with large fluctuations in weight, such weight changes are not expected in an active duty population because of recurring Physical Readiness Assessments. These findings support having U.S. Navy mask fit be assessed with a single initial fit with refit only for large changes in weight (i.e., one standard deviation or 33 lbs.) or an event that would change the facial structure such as maxillofacial surgery or injury. Therefore, the current five-year periodicity is adequate for most sailors with rare exceptions, such as surgery, that result in direct changes to facial structure.