

***Saskatchewan  
Advanced  
Insulin Dose  
Adjustment  
Module***

November 2010



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## **INTRODUCTION**

Saskatchewan has had a basic insulin dose adjustment module since 2002 with the most recent update done in 2010. As a result of the last update a recommendation was made to the Provincial Diabetes Advisory Body to create an advanced module covering Insulin Dose Adjustment (IDA) for sick days; travelling across time zones and shift work. Other aspects of IDA are also considered 'advanced' and are not covered by this module: children with diabetes; insulin pumps; pregnancy in women with pre-existing diabetes (type 1 or type 2); gestational diabetes.

The basic module is available on the website of the Ministry of Health<sup>1</sup>. Health care providers who wish to use the advanced module should be familiar with the policies and procedures in the basic module.

## **PURPOSE**

The purpose of the advanced module is similar to the basic one: to facilitate and ensure:

- development and continuing competency for the Registered Nurse who meets the qualifications to adjust insulin in the special circumstances covered in this module
- promotion of client safety, self-care management and/or enhancing the quality of life for people with diabetes
- achievement of optimal blood glucose control, or as close as possible, in special circumstances

As with basic IDA, the advanced module is a template which will require review and, as needed, customizing of the policy and procedures by each Health Region. The Transfer of Medical Function is a Region-specific process. There are several options for the actual process. Registered Nurses and physicians in each Region must agree and be comfortable with the parameters which are region specific.

## **HOW TO USE THE TEMPLATE**

The purpose of the template is to provide guidance for Health Regions and other health care organizations to have the Registered Nurse, who meets the required competencies, adjust insulin doses for sick day management; travel across time zones or for shift work.

The following steps are helpful in applying the template:

### 1. Review the full module

The module includes the policy template, guidelines for each of the three topics and the practice cases. As these are a guide, you may have to customize either the policy and/or the procedures to suit the particular organizational policies and/or client needs.

For example, an organization may decide to exclude one or more of the components of the advanced module from the Transfer of Medical Function.

### 2. Write the policy as it applies to the organization. If you are not familiar with the policies and procedures for a Transfer of Function within the organization, consult within the Nursing and/or

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<sup>1</sup> <http://www.health.gov.sk.ca/diabetes-info> cited 25August2010

Medical Departments for advice. Most health organizations will have guidelines for obtaining the Transfer of Function through a Medical Advisory Committee or a similar process.

3. Implement a process for the Registered Nurse to learn about the advanced IDA components. The Registered Nurse must demonstrate competency to perform advanced IDA. To learn more about IDA a Registered Nurse may do all or some of the following:
  - a. Review the procedures and references. The procedures are written to provide guidelines and to serve as a study guide. The Registered Nurse will need to read several of the references as well as the information in the procedures. In some cases, as the references are very detailed, only a summary is provided within the procedures section. To have the appropriate degree of understanding and skill necessary to achieve the advanced competencies IDA, more detailed reading will be necessary.
  - b. Consult with others. For some of the competencies there are no research studies and limited references in the literature. A Registered Nurse may choose to 'mentor' with another Registered Nurse or Physician who has experience with any of the three components.
  - c. Complete the practice cases. The answers are found at the end of module. If you are unsure about an area, talk with Registered Nurses who are already practicing with a delegated medical function for IDA and/or your local physicians.
  - d. Attend a provincial workshop on IDA when it is available. When a workshop is held, there will be details on the website for the Ministry of Health.

### **Implement a process for the Registered Nurse to demonstrate competency in advanced IDA**

There are two steps to demonstrate competency as part of the provincial template:

1. Write and successfully pass the provincial exam. The exam can be obtained from Primary Health Services Branch, Saskatchewan Health and is issued by the Branch and written in a supervised situation. The completed exam is returned to the Branch, marked and the results are sent to the candidate. A pass mark is 80%. Successful candidates will receive written documentation to use as part of their Transfer process.
2. Complete physician-supervised cases. The successful delegation of a medical function requires a good working relationship between the Registered Nurse and the physician(s) who participates. The Registered Nurse and physician(s) need to feel confident that clients with diabetes will receive optimal diabetes management in the three advanced components.

Therefore, the provincial template suggests that the Registered Nurse be supervised by a physician before obtaining the Transfer of Function. Ideally the cases will represent a diversity of client situations which are likely to be encountered in practice. Through this practice supervision, the physician will be able to ensure the Registered Nurse demonstrates the required competencies.

The supervising physician may be an endocrinologist, an internist or a family physician with an interest in diabetes management and a willingness to provide the supervision.

Sign and Implement the Transfer of Function. A sample signature form for Transfer of Medical Function is provided in the policy template.

Each organization will need to decide on the best implementation method to meet the needs of the Registered Nurse, the physician and the person with diabetes. In each situation below, the policy template was adapted to reflect the method chosen.

Examples of implementation include:

- The Diabetes Program has a Medical Director who provides the case supervision for the Registered Nurse. The Director signs the competency sheet and the Transfer of Medical Function is authorized for all physicians in the Region. Physicians have the choice to “opt out” of the Transfer of Medical Function and may state that they do not wish to have the Registered Nurse provide the IDA service for their clients.
- The Diabetes Program may not have a Medical Director. A physician with an interest in diabetes management is asked to provide the supervision for the Registered Nurse. This physician signs the competency sheet to complete the Transfer of Function. The Registered Nurse then approaches individual physicians or physician group practices, explains the policy and procedures and requests their signatures for participation in the IDA service.

Establish a policy for annual demonstration of competency. The competency performance checklist should be signed annually to ensure continuing competency. Ideally, the signing physician will be familiar with the practice of the Registered Nurse in IDA.

There are several options to ensure continuing competency:

- A physician who is very familiar with the Registered Nurse's practice can complete the performance checklist based on ongoing and regular review over the year.
- A physician could complete a chart audit of 3-5 recent cases where the Registered Nurse was adjusting insulin for the advanced components
- A physician could provide practice supervision similar to the initial competency assessment.

**RESOURCE PERSONNEL**

The following are Registered Nurses and/or Managers who have experience with the Transfer of Medical Function and the advanced competencies and are willing to talk with others who need support or mentoring.

	Email	Telephone	Available as a resource for the following:		
			Travel	Shift Work	Sick Day Mgt.
Linda Bachiu, Nurse Clinician	linda.bachiu@saskatoonhealthregion.ca	655-1571		x	
Jone Barry, Nurse Practitioner	jbarry@communityclinic.sk.ca	652 0300			x
Connie Brausse, Diabetes Nurse Educator	connie.brausse@pnrha.ca	820-6096	x	x	x
Marlene Deobald, Diabetes Nurse Educator	marlene.deobald@cypressrha.ca	778-9489		x	x
Dona Dixon, Nurse Clinician	dona.dixon@saskatoonhealthregion.ca	655-7406	x	x	x
Nola Kornder, Nurse Clinician	nola.kornder@saskatoonhealthregion.ca	655-2147	x	x	x
Charlene Obrigewitsch, Diabetes Nurse Educator	charlene.obrigewitsch@rqhealth.ca	766-3776	x	x	x

**For more information about the advanced provincial template or to apply for the advanced IDA exam, contact:**

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Primary Health Services Branch  
Saskatchewan Health  
3475 Albert Street  
Regina SK S4S 6X6

Ph: 787-0886  
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## **POLICY FOR TRANSFER OF MEDICAL FUNCTION FOR ADVANCED INSULIN DOSE ADJUSTMENT (IDA)**

### **PURPOSE**

A Registered Nurse, who has demonstrated advanced competence to adjust insulin doses, may make changes to insulin doses and assist clients to make their own changes for sick day management; travel across time zones or shift work. Insulin doses will be adjusted for the purposes of optimizing blood glucose control, promoting self-care management and/or enhancing safety and quality of life.

### **PERSONNEL**

A Registered Nurse who meets the criteria and demonstrates advanced competency in IDA is eligible to obtain the Transfer of Medical Function.

### **POLICIES**

Adjustment of insulin dosages may be done by a Registered Nurse who demonstrates advanced competency and has completed all the requirements and obtained the basic Transfer of Function. Extensive experience in educating clients in diabetes self-care and demonstrated competence for adjusting insulin dosages are prerequisites. See Appendix B for a detailed overview of RN competencies for the advanced Transfer of Function.

Transfer of Function may be granted for Nurses to provide advanced insulin dose adjustment which is confined to sick day management; travel across time zones and shift work. With additional training and experience, appropriate Registered Nurses may obtain an advanced Transfer of Function in other clinical aspects of IDA<sup>2</sup>, but these are not covered by this policy.

#### Experience

To obtain the advanced Transfer of Function covered by this policy, a Registered Nurse must have obtained the basic Transfer of Function according to the Health Region or organizational policy and have a minimum of 6 months of practice with the basic Transfer<sup>3</sup>.

To be prepared to write the advanced provincial exam, obtain the Transfer of Function and implement it, Registered Nurses need to master several competencies. These are detailed in Appendix B.

#### Advanced Transfer of Medical Function

The delegation of medical function will apply to IDA for adults, with either type 1 or type 2 diabetes for:

- sick day management which can be handled in the community and does not require hospital admission; travel across two or more time zones; shift work; and
- any insulin schedule including intensive therapy/multiple injections.

#### Maintenance of Transfer of Function

Maintenance of the Transfer will be completed annually by the Registered Nurse.

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<sup>2</sup> Diabetes in children; pre-existing diabetes in pregnancy (type 1 or type 2); gestational diabetes and insulin pump management.

<sup>3</sup> This is a general recommendation and will need to be reviewed by each Health Region in development of their own policy

### Physician-Registered Nurse Collaboration

- The Physician retains responsibility for the insulin schedule that is ultimately selected – initial dose (amount, type of insulin, timing) and any subsequent adjustments to insulin type and/or timing; for example, moving an insulin dose from supper to bedtime or switching from a pre-mixed to short and intermediate-acting insulins.
- The Registered Nurse, Physician and client will collaborate to establish the appropriateness for both Registered Nurse involvement and client participation in IDA.
- The Registered Nurse and Physician will collaborate on a regular basis to ensure that the client is receiving optimal insulin doses.

### Conditions – Registered Nurses and Physicians

This procedure will only be considered for specific clients referred by a Physician who is willing to be available to provide ongoing advice and support to the Registered Nurse. Both parties must mutually agree to this.

Neither a Physician nor a Registered Nurse will be obliged to participate in this particular delegation of a medical function unless there is mutual agreement.

A Registered Nurse and Physician(s) who wish to use this Advanced Transfer of Medical Function will sign an agreement to indicate their mutual willingness to participate in all the responsibilities of the delegation of the medical function.<sup>4</sup>

When a medical function has been delegated and accepted by Nursing, the Registered Nurse is responsible and accountable for competent performance.

The Advanced Transfer of Medical Function is applied only with clients whom the Registered Nurse assesses, teaches and reviews directly. The delegation of this medical function does not include the Registered Nurse doing IDA for other health care providers such as Home Care Nurses, Dietitians, Pharmacists, etc.

Insulin doses will be changed according to the IDA guidelines. There will be appropriate resources to facilitate client learning.

The Registered Nurse will continuously assess a client's metabolic status and refer a client to their physician in all situations that are beyond their scope of practice, and/or situations where the clients' metabolic control is deteriorating despite adjustments made to the insulin or other components of the treatment plan.

If the client is seen for periodic follow-up or returns to the Diabetes Education Program, the Registered Nurse may continue to guide the client who requires ongoing interventions to maintain blood glucose control with agreed periodic contact with the physician of record.

If the client does not demonstrate the potential for, or interest in safe self-adjustment of insulin, the attending Physician will resume responsibility for the client's insulin dosage.

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<sup>4</sup> A sample form is provided in the Policy Appendix A. The Registered Nurse and Physician signatures mean the Transfer applies to all the appropriate clients as designated in the Health Region Policy

It is understood by all parties that the Registered Nurse will only be available to support clients in IDA during regular working hours [insert Region schedule].

#### Conditions – Clients

The policy applies to clients who are living independently in the community and do not reside in an acute care setting or long term care facility.

To receive education about IDA and/or support in actually making the adjustments, clients will meet the following conditions:

- Able and willing to frequently monitor blood glucose, record and report the results.
- Able and willing to contact the Registered Nurse on a regular basis for assistance and further education regarding IDA.
- Not acutely or severely ill (examples: immediately post-op, end stage renal disease).
- Demonstrate an interest in improving control and having regular follow-up.
- Has had a consultation with a Dietitian and has a suitable nutrition strategy to support IDA.

#### Client Assessment

In the procedures for each advanced component, detailed information is provided for client assessment.

#### Precautions

There is a potential for hypoglycemia or hyperglycemia when adjusting insulin doses.

#### Documentation and Reporting

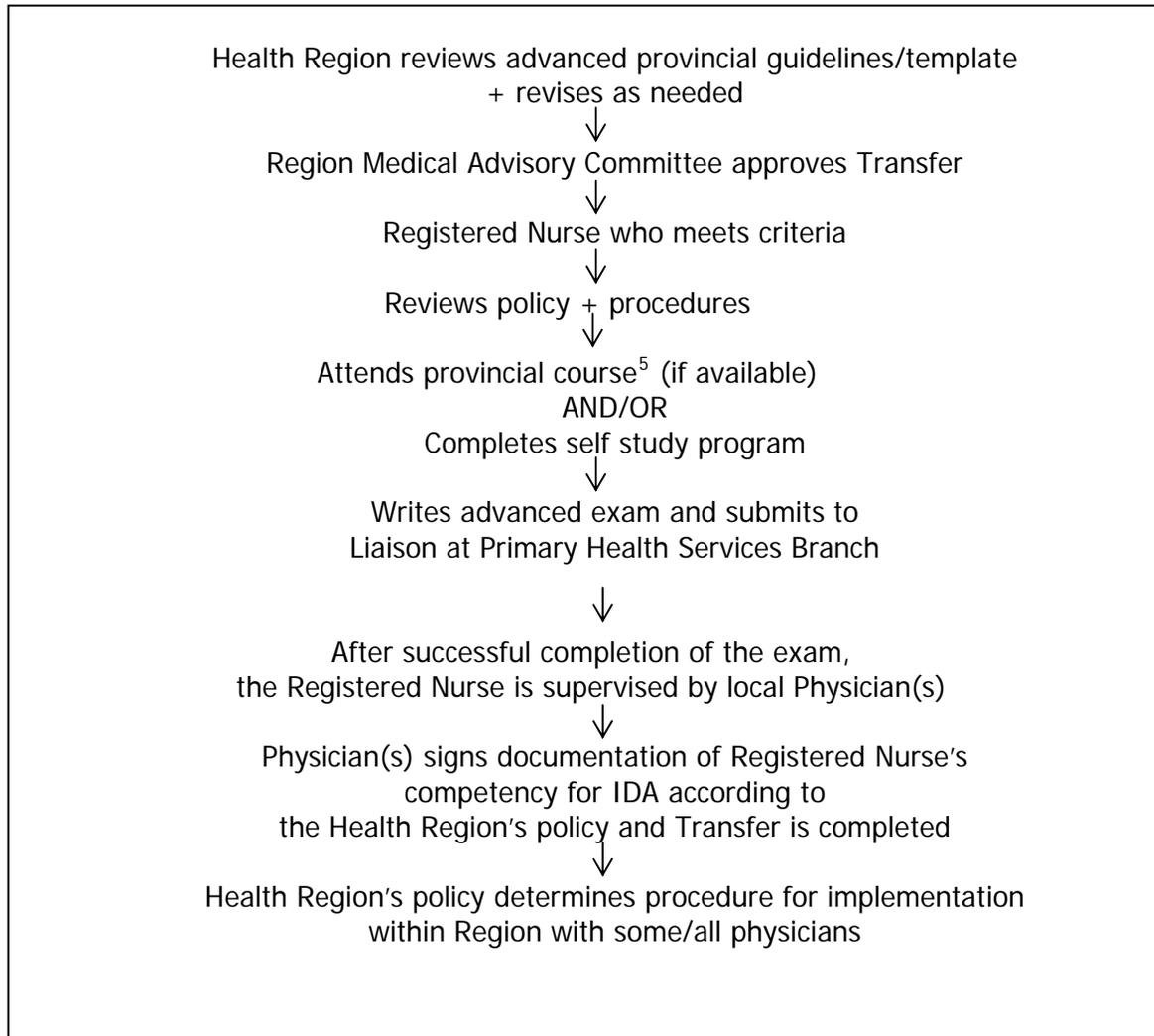
A detailed note will be written for each client's outpatient visit. This will contain relevant data, assessment and plan including the specific recommendations for sick day management, travel or shift work. A copy of the note will be sent to the client's physician.

If the client's visits are frequent and close together, as a minimum, a summary letter will be written monthly and sent to the client's physician.

## **PROCEDURES**

### Transfer of Medical Function

The following diagram outlines the process to achieve a Transfer of Medical Function.



### **Procedures for Adjusting Insulin Doses**

A Registered Nurse practicing an advanced delegated medical function to adjust insulin doses will follow the procedures outlined in the Saskatchewan Advanced Insulin Dose Adjustment Module. If the procedures are amended by the Health Region, changes will be documented in the Module.

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<sup>5</sup> Registered Nurses are encouraged to invite a physician to attend with them

**APPENDIX A - SAMPLE PHYSICIAN/REGISTERED NURSE SIGNATURE SHEET**

The following is a SAMPLE sheet which may be used within a Health Region for the Registered Nurse and Physician(s) to sign once the Registered Nurse has successfully demonstrated the advanced competencies for IDA.

\_\_\_\_\_ HEALTH REGION

**PHYSICIAN/REGISTERED NURSE SIGNATURE SHEET**

**TRANSFER OF FUNCTION  
ADVANCED INSULIN DOSE ADJUSTMENT<sup>6</sup>**

\_\_\_\_\_ has achieved advanced competency to adjust insulin for clients  
[Name of Registered Nurse]

with diabetes according to policy \_\_\_\_\_. We have read the Health Region policy for advanced  
insulin dose adjustment and agree to the conditions outlined in the policy.

Signed: \_\_\_\_\_ Physician

Signed: \_\_\_\_\_ Diabetes Nurse Educator

Date: \_\_\_\_\_

<sup>6</sup> This form can be customized to cover all advanced procedures or selected ones depending on the scope of the delegated function

**APPENDIX B - COMPETENCY PERFORMANCE CHECKLIST**

Registered Nurse: \_\_\_\_\_

	<b>PERFORMANCE CRITERIA</b>	<b>OBSERVED</b>	<b>NOT OBSERVED</b>	<b>COMMENTS</b>
<b>GENERAL COMPETENCY</b>				
1	Demonstrates full competence and is confident with basic insulin dose adjustment and has at least 6 months experience after obtaining the basic transfer of function.			
<b>TRAVEL ACROSS TIME ZONES</b>				
1	Identifies variables in diabetes management and client capacity which may affect IDA for travel.			
2	Identifies variables in the client's travel plan which will influence IDA.			
3	Using recognized principles and guidelines creates a client specific travel plan.			
4	Provides client education about the travel plan and other travel resources.			
5	Makes appropriate referrals, as needed related to travel (for example; dietitian, physician, travel clinic).			
<b>SHIFT WORK</b>				
1	Identifies variables in diabetes management and client capacity which may affect IDA for shift work.			
2	Identifies variables in the client's shift work pattern which will influence IDA.			
3	Using recognized principles and guidelines, can create a client-specific plan for shift work + counsels client re the benefits of MDI.			
4	Provides client education about the shift work management.			

	<b>PERFORMANCE CRITERIA</b>	<b>OBSERVED</b>	<b>NOT OBSERVED</b>	<b>COMMENTS</b>
5	Makes appropriate referrals, as needed related to shift work (for example; dietitian, physician).			
6	Describes client advocacy issues for safety with shift work.			
<b>SICK DAY MANAGEMENT</b>				
1	Able to rapidly assess client situation for home management versus emergency room visit/ hospital admission.			
2	Identifies variables in diabetes management and client capacity which may affect IDA for home management of sick days.			
3	Using recognized principles and guidelines can create a client-specific plan for sick day management.			
4	Identifies circumstances requiring client follow up and identifies need for medical follow-up or management.			
5	Identifies situations which require referral to medical care or hospital or are not suitable for IDA by RN.			
6	Identifies the need for client follow up post acute illness for continuing education + preparation for self management during an illness in the future.			

## **INSULIN DOSE ADJUSTMENT FOR TRAVEL**

### Learning Objectives

1. To state the principles for IDA to be considered when creating an individualized client plan for travel with more than two hours time change.
2. To demonstrate application of the principles of IDA in selected case scenarios

### Required Registered Nurse Competencies

See page 14. Review the competencies, complete a self assessment and identify learning needs for IDA for travel prior to beginning this section of the learning module.

### Principles for Adjusting Insulin for Travel

#### 1. Assessment:

Usual diabetes care practices:

- a. What is the current insulin regime and schedule eg multiple dose insulin (MDI) versus pre-mixed insulin?
- b. What is the usual pattern of blood glucose across the day (frequency and timing of blood glucose monitoring)?
- c. What is the usual pattern of meals/snack times
- d. What method of carbohydrate (CHO) management does the client practice eg carbohydrate consistency or use of an insulin to CHO ratio? What is the client's understanding and use of the method?
- e. What is the current frequency and timing of hypoglycemia? Does the client have hypoglycemia unawareness?
- f. What is the client's ability to problem solve unexpected changes in the travel and insulin adjustment plan? Will a support person be involved?

Travel Plan:

- a. What is the travel itinerary? - departure and arrival times, duration of flights and the time lost/gained between departure and arrival centers; meals provided onboard
- b. What is the client's plan for timing of eating and sleeping during travel?
- c. Does the client know what he/she should include in his/her carry-on baggage eg enough insulin, meter and supplies to last the entire trip (include extra).
- d. What type of food/snacks and sources of glucose is the client planning to pack in his/her carry-on baggage eg complex carbohydrates and protein snacks, glucose tablets?
- e. What is the usual food in the client's destination; will assistance be needed to learn new CHO information for unfamiliar foods?
- f. Does the client have past experience using IDA for travel? What worked well and what were the challenges?

Other Aspects of Travelling:

- a. Does the client have travel/health insurance and familiarity with the coverage when outside Canada? Does the client carry diabetes identification?
- b. Does the client know how to access medical assistance when travelling?

- c. Has the client attended a travel clinic or doctor's office to review and obtain necessary vaccinations?
- d. Is the client familiar with any current travel restrictions or rules/regulations with the airline(s) or foreign countries eg carry-on baggage restrictions? Does the client have or need a letter of proof from the physician or have insulin/ medication pharmaceutically labeled?

2. Creating the Insulin Dose Adjustment (IDA) plan for travel:

- a. Request client bring a detailed travel itinerary that includes departure and arrival times of all flights, including connections. In addition, it will be helpful to know which meals, if any, are provided on flights and the approximate time they will be served.
- b. Prior to giving client travel guidelines, request, if possible, daily blood glucose monitoring and recording for at least 3 days pre-visit. This will help to determine the usual patterns
- c. Travel north and south does not usually require any change to the insulin regime. Westward travel means a longer day and may require more insulin and eastward travel means a shorter day which may require less insulin.
- d. When creating the travel plan ensure that those with type 1 diabetes have 24-hour basal insulin coverage. At times, extra rapid or short-acting insulin may be needed both to correct hyperglycemia, but also because of a longer than usual gap between basal insulin injection times. Depending on the flight schedule, the basal insulin dose(s) may also need adjustment. This may mean more or less of a usual basal dose or even the addition of an extra dose of basal insulin to ensure 24 hour coverage.  
People with type 2 diabetes and using insulin will usually be able to tolerate a small gap in the usual time between basal insulin injections, but they too may benefit from additional rapid or short-acting insulin.
- e. The goal is to switch to the local time at the destination as quickly as possible on arrival.
- f. **On travel day(s), leave watch on the time at the departure location until the final destination is reached. IDA may be needed in transit to account for changes in meals and/or activity. On arrival at the destination, an IDA may be needed when converting to local time, to account for the time change (hours lost or gained) and to avoid hypoglycemia or hyperglycemia.**
- g. IDA for travel includes suggestions not rules, adaptations may be necessary. Less than optimum diabetes control may occur during travel, but it is advised to err on the side of hyperglycemia rather than risk hypoglycemia.
- h. In creating the travel plan the RN will need to consider the client's capacity and confidence in making insulin dose adjustments, problem solving and current insulin regimen. If a change in insulin type is considered, the client may need to check out his/her insurance coverage. Some policies are affected if there is a medication change in the months prior to departure.

3. Key Principles:

Each travel plan will need to be individualized for the person with diabetes and many details of the plan are dependent on the client's understanding and skills in managing diabetes.

In preparing a plan there are some key principles to keep in mind.

- a. Create a time line for the client to follow, plotting the times using the actual time at the departure location and continuing in that time zone for all times on the left hand side. Convert to local time for the arrival time at the destination on the right hand side of the

table. This will allow maintenance of the usual pattern of insulin and meals throughout travel until the destination is reached.

The following grid may be useful and is used in the case examples in the module.

**Template Travel Timeline Example:**

Departure						Destination	
Date	Time	Itinerary	Comments		Date	Time	

- b. The possibility of hypoglycemia during travel needs to be discussed with the client. Encourage the client to test prior to treatment to confirm hypoglycemia if signs/symptoms are experienced.
- c. An increased frequency of blood glucose monitoring will be needed during travel. At a minimum, suggest the client test prior to each injection of insulin and do some follow-up testing to determine the effectiveness of an insulin change. Extra testing may also be needed in the 24-48 hours after converting to local time at the destination.
- d. Unforeseen changes can impact travel plans. Travel can be stressful, delays and cancellations can occur, so the client should know how to make adjustments to the travel plan. The client may have unexpected activity due to the distances from one gate to another in airports. Timing of meals and the ability to get food may be unpredictable. Ensure the client has a plan for regular food intake and carries appropriate carbohydrate for meals, snacks, treating hypoglycemia and managing increased activity.

See page 29 for travel resources with more information for client education about travel.

- e. The client should have in carry-on luggage: insulin and injection supplies, meter and testing supplies, food and treatment for hypoglycemia. During travel the client should be prepared to do frequent blood glucose testing to make any necessary adjustments to the regime to prevent hypoglycemia or hyperglycemia.
- f. If the client is on more than a once daily injection of basal insulin, it is suggested the timing of the doses be approximately 10-12 hours apart. The long-acting basal analogue insulins (Lantus and Levemir) may not require adjustment based on the time action and lack of a peak action time. If the client is on a once daily long-acting basal insulin, particularly for those with type 1 diabetes, an extra dose of basal insulin may be needed to ensure 24 hour basal insulin coverage.

- g. It may be practical and safer to use short/rapid insulin to correct elevated blood glucose. Rapid acting insulin can be given every 3-4 hours and short-acting every 4-6 hours. The extra insulin may be added to the usual dose or taken as an additional injection. Base the amount of extra short/rapid acting insulin on what the client currently uses to correct an elevated blood glucose reading.

If the use of rapid or short-acting insulin is not usual for the client, advise the client to check his/her insurance to find the effect, if any, on insurance coverage.

Although standard formulas<sup>7</sup> (see section below) to increase or decrease basal insulin are provided, they need to be assessed for each individual client situation and especially for crossing the international dateline.

- h. Number of times zones crossed is not the same as the travel time. For instance, the time in Sydney, Australia is 16 hours ahead of Saskatchewan (central time), but the number of times zones crossed, if traveling west, is 8.

### Eastward Travel Across Times Zones

- a. The day will be shorter, therefore less intermediate or long-acting basal insulin may be required
- b. If two injections of basal insulin are taken per day, a dose(s) may need to be reduced for the travel day depending on the specific circumstances.
- c. If one injection of basal insulin is used per day, depending on flight schedules, it may be necessary to add a second basal insulin injection when converting to local time and to ensure 24-hour basal insulin coverage. The formula below could be used to calculate the amount of the extra basal insulin dose.
- d. Depending on the travel itinerary, it may be safer to make minor time adjustments in the basal insulin and use short/rapid insulin to correct elevated blood glucose readings.
- e. The following is an example of a formula that has been used over many years. It may not work in every type of travel or insulin schedule. The Registered Nurse will need to consider the applicability of the formula to each client and each travel scenario.

*East ward travel formula:*

$$\text{Usual basal insulin dose minus } \left[ \frac{(\text{usual dose}) \times (\# \text{ hours lost})}{24} \right] = \text{New dose}$$

When travelling east, the 24 hour day is shorter (hours lost) so there is a risk of overlap of

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<sup>7</sup> Building Competency in Diabetes Education: Advancing Practice, Canadian Diabetes Association. Toronto, Ontario:CDA;2009, pages 2-70 to 2-74 and Insulin Dose Adjustment Policies & Guidelines Manual, Diabetes Care Program of Nova Scotia (revised, December, 2005), pages 40-43.

between the basal insulins, so a dose may need to be reduced after arrival at the destination and converting to local time.

For example: to reduce the evening dose of NPH with a usual dose of 30 units at 10 pm if the number of hours lost is 7:

$$30 \text{ units (usual dose) MINUS } \left[ (30) \times \frac{(7)}{24} \right] = 21 \text{ units as the new dose}$$

- Number of hours lost across time zones divided by 24 is  $7/24 = 0.29$
- $30 \text{ units} \times 0.29 = 8.76$ , round up to 9 units insulin reduction

### Westward Travel Across Time Zones

The day will be longer, therefore there may be a gap between the injections of basal insulin. There are options for insulin coverage for the 'longer' day and each is described below in detail. The options are also illustrated in the examples with the pros and cons of each option provided in the explanation section.

*West ward travel formula:*

For many years the formula provided below has been used to assist with IDA for travel. This is a less than ideal method as the increase in basal insulin may be significant and while the efficacy at the peak is increased for intermediate acting insulin, the length of time action of the insulin will be only minimally affected.

So although the formula is presented, option 2, the addition of extra rapid or short-acting insulin to correct a high blood glucose is preferred and often safer.

#### OPTION #1

$$\text{Usual basal insulin dose plus } \left[ (\text{usual dose}) \times \frac{(\# \text{ hours gained})}{24} \right] = \text{New dose}$$

When travelling west, a "day" may be longer than 24 hours because of the hours gained. So there may be a need for additional basal insulin to cover the additional hours.

For example: to increase the evening dose of NPH with a usual dose of 40 units at 10 pm and 4 hours gained (time zones crossed - 4)

$$40 \text{ units (usual dose) PLUS } \left[ (40) \times \frac{(4)}{24} \right] = 47$$

- Number of hours gained across time zones divided by 24 is  $(4/24) = 0.167$
- $40 \text{ units} \times 0.167 = 6.68$ , round up to 7 units additional insulin

## OPTION #2

If the client is used to making his/her own insulin adjustments to correct a high blood glucose then follow the insulin correction factor which the client usually applies. Review the travel scenario and where the extra short or rapid-acting insulin may be needed.

If the client is not used to using additional short or rapid-acting insulin, he/she will likely need a detailed guide perhaps with a grid to follow.

One reference suggests the extra insulin only be given if the blood glucose is above 11 mmol/L<sup>8</sup>. The RN will need to consider the client's capacity and confidence in making recommendations on the details of an insulin grid. More detail about creating insulin corrections factors and grids is described in the Saskatchewan basic IDA module.

### Examples of IDA for Eastward and Westward Travel

The following section provides case examples for both east and west ward travel. Several are provided to illustrate the application of the principles with different insulin regimens. In addition, there are also examples where the international dateline is crossed. The later are more complex.

The focus of the cases is the insulin dose adjustment. As the clinician works with the client consider preferences for meals, snacks, sleeping patterns, experience with long distance travel and potential to handle emergencies such as hypoglycemia or an acute illness. Involve a support person in the discussions, if possible.

**NOTE:** In the examples, for the sake of brevity, not all possible times to test blood glucose are indicated. The detail of the travel plan will depend on the learning needs and problem solving ability of the individual client.

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<sup>8</sup> Diabetes Care Program of Nova Scotia, December 2005, page 42.

**Travelling East:**

EXAMPLE - Adjusting for one or two injections a day of Intermediate or Long-acting Basal Insulin Analogue

Travel: Jen is travelling from Regina to London England (7 hours lost while travelling). She travels to Toronto and changes planes.

Insulin: Breakfast: Novolin NPH 20 units at 8am  
Evening: Novolin NPH 35 units at 10pm

Departure Regina				Destination London	
Date	Time	Itinerary	Comments	Date	Time
Jun 1	8:00 am		Take usual breakfast Novolin NPH 20 units		
	2:00 pm	Leave Regina	Have lunch pre-departure		
	5:00 pm	Arrive Toronto	Have supper (if time permits) or snack in airport		
	6:25 pm	Leave Toronto	If supper not taken in airport she should eat on the plane		
	8:00 pm		Take Novolin NPH 35 units, evening dose (take early)		
Jun 2	1:35 am	Arrive London	Switch to London time	Jun 2	8:35 am
			Check blood glucose, eat breakfast, reduce the dose of usual breakfast insulin to Novolin NPH14 units OR omit the dose		10:00 am
			Take Novolin NPH 35 units, evening dose		10:00 pm
			Resume usual insulin schedule	Jun 3	8:00 am

Explanation:

As she will be losing hours when traveling, Jen could take her evening Novolin NPH earlier than usual, about 8 p.m. (12 hours since her morning dose). When she arrives in London, it will be 5.5 hours since the insulin dose. Once she gets her luggage, goes through customs and gets settled, likely another 2 hours will pass. She could then take a reduced dose for the morning Novolin NPH to reduce the overlap with the previous injection. The suggested dose is based on using the travel east formula. It would be advisable for her to test her blood glucose pre-injection.

If, for some reason she has a lower blood glucose reading or feels unsafe, she could omit the morning insulin dose. If she chooses this option, she may consider taking her evening dose of Novolin NPH at 8 p.m. (a bit earlier than usual).

She can then get back onto her usual regime the next morning, June 3<sup>rd</sup>, London time.

Note: some clients may be familiar with using short/rapid insulin to correct high blood glucose readings and could incorporate this insulin adjustment for travel.

**EXAMPLE - Insulin Dose Adjustment for MDI or BID Rapid/Short-acting and Long acting Basal insulin analogue/Intermediate Insulin**

Travel:

Trevor is travelling from Sydney Australia to Regina and his flight plan takes him through Vancouver. There is a 16 hour time difference between Regina and Sydney, and he will cross over the international dateline and will lose a day. Crossing the date line, will move the date back by 24 hours but the actual times zones crossed is 8. The approximate flight time from Sydney to Vancouver is 14 hours.

Insulin (Humulin)

Breakfast: 18 units N, 6 units R	Supper: 10 units R	Evening: 32 units N (10pm)
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Departure Sydney				Destination Regina	
Date	Time	Itinerary	Comments	Date	Time
Jun 22	8:00 am		Usual breakfast insulin doses		
	10:25 am	Leave Sydney		Jun 21	6:25 pm
	12:00 pm noon		Noon Lunch on plane		
	5-6:00 pm		Supper R10 when meal is served		
	8:00 pm		Evening N32 (dose taken early)	Jun 22	4:00 am
Jun23	12:30 am	Arrive Vancouver			
	1:50 am	Leave Vancouver			
	3:40 am	Arrive Regina	Switch to Saskatchewan time		11:40 am
			At next meal, take reduced breakfast dose, N12 units plus R, if needed to correct a high blood glucose		1:00 p.m.
			Return to usual supper insulin dose and meal		5-6 pm

Explanation:

Trevor's day will be shorter on June 22<sup>nd</sup> (arrival date) and it will be safest for him to reduce the morning N insulin when he arrives home, switches to local time and eats a meal. It will be 8+ hours since he last took insulin. When he took insulin at 8 p.m. on June 22<sup>nd</sup> (departure time) it was 0400 hours, June 22<sup>nd</sup> at his destination time (8 hours time difference).

This reduced dose (see calculation below) will cover the time gap between the last travel dose of Humulin N and his regular bedtime Humulin N. He will take the evening Humulin N at his usual Regina time of ~ 10 p.m. He may also need to adjust the dose of Humulin R based on his meals and the need to correct a high blood glucose reading or reduce due to risk of hypoglycemia.

Calculation to account for time lost:

$$\text{Usual basal insulin dose minus } \left[ (\text{usual dose}) \times \frac{(\# \text{ hours lost})}{24} \right] = \text{New dose}$$

$$\begin{array}{l} \text{Humulin N 18 (usual dose)} \\ \text{Morning dose} \end{array} \text{ MINUS } \left[ \frac{18 \times (8)}{24} \right] = 12 \text{ units}$$

- o Number of hours lost across time zones divided by 24 is (8/24) = 0.33
- o Usual morning dose of Humulin N 18 units x 0.33 = 5.9, round to 6 units

**EXAMPLE:** Insulin Dose Adjustment for Pre-Mix Insulin: 30/70, Mix 25, Mix 50, Novo mix 30

Travel:

Alicia is travelling from Regina to Frankfurt Germany (8 hours lost). Her flight leaves at 6:25 am Regina time.

Insulin:

Novolin 30/70 insulin, 22 units before breakfast and 44 units before supper

Timeline:

Departure Regina				Destination Frankfurt	
Date	Time	Itinerary	Comments	Date	Time
Jun 1			Usual 30/70 dose 22 units w breakfast on the plane or at home		
	6:25 am	Leave Regina		Jun 1	2:25 pm
	1:15 pm	Arrive Toronto	Will need some lunch, either brings her own food or has a small snack on the plane and eats lunch when she arrives in Toronto		
	3:30 pm	Leave Toronto			
	5:30 - 6:30 pm		Take usual supper dose 44 units (30/70). A meal should be served on an international flight, but should check and she could take her supper insulin when served.	Jun 2	
	11:00 pm	Arrive Frankfurt	Change to local time. When the next meal is eaten ~ 9 a.m. destination time, take a reduced breakfast insulin dose of 15 units OR omit usual breakfast dose of insulin		7:00 am
			Take insulin, 44 units, and an early supper on local Frankfurt time if insulin was omitted in the morning or at usual time if insulin was taken		4:00 pm

Explanation:

Alicia is leaving early in the morning and will need to be at the airport early. She will either need to eat breakfast at the airport, or take some food with her to eat at the airport, but she should give her morning dose of insulin with food. She would not want to take her insulin too early the morning of departure as she might risk overlap from the evening before and be at risk of hypoglycemia.

She will arrive in Frankfurt at 7am but it will be only 11:00pm at the departure time. It will be only 5 ½ hours since she took her supper dose of insulin. She will be tired and want to get settled and probably rest. She will have the option of eating a breakfast once settled and taking a reduced dose of insulin calculated using the eastward travel formula. Or, it may be safer to omit this dose and eat an early supper and take her usual supper insulin and then resume her usual schedule.

If she was capable of making corrections for high blood glucose using short/rapid-acting insulin, she could do this at meal times.

**Travelling West**

EXAMPLE - Adjusting for one or two injections a day of Intermediate or Long-acting Basal Insulin Analogue Insulin

Travel:

Ralph is travelling from Saskatoon to Maui (4 hours gained). Flying time is approximately 5.5 hours from Vancouver.

Insulin:

Ralph takes Novolin NPH 54 units at 10 p.m.

Timeline:

Departure Saskatoon				Destination Maui	
Date	Time	Itinerary	Comments	Date	Time
Jun 1			Usual meals pre-departure		
	12:20 pm	Leave Saskatoon		Jun 1	8:20 am
	2:20 pm	Arrive Vancouver			
	6:20 pm	Leave Vancouver	Supper in airport or on the plane		
	10:00 pm		Take increased dose of Novolin NPH 63 units		
Jun 2	12:15 am	Arrive Maui	Switch to local time – sleep – do not take insulin as the increased evening dose has already been given		8:15 pm
			Take usual evening dose NPH – 54 units	Jun 2	10:00 pm

Explanation:

Travelling west, Ralph's day will be longer. Change to local time on arrival. Before going to bed on June 1<sup>st</sup>, check blood glucose to ensure he is not too low from the extra NPH insulin. He should also check when he wakes up in the morning. He can resume his usual insulin regime on night two in Hawaii (June 2).

This is an example of using the insulin adjustment formula to increase the dosage for a longer day, see calculation below.

Calculation for Insulin Dose Increase:

$$\text{Novolin NPH 54 units PLUS } \left[ 54 \times \frac{(4)}{24} \right] = 63 \text{ units}$$

- Number of hours gained divided by 24:  $(4/24) = 0.167$
- 54 units (usual dose)  $\times 0.167 = 9.02$ , round down to 9 units added to his usual dose

Alternatively, using the second option to manage westward travel, Ralph could leave the NPH dose the same on June 1<sup>st</sup>. He would use short/rapid-acting insulin to correct high blood glucose at meal times on June 1<sup>st</sup> and 2<sup>nd</sup>. Depending on his skill in using a correction factor, the RN may need to provide him with written guidelines based on his usual insulin and blood glucose pattern.

If Ralph was not able to use short/rapid-acting insulin and/or was hesitant to increase his insulin, he should be prepared to see higher than usual blood glucose levels that may take a few days to return to his normal.

**EXAMPLE:** Insulin Dose Adjustment for MDI or BID Rapid/Short-acting and Long acting Basal insulin Analogue/Intermediate Insulin:

Travel:

Trevor is travelling from Regina to Sydney Australia and his flight plan takes him through Vancouver. There is a 16 hour time difference between Regina and Sydney and he will cross over the international dateline and the day will advance. Crossing the date line will move the date forward by 24 hours. The actual number of times zones crossed is 8. The approximate flight time from Vancouver is 15 hours.

Insulin: Humulin

Breakfast: 18 units N, 6 units R	Supper: 10 units R	Evening: 32 units N (10pm)
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Departure Regina				Destination Sydney	
Date	Time	Itinerary	Comments	Date	Time
June 1			Take usual dose of N-18, R-6 with breakfast. Trevor may want to eat some lunch before leaving Regina, or take provisions for lunch on the plane		
	12:20 pm	Leave Regina		June 2	4:20 am
	2:35 pm	Arrive Vancouver			
	5-6:00pm		Take usual supper dose of R-10 with supper meal at the airport		
	10:00 pm		Take usual dose of evening N – 32 units		
June 2	12:50am	Leave Vancouver			
	8:00 am		Eat and take usual breakfast dose of Humulin N-18, R-6		
	12-1:00 pm		Meal/snack on the flight, may need Humulin R to cover food		
	4:15 pm	Arrive Sydney	Switch to local time – check blood glucose	June 3	8:15 am
			Take R if eating and extra to correct a high glucose level if needed. Take morning dose of N – 18 units or could reduce by 10-20% if planning to sleep		~10:00 am (about 10 hrs post last N injection)
			Resume usual routine		

Explanation:

Change to local time. As it is breakfast time in Australia, check blood glucose level and take Humulin R to match carbohydrate taken (and extra to cover a high blood glucose reading, if needed) and usual morning dose of Humulin N (18 units) to cover the first day in Sydney. If he is planning to sleep, he may make a modest reduction in the dose of Humulin N, 10-20% or 2-4 units. He should plan to get up after 6 hours and check his blood glucose. Eat supper and take usual supper and bedtime insulin. If pre-supper blood glucose is elevated, he can adjust the dose of Humulin R.

**EXAMPLE:** Insulin Dose Adjustment for Pre-Mix Insulin: 30/70, Mix 25, Mix 50 or Novo Mix 30

Travel:

Sheldon is travelling from Dubai to Saskatoon and his flight plan takes him through Frankfurt and Toronto. There is a 10 hours gained between Saskatoon and Dubai.

Insulin:

Humulin Mix 25: at breakfast; 38 units and at supper; 48 units.

Departure Saskatoon				Destination Dubai	
Date	Time	Itinerary	Comments	Date	Time
Jun 1			Take usual breakfast and supper insulin		
	1:50 am	Leave Dubai		May 31	3:50 pm
	6:30 am		A meal may be served before landing and if so breakfast dose can be taken, otherwise wait until landing in Frankfurt, eat and take breakfast dose of 38 units with food		
	8:20 am	Arrive Frankfurt			
	12:45 pm	Leave Frankfurt			
	5:00 pm		Eat and take supper dose of insulin – 48 units		
	9:00 pm	Arrive Toronto		Jun 1	11:00 am
Jun 2	12:10 am	Leave Toronto			
	3:30 am	Arrive Saskatoon	Switch to local time		5:30 pm
	5:30 am		Recommend he check his blood glucose, eat a light supper meal and take his <u>morning</u> dose of insulin, Mix25, 38 units. The meal should contain carbohydrate equivalent to his usual breakfast. Test blood glucose again prior to bedtime, a snack may be needed.		7:30 pm

Explanation

It is now supper time in Saskatoon, but is the middle of the night on departure time. By the time he is ready to eat, estimated at 7:30 p.m., it will be about 12 hours since his last insulin injection. If he does not take insulin, by the next morning it will be 24 hours between insulin injections.

Use of the westward travel formula does not seem appropriate for this situation as he will have to rely on an artificial increase in his supper insulin dose on June 1<sup>st</sup> (Dubai time) to cover 24 hours. Westward travel usually requires extra insulin due to the lengthen day. As the morning dose of insulin is less than the evening one, this dose was selected rather than repeating the evening dose within 24 hours.

The RN could construct a guide for the client to use to adjust the morning dose of Mix25 based on the blood glucose result at about 7:30 p.m. For example, less than the usual morning dose amount would be recommended if the blood glucose is 6 mmol or less.

Another alternative might be the use of short or rapid-acting insulin at 7:30 p.m. destination (Saskatoon) time. The amount would be based on the blood glucose result. Using this method would help to control the blood glucose until morning, but the client would still lack basal insulin for many hours.

He can resume his usual schedule the next morning (June 2).

## Resources

1. Travel tips for People with Diabetes: Canadian Diabetes Association; online resource can be accessed at: <http://www.diabetes.ca/diabetes-and-you/living/guidelines/travel/>
  
2. Samples of time zone maps and time converters
  - <http://www.timeanddate.com/>
  - [http://aa.usno.navy.mil/faq/docs/world\\_tzones.php](http://aa.usno.navy.mil/faq/docs/world_tzones.php)
  - <http://www.worldtimezone.com/>
  
3. Online references such as:
  - International Association for Medical Assistance to Travelers  
<http://www.iamat.org/index.cfm>
  - Tips on Travel, Health and Life Insurance and Diabetes:  
[http://www.diabetes.ca/files/about-diabetes/CDA\\_Travel-Tips.pdf](http://www.diabetes.ca/files/about-diabetes/CDA_Travel-Tips.pdf)
  - Answers to Common Questions about Insurance and Diabetes:  
[http://www.diabetes.ca/files/about-diabetes/CDA\\_Insurance-QandA.pdf](http://www.diabetes.ca/files/about-diabetes/CDA_Insurance-QandA.pdf)

## **Insulin Dose Adjustment (IDA) for Shift Work**

### Learning Objective

To create an individualized client plan for shift work to include client assessment, education and follow-up.

### Required Registered Nurse Competencies

See page 14. Review the competencies, complete a self assessment and identify learning needs for IDA for shift work prior to beginning this section of the learning module.

Note: in the preparation of this section, a thorough review of the literature was done as well as an internet search for relevant information. No research studies on shift work and insulin dose adjustment were found. The resources are guidelines prepared by other jurisdictions.

### Principles to Consider When Adjusting Insulin for Shift Work

#### 1. Client assessment:

- a. What is the current insulin regimen and what are the flexibilities eg MDI versus pre-mixed insulin?
- b. What is the usual pattern of blood glucose across the day?
- c. What is the current frequency and timing of hypoglycemia? Does this person have hypoglycemia unawareness?
- d. Is the client able and willing to do extra blood glucose monitoring related to shift changes and, as needed, to refine insulin dose adjustment?
- e. How independent is the client now in IDA so he/she can adapt the guidelines given by the RN, if needed?
- f. Has the client told others about his/her diabetes and how to assist with hypoglycemia management, if needed?
- g. What has been the client's experience with adjusting insulin for shift work? How was it handled in the past and how did the changes work?
- h. Ask client if he/she has been given instructions by any other care provider.
- i. Has the client seen a dietitian recently? Would it be beneficial to include a dietitian visit as part of the shift work planning?

#### 2. Shift Work Schedule:

- a. What is the client's satisfaction with his/her current method of handling shift work?
- b. What is the usual pattern of each shift: eating (meals/snacks) times; insulin injection times; changes in levels of activity, sleeping pattern; habits on shift change days? It may be useful for both the client and the educator to draw out a 24 hour schedule for each shift and change-over days. See the example case study.
- c. What is the client's method of carbohydrate management: consistent CHO; insulin:CHO ratio, client understanding and use of CHO counting?
- d. Has the client had any recent hypoglycemia and cause(s); risk associated with hypoglycemia at work
- e. What is the usual pattern of blood glucose results on the different shifts; testing frequency and timing
- f. What are the client's concerns and past experiences with shift and IDA

3. Creating the plan for shift work:

- a. A plan will be specific for each individual client and will include the elements of assessment indicated in Sections 1 and 2 as well as engagement of the client in planning and decision making.
- b. Day shift: this shift will establish the baseline for managing diabetes at work for the client including adjustments for changes in activity levels; hypoglycemia management and meal/snack times.
- c. Evening shift: usually few adjustments will be needed when changing from a day to evening or evening to day shift. Some clients may sleep later when working an evening shift so basal insulin injections may be adjusted for a few hours. Short or rapid acting insulin can be matched to meal time.
- d. Night shift: managing diabetes on this shift is the most challenging.
  - i. It will be easiest to manage with long-acting basal analogue insulin which can be given at the same time every day. Even if the long acting basal insulin is given twice daily, the injection times can remain unchanged for shift changes.<sup>9</sup>

If the basal insulin is intermediate acting (Novolin NPH or Humulin N), consider switching the doses for the night shift or adjusting the dose to match the activity and eating patterns. For example, less basal insulin may be needed when sleeping

If there is a significant increase in physical activity during the night shift, an insulin dose reduction may be needed.

- ii. Short or rapid-acting insulin can be given whenever there is a meal time and the dose can be adjusted based on the insulin to carbohydrate ratio or consistent amount of carbohydrate taken at a particular meal time.

If a person working nights eats a meal mid-shift, for example, around 0300 hours, then short or rapid acting insulin would be needed to cover the carbohydrate intake.

- e. If the client is using a twice daily insulin regimen most guidelines and diabetes experts recommend switching to a multiple daily injection system. The Registered Nurse may need to have several discussions with the client about the benefits.

A client may be willing to do a "test" scenario with a different insulin regimen for a month and use self discovery to ascertain the benefits.

Older resources do reference a complicated method using twice daily insulin, but as this is not in the best interests of client care for shift work, it has not been replicated in the advanced insulin dose adjustment module.

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<sup>9</sup> Building Competency in Diabetes Education: Advancing Practice. Canadian Diabetes Association. Toronto, Ontario:CDA; 2009, page 2-83

#### 4. Diabetes in the Work Place:

People with diabetes may require support and/or advocacy by a diabetes educator to assist them in diabetes management in the work place.

A useful resource is the Canadian Diabetes Association and their website which has a position statement: *Diabetes in the Workplace: A Guide for Employers and Employees*<sup>10</sup>.

Despite best efforts some people with diabetes may find shift work too disruptive to good diabetes management and/or management of other aspects of diabetes care<sup>11</sup>. Collaboration maybe needed amongst the client, the employer and care providers, including the physician, to examine work alternatives.

#### Case Study

John, who has had type 1 diabetes for ten years, just graduated as an electrician and has a new job at the local mine. He will be required to work 12 hour shifts. The day shift starts at 7:00 am and the night shift at 7:00 pm. While going to school he has been living at home, but will be moving away to take this job.

#### Present insulin regimen:

Basal insulin:

- Lantus 32 units at 10:00 pm
- Pre-meal insulin: Humalog at each meal with a ratio of 1:8 but he tells you he just sort of “eye balls” the food and the amount of insulin. He will use correction insulin if the reading is “really bad”

#### The job:

- Shifts are 12 hours with two meal breaks on each and two coffee breaks
- Level of activity is about the same on each shift
- He will work 7 consecutive shifts and then have a week off. He will alternate between day and night shifts
- When he is at the mine, food is provided and served in a cafeteria style – portion provided by the server once John makes a selection

#### Diabetes background:

- Last A1C about 2 months ago was 7.4%
- No recent hypoglycemia; has never had a severe hypoglycemic episode – keeps bg pre-meals about 6-7 to avoid hypoglycemia
- Active and expects his job will be about the same amount of activity as he has now
- Wants to be independent in his first “real” job and not have diabetes hold him back; reluctant to tell co-workers about diabetes/hypoglycemia management
- Usual bg pattern: [does not test pc meals]

Breakfast	Noon	Supper	Evening
6-8	6-7	6.5-8	7-8

<sup>10</sup> <http://www.diabetes.ca/about-us/what/position-statements/discrimination/workplace/>

<sup>11</sup> Howard JA, Bower K, Putnam W. Factors Influencing the Management of Hypertension in Type 2 Diabetes. Can J Diabetes 2006;30(1):38-45

The Questions:

1. What concerns would you raise in discussion with John in preparation for his new job?

- Reluctance to tell others about his diabetes/hypoglycemia. This would need to be done sensitively and you would want to find out his thoughts and feelings before giving information or making suggestions or recommendations.
- As he will be eating in an unfamiliar situation, he may need to “brush up” on carbohydrate counting, estimating portion sizes and review the insulin to carbohydrate ratio to see if it is still appropriate. Arrange an appointment with a dietitian.
- Even though he does not expect an increase in activity it would be useful to discuss handling changing levels of activity and hypoglycemia management. Does he carry something to treat hypoglycemia and what are his plans for the new work situation?
- Are there any safety hazards to be concerned about in relation to potential hypoglycemia? You might also review his usual treatment of hypoglycemia, what he plans to carry with him to treat hypoglycemia and the possible need for extra carbohydrate to eat to prevent another hypoglycemia episode prior to the next meal time.
- Ask if he has ever worked shifts before (past experience). Some people will come home and sleep after working the night shift, others might not sleep until later. He might not know this yet, but his preferences can be considered in planning.

2. Draw out a possible timeline for each shift indicating meal/break times and any considerations for John. [Make up the times]. When would you recommend he test his blood glucose?

**DAY SHIFT – 7:00 am – 7:00 pm**

6:00am	7:00 am	9:00 am	12:00 pm	2:30 pm	5:30 pm	7:00 pm	10:00 pm
Check bg Breakfast Humalog	Start of shift	Break, snack if desired	Check bg Noon meal Humalog	Break, snack if desired	Check bg Supper meal Humalog	Off shift	Lantus Bedtime snack if desired Check bg

If possible, it would be helpful to ask John to consider doing some 2 hour post meal blood glucose readings to assess the effectiveness of his dose of Humalog.

At present John is a bit reluctant to reveal his diabetes to others. He will have to decide how he wants to handle meal time insulin injections – does the site have a clinic or other clean location he can use?

**EVENING/NIGHT SHIFT – 7:00 pm –7:00 am**

7:00 pm	9:00 pm	12 midnight	3:00 am	7:00 am	7:30 am	12 noon	4:30 pm
Shift start Supper, Humalog at home	Break, snack if desired Lantus 9- 10 pm	Check bg Meal break Humalog	Break, snack if desired	Off shift	Check bg Breakfast Humalog Sleep	Maybe get up to check bg, as needed	Check bg Supper about 5:30 pm Humalog

If possible, it would be helpful to ask John to consider doing some 2 hour post meal blood glucose readings to assess the effectiveness of his dose of Humalog.

On the change over between shifts, he will keep the dose and timing of Lantus unchanged. He can vary the timing of the Humalog with his meal times which may be adjusted coming off nights or when he re-starts night shift.

3. What changes, if any would you recommend in his insulin doses?

As his current blood glucose levels provide a bit of a "cushion" at most times of the day and he does not expect increased activity, he could continue with his usual doses. After discussion with the dietitian, there may be an adjustment to his insulin to carbohydrate ratio.

He did mention that he only used the correction factor for "really bad" readings. He seems concerned about hypoglycemia and wants to avoid it. Once John is comfortable in his new job situation and test results are available, it may be useful to review the purpose and use of the correction factor, consider the need to adjust the previously recommended level. Also, continue the discussion of hypoglycemia and his concerns.

## Diabetes Management for Sick Days

### Learning Objective

1. To state the principles of sick day management for clients on insulin with either type 1 or type 2 diabetes.
2. To assess rapidly a client call on a sick day to determine degree of illness; safety at home and what, if any, insulin dose adjustment advice should be given.

### Required Registered Nurse Competencies

See page 15. Review the competencies, complete a self assessment and identify learning needs for IDA for sick day management prior to beginning this section of the learning module.

### Required Reading in Addition to the Module

To provide adequate and safe advice for a person on insulin who is experiencing an inter-current illness, the Registered Nurse requires a detailed understanding of the pathophysiology of diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state (HHS). This information is well documented in Building Competency in Diabetes Education: Advancing Practice<sup>12</sup> and in the CDA Clinical Practice Guidelines<sup>13</sup>. Alternatively, the information can be found on-line<sup>14</sup> or in a basic textbook on diabetes.

It is recommended that a Registered Nurse who will be working with this Transfer and clients with an inter-current illness thoroughly study DKA and HHS.

### Assessment<sup>15</sup>

Usual diabetes care practices:

- a. Usual insulin type, amounts and timing
- b. How much insulin has been taken today?
- c. Usual blood glucose levels across the day?
- d. Blood glucose monitoring done today and results?
- e. Blood and/or urine ketone testing done in the last 24 hours and results?
  - i. If no testing has been done, does the client have the meter and strips for blood testing or strips for urine ketone testing? Does he/she know how to perform the test? Are the strips outdated? Is anyone able to obtain strips for the client?
- f. What has been his/her experience in the past with this type of inter-current illness – has the blood glucose changed either up or down?
- g. Has there been any recent hypoglycemia? Explained or unexplained? Does the client have hypoglycemia unawareness?
- h. Use of other medications such as Metformin (type 2), Angiotensin Converting Enzyme Inhibitors (ACEI) or Angiotensin II Receptor Blockers (ARB) or diuretics

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<sup>12</sup> Building Competency in Diabetes Education: Advancing Practice: 2009. Sick Day Guidelines, pages 2-75 to 2-81

<sup>13</sup> CDA Clinical Practice Guidelines:2008. Hyperglycemic Emergencies in Adults, pages S65-70

<sup>14</sup> Approach to the Management of Diabetes Mellitus, 7<sup>th</sup> edition. Banting and Best Diabetes Centre <http://www.bbdc.org/> - Chapters 11 and 14 cited 10jul2010

<sup>15</sup> See Appendix C for assessment guidelines and protocol provided by Saskatchewan HealthLine

The illness:

- a. How long has the illness lasted, what are the signs and symptoms?
- b. If the following have not been stated, ask specifically about:
  - i. Vomiting and/or diarrhea – frequency, when did it last happen?
  - ii. Nausea and ability to eat solids or drink fluids – approximate intake of fluids in the last 12 to 24 hours?
  - iii. Signs and symptoms of dehydration (dry mouth, excessive thirst, decreased urination, weight loss, rapid breathing, rapid pulse or sunken eyes)?
  - iv. Fever? Level, how long?
  - v. Signs or symptoms of ketoacidosis: nausea, abdominal or chest pain, ketotic breath, hyperventilation or altered consciousness?
  - vi. Has the client ever had an illness like this in the past? If yes, what has been the usual course?

Guidelines for IDA During an Inter-current Illness

The following guidelines are recommended only for adults who are sick with an inter-current illness such as cold or flu. The RN will need to use his/her clinical judgment to decide on the extent of IDA advice given as well the recommended follow-up instructions.

1. Test blood glucose every 2-4 hours. The frequency will depend on the severity of the illness and whether or not ketones are present. More frequent testing (every 2 hours) is recommended with positive ketones.

Adults with type 2 diabetes on insulin with use multiple daily doses (MDI) should test for ketones. Generally others with type 2 diabetes and on insulin would not be expected to have positive ketones.

Target blood glucose can be 'relaxed' during an inter-current illness. Depending on usual control, a target of 10 to 13 mmol/L would be acceptable for most adults. Avoid hypoglycemia.

2. Test for ketones every 4 to 5 hours<sup>16</sup>. Testing blood for ketones is preferred over urine testing as it is a more accurate method for persons with type 1 diabetes<sup>17</sup>.

Urine ketone strips can give false positive or negative results.

- False positives occur with several sulhydryl drugs, including captopril
- False negatives occur with large doses of Vitamin C (acidic urine). Expired test strips may also give false negative results.

3. If the individual cannot tolerate solid foods, recommend ~ 15 grams of carbohydrate in liquid or soft food form every 1-2 hours. See the client handouts produced by Regina Qu'Appelle Health Region<sup>18</sup>. The carbohydrate will prevent starvation ketosis and dehydration. Encourage 'extra' fluids (water, broth, sugar-free drinks) again to prevent dehydration.

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<sup>16</sup> Nova Scotia Insulin Dose Adjustment Module: 2005, page 28

<sup>17</sup> Building Competency in Diabetes Education: Advancing Practice: 2009, pages 2-76 to 2-77.

Laffel LM, Wentzell K, Loughlin C, Tovar A, Moltz K, Brink S. Sick day management using blood 3-hydroxybutyrate (3-OHB) compared with urine ketone monitoring reduces hospital visits in young people with T1DM: a randomized clinical trial. *Diabet Med.* 2006;23(3):278-84.

<sup>18</sup> Client education materials from RQHR available on the Ministry of Health, Saskatchewan website for download.

4. Physician or Nurse Practitioner contact is recommended in the following situations:
  - a. Unable to eat or drink at all
  - b. Recurrent vomiting (ongoing for more than 4 hours)
  - c. Recurrent diarrhea
  - d. Extra short or rapid insulin has been taken – up to two extra doses – but there is no improvement in hyperglycemia and/or ketones
  - e. Illness is becoming worse or is longer than 12-24 hours
  - f. Problems with hypoglycemia or unable to consistently keep blood glucose above 6 mmol/L
  - g. Signs or symptoms of DKA or HHS
  - h. Signs and symptoms of dehydration and use of medications such as Metformin, ACEI or ARB or diuretics. These medications may need to be discontinued temporarily in consultation with the physician or NP.
  
5. Insulin Dose Adjustment
  - a. Always take some insulin, never discontinue insulin
  - b. Generally the basal insulins (intermediate or extended long-acting insulin analogue) can remain unchanged. Reduce if blood glucose is below 6 mmol/L and client is unsure about food/fluid intake. For some clients, the reduction could be up to 50% of usual dose. Frequent blood glucose monitoring is required.
  - c. Extra insulin is given as rapid or short-acting insulin and the amount is based on:
    - total daily insulin dose – the sum of the usual amount of insulin taken in 24 hours
    - current blood glucose level
    - absence or presence of ketones

The following provides general guidelines. These may need to be adapted for an individual client.

**Guidelines for Extra Insulin During An Illness<sup>19</sup>**

Blood Glucose (mmol/L)	Ketones		Extra Short or Rapid-acting insulin every 4 to 6 hours
	Urine	Blood (mmol/L)	
14 - 16	Negative to small	1.4 or less	Usual dose
	Moderate – Large	1.5 or more	Usual dose + <b>10%</b> of total daily units of insulin
16.1 - 22	Negative to small	1.4 or less	Usual dose + <b>10%</b> of total daily units of insulin
	Moderate – Large	1.5 or more	Usual dose + <b>15%</b> of total daily units of insulin
22.1 or more	Negative – Small	1.4 or less	Usual dose + <b>15%</b> of total daily units of insulin
	Moderate – Large	1.5 or more	Usual dose + <b>20%</b> of total daily units of insulin

<sup>19</sup> Source: Fraser Health Authority, British Columbia Cited: 27May2010  
<http://www.fraserhealth.ca/media/Type%201%20Diabetes%20Sick%20Days%20Colour%20Sept%202009.pdf>

## APPENDIX C - Triage for Sick Day Management

The following information and guide have been abstracted from the nursing protocol used by Saskatchewan's Health Line. The purpose in providing the information with this module is to help the nurse triage a call from a person with diabetes with an inter-current illness.

This is a guide only and the RN must use clinical judgment to assess the client illness, diabetes management and advice, if any, which will be given.

Source: "Diabetes – Prior Diagnosis" Saskatchewan Health Line Protocol

Last reviewed: February, 2010 and personal communication with Barbara Deets, Clinical Content Nursing Consultant, and HealthLine (November, 2010)

### PRIORITY EVALUATION

The following require immediate emergency department care - call an ambulance/911 if necessary: unconsciousness, mental status changes, cardiac/respiratory distress, seizures, new onset speech difficulty, sudden vision loss/disturbance, possible overdose of diabetic medications. If the client has no priority symptoms then the following detailed assessment questions are asked.

### GENERAL QUESTIONS

Age?

How feeling now?

Experiencing any other symptoms or problems?

History of diabetes?

How long have you had diabetes?

Type of diagnosed diabetes?

- Type 1?
- Type 2?
- Gestational?
- Other?
- Unknown?

Past medical history?

Underlying medical problems?

NOTE ESPECIALLY – Risk Factors:

- Hospitalized or unconscious with hypoglycemic episodes?
- Recent (past 4 weeks) surgery?
- Heart disease?
- Kidney disease?
- Transplant?
- Dialysis?
- Vision problems r/t diabetes?
- Foot/leg sores?

- Amputations?
- Malignancy or current cancer treatment over past 6 months?
- Long term (>14 days) oral steroids (not inhaled)?
- Substance use (alcohol, drugs, etc.)?
- Current medications?
  - Recent changes?
- Do you have a management plan for diabetes?
  - Are you involved with a Regional Diabetes Education Centre?
  - If YES, how long? how often?
- Allergies?
- Pregnant?
  - LMP?
- Breast feeding?
- Any related visits to a physician?
  - When?
  - Diagnosis?

DIRECTED QUESTIONS	CAUSES FOR CONCERN
<ul style="list-style-type: none"> <li>• Medications for diabetes? (insulin/oral other agents) When was medication last taken?</li> <li>• Recent change in medicines?</li> <li>• Any medications that you do not like to take? If YES, which ones and why?</li> <li>• Wrong dose/overdose?</li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes</p>
Changes in vision (r/o hypoglycemia)?	Yes
<ul style="list-style-type: none"> <li>• Recently had blood glucose checked? (by self or other)</li> <li>• When?                             <ul style="list-style-type: none"> <li>○ If YES, what is the reading?                                     <ul style="list-style-type: none"> <li>• Blood glucose &gt; 14.0 mmol/L?</li> <li>• Blood glucose &lt; 4.0 mmol/L?</li> </ul> </li> </ul> </li> <li>• Urine ketones present? (<u>mainly type 1 diabetes</u>)                             <ul style="list-style-type: none"> <li>○ If YES, what is reading?</li> </ul> </li> <li>• Serum ketones present?                             <ul style="list-style-type: none"> <li>○ If YES, what is reading?</li> </ul> </li> </ul>	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>Yes</p>
Symptoms of possible hypoglycemia? For Example: <ul style="list-style-type: none"> <li>• Sweating</li> <li>• Anxious</li> <li>• Tremulous</li> <li>• Blurred vision, decreased level of consciousness</li> </ul>	Yes
Vomiting? <ul style="list-style-type: none"> <li>• How many episodes in the past 24 hours?</li> </ul>	Yes

DIRECTED QUESTIONS	CAUSES FOR CONCERN
<ul style="list-style-type: none"> <li>• Has any treatment been tried?                             <ul style="list-style-type: none"> <li>○ What?</li> <li>○ When?</li> </ul> </li> <li>• Treatment effective?</li> </ul>	No
Symptoms of dehydration? For example: <ul style="list-style-type: none"> <li>• dry mouth</li> <li>• excessive thirst</li> <li>• decreased urination</li> <li>• rapid breathing</li> <li>• rapid pulse</li> </ul>	Yes
<ul style="list-style-type: none"> <li>• Diarrhea?                             <ul style="list-style-type: none"> <li>○ How many episodes in the past 24 hours?</li> </ul> </li> </ul>	Yes
<ul style="list-style-type: none"> <li>• Has any treatment been tried?                             <ul style="list-style-type: none"> <li>○ What?</li> <li>○ When?</li> </ul> </li> <li>• Treatment effective?</li> </ul>	No
Signs of local infection? For example: <ul style="list-style-type: none"> <li>• Fever/chills?                             <ul style="list-style-type: none"> <li>○ Onset?</li> </ul> </li> <li>• Temperature reading?</li> <li>• Appropriate dose of Antipyretic?                             <ul style="list-style-type: none"> <li>○ Response to Antipyretics?</li> </ul> </li> <li>• Increasing swelling, redness</li> <li>• Pain/tenderness</li> <li>• Warm to touch</li> <li>• Red streaking</li> <li>• Purulent drainage</li> </ul>	Yes

**Dehydration** secondary to fluid losses from vomiting or diarrhea or from reduced fluid intake WITH blood glucose level significantly abnormal/elevated for > 24 hours WITH or WITHOUT moderate to large ketones.

**NOTE ESPECIALLY**

- vomiting or diarrhea > 6 hours
  - large fluid loss from diarrhea
- unable to eat or drink > 4 hours
- inadequate fluid intake secondary to nausea, fatigue, mouth sores, etc.
- feeling of excess thirst
- dizzy when standing

**DECISION POINT:**

- Refer to regular physician for insulin dose adjustment or assume responsibility for IDA and communicate with physician.

Urine output is often normal during illness despite the body's overall fluid deficit. Hyperglycemia causes water to be drawn from the body as urine output.

Depending on the presenting and/or assessed symptoms, a recommendation is made to seek Medical Care within the following specified times:

**EMERGENT CARE (0 - 4 Hours)**

(Talk With or See Physician Definitely Within 4 Hours)

**#1. Possible Hypoglycemia with or without Symptoms**

**NOTE**

Potential wrong dose of insulin medication or change in medication, diet, exercise

Hypoglycemia unawareness

If symptoms resolve, can stay at home

**#2. Dehydration (see above)**

**URGENT PHYSICIAN REFERRAL (24 Hours)**

**URGENT PHYSICIAN REFERRAL**

(Talk With or See Physician Definitely Within 24 Hours)

**#1 Hyperglycemia greater than 14 mmol/L for > 24 HOURS by blood glucose meter reading.**

- PLUS Recent changes in medication or missed medications
- OR Current illness such as vomiting/diarrhea, upper respiratory infection, cough
- OR New marked changes in diet, intake, activity or exercise levels

**UPGRADE FOR EARLIER EVALUATION** If caller is also testing for ketones (results verified with repeat test) AND urine dipstick reading is mod-large ketones (purple) OR is using blood testing (Precision Meter) and Serum Ketones = 1.5-3.0 mmol/L

**NOTE:**

If blood glucose testing indicates consistent hyperglycemia, referral to regular physician for assessment.

Encourage caller to follow prescribed treatment plan

If no plan or plan is ineffective, assessment by regular physician is warranted

**NOTE:**

- If reading is not verified with a repeat test, have caller retest.
- Contamination of strip is possible. Suggest caller wash and dry hands prior to re-test.

#2 Signs of Skin Infection

**NOTE ESPECIALLY:**

- fever/chills
- red streak extending from wound
- pus-like drainage
- increasing pain/tenderness
- redness/swelling
- area unusually warm to touch
- nurse's judgment

**NOTE:** Rash suggestive of rapidly spreading skin or soft tissue infection warrants earlier assessment:

- Rapid spread of redness and swelling especially if spreading in asymmetrical fashion: (e.g. extending up an extremity at >2 cm per hour)
- Marked increase in tenderness or pain (e.g. with even light touch or minimal movement) despite pain relief measures.

**PHYSICIAN REFERRAL (72 Hours)**

Talk With Physician Definitely Within 72 Hours

#1. Recent Increase in Blood Glucose Level

OR increased urination  
OR increased thirst  
WITHOUT other symptoms

**NOTE:**

- Reinforce Blood testing guidelines
- If blood glucose testing indicates consistent hyperglycemia referral to regular physician for assessment.

#2. Blood glucose 2 HOURS AFTER MEALS over 14 mmol/L consistently for over 1 week with no other symptoms

OR Fasting Blood Glucose consistently more than 10 mmol/L

- Encourage earlier contact with clinician if other concerning factors present such as marked change in diabetic control, lack of understanding or social supports, other medical conditions, etc.

#3. Foot or leg cuts/sores/ulcers that are not healing well

PLUS no change in blood glucose level

**NOTE:**

If caller describes known difficulties with extremity circulation and wounds are present that are worsening daily, consider early assessment.

**CASE STUDIES**

The case studies will help you practice the advanced module skills. The answers are in the next section, page 55.

**CASE 1**

Sarah is travelling to Auckland New Zealand from Regina. Sarah has had type 1 diabetes for the past 10 years. Her last A1C was 7.6%. She has the occasional low blood glucose. She knows how to count carbohydrates and understands how to use a correction factor. Unfortunately, she forgot her logbook at home. She has travelled before but this is the longest trip she has ever taken. She is travelling with a girlfriend. She brings her travel itinerary as indicated below.

Insulin:

Breakfast:	Novolin NPH – 12 units NovoRapid– 8 units
Lunch:	NovoRapid – 6 units
Supper:	NovoRapid – 10 units
Evening (10pm)	Novolin NPH – 28 units

**All times are local as provided by the airlines**

Travel:

Sept 1: Flight time from L.A to Auckland is about 13 hours. Leaves Regina at 8:45 am  
Arrives Vancouver 10:00 am  
Leaves Vancouver 1:00 pm  
Arrives L.A 4:00 pm  
Leave L.A 9:30 pm  
Arrive Auckland 5:25 am (+2days)

Return: Sept 22 Flight time from Auckland to Vancouver is about 12.5 hours  
Auckland leaves: 7:00 am  
Arrive Sydney 8:30 am  
Leave Sydney 10:25 am  
Arrive Vancouver 7:30 am  
Leave Vancouver 1:35 pm  
Arrive Regina 4:33 pm

**What would be key initial assessment questions for Sarah to help her plan her trip?**

**What other information might Sarah want to consider before her trip**

**Create a detailed travel plan for Sarah using the above information and the template provided in the module. Explain rationale for your recommendations.**

## CASE 2

Jacob and his wife are planning a winter vacation and cruise around the Hawaiian Islands. He is an experienced traveler. He has Type 2 diabetes for 20 years; the last 4 years he has taken insulin. He likes to keep his blood glucose tightly controlled so is prone to frequent hypoglycemia. He brings a record of his blood glucose levels to the appointment. He is consistent with his CHO intake although he doesn't really 'count carbs'

His insulin is:

Breakfast: (7 am)      no insulin  
Supper:                      Humalog 12 units  
Evening: (8 pm)        Lantus 44 units

Here is a sample of last 3 days of testing

	Breakfast	pc	Noon	pc	Supper	pc	Evening
Day 1	4.1	9.2	7.1	8.9	7.2	8.5	7.3
Day 2	3.5		6.4	10	5.5	8.2	9.9
Day 3	3.9	8.0	6.2	9.2		7.2	6.8

### All times are local as provided by the airlines

Jan 17,

Leave Saskatoon 7:05 am

Arrive Calgary 7:15 am

Leave Calgary 8:00 am

Arrive Vancouver 8:28 am

Leave Vancouver 10:05 am

Arrive Honolulu 2:31 pm

Jan 31

Leave Honolulu 11:25 pm

Arrive Vancouver 7:03 am

Leave Vancouver 10:00 am

Arrive Saskatoon 3:05pm

**After reviewing his blood glucose results and his history of hypoglycemia, what might you want to discuss with Jacob before he goes on his trip?**

**What might he need to know about 'cruising'?**

**Create a travel plan for Jacob using the template provided in the module. Explain rationale for your recommendations.**

### **CASE 3**

Janina works in a factory which has a 24-hour operation. Her job involves standing, lifting a modest amount of weight and she is active (moving around, walking) during the entire shift. Her rotation includes 3 shifts (days, evenings, nights) and usually she works 6-7 shifts consecutively. She will have 2-4 days off at a time depending on the rotation.

Lately her blood glucose control has deteriorated and she would like to improve, but dreads any hypoglycemia 'on the job'. She rarely has hypoglycemia. Her last A1C was 8.1%.

She has type 1 diabetes and her usual insulins are

Breakfast: Humulin R 10, Humulin N 26  
Supper: Humulin R 12  
Bedtime: Humulin N 10 [usually taken about 10 p.m.]

She does not bring any blood glucose readings with her to the appointment and says: "they are usually a little on the high side".

**What will be some of the key questions you might ask in your initial assessment?**

**Work out a possible schedule of insulin/meals, snacks for all three shifts which she works and transitions to days off. Use her current insulins and amounts. [You will have to make up some parts, but consider the shifts as 0700 to 1500; 1500 to 2300 and 2300 to 0700]**

**What are the challenges with her current system and what recommendations might you make?**

#### **CASE 4**

Brett, who is 63 years old, has type 2 diabetes and has been using insulin for 5 years along with Metformin 500 mg BID. His A1C readings are usually in the range of 6.9-7.1. He tests his blood glucose periodically, but finds the readings are usually in the 4-7 range pre-meals. The occasional post-meal test is < 10 mmol/dL.

Insulin:

Morning: Novolin NPH 34 units

Supper: NovoRapid 14 units

Bedtime: Novolin NPH 29 units

1. Brett phones you at the diabetes program at 0800 when you open, saying he has been ill with a flu for the past three days. It's the worst flu he has ever had, in fact last evening he felt so poorly, was not eating or drinking so he was afraid to take his evening insulin and skipped it. This morning his blood glucose is 19.6.

**What will be some of your assessment questions?**

**What are you screening for in your questions?**

2. Brett gives you the following information:
  - o Yesterday he reduced his usual a.m. dose of Novolin NPH from 34 to 20 units; took Novorapid 6 units at supper and no insulin at bedtime
  - o He has been sick for 3 days with nausea, vomiting, headaches – he thinks he is getting worse and does not think he can eat or drink anything right now. He had some diarrhea on the first two days.
  - o Yesterday he checked his blood glucose and readings were fasting: 10.2; noon 13.6; supper 16.9. He did not check at bedtime. He does not have any materials to check for ketones by urine or blood.

**What advice will you give to Brett?**

### **CASE 5**

Melvina has type 1 diabetes and calls saying she has been sick for several days. Her blood glucose is getting worse – she thinks she should take extra insulin, but has lost the sheet which tells her how much to take. She did remember that she's supposed to check for ketones and bought some sticks yesterday. Her blood glucose right now is 18.9 and her urine ketones are large.

She has been trying to take fluids – mostly sugar free pop and sugar free Jell-O. She says it's hard, but she forced herself.

Her insulin program is MDI with Novorapid before meals based on carbohydrate intake with a ratio of 1:8. She uses a correction factor of 2. Most days her pre-meal amounts are 10, 6 and 14 units.

Her basal insulin is Levemir 32 units which she takes at bedtime daily.

**What insulin dose would you recommend she take now at 0800 hours?**

**What other advice would you give to Melvina?**

## ANSWERS FOR CASE STUDIES

### CASE 1

**What would be key initial assessment questions for Sarah to help her plan her trip?**

- What is her usual blood glucose pattern across the day?
- How comfortable is Sarah in making insulin adjustments?
- How does she manage hypoglycemia, and is her travelling companion familiar with management of hypoglycemia? Does she carry glucagon and is her companion able to administer, if needed?
- Would she benefit from a review of her meal plan and CHO counting with the dietitian?
- How has she handled other air travel experiences and what did she find unexpected or challenging?

**What other information might Sarah want to consider before her trip**

- Vaccinations/insurance
- Extra diabetes supplies and availability of her types of insulin in New Zealand
- Airline rules and regulations for carry on since she will want to take extra food/snacks and her diabetes supplies
- Timing of meals/snacks served on the flights
- Length of layovers in between flights
- Contingency plans for delays or cancellations

**Create a detailed travel plan for Sarah using the above information and the template provided in the module. Explain rationale for your recommendations.**

**NOTE:** The departure column contains the time in Regina which Sarah will use as she travels to adjust meals/insulin.

Departure Regina		Destination Auckland			
Date	Time	Itinerary	Comments	Date	Time
Sep 1	8:45 am	Leave Regina	Take insulin with breakfast meal NPH 12, NovoRapid - 8 before heading to the airport	Sep 2	2:45 am
	11:00 am	Arrive Vancouver	Sarah has 3 hours before the next flight so she can take lunch at the Vancouver airport or eat food that she has packed. She would take usual noon insulin, NovoRapid-6 or adjust depending on CHO intake or need to make a correction.		
	2:00 pm	Leave Vancouver	Snack on plane, to prevent hypoglycemia in case her supper meal is delayed.		
	5:00 pm	Arrive L.A	Have supper with her or in the L.A airport and take usual supper dose of NovoRapid – 10 or adjust depending on CHO intake or need to make a correction.		
	10:30 pm	Leave L.A	Take evening dose of NPH – 28 units before boarding along with evening snack.		
			<i>Continued on next page</i>		

Departure Regina						Destination Auckland	
Date	Time	Itinerary	Comments	Date	Time		
	8:00 am		Sarah will probably try to get some sleep and early in the morning she should check her blood glucose. If there is a meal served she could take some NovoRapid units based on CHO content, correct if needed plus her morning dose of NPH – 12 units with food. If there is not a meal served Sarah should eat food that she has packed in order to take her insulin and prevent hypoglycemia.				
Sep 2	11:25 am	Arrive Auckland	On arrival, change to local time and check blood glucose, and use her NovoRapid with food and to correct glucose level if elevated throughout the day. She will have taken her breakfast NPH and would not want to take this again.	Sep 3	5:25 am		
			Resume usual routine on local time and take evening NPH at usual time in Auckland.				

Remind Sarah to keep her watch on Regina time until she reaches Auckland where she can then change to local time.

On the day of arrival in Auckland, it is early morning, but noon Regina time. She will need some basal insulin to cover the day, so she can take her NPH on the plane to give her some coverage over the day until evening in Auckland. She can supplement during the day using her NovoRapid with her meals and/or as a correction.

It is important to note that there will be a gap of time that Sarah will not have coverage of her basal insulin and she should be reminded to check her blood glucose during this time. She may require extra rapid insulin during this time to prevent hyperglycemia.

**Return Trip** – the departure column has the time in Auckland which Sarah will use as she travels to adjust meals/insulin.

Departure Auckland				Destination Regina	
Date	Time	Itinerary	Comments	Date	Time
Sep 22			Sarah might check her blood glucose and have a snack before leaving for the airport to prevent hypoglycemia should her breakfast be delayed and she will likely be more active than usual in the early morning.	Sep 22	
Sep 22	7:00 am	Leave Auckland	Since Sarah will need to be at the airport early she could wait until checked in to take her usual morning insulin along with breakfast. NPH – 12, NovoRapid – 8 units.	Sep 21	1:00 pm
	10:30 am	Arrive Sydney	Sarah could take her noon insulin before boarding for Sydney or if she had checked and a meal was to be served early on the plane, she could wait and take her noon NovoRapid at that time – 6 units.		
Sep 22	12:25 pm	Leave Sydney			
	5:00 -6:00 pm		Around supper time if meal served or with provisions Sarah has packed, take a meal with her usual supper NovoRapid – 10 units.		
	10:00 pm		Take regular dose of evening NPH insulin – 28 units.		
Sep 23	2:30 am	Arrive Vancouver			
	8:35 am	Leave Vancouver	Take usual dose of breakfast NPH or could use the eastward travel formula to get a reduction of ¼ of usual dose. Sarah could take NPH 8-9 units. With breakfast she can also take her breakfast NovoRapid.		
	10:35 am	Arrive Regina	Resume usual routine.	Sep 22	4:35 pm
			Take evening NPH of 28 units. Check blood glucose and if concerned, could consider reducing this dose by 10-20% to err on the side of higher blood glucose to avoid hypoglycemia.		10:00 pm

Sarah's day will be shorter on the trip home, so an insulin reduction will be necessary for her basal insulin. She is better to err on the side of hyperglycemia for that day and once she has recovered from jet lag, resume usual routine. It is helpful to remember to try and keep the basal insulin about 10 to 12 hours apart.

Sarah will want to do frequent blood glucose checks and make appropriate corrections. Her blood glucose levels may be higher with more sitting and standing in lines. On the other hand, she will have to judge this due to length of travel between gates in some of the larger airports, she may do more walking/running that she thought!

**CASE 2**

**After reviewing his blood glucose results and his history of hypoglycemia, what might you want to discuss with Jacob before he goes on his trip?**

- Review signs and symptoms of hypoglycemia...is he experiencing hypoglycemia unawareness
- Is his wife familiar with treatment, etc of hypoglycemia
- Carry extra supplies
- Has he ever had a severe episode of hypoglycemia requiring medical assistance
- Should you discuss carrying glucagon?
- Does he adjust his own insulin and make corrections based on his blood glucose patterns
- During travel might he consider lowering his Lantus to avoid hypoglycemia or he might want to lower it now?
- Does he need to make an overall reduction in his Lantus dose due to recent hypoglycemia and lower fasting readings? [note – travel plan is created using current dose].

**What might he need to know about ‘cruising’?**

- When do they board the ship, usually you arrive the day before boarding the ship, but this would be important to know how relaxed or rushed his arrival day might be.
- Some cruises have set eating times, others are more flexible.
- Many people tend to overeat on a cruise with the seemingly unlimited amount of food. You would want to explore his ability to adjust his insulin or how to possibly add more Humalog as an additional or correction dose at other times of the day, such as breakfast and lunch. Ask about use of alcohol and knowledge of insulin and alcohol interaction.
- Does his cabin have a fridge to store insulin and/or food

**Create a travel plan for Jacob using the template provided in the module. Explain rationale for your recommendations.**

**NOTE:** The departure column as the time in Saskatoon which Jacob will use as he travels to adjust meals/insulin

Departure Saskatoon				Destination Honolulu	
Date	Time	Itinerary	Comments	Date	Time
Jan 17	7:05 am	Leave Saskatoon		Jan 17	3:05 am
	8:15 am	Arrive Calgary			
	9:00 am	Leave Calgary			
	10:28 am	Arrive Vancouver	Have a snack or light lunch before boarding in Vancouver. Check blood glucose.		
	12:05 pm	Leave Vancouver			
	3:25 pm	Arrive Honolulu	On arrival, change to local time and check blood glucose, if eating he may need to use some Humalog if glucose is elevated and he eats a meal at this time.	Jan 17	11:25 am
			Resume usual meals/insulin at supper.		
			Resume usual evening Lantus 44 units.		

There will not likely be a breakfast served on this first flight to Calgary so he will want to take provisions with him or eat breakfast at home or after clearing security at the Saskatoon airport. He should be prepared and have food packed in his carry-on luggage.

He should be encouraged to check his blood glucose often and he may need some extra Humalog based on his readings.

This is an example of using option #2 for westward travel. It will be safer for him to add extra Humalog to correct for elevated blood glucose rather than using the formula to increase his Lantus the first night in Hawaii

**NOTE:** The departure column as the time in Honolulu which Jacob will use as he travels to adjust meals/insulin

Departure Honolulu				Destination Saskatoon	
Date	Time	Itinerary	Comments	Date	Time
Jan 31	11:25 pm	Leave Honolulu	Take evening Lantus before departure a bit later than usual around 10 pm.	Feb 1	3:25 am
Feb 1	5:13 am	Arrive Vancouver			
	8:00 am	Leave Vancouver			
	11:05 am	Arrive Saskatoon			3:05 pm
			Take his supper dose of Humalog – 12 units with his meal.		5:00 pm
Feb 1	4:00pm		Switch to local time.		8:00 pm
			Check blood glucose at bedtime. Take reduced dose of Lantus – 37 units (dose calculated using formula for eastward travel).		10:00 pm

This is an example where the IDA formula for eastward travel could be used to reduce the basal insulin upon arrival in Saskatoon to prevent the possibility of nighttime hypoglycemia.

**CASE 3**

**What will be some of the key questions you might ask in your initial assessment?**

- What are your goals for diabetes control and managing your work shifts?
- What challenges do you have on each of the shifts?
- What support do you receive from your employer (eg meal/snack breaks, insurance coverage, managing hypoglycemia)?

You would also ask questions related to the assessment topics outlined on page 29 in the module. Most important is the client's perspective, understanding her perceptions of diabetes and its management, interest in learning new methods.

**Work out a possible schedule of insulin/meals, snacks for all three shifts which she works and transitions to days off. Use her current insulins and amounts. [You will have to make up some parts, but consider the shifts as 7:00 am to 3:00 pm; 3:00 pm to 11:00 pm and 11:00 pm to 7:00 am.]**

Day Shift: 7:00 am – 3:00 pm

6:00 am	9:30am	1200 pm	3:00 pm	6:00 pm	10:00 pm		
Breakfast Humulin R and N	Break, snack if needed/ desired	Lunch, no insulin	End of shift, snack	Supper Humulin R	Bedtime Humulin N		

Days moving on to evenings:

May need less Humulin R at supper if activity at work exceeds a typical evening at home. If there is a break mid-evening, may need a snack depending on blood glucose, activity level and appetite.

8:00 am	10:00 am	1200 pm	3:00 pm	5:30 pm	10:00 pm	11:00 pm	11:30 pm
Breakfast Humulin R and N	Break, snack if needed/ Desired	Lunch, no insulin	Start of shift, snack pre shift	Supper Humulin R? decrease	Break, snack if needed/ Desired	End of shift	Bedtime Humulin N at home

Evenings will required minimal adjustments in the timing of insulin – may take evening insulin later and sleep in later in the morning.

Moving on to nights – the first night and insulin adjustments will depend on the usual pattern of eating and sleeping/napping in preparation for the shift.

The late night dose of Humulin N may need to be reduced depending on activity.

If a meal is taken during the night, Humulin R may be needed to cover the carbohydrate intake – pre and post testing will help with this decision.

Adjustments may be needed to the morning dose of Humulin R and N as she will be sleeping, less active. Suggest she check her blood glucose when she gets home to compare to the 'usual' fasting – she may need to adjust her insulin.

The table below illustrates the pattern for a usual night:

7:30 am	12 noon	4:00-5:00 pm	6:00-7:00 pm	10:00 pm	3:00 am	7:00 am
End of shift, breakfast and insulin at home	May sleep through this meal	Get up? snack	Supper Humulin R	Humulin N pre work at 11:00 pm	Meal or snack? Humulin R	End of shift

Completing nights – insulin adjustments will depend on eating/sleeping pattern for the transition day. If there have been adjustments to the Humulin N doses, will be able to resume usual doses for day time.

**What are the challenges with her current system and what recommendations might you make?**

- To assess and adjust the Humulin R, it will be helpful if she can do some pre and 2-hour post meal testing. This may have to be approached in a step-wise fashion so she is not overwhelmed and adjustments are made to match work shift and activity. Consideration will be needed for snacks – desired for appetite, eliminate for weight control, needed to help cover for increased activity.
- The Humulin N may or may not be an adequate basal insulin. If increases cause hypoglycemia, a trial of extended long-acting insulin may be helpful.
- May need to involve physician and work with employer for consistent shift work if there are problems.

**CASE 4**

**What will be some of your assessment questions?**

**What are you screening for in your questions?**

- What are your symptoms and how long have you had them?
- What have you had to eat or drink in the past 24 hours?
- What insulin did you take yesterday and what were your blood glucose test results?
- Who is with you to help with meals, fluids etc

The questions will help to screen for:

- Severity of illness
- Dehydration
- Symptoms of HHS. DKA is possible, but unlikely with type 2 diabetes
- Ability to manage at home, need to see MD.

**What advice will you give to Brett?**

Insulin:

Even though he is not eating or drinking, his blood glucose has gradually increased and he missed a dose of insulin.

According to the illness guidelines, he needs an additional 10% added to his usual dose or morning insulin. His total daily dose is 77 units, 10% would be an additional 8 units NovoRapid plus his usual a.m. dose of Novolin NPH, 34 units. He may need reassurance about using NovoRapid at breakfast as he does not normally do this.

You will need to determine if Brett is able to continue to make his own insulin adjustments and what type of information and/or follow-up he will need.

You could review with Brett fluids which he may be able to tolerate in small amounts, even sips eg. Gingerale.

General Health:

Brett's flu is not improving and he has not been drinking or eating for over 24 hours. You should recommend he seek medical attention wherever he can be seen in the next few hours to have an assessment eg physician, walk-in, nurse practitioner or emergency.

If Brett is taking Metformin, ACEI, ARB or a diuretic he may need medical advice about continuing these medications. The RN may need to advocate on behalf of the client.

### **CASE 5**

#### **What insulin dose would you recommend she take now at 0800 hours?**

Her TDD is 62 units. Based on her blood glucose and ketone readings, she needs to calculate a dose of Novorapid which is 15% or 9 units of extra insulin. This would be added to her usual dose of 10 units.

#### **What other advice would you give to Melvina?**

- Test blood glucose and ketones every 2-4 hours while sick
- Take extra Novorapid according to guidelines every 4 hours, as needed
- In addition to sugar free liquids also use carbohydrate containing liquids. She may need advice about what to take and the quantity
- Seek medical/NP advice about management of her illness.

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