Insucool: An Affordable Insulin Cooling Device for Transportation and Storage

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Background: Insulin is the life-essential treatment for patients with Type 1 diabetes mellitus, and it can be for Type 2 diabetes mellitus. Yet, a reported 33% of families with children with diabetes lack crucial home refrigeration in 30 of 37 low- and lower-middle income countries. Aim: Produce a simple, cost-efficient wallet for insulin transportation and storage, and then compare designs used in resourced-challenged settings. Methods: An insulin wallet was modeled, manufactured, and tested versus alternatives (clay pots, the EADSG recommended device, and a Frio insulin cooling case). A controlled chamber was constructed to mimic ambient environments, and an ounce of ice was used with electronic loggers to measure internal device temperatures for more than 3 hours. Cooling efficacy was assessed with average absolute temperature differences (internal vs. ambient) and mean kinetic temperature differences. Results: A fully-functioning prototype was produced within an affordable budget for resourced challenged populations ($1.50 per/lifespan Prototype, $18.00 per/year Frio's). The mean ambient temperature was controlled at 32°C. The prototype's mean cooling temperature was 15.9°C, with high statistical significance achieved compared to the clay pot (p=0.0009), EADSG recommended device (p=0.01333), and the Frio insulin cooling case (p=0.0025). Similar statistical significance was seen among the mean kinetic temperatures, analyzing potency-risking temperature fluctuations as the FDA mandates. Conclusions: The insulin wallet prototype is more affordable and efficacious in reducing temperatures compared to other insulin transportation and storage devices.