



Development of a protocol to investigate the stability of drugs used by Qatar's National Ambulance Service in rapid response vehicles

Ousama Rachid^{1,2,*}, Ahmed Makhoulouf³, Meral Abdulsalam¹, Sarra Benammar¹, Elaf Omer¹, Salma AlDakhkhny¹, Alzahraa Abolward¹, Habib Kerkeni³, Loua Al Shaikh³, Guillaume Alinier^{3,4,5,6}

ABSTRACT

Background: Paramedics need a range of medications that are stored in bags for easy transportation to the patient's side and are exposed to temperature variations, especially in a hot country like Qatar¹. The thermal stability of some medications was examined in previous studies^{2,3}.

Methods: A safe and practical solution had to be found and should be approved by the Production committee to investigate the thermal stability of a range of 13 medications over different periods of time (Table 1).

Results: Six medication bags have been specially prepared with the drug samples presented in Table 1. While one data logger was fixed to the metal net divider at the back of the rapid response vehicle, each bag contained a radio-frequency identification (RFID) tag for tracing, two data loggers to measure the temperature and humidity every 10 minutes over a 3 to 12-month period, and an initial total of 15 drug samples (Table 1). The bags have been labeled "For research purpose" and placed at the back of rapid response vehicles (Figure 1). At collection times, 3 samples of each medication will be removed for analysis and replaced by new samples. Similarly, data loggers will be collected and replaced with new ones. As per Qatar Ambulance Service's standard operating procedures, paramedics are required to always keep their medication bag with them when they leave their vehicle for a break or to treat a patient, but for practical and safety reasons it will not be the case with the research samples. Although this means that the research bags will have less exposure to the outdoor environment, they will still be subjected to temperature variation in case the vehicle is parked without air conditioning¹. The collected samples will be kept at 4°C until analyzed by high-performance liquid chromatography.

Conclusion: Based on the findings of this study, the results may have a significant impact on how some of the drugs are handled in the pre-hospital setting, especially, possible modification of the recommended expiration date specified by manufacturers to ensure patient safety.

Keywords: Prehospital, Thermal stability, Medications, Ambulance Service, Emergency Medical Service

¹College of Pharmacy, QU Health, Qatar University, Doha, Qatar

²Biomedical and Pharmaceutical Research Unit, QU Health, Qatar University, Doha, Qatar

³Ambulance Service, Hamad Medical Corporation, Doha, Qatar

⁴Department of Allied Health Professions, Midwifery and Social Work, School of Health and Social Work, University of Hertfordshire, Hatfield, UK

⁵Weill Cornell Medicine Qatar, Doha, Qatar

⁶Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne, UK

*Email: orachid@qu.edu.qa

<http://dx.doi.org/10.5339/jemtac.2022.qhc.57>

Submitted: 27 July 2021

Accepted: 19 September 2021

Publication date: 15 January 2022

© 2022 Rachid, Makhoulouf, Abdulsalam, Benammar, Omer, AlDakhkhny, Abolward, Kerkeni, Al Shaikh, Alinier, licensee HBKU Press. This is an open access article distributed under the terms of the Creative Commons Attribution license CC BY-4.0, which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

Table 1. The list of medications with a schedule of sample collections.

Item Name	Group 1		Group 2		Group 3		Group 4		Group 5		Group 6		Group 7	
	Insertion Date	Collection Date	Insertion Date	Collection Date	Insertion Date	Collection Date	Insertion Date	Collection Date	Insertion Date	Collection Date	Insertion Date	Collection Date	Insertion Date	Collection Date
Adenosine 3 mg/ml														
Atropine 0.5 mg/ml (1:1,000) Amp														
Diphenhydramine 50 mg/ml														
Epinephrine (Adrenaline) 1 mg/ml (1:1,000) Amp														
Furosemide 20 mg/2ml														
Naloxone 0.4 mg/ml														
Ondansetron 4 mg/2ml	01-01-21		01-04-21		01-01-21		01-07-21		01-01-21		01-10-21		01-01-21	
Phenylephrine 10 mg/ml														
Salbutamol 0.5 mg/ml (Albuterol amp)														
Insulin Regular 100IU/10ml -> 1 month out of fridge														
Rocuronium Bromide 10 mg/ml -> 84 days out of fridge														
Glyceryl Trinitrate 5 mg/5ml														
Paracetamol 1 G/100ml														

(All dates are formatted as dd/mm/yy)

**Figure 1.** Research bag containing drug samples and data loggers.

Ethical approval: The research protocol was approved by Hamad Medical Corporation Ambulance Service Production Committee, Doha, Qatar.

Acknowledgments: Special thanks to Professor Mohamed Izham Mohamed Ibrahim for facilitating the initial collaboration between Qatar University and Hamad Medical Corporation Ambulance Service (HMCAS). The researchers acknowledge HMCAS for funding the study by providing the required medication samples. This work was made possible by the Qatar National Research Fund [UREP25-069-3-021] and Qatar University Student Grants [QUST-1-CPH-2020-11, QUST-2-CPH-2019-23, QUST-1-CPH-2019-7, QUST-2-CPH-2018-6]. The contents herein are solely the responsibility of the authors.

REFERENCES

- [1] Rachid O, Mohamed Ibrahim M, Diab M, Makhlof A, Alinier G. Monitoring temperature and humidity in ambulance service rapid-response vehicles and paramedics medication bags: a pilot study. *J Emerg Med Trauma Acute Care*. Volume 2022, Issue 1-Qatar Health 2022 Conference abstracts:(impress).
- [2] Rachid O, Obasi J, Mohamed Ibrahim M, Diab M, Al-Moslih A, Makhlof A, et al. A systematic review of stability of medicines used in emergency medical service settings. *J Emerg Med Trauma Acute Care*. 2020(3):8. Available from: <https://www.qscience.com/content/journals/10.5339/jemtac.2020.qhc.8>
- [3] Armenian P, Campagne D, Stroh G, Ives Tallman C, Zeng WZD, Lin T, et al. Hot and Cold Drugs: National Park Service Medication Stability at the Extremes of Temperature. *Prehosp Emerg Care*. 2017;21(3):378–85.