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BACKGROUND

Military personnel are routinely exposed to blast forces across training and operational settings. Low-level blast exposures are common, repetitive, and often occupationally driven, but cumulative career exposure is difficult to estimate in large datasets.

The field also uses overlapping terms that can conflate exposure, injury mechanism, and clinical outcome, limiting comparability across studies and eras of service.

- OBJECTIVES**
- Define** Military Occupational Blast Exposure (MOBE) as a construct within existing nomenclature, spanning both LLB and HLB.
 - Operationalize** cumulative military occupational blast exposure using reproducible military occupation-based risk groups.
 - Validate** MOBE risk classification against individual-level blast history and blast TBI.

METHOD

MOBE risk groups (MOBE+/MOBE-) were assigned from military occupational codes (MOC) in an epidemiological sample (Phenotype Study). The LIMBIC-CENC PLS sample was used to compare these classifications with Blast Exposure Threshold Survey (BETS) General Blast Exposure Value (GBEV) scores and clinical blast TBI history.

LIMBIC-CENC Phenotype Study	LIMBIC-CENC PLS Validation Sample
Retrospective cohort N = 2,522,880 post-9/11 SM/V	Multi-site prospective cohort N = 1,666 combat-exposed SM/V

ANALYSIS

Group differences were evaluated using χ^2 tests, tests of medians, and independent samples *t*-tests.

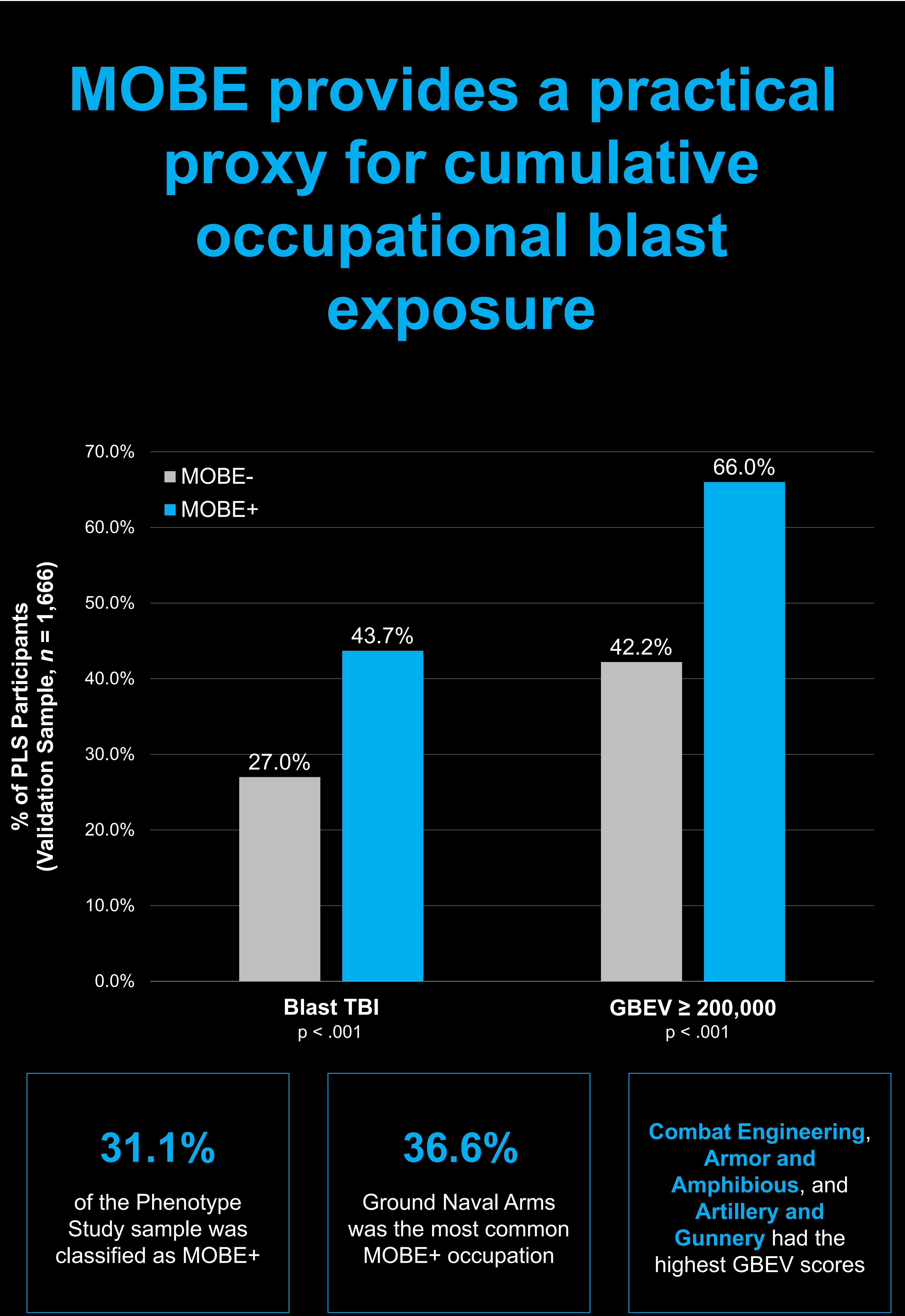
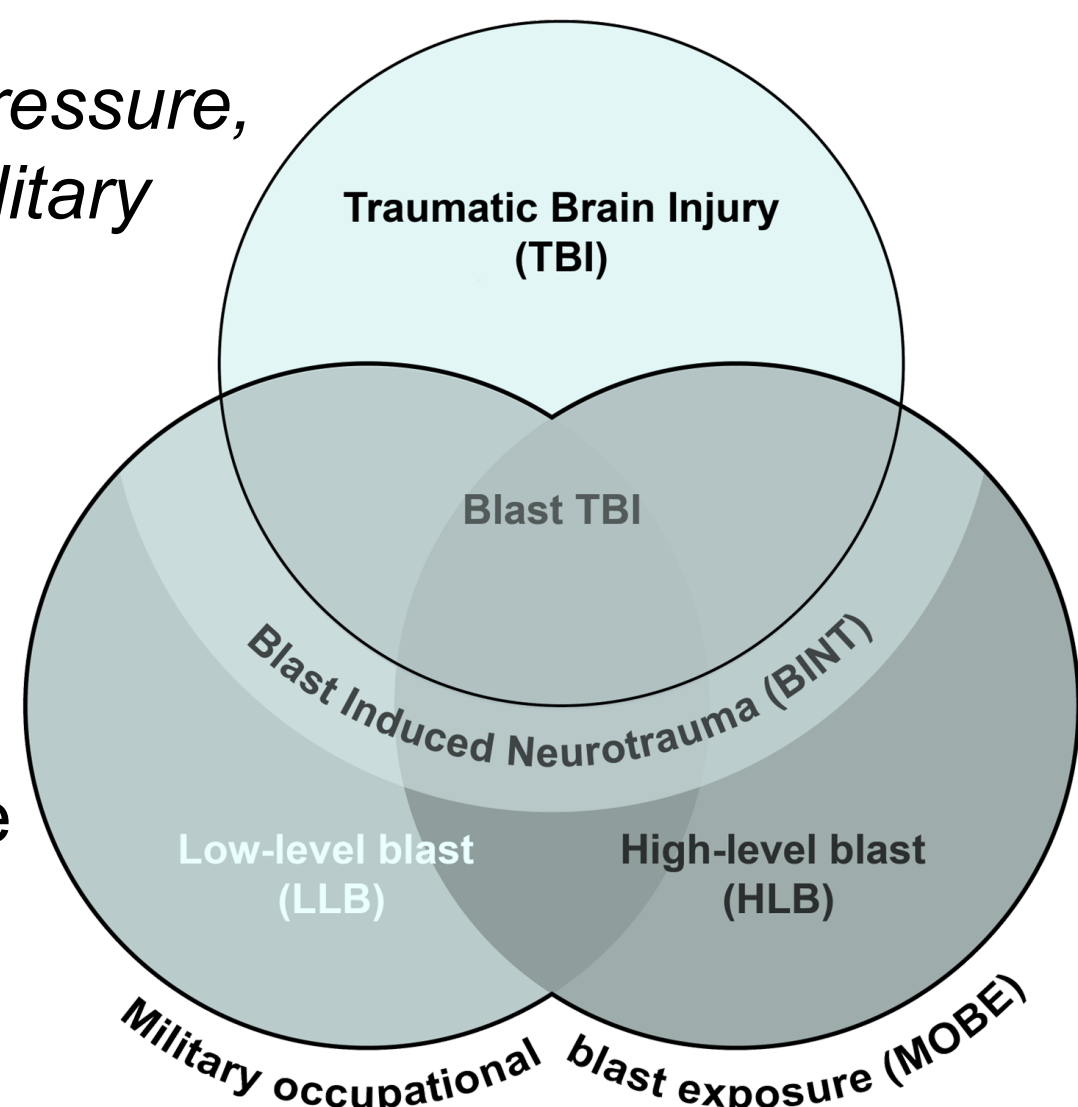
MOBE CONSTRUCT

MOBE is defined as *exposure to blast overpressure, impulse, and related forces resulting from military occupational activities and environments.*

- TBI-Agnostic:** Exposure is considered separately from injury.
- Career-Focused:** Cumulative risk can accrue across duty roles.
- Scalable:** Military occupation codes can be used in large cohorts.

KEY TERMS

Term	Definition
Blast TBI	Clinical diagnosis requiring evidence of TBI temporally connected to a blast event. The TBI can be induced due to primary, secondary, tertiary, or quaternary blast effects.
High-Level Blast (HLB)	Exposure as a result of incoming munitions, such as enemy-initiated weapon fire. Typically occurs in operational settings and frequently associated with injuries beyond primary blast injury.
Low-Level Blast (LLB)	Exposure as a result of outgoing munitions, specifically being the source of the fired weapon. Occurs both in training and operational settings and environments. May be associated with primary blast injury, but rarely with injuries beyond primary.
Subconcussive Blast Exposure	Exposure to a blast (LLB, HLB, or non-military related) that does not result in symptoms congruent with a diagnosis of traumatic brain injury.

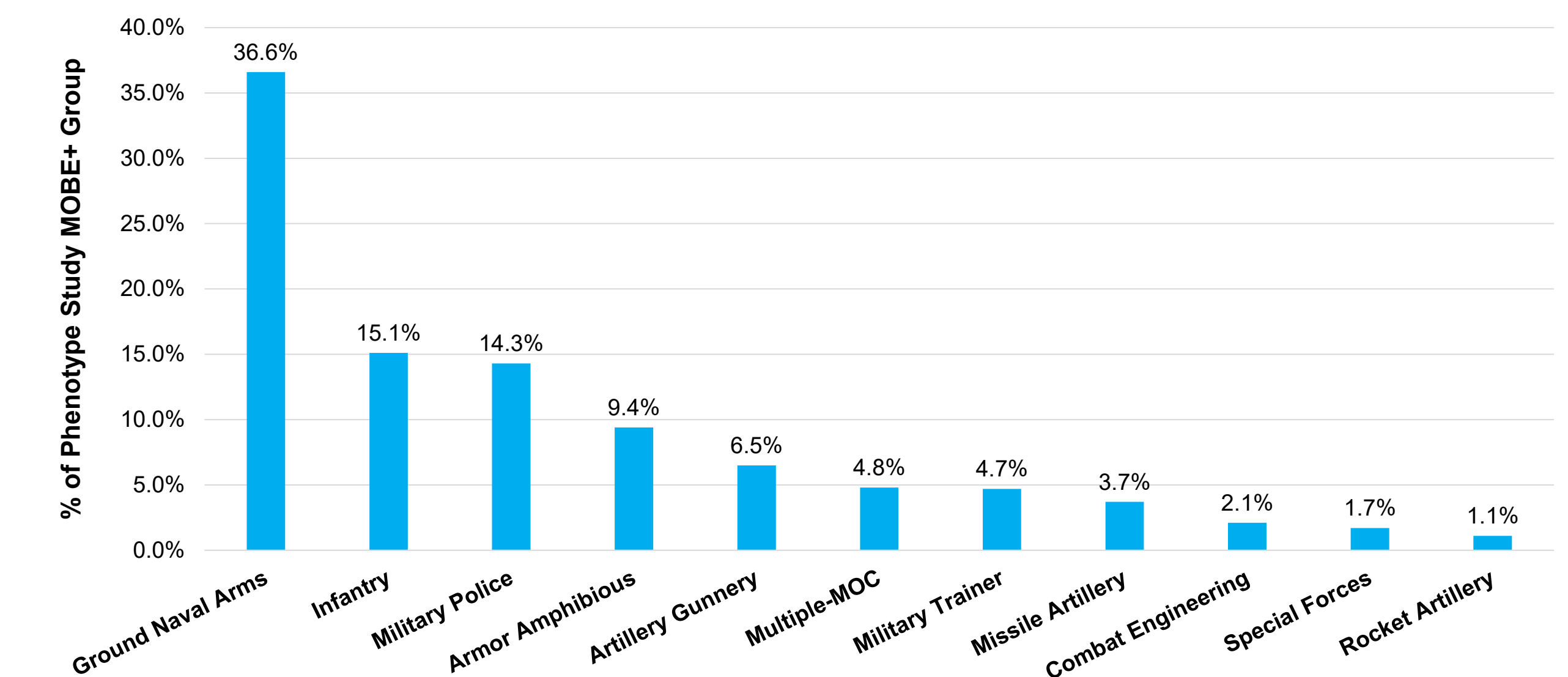


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RESULTS

In the Phenotype Study, 784,567 (31.1%) of 2,522,880 individuals were classified as high-risk for MOBE (MOBE+) MOC. Ground Naval Arms, Infantry, and Military Police were the most common high-risk groups.

Compared with MOBE-, MOBE+ occupations had higher deployment rates and differed by sex, race/ethnicity, education, branch, and rank.



VALIDATION RESULTS

MOBE+ participants were more likely to have a history of blast TBI and exceed the GBEV threshold than MOBE- (**Center Figure; Table 1**).

MOBE+ participants had higher average scores across all five BETS blast exposure categories (BECs; not pictured).

GBEV scores were highly variable, underscoring that MOBE- occupations should be interpreted as lower occupational risk, not unexposed.

Table 1. PLS validation sample (n = 1,666)

Occupation	N	Blast TBI	≥ GBEV Threshold
MOBE – (low-risk)	966	27.0%	42.2%
MOBE + (high-risk)	700	43.7%	66.0%
Armor/Amphibious	24	45.8%	75.0%
Artillery/Gunnery	39	48.7%	79.5%
Combat Engineering	46	43.5%	56.5%
Ground Naval Arms	125	40.8%	64.0%
Infantry	208	49.5%	64.9%
Military Police	86	36.0%	68.6%
Military Trainer	33	27.3%	42.4%
Special Forces	36	52.8%	69.4%
Multiple-MOC	94	42.6%	74.5%

DISCUSSION

Occupation-based classification can harmonize blast exposure estimation in large administrative and epidemiological datasets.

MOBE risk classification does not estimate individual blast dose and should be paired with detailed exposure measures when available.

MOBE- indicates lower occupational risk, not absence of blast exposure.

MOBE risk classification is a practical, reproducible, and scalable approach for estimating occupational blast exposure risk when objective records or detailed lifetime interviews are unavailable.