

# Have Insulin, Will Fly: Diabetes Management During Air Travel and Time Zone Adjustment Strategies

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**T**he world definitely has become a smaller place. Traveling across multiple time zones within the span of a few hours or days is now commonplace.

Overseas travel poses special problems for people with diabetes, especially those on insulin. However, the fear of dealing with medications and acute complications should not prevent people with diabetes from traveling, whether for work or recreation. Advanced planning can help to prevent or minimize emergencies that may occur away from home.

One problem insulin-treated people with diabetes face when flying across time zones is confusion about how to adjust their insulin times and dosage amounts to avoid being “out of sync” with local time on arrival. Very little information is available regarding time zone insulin adjustment strategies. A British study in 1993 clearly demonstrated that most physicians, including diabetologists, are uncertain about how to adjust insulin doses for patients who travel across several time zones.

This article provides some recommendations on managing diabetes during air travel. It is important to remember, however, that these are general guidelines and that management should be individualized for each patient.

## Planning Ahead

Ideally, patients who are planning overseas travel should schedule an office visit with their health care provider at least 4–6 weeks before departure. This gives providers an opportunity to assess their patients’ current level of diabetes control, to give specific advice regarding

diabetes management and prevention of acute complications, to offer information on preventing and managing common travel-related problems, and to determine the need for any immunizations. Any changes in medication regimen should be made well in advance of departure so that there is enough time to incorporate them into daily routines.

It is important for patients to obtain a travel itinerary showing departure and arrival times, durations of flights, and time differences between the points of embarkation and disembarkation. With this information, providers will be able to “guesstimate” necessary adjustments

during travel. Patients with dietary restrictions should contact their airline in advance about special meal options. “Diabetic meals” on airplanes are usually very low in carbohydrates and designed more for patients with type 2 diabetes than for those with type 1 diabetes. It is also helpful to find out beforehand what time(s) meals are served during the flight.

## Before Boarding

Patients should have enough, or, if possible, more than enough, of all medications and diabetes supplies to last the entire trip (Table 1). This should include

**Table 1. What to Pack**

- Two blood glucose monitoring devices, with extra batteries, packed in separate bags
- Enough insulin, syringes, lancets, and test strips to last the entire trip
- For pump users, enough pump supplies for the entire trip, extra batteries, and supplies of long-acting insulin (ultralente or glargine) and regular or rapid-acting insulin analog (lispro or aspart) and syringes for use in case of pump malfunction or battery failure
- Prescription medicines (including a glucagon emergency kit), for diabetes and other medical conditions
- Simple carbohydrate sources, such as glucose tablets, gels, candy, and nondietetic soft drinks to relieve symptoms of hypoglycemia
- Complex carbohydrate sources, such as breakfast bars, cheese crackers, granola bars, and trail mix to serve as snacks when meals are missed or delayed
- Regular insulin or short-acting insulin analogs for treating high blood glucose and for sick-day management even if these are not part of the patient’s regular regimen
- Identification (diabetes identification card, Medic Alert necklace or bracelet)
- Insurance papers (Confirm before travel what medical coverage is available from the insurer in the event of a medical problem abroad.)
- Medications for vomiting and diarrhea
- A first aid kit, including analgesics, antibiotic and antifungal creams, bandages, sterile gauze, and adhesive tape

two blood glucose monitoring devices (packed in separate bags) with extra batteries; insulin lancets, test strips, and syringes; and, for insulin pump users, pump supplies, extra batteries, and insulin and syringes in case of pump failure.

All medications and supplies should be packed in carry-on luggage rather than in checked baggage. This is not only to prevent loss from bags being misplaced, but also because baggage stored in cargo holds can be subject to extreme temperature changes that may alter the potency of insulin.

The American Diabetes Association has published new air travel guidelines from the Federal Aviation Association (FAA). These guidelines, which cover U.S. travel only, are available online at <http://www.diabetes.org/main/type2/living/travel/default.jsp>. According to the updated FAA guidelines, boarding aircraft with syringes or insulin delivery systems is acceptable only if the insulin vials/pens/cartridges have a professional, preprinted pharmaceutical company label clearly identifying the medication. The FAA recommends that passengers bring the original insulin box, which usually displays label and pharmacy instructions. Boarding with lancets for blood glucose monitoring is acceptable as long as the lancets are capped and brought aboard with a glucose meter that has the manufacturer's name printed on it (i.e., "One Touch"). The FAA further recommends that passengers traveling with glucagon kits keep them intact in their original containers that bear preprinted pharmaceutical company labels. Although written prescriptions and letters from health care providers may be helpful once travelers reach their destinations, the FAA, because of forgery concerns, no longer accepts them as adequate proof of insulin necessity.

Insulin is stable under normal conditions at airport terminals and passenger security check points and when passing through X-ray machines that scan carry-on baggage. X-ray machines also should have no effect on currently available blood glucose monitoring devices and

insulin pumps. If there is any concern, passengers can request that their carry-on bags be hand-checked.

### On Board

#### Adjusting insulin injections and mealtimes while crossing time zones

Frequent blood glucose monitoring is essential for safety during flight. Even individuals who do not test frequently at home should test at least every 4–6 hours while traveling. Patients should be cautioned to keep themselves well hydrated with nonalcoholic, caffeine-free beverages throughout their flight.

Diabetes management is usually based on a normal 24-hour medication schedule. When traveling north or south, no adjustments in the 24-hour schedule are needed. However, east or west travel across time zones abbreviates or extends the day depending on the direction of travel.

In general, adjustments to insulin doses are unnecessary if patients are crossing fewer than five time zones. Traveling east will shorten one's day, and, in general, may necessitate a reduction in insulin (especially for shorter flights) because insulin doses would be administered closer than normal and thus could cause hypoglycemia. In contrast, westward travel means a longer day, and so insulin doses may need to be increased. However, this seemingly simple and workable rule of "westward = more insulin; eastward = less insulin" may not always hold true. Differing times of departure and prolonged flights may require a more complicated approach.

Patients who are not insulin pump users should be transferred to a "basal-bolus" insulin regimen before traveling if they are not on one already, because,

short of pump therapy, this is the ideal system to cope with all time zone travel situations. Changing to insulin glargine (Lantus) for basal insulin, with lispro (Humalog) or aspart (Novolog) coverage before each meal, would probably be the most flexible and effective regimen.

In general, patients should be advised to leave their wristwatches unadjusted during flight so that they continue to correspond to the time at their point of embarkation. This will make it easier for patients to judge the timing of their insulin injections and meals.

#### Advice for traveling east across five or more time zones

An example of an eastward-bound flight would be one from Los Angeles, Calif., to London, U.K., as shown in Table 2. The flight departs Los Angeles at 8:45 p.m., which is 4:45 a.m. London time. It arrives in London at 7:15 a.m. Los Angeles time, which is 3:15 p.m. London time. Total flight time is 10.5 hours.

**Scenario 1.** Assume that the patient taking this flight normally takes insulin (basal and rapid-acting) on a twice-daily schedule as follows: NPH plus regular insulin, 16 units and 10 units, respectively, before breakfast, and 10 units and 10 units, respectively, before dinner. Assuming that he will be served two meals and a snack (dinner shortly after takeoff, a mid-flight snack, and breakfast before landing), the following course can be recommended:

Before departure, he should take his usual evening dose of 10 units NPH plus 10 units regular. Keeping his wristwatch synchronized to Los Angeles time while in flight, about 11–12 hours later, he should take half of his usual morning dose of NPH (8 units) plus the full com-

**Table 2. Time Differences Between Departure and Destination Points on an Eastward-Bound Flight From Los Angeles, Calif., to London, U.K.**

	Los Angeles time	London time
Departure	8:45 p.m.	4:45 a.m.
Arrival	7:15 a.m.	3:15 p.m.

plement of regular insulin (10 units), followed by a meal (which, in this case, is likely to be breakfast). Because of the long duration of the flight, however, extra short-acting insulin may be necessary for meals or snacks consumed at times that are not similar to the patient's normal routine (e.g., the dinner and the mid-flight snack). That evening in London, just before dinner (London time), the remaining half of the usual morning dose of NPH insulin (8 units) plus the full complement of regular insulin (10 units) is taken.

Thus, the patient's total NPH insulin dose has not been altered, but rather has been split to help him adjust to the change in time zone. The next morning in London, on local time, the patient's pre-travel regimen can be resumed.

**Scenario 2.** Assume that the patient taking this flight is instead on a regimen of once-daily glargine (24 units at bedtime) with a premeal rapid-acting insulin analog (10 units lispro before each meal). An alternative would be to take the usual dose of glargine at the usual time, say 10:00 p.m. Los Angeles time (this would be on the flight). Twenty-four hours later (i.e., again around 10:00 p.m. Los Angeles time, which would be around 6:00 a.m. London time on the morning of the day after arrival), he can take half his usual glargine dose (12 units). That night at bedtime (London time) he can take the remaining half of his usual glargine dose (12 units), thus keeping the total 24-hour glargine dose the same. Premeal coverage using short-acting insulin would remain the same or be increased if he will be eating more than his usual amount or if there are more meals than usual. The pre-travel regimen of 24 units of glargine at bedtime can be resumed on the third night (second night in London).

For shorter stays, especially if patients are on glargine, it might be easier just to continue taking the insulin according to the usual time in Los Angeles, recognizing that this might involve some inconvenience. For example, the "bedtime dose" of glargine, normally

taken at around 10:00 p.m., would have to be taken at around 6:00 a.m. while in London.

#### **Advice for traveling west across five or more time zones**

An example of a westward-bound flight would be from New Jersey to Honolulu, Hawaii, as shown in Table 3. The flight departs New Jersey at 11:40 a.m., which is 6:40 a.m. in Honolulu. It arrives in Honolulu at 10:40 p.m. New Jersey time, which is 5:40 p.m. Honolulu time. Total flight time is 11 hours.

**Scenario 1.** If this is the same patient as in scenario 1 for eastward travel above, i.e., someone who normally takes insulin on a twice-daily schedule of 16 units NPH plus 10 units regular in the morning and 10 units NPH plus 10 units regular in the evening, the following course can be recommended:

He should take his usual morning dose (16 units NPH plus 10 units regular) in the morning before departure. Again, keeping his wristwatch synchronized to New Jersey time, about the time of his usual evening meal (i.e., about 10 hours after the morning dose of insulin), he should take half of his usual evening NPH plus the full complement of short-acting insulin (i.e., 5 units NPH plus 10 units regular), followed by a meal or snack. That evening at dinner (Honolulu time), he should take the remaining half of the intermediate-acting insulin along with his full dose of short-acting insulin (i.e., 5 units NPH plus 10 units regular). The next morning (local time), his usual insulin doses can be resumed.

**Scenario 2.** Assume, as in scenario 2 for eastward travel above, that the patient taking this flight is on a once-daily regimen of glargine (24 units at bedtime) with premeal rapid-acting insulin analog

(10 units lispro before each meal). The alternative would be to take his usual dose of glargine (24 units) the night before his departure. Twenty-four hours later, which in this case would be just before landing in Honolulu, he can take half of his usual dose (12 units). That night at bedtime (Honolulu time), he can take the remaining half of his usual bedtime dose of glargine (12 units). Again, the 24-hour glargine requirement would remain the same, but the dose would be split to help him adjust to the change in time zone. Premeal coverage with a rapid-acting insulin analog would also remain the same or, if more than the usual amount of food or number of meals are consumed, extra lispro could be given during the flight, based on carbohydrate content of the food to be consumed and blood glucose values.

#### **Advice for those who use insulin pumps**

Patients using insulin pumps can continue with their normal routine of basal and bolus doses, and they can change the time setting on their pump once reaching the destination. It may be safer to allow blood glucose levels to run slightly higher than normal for the first day or so rather than to risk hypoglycemia.

Patients on pumps should carry supplies of long-acting insulin (ultralente or glargine) and regular insulin or rapid-acting insulin analog (lispro or aspart), along with syringes and extra batteries to use in case of pump malfunction or battery failure. In such cases, patients should be instructed to administer a once-daily dose of glargine equivalent to the total 24-hour basal dose. If the patient has ultralente, the total dose (which is again equivalent to the total basal rate) should be split between the

**Table 3. Time Differences Between Departure and Destination Points on a Westward-Bound Flight From New Jersey to Honolulu, Hawaii**

	New Jersey time	Honolulu time
Departure	11:40 a.m.	6:40 a.m.
Arrival	10:40 p.m.	5:40 p.m.

morning and evening. All doses of short- or rapid-acting insulin should remain the same and should be given before each meal as usual.

#### **Advice for those on oral agents for diabetes**

The timing of oral medications for diabetes is not as crucial as that of insulin. If the patient is on a twice-daily regimen of metformin (Glucophage), a thiazolidinedione, or a sulfonylurea, for instance, it might be easier to skip a dose and have slight hyperglycemia for 6–8 hours rather than to take two doses too close together and risk becoming hypoglycemic. Patients on carbohydrate absorption inhibitors (i.e., acarbose [Precose]) or one of the newer nonsulfonylurea secretagogues such as repaglinide (Prandin) or nateglinide (Starlix) can continue their usual regimen of taking it before meals.

#### **Throughout the Trip**

Travel usually involves a drastic departure from daily routine. Meals may be delayed or unavailable, and physical activity is often greatly increased. These factors can greatly increase the risk of hypoglycemia.

Carrying suitable snacks, such as crackers, dried fruits, or nuts, to eat if meals are delayed or to supplement meals when necessary is especially important while traveling. Glucose tablets or gels should also be available in case of hypoglycemia, which may occur at unusual times. People with diabetes should advise their traveling companions about the signs of hypoglycemia and teach them how to use a glucagon kit.

Open insulin vials retain their potency at room temperature for at least 1 month, but in warm climates, insulin should be stored either in a refrigerator

or in thermal insulated bags or containers. If refrigerated, the insulin should be inspected before use for crystals, since crystallization can alter its potency.

Extreme temperatures and humidity can also affect glucose meters and test strips. Meters generally perform best within temperatures of 15–35°C (59–95°F). When a meter is to be used in extreme temperatures, most manufacturers recommend performing frequent quality-control checks using glucose solutions to ensure that the meter is maintaining its accuracy.

People with diabetes who travel also need to know that while “U-100” insulin and syringes are standard in the United States, many other countries still use “U-40” and “U-80” insulin and syringes. A U-100 syringe used to draw up U-40 or U-80 insulin will provide a smaller dose than is needed, whereas a U-40 or U-80 syringe used with U-100 insulin will provide a larger dose than is needed. Patients who must switch to a U-40 insulin preparation while abroad should know that they must also use U-40 syringes, because the syringes are calibrated to match the insulin preparation, or they should adjust the drawn up amount accordingly. For example if the patient is on 20 units of NPH, and if the only insulin available is U-40, he can use his U-100 syringe but should draw up 0.5 cc rather than 0.2 cc.

#### **Obtaining Medical Assistance Abroad**

The names of English-speaking physicians practicing in foreign countries can be obtained from the International Association for Medical Assistance to Travellers at [www.iamat.org](http://www.iamat.org). If people with diabetes experience a medical emergency while traveling and do not have that list, they can contact the nearest United States Embassy or local med-

ical schools for a list of English-speaking doctors.

#### **Summary**

Planning ahead for travel is especially important for people with diabetes. Pre-travel office visits give diabetes care providers an opportunity to review diabetes management with their traveling patients and to provide valuable information for blood glucose control during long flights. Such advice needs to be simple and individualized. Variations of the “westward = more insulin; eastward = less insulin” rule can be employed for adjusting insulin doses when patients are traveling across multiple time zones. With some simple precautions, people with diabetes and wanderlust can safely go wherever their hearts lead them.

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**Note of disclosure:** Dr. Edelman has received honoraria for speaking engagements from Eli Lilly and Co., Aventis, and Novo Nordisk Pharmaceuticals. These companies manufacture insulin and other products for the treatment of diabetes.