

Listed here are seven (7) peer-review research studies spanning (2007-2020).

Overall conclusion; prone position (weight on your back, healthy, or obese) is not directly related to in-custody deaths. It is suggested being in this position may be a factor, but no evidence can be found for position to be the factor or a significant factor.

When it comes to making policies that dictate how law enforcement officers do their job, it is only fair to base such outcomes on scientific evidence, not on emotions we are simply experiencing this year.

These sources state,

1. Position of person is only one factor of many that may assist in the cause of death.
2. Study results indicate that prone positioning was common and was not associated with death in our cohort of consecutive subjects following police use of force.
3. There was no significant difference in sudden in custody death, in a worst case scenario 99.8% of subjects would be expected to survive being in either the prone or non-prone position following police use of force.
4. No evidence to support the notion that prone positioning caused respiratory embarrassment by preventing diaphragmatic movement. The idea off respiratory comprise in the obese sounds plausible, it just happens to be unsupported by clinical or experimental evidence.
5. Found that in the hogtie or hobble restraint position, was less metabolically taxing during one minute struggle than on max treadmill.
6. When handcuffed, on your stomach, with and without weight force, study found no significant changes in oxygenation or cardiac function.
7. Found obese subjects had no clinically significant differences in the cardiovascular and respiratory measures comparing seated, prone, and prone maximum restraint position following exertion.

Sources

1. Dijkhuizen, L., Kubat, B., & Duijst, W. (2020). Sudden death during physical restraint by the Dutch police. *Journal of Forensic and Legal Medicine*, 72, 101966–. <https://doi.org/10.1016/j.jflm.2020.101966>.

Position of person is only one factor of many that may assist in the cause of death.

Subjects who die after physical restraint appear to have a multifactorial cause of death, and is comprised of both personal factors and factors during and after the struggle. The different factors are comingled and augment each other. Police officers get engaged in a struggle and the excited person gets even more excited. The struggle becomes fiercer and more police officers get involved causing more stress in the individual. The stress leads to a fight reaction (because flight is impossible) leading to even more stress and heat production due to muscle activity. The subject ends up in a prone position and several police officers apply pressure to the thorax, leading to relative hypoventilation, more stress and heat production. Finally, the body is no longer able to compensate the heat production and stress reaction, leading to fatal hyperthermia and

arrhythmia. The process described is not a linear process. The different factors are comingled and augment each other. The end effect is that the subjects end up in a deadly spiral.

2. Hall, C., McHale, A., Kader, A., Stewart, L., MacCarthy, C., & Fick, G. (2012). Incidence and outcome of prone positioning following police use of force in a prospective, consecutive cohort of subjects. *Journal of Forensic and Legal Medicine*, 19(2), 83–89.
<https://doi.org/10.1016/j.jflm.2011.12.008>.

Study results indicate that prone positioning was common and was not associated with death in our cohort of consecutive subjects following police use of force.

The safety of placing suspects in the prone position following police use of force has been debated extensively, particularly in the context of sudden in-custody death. The proportion of individuals who remain in the prone position following police use of force is not known, nor has the epidemiology of sudden in-custody death in any position after police restraint been documented. Using a consecutive cohort of individuals in whom police used force, we prospectively documented the number of individuals who were placed in a prone versus not-prone position, and the prevalence of sudden in-custody death in either position. Data were collected for three consecutive years, through a single urban police service, in a city of over 1.1 million citizens. Officers prospectively documented the final position of the subject, among other data points, via electronic study forms embedded in standard use of force report forms. Final resting position was available for 1255/1269 subjects. The majority of subjects are male and demonstrated one or more abnormalities at the time of the event. We found that the majority (57.2%) of subjects were left in a not-prone position; the remainder were left in prone position. One subject died in a not-prone position, no subjects died in the prone position. The sudden in-custody death rate following police use of force was low overall (0.08%, 95% confidence interval (CI) $\frac{1}{4}$ 0.002, 0.44) and the difference in the proportion of subjects who died suddenly in either position was not significant at 0.14%, (95%CI $\frac{1}{4}$ 0.8, 0.9).

3. Hall, C., Votova, K., Heyd, C., Walker, M., MacDonald, S., Eramian, D., & Vilke, G. (2015). Restraint in police use of force events: Examining sudden in custody death for prone and not-prone positions. *Journal of Forensic and Legal Medicine*, 31, 29–35.
<https://doi.org/10.1016/j.jflm.2014.12.007>.

There was no significant difference in sudden in custody death, in a worst case scenario 99.8% of subjects would be expected to survive being in either the prone or non-prone position following police use of force.

Little is understood about the incidence of sudden death, its underlying pathophysiology, or its actual relationship to subject positioning. We report data from 4,828 consecutive use of force events (August 2006, March 2013) in 7 Canadian police agencies in Eastern and Western Canada. Consecutive subjects aged >18 years who were involved in a police use of force event were included regardless of outcome. Officers prospectively documented: final resting position of the subject (prone or non-prone), intoxicants and/or emotional distress, presence of features of

excited delirium, and the use of all force modalities. Our outcome of interest was sudden in-custody death. Our study has 80% power to detect a difference of 0.5% in sudden death between the positions. In over 3.25 million consecutive police-public interactions; use of force occurred in 4,828 subjects (0.1% of police public interactions; 95% CI \pm 0.1%, 0.1%). Subjects were usually male (87.5%); median age 32 years; 81.5% exhibited alcohol and/or drug intoxication, and/or emotional distress at the scene. Significantly more subjects remained in a non-prone vs. prone position; but over 2000 subjects remained prone. One individual died suddenly and unexpectedly in the non-prone position with all 10 features of excited delirium. No subject died in the prone position.

4. Karch, S. (2016). The problem of police-related cardiac arrest. *Journal of Forensic and Legal Medicine*, 41, 36–41. <https://doi.org/10.1016/j.jflm.2016.04.008>.

No evidence to support the notion that prone positioning caused respiratory embarrassment by preventing diaphragmatic movement. The idea off respiratory comprise in the obese sounds plausible, it just happens to be unsupported by clinical or experimental evidence. MRI studies of healthy volunteers show lung perfusion is significantly greater in the prone position than when studied in volunteers lying supine.

The term “positional asphyxia” was originally used to describe the situation in which the upper airways becomes compromised by sharp angulation of the head or neck, or where the chest wall is splinted and the diaphragm is prevented from moving because of an unusual position of the body. The term was redefined in the early 1980s to describe sudden death during physical restraint of an individual who is in a prone position. A large percent of reported victims were overweight males. Most were in early middle age and manifesting psychotic behavior at the time of death. Most were reported to have unremarkable autopsies, save for the finding, in many cases, of cocaine or methamphetamine (more recently synthetic cannabinoids and cathinones as well). As no cause of death was apparent (other than non-specific signs such as pulmonary edema), it became common practice to attribute death to force exerted on the decedent’s back. When experimental studies with human volunteers disproved this notion, the term “restraint asphyxia” was substituted for positional asphyxia, but with nearly the exact same meaning. No experimental study has ever determined the actual amount of force necessary to cause asphyxia by force applied to the back (although the range of required static force is known), nor the duration for which it must be applied.

5. Michalewicz, B., Chan, T., Vilke, G., Levy, S., Neuman, T., & Kolkhorst, F. (2007). Ventilatory and Metabolic Demands During Aggressive Physical Restraint in Healthy Adults. *Journal of Forensic Sciences*, 52(1), 171–175. <https://doi.org/10.1111/j.1556-4029.2006.00296.x>.

Found that in the hogtie or hobble restraint position, was less metabolically taxing during one minute struggle than on max treadmill.

This study attempted to investigate the impact of varying weight force upon the back in healthy individuals in the prone position. We recognize the differences between the laboratory setting

and actual field conditions; nonetheless, we found no clinically important restriction of ventilatory reserve when subjects were placed in the PMRP or when prone with up to 90.2 or 102.3 kg of weight on their back. Likewise, when subjects were maximally struggling for 60 sec while in the PMRP, there were no clinically important limitations of metabolic or ventilatory functions. Based on these observations in healthy subjects, we conclude that PMRP and prone positioning with moderate weight force on the back do not in and of themselves restrict metabolic or ventilatory demands to any clinically important degree. As such, factors other than isolated ventilatory failure should be considered when evaluating deaths occurring in the setting of restraint in the field.

6. Savaser, D., Campbell, C., Castillo, E., Vilke, G., Sloane, C., Neuman, T., Hansen, A., Shah, V., & Chan, T. (2013). The effect of the prone maximal restraint position with and without weight force on cardiac output and other hemodynamic measures. *Journal of Forensic and Legal Medicine*, 20(8), 991–995. <https://doi.org/10.1016/j.jflm.2013.08.006>.

When handcuffed, on your stomach, with and without weight force, study found no significant changes in oxygenation or cardiac function.

The prone maximal restraint (PMR) position has been used by law enforcement and emergency care personnel to restrain acutely combative or agitated individual. The position places the subject prone with wrists handcuffed behind the back and secured to the ankles. Prior work has indicated a reduction in inferior vena cava (IVC) diameter associated with this position when weight force is applied to the back. It is therefore possible that this position can negatively impact hemodynamic stability. Objectives we sought to measure the impact of PMR with and without weight force on measures of cardiac function including vital signs, oxygenation, stroke volume (SV), IVC diameter, cardiac output (CO) and cardiac index (CI). Methods We conducted a randomized prospective cross-over experimental study of 25 healthy male volunteers (22–43 years of age) placed in 5 different body positions: supine (SU), prone (PR), prone maximal restraint with no weight force (PMR-0), prone maximal restraint with 50 lbs added to the subject's back (PMR-50), and prone maximal restraint with 100 lbs added to the subject's back (PMR-100) for 3 min. Heart rate (HR), blood pressure (BP), and oxygenation saturation (O₂ sat) were monitored. In addition, echocardiography was performed to measure left ventricular outflow tract diameter (LVOTD), and SV, CO, and CI were then calculated. Data were analyzed using repeated measures ANOVA with pair-wise comparisons when appropriate to evaluate changes with each variable with respective positioning. Results Despite a small decrease in SV between SU and PMR positions, there were no statistically significant differences in CO between the 5 different positions. There were also no differences in CI between positions other than a small decrease when comparing SU and PMR-50 only (mean difference -0.39 L/stroke, $p = 0.005$). There was no evidence of hemodynamic compromise in any of the PMR positions when evaluating HR, MAP or O₂ sat. Conclusions PMR with and without weight force did not result in any changes in CO or other evidence of cardiovascular or hemodynamic compromise.

7. Sloane, C., Chan, T., Kolkhorst, F., Neuman, T., Castillo, E., & Vilke, G. (2014). Evaluation of the ventilatory effects of the prone maximum restraint (PMR) position on obese human subjects. *Forensic Science International*, 237, 86–89. <https://doi.org/10.1016/j.forsciint.2014.01.017>.

Found obese subjects there were no clinically significant differences in the cardiovascular and respiratory measures comparing seated, prone, and prone maximum restraint position following exertion.

The study sought to determine the physiologic effects of the prone maximum restraint (PMR) position in obese subjects after intense exercise. We designed an experimental, randomized, cross-over trial in human subjects conducted at a university exercise physiology laboratory. Ten otherwise healthy, obese (BMI > 30) subjects performed a period of heavy exertion on a cycling ergometer to 85% of maximum heart rate, and then were placed in one of three positions in random order for 15 min: (1) seated with hands behind the back, (2) prone with arms to the sides, (3) PMR position. While in each position, mean arterial blood pressure (MAP), heart rate (HR), minute ventilation ($\dot{V}E$), oxygen saturation (SaO₂), and end tidal CO₂ (etCO₂) were measured every 5 min. There were no significant differences identified between the three positions in MAP, HR, $\dot{V}E$, or O₂sat at any time period. There was a slight increase in heart rate at 15 min in the PMR position over the prone position (95 vs. 87). There was a decrease in end tidal CO₂ at 15 min in the PMR over the prone position (32 mmHg vs. 35 mmHg). In addition, there was no evidence of hypoxia or hypoventilation during any of the monitored 15 min position periods.