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Monitoring temperature and humidity in ambulance service rapid-response vehicles and paramedics medication bags: A pilot study

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ABSTRACT

Background: In the pre-hospital context, paramedics carry medications in multi-compartment medication bags. However, these medications are occasionally subjected to temperature and humidity variations as they are being carried around by paramedics during their operational duties.^{1,2} To develop a protocol to investigate medications' stability inside these bags, a pilot study was needed to build a basic understanding of the temperature and humidity variations within both vehicles and bags and to guide the development of such a protocol.

Methods: Data loggers, pre-programmed to record temperature and humidity every 5 minutes, were inserted inside two operational rapid-response vehicles and their respective medication bags for two full days (16-17/09/2020) when the outside temperature ranged from 30 to 40°C and the humidity ranged from 39% to 74%.³ Following this, 4 data loggers were installed for one month inside 4 different medication bags (28/09/2020-28/10/2020) in similar operational vehicles when the outside temperature ranged from 23 to 42°C and the humidity ranged from 18% to 80%.³ Logging data were extracted using special software (ElitechLog V6.0.3).

Results: For the two-day study, temperature and humidity recordings were obtained (Figure 1). The mean (SD) temperature differences between both medication bags and their respective vehicles were -1.04°C (3.01) and 0.09°C (2.64).

Variations above and below the mean temperature difference were found to be random, and within the 3 sigma control limits, which demonstrates the stability and predictability of these temperature differences. Data from the one-month study showed similar recorded ranges (Figure 2).

Conclusion: The findings illustrate that temperature readings inside air-conditioned vehicles and their respective medication bag were very similar in the context of Qatar. Therefore, it is possible and feasible to depend on recordings from either of them alone. These results will guide the development of a protocol for a future research project investigating drugs' stability inside medication bags.

Keywords: Prehospital, Monitoring, Medications, Temperature, Humidity

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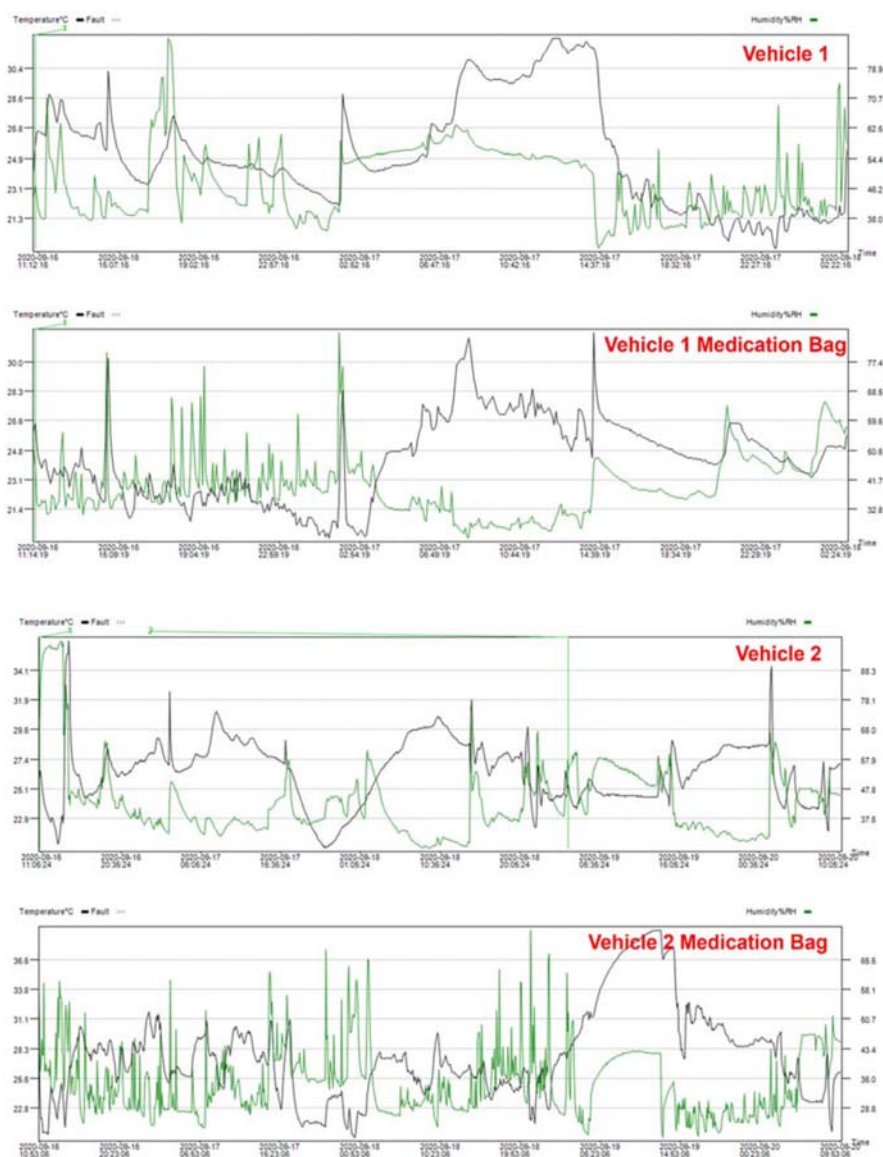


Figure 1. Temperature and humidity readings of the two emergency response cars and their respective medication bags (Temperature recording in black and humidity recording in green)

Ethical approval: This pilot study was approved by Hamad Medical Corporation Ambulance Service Production Committee.

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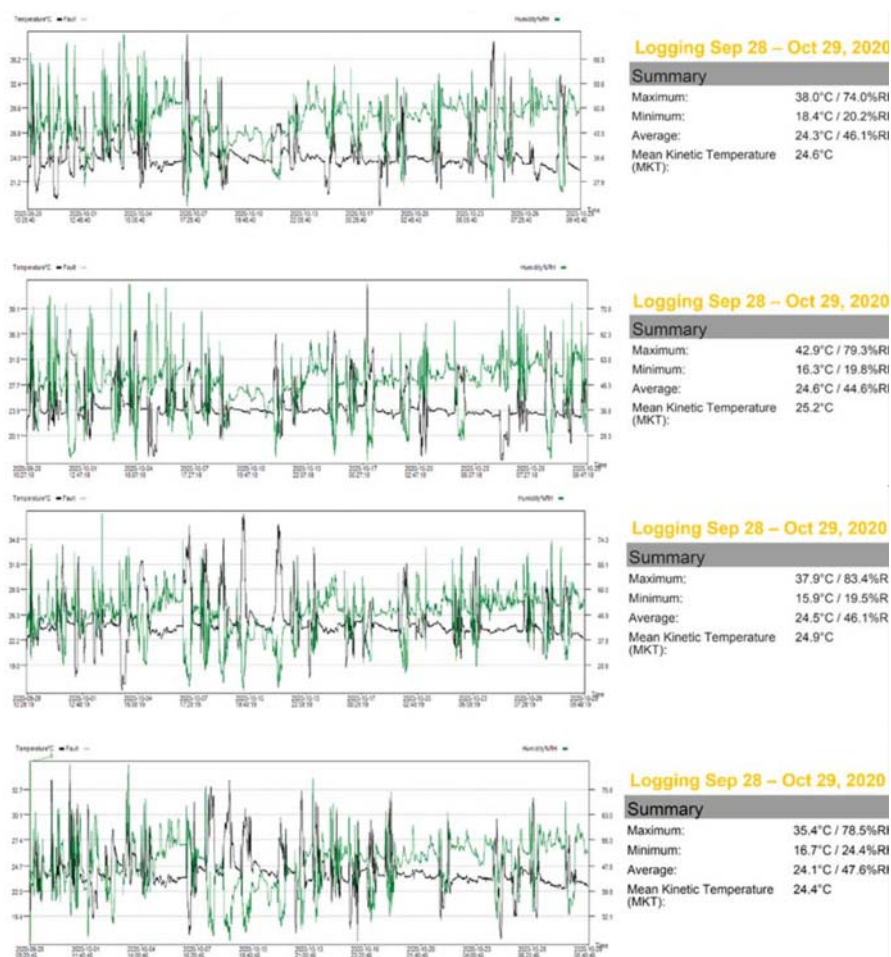


Figure 2. Temperature and humidity readings in four different medication bags (Temperature recording in black and humidity recording in green).

REFERENCES

- [1] Gammon DL, Su S, Jordan J, Patterson R, Finley PJ, Lowe C, et al. Alteration in prehospital drug concentration after thermal exposure. *Am J Emerg Med.* 2008 Jun;26(5):566–73.
- [2] Brown LH, Krumpferman K, Fullagar CJ. Out-of-hospital medication storage temperatures: a review of the literature and directions for the future. *Prehosp Emerg Care.* 2004 Apr-Jun;8(2):200–6.
- [3] Weather in September 2020 in Doha, Qatar. [cited 2021 Aug 23]. <https://www.timeanddate.com/weather/qatar/doha/historic?month=9&year=2020>