Storage Conditions of Insulin in Domestic Refrigerators and when Carried by Patients: Insulin is Often Stored Outside the Recommended Temperature Range

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OBJECTIVE
Not much is known about how patients with diabetes store their insulin in daily life. The objective of our study was to monitor the temperature of refrigerated and carried insulin in industrialized countries to investigate how often storage conditions do not meet the manufacturers’ recommendations.

METHOD
Patients in 230 (46% in the US, 41% in the EU) put a total number of 482 temperature-loggers (MedAngel DE, The Netherlands) next to their insulin, either in their refrigerator or their diabetes bag. The temperature was measured every 3 min (up to 480 times/day). The measurements were sent to an app and stored in a protected online database. Whenever temperature exceeded the recommended range (2-8°C for refrigerated insulin, 2-30°C when opened/carried as a spares), the user was notified by an alert. Data was collected from November 2016 to February 2018 with an average protocol length of 49 days.

RESULTS
A number of 66 sensors (16.5%) measured temperatures below 0°C (57 refrigerated, 9 carried). Average temperature deviation of 1.11K (SD 1.24K). 0.54% of the time (0.48%-0.64%; 8 min/day) with an average temperature deviation of 3.68K (SD 5.02K).

CONCLUSION
Long-term storage conditions of insulin are known to have an impact on its blood-glucose lowering effect. These observational data showed that in a significant number of cases, insulin was exposed to temperatures outside the recommended range, especially when refrigerated. Thus, domestic refrigerators may pose an undetermined risk for insulin quality. The extent of how temperature deviations in storage affect insulin efficacy and patient outcomes needs further systematic investigation.