

Abstract

Objective: Not much is known about how people with diabetes store their insulin. Objective of our evaluation was to analyze at which temperature insulin is stored in domestic refrigerators and when opened/carried as a spare, and if these temperatures meet the manufacturers' recommendations.

Methods: People with diabetes ($n = 338$; 46% US, 41% EU) put Bluetooth-enabled temperature sensors (MedAngel ONE, Netherlands) next to the insulin into their refrigerator or diabetes bag. Measurement results were transferred to an app and stored in a protected online database.

Results: Temperature logs from 400 sensors were analyzed (230 for refrigerated, 170 for carried insulin). Deviations outside the recommended range were found in 315 (78.8%) logs (230 [100%] refrigerated, 85 [50%] carried). For refrigerated insulin, temperature recorded was out of range 11.3% of the time, on average 2 h 43 min/day with an average deviation of 3.7 K. For carried insulin, temperatures were out of range 0.5% of the time (8 min/day) with an average deviation of 1.1 K. Seventeen percent of sensors measured temperatures $<0^{\circ}\text{C}$ (57 of sensors for refrigerated, 9 for carried insulin).

Conclusions: Storage conditions of insulin are known to have an impact on its blood glucose-lowering effect. This is the first study investigating temperature conditions of insulin storage in industrialized countries. In a clinically relevant percentage of storage time, insulin was exposed to temperatures outside the recommended range, especially when refrigerated. Thus, domestic refrigerators may pose an underestimated risk for insulin quality.

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