
# Repetitive Blast Exposure

## Human Exposure to Occupational Repetitive Blast: Immediate, Acute, and Longitudinal Effects

The Walter Reed Army Institute of Research (WRAIR; Silver Spring, MD) is conducting multiple studies in conjunction with operational training exercises to support evidence-based decisions regarding repeated low-level blast exposure effects, monitoring feasibility, and health risk assessment. These studies characterize personnel exposure to low (≤4 psi) and moderate overpressure (4–8 psi) from a variety of weapon systems (e.g., 50 caliber rifle, Gustaf recoilless rifle, hand grenades) and tactical scenarios (e.g., shotgun breaching, heavy wall breaching). Researchers are investigating neurocognitive performance, symptom reporting, and physiological responses including blood-based biomarkers for neurotrauma, epigenetics, eye-tracking, and balance.

Data are collected immediately following blast exposure, at end of the day, and, where available, longitudinally across 2–3 years from a cadre of instructors. Recruitment is active with 337 subjects to date at 13 sites, including ongoing longitudinal data for 39 subjects, with 15 visits over 18 months completed. Results from these investigations indicate that current guidelines for minimum safe distances are often inaccurate in complex environments, as overpressure exposures have consistently exceeded the 4 psi incident safety threshold prescribed by U.S. Army doctrine across the studied weapons systems. Cognitive deficits (i.e., 30 percent degradation in Simple Reaction Time (SRT; a component of the Defense Automated Neurobehavioral Assessment)) identified immediately after blast exposure were associated with higher peak overpressures, with those presenting SRT deficits having significantly higher single and cumulative average overpressure exposures than those not presenting deficits. Longitudinal effects have not been observed to date, but studies are ongoing.

Additional experiments include collecting data from biofidelic human head and brain surrogates equipped with interior and exterior pressure sensors and cell packs of live mouse neurons; this work examines the biomechanical effects of blast loading on the head and brain (e.g., pressure, strain, multi-component displacement, acceleration, cellular function). Surrogate brains exposed to 8 and 12 psi incident pressures had 50 and 60 percent reductions in metabolic activity, respectively. Overall, this program provides critical information for understanding occupational blast exposure and associated neurological and physiological effects. Results are an asset for risk/benefit assessment and aid in developing detection and mitigation strategies for Service members in combat and training environments.

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