# Report on the Administration of Ketamine

# by EMS in Maryland

**Report required by Senate Bill 78, Chapter 493, Sec.1, 2021**

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**Maryland Institute for Emergency Medical Services Systems (MIEMSS)**
**653 West Pratt Street**
**Baltimore, Maryland 21201**
**410-706-5074**

## Executive Summary

Senate Bill 78 (Ch. 493, Sec.1, 2021) requires the Maryland Institute for Emergency Medical Services Systems (MIEMSS) to report annually, from 2022 through 2024, on various aspects of the administration of ketamine by Emergency Medical Services (EMS) personnel in Maryland. This first report encompasses a one-year period from October 1, 2021 – October 1, 2022.

Ketamine is a sedative medication that may be administered by EMS Advanced Life Support (ALS) clinicians to patients who meet specific criteria. During the one-year reporting period, Maryland EMS services responded to 823,317 medical emergencies and transported 521,332 patients. In this same time interval, ALS clinicians treated 1,422 patients with ketamine. Most patients received this medication at low dose for pain management (69%), while 20% of patients received ketamine for treatment of severe agitation. Patients requiring sedation after a breathing tube was placed for respiratory support accounted for the remaining 11% of ketamine administrations. In Maryland, ketamine is administered by EMS only after a careful consideration of risk and benefit to the patient.

## Background

Senate Bill 78 (Ch. 493, Sec.1, 2021) focused on the EMS administration of ketamine to emergency patients during the prehospital phase of care. Several years before, two incidents in in Colorado had drawn attention to the administration of ketamine to emergency patients involved in altercations with police. As a result, SB 78 called for the Maryland Institute for Emergency Medical Services Systems (MIEMSS) to report annually, from 2022 through 2024, on various aspects of ketamine administration by Emergency Medical Services (EMS) personnel in Maryland.

MIEMSS is an independent state agency with statutory responsibility for oversight and coordination of all components of the statewide EMS system. MIEMSS is governed by an 11-member Governor-appointed State EMS Board which promulgates regulations for the operation of the EMS system. Oversight responsibilities include licensing / certifying EMS clinicians, promulgating standardized medical protocols used by EMS, designation of trauma centers and specialty care centers, regulation of commercial ambulance services, operation of the statewide EMS communications systems, and improving system effectiveness.

EMS personnel provide care and treatment to patients during emergencies under standardized treatment protocols. The *Maryland Medical Protocols for EMS* are developed by a committee comprised of physicians, nurses, EMS clinicians, and other subject matter experts to ensure effective care and patient safety; approved by the State EMS Board; incorporated by reference into State regulations; and reviewed and updated annually[1]. In addition, EMS clinicians provide

[1] See https://www.miemss.org/home/Portals/0/Docs/Guidelines_Protocols/MD-Medical-Protocols-2022-Print-20220830-min.pdf

treatment under the medical direction of a physician, and each public safety jurisdiction and commercial service has a physician medical director who oversees medical care and quality assurance.

EMS personnel record information on all EMS patient interactions which, since 2015, is saved in the MIEMSS-implemented electronic reporting system, "eMEDS®." EMS Clinicians must complete and submit electronic patient care reports for every patient encounter, whether the patient is transported or not. MIEMSS has partnered with CRISP, the State-designated health information exchange, to create unidirectional data linkage from eMEDS® to CRISP. This linkage allows hospitals to access pre-hospital care data from eMEDS® and EMS personnel to access some information held by CRISP. Information presented in this report was obtained from eMEDS® records and provides information on treatment rendered during the one-year period October 1, 2021 through October 1, 2022.

## Ketamine

Ketamine is a rapid-acting sedative medication that is used by EMS throughout most of the United States. It is effective in pre-hospital care for pain management, sedation, control of delirium, and drug intoxications[2]. Over the past decade, EMS medical directors and leaders have searched for more effective ways to manage refractory pain and severely agitated patients. The latter resulted in patients having physical restraints applied for prolonged periods, while waiting for slower-onset sedative medications, such as midazolam or haloperidol, to take effect. Ketamine was added to EMS formularies to provide a treatment option with faster onset, with a goal to decrease the risk of patient injury or positional asphyxia. A survey conducted in 2020 by the National Association of State EMS Officials (NASEMSO) indicated that ketamine was used by EMS in all 43 states that responded.

In Maryland, ketamine was introduced into the *Maryland Medical Protocols for EMS* (Protocols) in 2018. Ketamine may be administered in the prehospital environment only by advanced life support (ALS) clinicians[3], i.e., Paramedics or Cardiac Rescue Technicians. ALS clinicians have extensive initial training in the assessment and treatment of medical and traumatic emergencies, airway management, use of medications in the prehospital phase of care, and intravenous medical therapy, and must complete 60 hours of continuing education every two years. Subsequent to the introduction of ketamine into the Protocols, MIEMSS issued guidance about the judicious use of ketamine and emphasized the need for close monitoring after medication administration. In addition, in each jurisdiction, EMS medical directors and EMS quality assurance officers review all cases in which ketamine was administered to a patient.

Under the Protocols, ALS clinicians are permitted to administer ketamine for any of the following four indications: (1) sedation of a severely agitated patient; (2) pain management; (3)

[2] American Society of Anesthesiologists/ American College of Emergency Physicians. Joint Statement on the Safe Use of Ketamine in Prehospital Care, August 26, 2020. See ASA/ACEP Joint Statement on the Safe Use of Ketamine in Prehospital Care | American Society of Anesthesiologists (ASA) (asahq.org)

[3] Advanced Life Support (ALS) clinicians include paramedics and cardiac rescue technicians.

sedation for a patient receiving mechanical ventilation through a breathing tube; or (4) sedation for a patient aware they are receiving CPR. The Protocols set forth weight-based doses that may be administered through intravenous, intraosseous, intranasal, or intramuscular routes.

The decision to administer any sedative medication, including ketamine, is a medical decision that involves careful consideration of the risks and benefits to the patient. Ketamine administration by Maryland ALS Clinicians cannot be, and is not, performed at the request of law enforcement personnel.

Regarding patient agitation, ketamine is indicated only for patients exhibiting *severe* agitation, which include those who are physically violent and present an *immediate* or *imminent* threat to themselves or others. Prior to ketamine administration, the ALS clinician must consult with a physician unless a delay for consultation would jeopardize the safety of the patient or EMS personnel. In that case, EMS may administer one dose of ketamine prior to medical consultation. In such cases, medication may facilitate avoidance of the necessity for physical restraints or a prolonged physical struggle, which can result in asphyxia or injury to the patient or EMS clinicians. In all cases, verbal de-escalation is attempted first.[4]

Appropriate sedation with medication enables a prompt and compassionate medical assessment. The Protocols require a thorough patient assessment and treatment of underlying causes of agitation as soon as possible. Patients are assessed for trauma, cardiac rhythm abnormalities, hypoxia, and low blood glucose, for example. Appropriate therapeutic measures then follow.

After the ALS clinician has administered ketamine to the patient, the Protocols require that the patient's airway and vital signs be monitored continuously during transport. A second EMS clinician must accompany the ALS Clinician during transport to assist with patient care. Oxygen and all necessary equipment to manage the patient's breathing, should it become compromised, are immediately available.

## Maryland EMS Ketamine Data: October 1, 2021 – October 1, 2022

From October 1, 2021 through October 1, 2022, Maryland ALS clinicians administered ketamine to 1,422 patients among a total of 521,332 transports. Most patients received ketamine for pain management (985, 69%), followed by sedation for severely agitated patients (284, 20%), and finally, for patients requiring sedation after placement of a breathing tube (153, 11%).

When compared to a 2019 study conducted among a consortium of 1,322 EMS agencies across the United States, ketamine was given for pain management more often in Maryland (69% vs. 49% of total ketamine administrations), and less often for behavioral emergencies / severe agitation (20% vs. 34% of total ketamine administrations).[5]

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[4] Keseg D, et al. "The Use of Prehospital Ketamine for Control of Agitation in a Metropolitan Firefighter-based EMS System" *Prehospital Emergency Care* (2015), 19:1, 110-115.

[5] Fernandez, A et al. "Out-of-Hospital Ketamine: Indications for Use, Patient Outcomes, and Associated Mortality." *Annals of Emergency Medicine*. 2021; 78: 123-131.

Most patients in Maryland received a single dose of ketamine (964, 68%), while 458 patients (32%) received multiple doses. Among those receiving multiple doses, 399 patients (87%) received two doses, 51 patients (11%) received three doses, 6 patients (1.3%) received four doses, and 2 patients (<1%) received five doses of ketamine. Pain management (328 patients, 82%) was the most common reason that patients received two doses of ketamine. Most of the patients who received three or more doses were those requiring sedation following placement of a breathing tube.

Of the 1,422 patients receiving ketamine in Maryland during this time period, 586 (41%) were female, 834 (59%) were male, and 2 (0.1%) were gender not recorded. Ketamine was administered to 637 (45%) White patients, 275 (19%) Black or African-American patients, 41 (3%) Hispanic or Latino patients, 13 (0.9%) Asian patients, and 28 (2%) Mixed or other race patients. Race was not recorded for 428 (30%) patients.

The median age of patients receiving ketamine in Maryland was 46 years (IQR 30-64); 9 patients did not have an age recorded. The median recorded weight for patients was 81.6 kg (IQR 68-100). Of note, weight is stated by the patient or estimated by the EMS clinician. Height is not a recorded field in the eMEDS® patient care record. Ketamine was administered to individual patients by the following routes: 968 (68%) intravenous, 293 (20%) intramuscular, 85 (6%) intranasal, and 76 (5%) intraosseous.

See Tables 1 and 2 in the Appendix for a summary of the data.

## Conclusion

Ketamine is a rapid-acting medication that may be administered by Paramedics and Cardiac Rescue Technicians for sedation or pain management under certain circumstances. The Protocols emphasize patient assessment and careful analysis of risk and benefit prior to administration of all medications, including ketamine. Prehospital ketamine usage is closely monitored by jurisdictional medical directors and the State EMS Medical Director. The Maryland EMS system remains committed to the appropriate and considered use of all medications, based on the patient's medical need and informed by medical judgment.

## Appendix

Table 1. Demographics of Patients Receiving Ketamine

| Characteristic | Variable | Value |
|---|---|---|
| Age | Min / Max | 1.0 / 99.0 |
| | Med [IQR] | 46.0 [30.0;64.0] |
| | Mean (std) | 47.3 (21.5) |
| | N (NA) | 1413 (9) |
| Gender | Female | 586 (41.21%) |
| | Male | 834 (58.65%) |
| | Unknown (Unable to Determine) | 2 (0.14%) |
| Race | White | 637 (44.80%) |
| | Black or African American | 275 (19.34%) |
| | Hispanic or Latino | 41 (2.88%) |
| | Other Race | 26 (1.83%) |
| | Asian | 13 (0.91%) |
| | American Indian or Alaska Native | 1 (0.07%) |
| | Hispanic or Latino, Black or African American | 1 (0.07%) |
| | NA | 428 (30.10%) |
| Patient Weight in Kg | Min / Max | 3.5 / 204.1 |
| | Med [IQR] | 81.6 [68.0;100.0] |
| | Mean (std) | 84.8 (24.6) |
| | N (NA) | 1422 (0) |
| Dose | Multiple (Max = 5) | 458 (32.21%) |
| | Single | 964 (67.79%) |

Table 2. Number of Doses of Ketamine Administered per Patient

| Doses of Ketamine Administered | Number of Patients |
|---|---|
| 1 | 964 |
| 2 | 399 |
| 3 | 51 |
| 4 | 6 |
| 5 | 2 |
| Total | 1422 |