Saskatchewan

Insulin Dose

Adjustment

Module

September 2016

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INTRODUCTION

The Saskatchewan Insulin Dose Adjustment (IDA) Module was originally created in 2002 with revisions in 2005, 2009, 2013 and 2016. With changes in clinical practice and to align with current Canadian Diabetes Association (CDA) Clinical Practice Guidelines (CPGs) as well as the new Saskatchewan Registered Nurses Association (SRNA) guidelines, these revisions ensure content is up to date. It is a guiding document created in partnership with the Ministry of Health, front line diabetes educators, as well as managers. Each organization may choose to adapt pieces of the module to suit their unique needs. Health Region will be used throughout the document. The policy and procedures can also be applied by other health care organizations such as Tribal Councils.

For the historical details capturing the evolution of this module please refer to Chapter 4.

Advances in diabetes care have enabled clients using insulin to attain near normal blood glucose control by means of self-monitoring of blood glucose (SMBG) and self-adjustment of insulin dosage. This level of self-care is encouraged because the Diabetes Control and Complications Trial (DCCT) and the United Kingdom Prospective Diabetes Study (UKPDS) have demonstrated that improved glucose control reduces the risk of long-term complications of diabetes. Finally, the ability to adjust insulin dosages enables the person with diabetes to enjoy a more varied and flexible lifestyle while maintaining acceptable blood glucose control. It is recognized that clients require support while learning to self-adjust their insulin dosage.

Registered Nurses (RNs) with advanced knowledge and skill in the area of IDA can be utilized to support clients in efforts to safely adjust their own insulin to optimize diabetes management. An RN exercising this skill set for IDA does so under the new SRNA RN Clinical Nursing Protocol.

In the preparation of this material consideration has been given to several variables:

- needs and safety of clients who will benefit from the RN practicing with the RN Clinical Protocol
- best practice as defined by the CDA CPGs and other current research in self-management principles
- scope of practice of RNs
- experience needed to perform the procedures
- collaborative relationships needed between the RN practicing and the physician/Registered Nurse (Nurse Practitioner) (RN(NP))
- applicable policy and an appropriate RN Clinical Protocol within Health Regions/organizations in Saskatchewan
- access to a physician/RN(NP) in a collaborative relationship for consultation as well as client specific health information.

This module reflects **Basic Insulin Dose Adjustment** and if not otherwise specified basic IDA can be presumed.

Basic IDA responsibilities include:
- IDA for adults with either type 1 or type 2 diabetes
- routine situations when the person with diabetes is in the community setting and is well
- a variety of insulin schedules including intensive therapy/multiple injections
- management of insulin for exercise
- IDA for tests and procedures.

Advanced IDA is <u>NOT</u> included in this module.

Advanced certification (not included in this module) may include some or all of the following specialty areas of IDA. Inclusion of these areas in an individual RN's certification will depend on the experience of the RN with the IDA specialty and the frequency that s/he will perform the dose adjustments. Advanced certification areas include:
- Children with diabetes
- Insulin pumps
- Sick day management
- Pregnancy in women with pre-existing diabetes (type 1 or type 2)
- Gestational diabetes – a provincial module exists
- Special circumstances (travel, shift work) – a provincial module exists.

For ease of use, this Module is divided into five separate chapters followed by Acknowledgements and References:
1. Implementing RN Clinical Protocol for IDA including policy development and expectations
2. Learning Package for RN performing IDA
3. Practice Cases and Answers
4. Historical Development
5. Printable Resources

CHAPTER 1 - IMPLEMENTING RN CLINICAL PROTOCOL FOR IDA

A. Process
B. Policy Development
C. Other Considerations
D. Resource Personnel
E. Competency Performance Involving 3 Supervised Cases
F. Self-Assessment for RNs: Competency Framework and Experience Record
G. Commonly Asked Questions & Answers

It is the Health Region/Organization's responsibility to have a policy in place to ensure that the RN has met her/his specific requirements, to monitor and track progress and certification, and to conduct on-going review of the policy to ensure continued competency.

RNs who have been performing IDA under a previous "transfer of medical function" are required to complete the entire process to obtain certification under the RN Clinical Protocol for IDA (Basic Competency).

A. Process

1. Review the full module
   This document provides the framework for both the RN and the employer to ensure competency in the area of IDA. There are templates and other resources that can be used as guides in helping organizations develop a policy to meet their individual needs. There is a learning package as well as practice cases to help prepare the RN for this RN Clinical Protocol for IDA. A physician must be designated to oversee the health service and provide consultation when required.

2. Ensure current policy reflects RN Clinical Protocol for IDA
   Refer to the various resources included to update current policy within your organization. If you are not familiar with the policies and procedures for the RN Clinical Protocol consult with the Regional and/or SRNA Practice Advisor for advice. A sample policy is included which can be utilized as it is or adapted to reflect unique organizational needs.

3. Ensure RN has met knowledge and experience requirements for RN Clinical Protocol for IDA as outlined below:

   A. Completion of learning package and practice cases within the module including completion of self-study components and other exercises to ensure personal learning needs are met. Consultation with experienced colleagues is recommended. If RN's do not have RN's performing IDA within their clinic they must reach out to RN's outside of their clinic. Names of people willing to provide support have also been included later in this chapter. RNs are expected to

review the module every 2-3 years based on personal learning needs and to review changes in the updated versions.

B. RN self-evaluation by completion of the personal competency assessment (Appendix B). To be completed annually at time of SRNA RN license registration renewal. This identifies opportunities for learning in certain areas and also captures competencies where RN fully meets requirements.
C. RN must have a sound foundation as a diabetes educator with diabetes self-management education experience. 2000 hours of direct diabetes related client care (~1 year of full time work or 2 years if working half-time in diabetes). While achieving the Certified Diabetes Educator (CDE) status is valuable, it does not replace the RN's direct experience requirements. As there are advancements in diabetes care including new insulin types it is expected that RNs performing IDA will keep knowledge and skills current to reflect best practice.
D. Provincial exam – the exam can be obtained from Primary Health Services Branch, Saskatchewan Ministry of Health by the candidate's manager. The exam is issued by the Branch and written in a supervised situation. The completed exam is returned to the Branch, marked and the written results are sent to the candidate and their manager. A certificate is issued with a pass mark of 80%. The candidate, if unsuccessful, can re-write the exam in three months.
E. Completion of three supervised case studies with a colleague (physician/RN(NP)) knowledgeable in IDA. Ideally the three cases will represent a diversity of client situations which are likely to be encountered in practice. Through this practice supervision and discussion, the physician/RN(NP) will be able to ensure the RN demonstrates the required competencies. This review is to be completed every 2-3 years depending on the knowledge and experience of each individual nurse. It may be needed more often for RNs working part time in this area or those with fewer years of experience. The documentation needs to be included with the organization's policy record for evidence of completion as well as the date it was completed.

There is no specific timeline to meet requirements, however all five steps are mandatory.

Other independent study will be required beyond what is included in the module. Attention must be given to the references that are sited as well as the suggested learning activities. Other opportunities for learning include but are not limited to: reading, conferences, on-line education, formal diabetes education courses (Saskatchewan Polytechnic, The Michener Institute of Education, etc.).

Mentorship opportunities can also be very valuable especially if within close proximity for frequent and timely feedback. It is most valuable if there is another RN practicing IDA within the clinic. For RNs practicing in the rural or remote areas, it is more difficult to have the discussions timely enough. They must proactively seek out opportunities for feedback and reflection to enhance their skills.

B. Policy Development

The following can be used as the foundations for policy development.
A printable copy is found in Chapter 5.

RN Clinical Nursing Protocol for Insulin Dose Adjustment (Basic Competency)

Date effective:

Date to be reviewed:

Issuing authority:

Purpose: The purpose of this document is to provide direction to organizations and Registered Nurses (RN) implementing the RN Clinical Nursing Protocol for Basic Insulin Dose Adjustment (IDA). It provides the foundation for safe practice as well as parameters to guide insulin dose adjustment within diabetes self-management education. An RN qualified to perform basic IDA will follow the direction as outlined in the Saskatchewan IDA Module for preparation and on-going competence.

DEFINITIONS

Basic Competency: includes insulin dose adjustment using any insulin schedule including intensive therapy, management of insulin for exercise, and for tests and procedures involving fasting.
Advanced Competencies are not included in this protocol and may include some or all of the following specialty areas of insulin adjustment: pregnancy/gestational diabetes mellitus (GDM) (includes women with pre-existing type 1 or 2 diabetes and women with gestational diabetes), travel, shift work, sick day management, insulin pumps, and children with diabetes. Two other modules address some of these competencies.

CLIENT CONSIDERATIONS

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

For clients to be involved in safe IDA within diabetes self-management the following must be considered:

- Able and willing to frequently monitor blood glucose, record and report the results.
- Able and willing to contact the RN on a regular basis for assistance, guidance and further education regarding IDA.
- Not acutely or severely ill (examples: immediately post-op, end stage renal disease).
- Demonstrate an interest in self-management including follow-up as needed.
- Coordinated care opportunities with other health care providers to ensure broader learning needs are met and support systems are in place.

OBJECTIVE

The RN, who has demonstrated competence for adjusting insulin doses, may teach and assist clients to adjust insulin to support diabetes self-management. Insulin doses will be adjusted for the purposes of optimizing blood glucose levels, promotion of self-management and/or enhancing quality of life.

ASSESSMENT

When teaching clients to adjust insulin, consider the following:

- Initial assessment of the client's learning needs, style, barriers and resources.
- Provision of self-education materials appropriate to the individual needs of the client.
- Confirmation of the accuracy of the client's self-monitoring blood glucose results by means of an annual laboratory to meter comparison and periodic observation of the client's technique.
- Confirmation that the client is aware of the symptoms of hypoglycemia and demonstrates an understanding of the appropriate treatment and prevention of hypoglycemia.
- Confirmation that the client is aware of insulin action (onset, peak, duration).
- Client understands the relationship between the carbohydrate content in food and the impact on blood glucose.
- Client has the resources to perform enough blood glucose monitoring to guide insulin dose adjustments. Clients may be eligible for additional strips if they meet the outlined exception criteria by Saskatchewan Health Drug Plan & Extended Benefits Branch.

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

HIGH ALERT SITUATIONS IN INSULIN ADJUSTMENT

Physician/RN(NP) must *be consulted and notified* regarding IDA in the following situations:

- Insulin doses dropping with no apparent cause.
- Recurrent or severe hypoglycemia with no apparent cause.
- Glycemic control is not improving or is deteriorating despite adjustments made to insulin or other components of the treatment plan.
- Total daily dose exceeds what is generally expected for age/body type.
- Client shows signs/symptoms of diabetic ketoacidosis (DKA), dehydration or other serious problems.
- Recurring/persistent vomiting or diarrhea.
- Disordered eating pattern.

- Significant error in dose or timing of insulin administered by person or caregiver.
- Situations requiring prolonged fasting (e.g. for religious or medical purposes).
- Change in brand or type of insulin.
- Change in frequency of injections; for example BID to Multiple Daily Injections (MDI).
- Change to different regimen; for example conventional therapy to basal-bolus with MDI or insulin pump (continuous subcutaneous insulin infusion, i.e. CSII).
- For clients with additional complex medical or endocrine conditions which may influence insulin requirements or client safety.
- In all situations that are beyond RN scope of practice and/or competency level.

PARAMETERS

IDA will be considered for specific clients under the care of a physician/RN(NP) who is willing to be available to provide on-going consultation and support to the RN. Both parties must mutually agree to this. A physician must be designated to oversee the Health Service and provide consultation when required.

- Neither a physician/RN(NP) nor an RN will be obliged to participate in the RN implementing a RN Clinical Protocol unless there is mutual agreement.
- Once an RN Clinical Protocol is agreed to by Nursing, Physicians and employers, the RN is responsible and accountable for competent performance and will practice in accordance with employer policy.
- The RN Clinical Protocol is applied only to clients whom the RN assesses, teaches and reviews directly.
- Clinical practice will reflect current best practice guidelines.
- Appropriate resources must exist to facilitate RN learning.
- The RN will perform ongoing assessment of the client's metabolic status and refer a client to their physician/RN(NP) in all situations that are beyond their scope of practice, and/or situations where the client's metabolic control is deteriorating despite adjustments made to the insulin or other components of the treatment plan.
- Appropriate resources must exist to facilitate client learning.

COMMUNICATION & DOCUMENTATION

- The physician/RN(NP) retains responsibility for the insulin initiation which includes the type, amount and timing of insulin(s).
- Any significant adjustment to the insulin regime would be done in consultation with the physician/RN(NP).
- The RN, physician/RN(NP) and client will collaborate to establish the appropriateness for

both RN involvement and client participation in IDA.

- The RN and physician/RN(NP) will collaborate on a regular basis to assess and support client's diabetes self-management and IDA.
- Progress updates reflecting client status will be made available via electronic medical records or paper reports and will be available to health care providers involved in the client's care.

EDUCATION & REQUIREMENTS

A. Completion of learning package and practice cases within the Saskatchewan IDA Module, including completion of self-study components and other learning to ensure personal learning needs are met. Consultation with experienced colleagues is recommended. If RN's do not have RN's performing IDA within their clinic they must reach out to RN's outside of their clinic. RNs are expected to review the module every 2-3 years based on personal learning needs and to review changes in the updated versions.

B. RN self-evaluation by completion of the personal competency assessment is to be completed annually at time of SRNA RN license registration renewal. This identifies opportunities for learning in certain areas and also captures competencies where RN fully meets requirements.

C. RN must have a sound foundation as a diabetes educator with diabetes self-management education experience. S/he must also have 2,000 hours of direct diabetes related client care (~one year of full time work or two years if working half-time in diabetes). While achieving the Certified Diabetes Educator (CDE) status is valuable, it does not replace the RN's direct experience requirements. As there are advancements in diabetes care, including new insulin types, it is expected that RNs performing IDA will keep knowledge and skills current to reflect best practice.

D. Provincial exam – The exam can be obtained from Primary Health Services Branch, Saskatchewan Ministry of Health. The exam is issued by the Branch and written in a supervised situation. The completed exam is returned to the Branch, marked and the written results are sent to the candidate and their supervisor. A certificate is issued with a pass mark of 80%. The candidate, if unsuccessful, can re-write the exam in three months.

E. Completion of three supervised case studies with a colleague (physician/RN(NP)) knowledgeable in IDA. Ideally the three cases will represent a diversity of client situations which are likely to be encountered in practice. Through this practice supervision and discussion, the physician/RN(NP) will be able to ensure the RN demonstrates the required competencies. This review is to be completed every 2-3 years depending on the knowledge and experience of each individual RN. It may be needed more often for RNs working part time in this area or those with fewer years of experience. The documentation needs to be included with the organization's policy record for evidence of completion as well as the date it was completed.

There is no specific timeline to meet requirements, however all five steps are mandatory.

REFERENCES

- Saskatchewan Health (2016). *Insulin Dose Adjustment Module.* http://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/chronic-disease/diabetes-resources-for-health-providers
- SRNA (2016) at www.SRNA.org with the following documents:
  - Tool for Developing RN Specialty Practice in Standards and Foundations for Practice
  - Documentation Guidelines (2011)
  - Standards and Competencies for RN Specialty Practice (2016)

An RN Clinical Protocol outlines a series of registered nursing actions that are implemented in pre-determined situations to provide specialized client care in Saskatchewan. An RN who implements an RN Clinical Protocol must meet the criteria as outlined in the SRNA document*, Standards for RN Specialty Practices (2014)*. This RN Clinical Protocol contains evidenced-informed content that is used in conjunction with an RN's critical thinking and clinical judgment to determine when it is appropriate for it to be implemented according to the client's presenting health situation.

C. Other Considerations

Expectations of RNs performing IDA:

- Works within professional and organization standards for IDA.
- Demonstrates current clinical and pharmacokinetic knowledge relevant to IDA.
- Understands meal planning principles and carbohydrate counting in relation to insulin and uses these in assessment, education and recommendations for IDA.
- Assesses blood glucose and appropriately interprets information to make changes to insulin doses(s) or other components of the diabetes treatment plan.
- Understands various insulin schedules and principles for IDA for conventional and intensive therapy (e.g. the specific number of injections/day with different or pre-mixed insulins).
- Assesses and addresses diabetes self-care learning needs and readiness to learn IDA.
- Communicates with the client and other team members toward the goal of appropriate IDA.
- Recognizes personal limitations and cases where IDA would be unsafe.

The physician/RN(NP) retains responsibility for the insulin initiation including the schedule that is ultimately selected – initial dose (amount, type of insulin, timing).

The RN performing IDA, physician/RN(NP) and client will collaborate to establish the appropriateness for both RN involvement and client participation in IDA.

When an RN Clinical Protocol is agreed to by RN, physician/RN(NP) and employer, the RN is responsible and accountable for competent performance.

Insulin doses will be changed according to the IDA guidelines.

If the client is seen for periodic follow-up or returns to the Diabetes Education Program, the RN may continue to guide the client who requires ongoing interventions to maintain blood glucose control with agreed periodic contact with the physician/RN(NP) involved.

If the client does not demonstrate the potential for, or interest in safe self-adjustment of insulin, the attending physician/RN(NP) will resume responsibility for the client's insulin dosage.

It is understood by all parties that the RN will only be available to support clients in IDA during regular working hours.

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

Documentation of progress as well as communication with other health care providers involved in the client's care needs to be accessible and timely.

Potential barriers to the learning process may preclude the client being able to effectively adjust their own insulin dosages. These could include but are not limited to:

a. unable to afford SMBG in accordance with current Saskatchewan approved quantities of blood glucose test strips.
b. unable to understand necessary concepts, e.g. insulin action times, target blood glucose range, etc.
c. unable to analyze abstract data, e.g. relationship of SMBG results to specific insulin action, identification of blood glucose trends, etc.
d. unable to take action to make necessary IDA due to insecurity or willingness to take over perceived medical function.

NOTE: Advanced IDA is NOT included in this module.

D. Resource Personnel

The following are RNs and/or Managers, who have experience with IDA and are willing to talk with others who are in the process of developing this RN clinical protocol.

NAME	ORGANIZATION	TELEPHONE	EMAIL
Karen Butler	Regina Qu'Appelle Health Region	306-766-3777	Karen.Butler@rqhealth.ca
Carlene Schmaltz	Kelsey Trail Health Region	306-862-7251	cschmaltz@kthr.sk.ca
Jan Cochrane	Saskatchewan Polytechnic	306-765-1796	Janice.cochrane@saskpolytec.ca

For more information about the IDA module or to apply for the IDA exam, contact:

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

Ph: (306) 787-0886
Fax: (306) 787-0890
email: lneufeld@health.gov.sk.ca

E. Competency Performance Involving Supervised Cases (3)

This competency performance checklist must be completed by physician/RN(NP)/colleague with a sound knowledge of diabetes. Evaluation of the RN is to be conducted through observation of practice or case study discussion. Complete checklist for initial competency and then every 2-3 years depending on identified needs.

	PERFORMANCE CRITERIA	OBSERVED	NOT OBSERVED	COMMENTS
1	Identifies variables in diabetes management which may be appropriate alternatives to IDA e.g. diet, exercise, injection sites.			
2	Insulin increase is based on a pattern of blood glucose readings above target.			
3	Insulin decrease is based on a pattern of blood glucose readings below target, unexplained hypoglycemia or change in routine which would necessitate an insulin reduction.			
4	Insulin to carbohydrate ratios are created according to guidelines.			
5	Insulin correction factors or insulin grids are created according to guidelines.			
4	Physician/RN(NP) is consulted for non-standard situations and/or failure of IDA to improve control.			
6	Documentation is completed according to established standards.			

____ Competency Acceptable ____ Competency NOT Acceptable

RN Signature: _____

Physician/RN(NP) Signature: _____

Date: _____

Next Review Date: _____

F. Self-Assessment for Registered Nurses: Competency Framework and Experience Record

The following resources have been adapted, with permission, from tools in development by the British Columbia RNs IDA Working Group in preparation for IDA by RNs in BC.

The purpose of the following competency framework and experience record is for self-reflection and to help guide and support RNs in their scope of practice for IDA.

In addition to their annual SRNA license renewal, RNs are expected to complete this self-assessment, but there is no expectation or requirement to submit to their manager.

This framework and experience record provides a template that can be customized to:
- suit the needs and policies of practice settings / organizations.
- assist RNs and organizations with assessing, developing and/or tracking RN competencies for IDA.

Space is included for making notes relevant to each competency.

Competencies in this framework are organized according to the main, overarching competencies required for IDA. Each main competency is accompanied by indicators which will enable an individual or organization to observe and track competency. The competencies and indicators can also serve as a guide for self-study, professional development, and may assist individuals preparing to write the Saskatchewan IDA Exam.

Assessment for IDA include both knowledge and application indicators. RNs must develop and maintain both types of competencies in order to perform IDA as part of their nursing practice. Knowledge competencies can be acquired through self-study, which includes but is not limited to the reading material and learning activities and/or attending relevant workshops. Application competencies require clinical experience, including observation of a competent practitioner (RN or physician/RN(NP)), supervised/joint practice, and independent practice.

Competency
PROFESSIONAL STANDARDS

Works within professional and organization standards for IDA by RNs

Competency Indicator	**Not at all confident** 1	2	3	4	**Very Confident** 5	**Notes**
Accepts responsibility for performing IDA and understands the professional and legal implications of doing so.						
Identifies and works within the scope of practice for RNs as defined by the *SRNA* and the employing health agency / organization.						
Identifies limits of own knowledge and skill and works within limits.						
Demonstrates initiative to advance and maintain knowledge and skills needed for safe IDA.						
Performs IDA often enough to maintain confidence and competence.						
Records accurate, clear and timely clinical notes of insulin dose adjustments and related client education or advice.						

Learning Activities and Experiences completed in this competency area:

Notes:

Date: _____ Signature of RN: _____

Competency
CLINICAL AND PHARMACOKINETIC KNOWLEDGE

Demonstrates current clinical and pharmacokinetic knowledge relevant to IDA

Competency Indicator	**Not at all confident** 1	2	3	4	**Very Confident** 5	**Notes**
Describes the pharmacokinetics and action time of all insulins available in Canada including onset, peak, duration and how these may be altered (e.g. by lipohypertrophy, age, pregnancy, renal impairment etc.).						
Identifies drugs that may inhibit or potentiate the action of insulin.						
Identifies potential side effects of insulin therapy and how to avoid/minimize and manage them (e.g. hypoglycemia, lipohypertrophy, weight gain, in rare cases allergy).						
Describes basic physiologic insulin requirements in type 1 and type 2 diabetes in adults as well as usual starting doses based on age, weight, diagnosis etc.						

Learning Activities and Experiences completed in this competency area:

Notes:

Date: _____ Signature of RN: _____

Competency
MEAL PLANNING, CARBOHYDRATE COUNTING AND INSULIN DOSES

Understands meal planning principles and carbohydrate counting in relation to insulin and uses these in assessment, education, and recommendations for IDA

Competency Indicator	**Not at all Confident** 1	2	3	4	**Very Confident** 5	**Notes**
Describes glycemic responses to different food groups / types.						
Describes the purposes of consistent carbohydrate use and or carbohydrate counting and identifies potential advantages/disadvantages of each, according to the client's situation.						
Calculates, uses and evaluates insulin: carbohydrate ratios.						
Calculates, uses, and evaluates insulin sensitivity factor, correction doses/or insulin scales.						
Identifies dietary, activity, and / or IDA that can be made to improve blood glucose excursions associated with food.						
Identifies dietary and/or IDA for physical activity.						
Identifies effect of alcohol consumption on blood glucose values and provides education and advice to minimize risk and prevent hypoglycemia.						
Works collaboratively with dietitians and makes appropriate client referrals for nutrition education and support.						

Learning Activities and Experiences completed in this competency area:

Notes:

Date: _____ Signature of RN: _____

Competency
ASSESSMENT & INTERPRETATION: BLOOD GLUCOSE

Assesses blood glucose and appropriately interprets information to make changes to insulin dose(s) or other components of diabetes treatment plan

Competency Indicator	**Not at all confident** 1	2	3	4	**Very Confident** 5	**Notes**
Identifies age appropriate blood glucose goals and rationale for these.						
Identifies situations in which standard blood glucose goals may need to be modified.						
Perform a comprehensive assessment of the client's blood glucose: • reviews recorded blood glucose values • obtains pertinent information regarding diet, activity, insulin, and any other factors which may be influencing blood glucose • ensures client's meter accuracy.						
Identifies patterns of hyperglycemia or hypoglycemia, or changes in routines which require adjustment of insulin and/or other components of treatment plan.						
Identifies when, why and how to assess for nocturnal hypoglycemia and potential rebound hyperglycemia.						
Analyzes relationship between blood glucose levels, insulin or other medications, nutritional intake/meal plan, and activity levels, and identifies appropriate adjustments/course of action.						
Interprets assessment data and plans appropriate intervention based on data.						
Communicates assessment findings to relevant team members as appropriate.						

Learning Activities and Experiences completed in this competency area:

Notes:

Date: _____ Signature of RN: _____

Competency
INSULIN SCHEDULES AND DOSE ADJUSTMENTS
Understands various insulin schedules, regimes and principles for IDA

Competency Indicator	**Not at all Confident** 1	2	3	4	**Very Confident** 5	**Notes**
Uses established principles and guidelines for IDA based on patterns.						
Identifies situations when an insulin scale or correction dose needs to be used and/ or adjusted.						
Uses pattern management principles to establish, adjust and evaluate baseline doses for different insulin schedules.						
Identifies when a change in the time of insulin administration would be appropriate and consults with MD as required by organization's policy.						
Applies exercise guidelines appropriate to the client insulin schedule.						
Applies guidelines appropriate to the client for short term IDA for a test or procedure						
Describes principles and concepts of basal-bolus insulin therapy.						
Uses pattern management to evaluate and adjust basal doses for MDI.						
Calculates and applies insulin sensitivity factors, correction doses and/or insulin scales for MDI.						
Calculates and uses insulin to carbohydrate ratios.						
Integrates pattern management principles with correction and supplemental doses for intensive therapy with MDI.						
Applies principles of basal-bolus therapy to optimize blood glucose control and/or quality of life (e.g. increased flexibility) with MDI.						
Completes comprehensive assessment of learning needs & provides timely, client centered education for IDA.						
Provides client/family education, as appropriate, using sound educational theories and principles.						

Learning Activities and Experiences completed in this competency area:

Notes:

Date: _____ Signature of RN: _____

Competency
DIABETES SELF-CARE LEARNING NEEDS
Assesses and addresses diabetes self-care learning needs and readiness to learn insulin dose adjustment

Competency Indicator	**Not at all confident** 1	2	3	4	**Very Confident** 5	**Notes**
Assesses knowledge, ability and readiness to learn principles / guidelines for: • basic IDA according to blood glucose patterns • intensive therapy with MDI.						
Identifies specific learning needs and formulates learning plan with client to address basic IDA.						
Evaluates learning and plans follow-up as appropriate to client/family needs and circumstances.						

Learning Activities and Experiences completed in this competency area:

Notes:

Date: _____ Signature of RN: _____

Competency
COMMUNICATION

Communicates with the client and other team members towards the goal of appropriate insulin adjustment

Competency Indicator	**Not at all Confident** 1	2	3	4	**Very Confident** 5	**Notes**
Involves client in reviewing and interpreting blood glucose values to make informed decisions about adjustments to the treatment plan.						
Deals sensitively with clients' questions, emotions and concerns.						
Assesses learning needs and provides clear, relevant instructions to the client about insulin and IDA (e.g. what insulin(s) to change, specific doses, and expected outcomes).						
Confirms client's understanding of instruction or advice provided.						
Builds relationships with clients to promote self-care and learning and does not encourage ongoing dependence on health professionals for IDA.						
Negotiates learning plan to assist clients in developing knowledge, skills and confidence for self-adjusting insulin doses.						
Notifies and/or consults with other team members as appropriate.						
Records relevant data on the appropriate records.						

Learning Activities and Experiences completed in this competency area:

Notes:

Date: _____ Signature of RN: _____

G. Commonly Asked Questions and Answers

1. If I have IDA under the previous transfer of medical function do I still need to write the exam?

ANSWER
Yes, all RNs are required to complete the process outlined in this document.

2. I am finding that some physicians expect me to take sole and ongoing responsibility for insulin dose management for their clients. How do others handle this?

ANSWER
The intent is to work collaboratively with physicians/RN(NP) and teach people with diabetes and their families to be as independent as possible in diabetes self-management and ensure shared care of clients. If this is an ongoing concern, you may need to have a discussion with the physician/RN(NP) about your scope of practice and workload management, you could involve your supervisor in supporting and explaining the intent of the RN Clinical Nursing Protocol for IDA, and send a letter to new physicians/RN(NP) in Region that the RN has met the competencies

3. Why is sick day management not included in the basic competencies? How can I help my clients with sick day management?

ANSWER
All educators can educate someone to self-manage sick days, but only those with an exhibited advanced competency can adjust insulin. This responsibility is considered 'advanced' because basic IDA competency involves care of the 'well' adult. Also, most educators work Monday to Friday and would not necessarily be available to take on responsibility for on-going insulin adjustments during an inter-current illness.

4. For client safety purposes, can I change the time of day the insulin is given without contacting a physician/RN(NP)?

ANSWER
Yes, moving insulin for safety reasons is a responsibility of the RN. Moving it to a time of day where the peak aligns closer to a mealtime rather than through the night can reduce the risk of hypoglycemia.

5. Other professionals (Home Care Nurse, RNs in Long Term Care, Pharmacist) sometimes call me and ask me to make insulin dose adjustments for their clients. Usually I do not know the client or have not made a recent assessment. How should I handle this? Can I make insulin dose recommendations?

ANSWER
The ability to adjust insulin is for only those clients who the RN has assessed. It is not intended to cover situations where the RN is not involved with the client and unable to do her/his own assessment. The health professional must consult directly with the client's physician or RN(NP).

CHAPTER 2 - THE LEARNING PACKAGE

A. Endogenous Insulin
B. Exogenous Insulin
C. Insulin Regimens
D. Practical Aspects of Insulin Management
E. Nutritional Considerations
F. IDA for Exercise or Increased Physical Activity
G. IDA for Tests/Procedures When Fasting is Required

A. Endogenous Insulin

Learning Objectives

Upon completion of this section you will be able to:

- Describe the hormonal regulation of blood glucose in the person without diabetes.
- Define key metabolic processes and whether insulin facilitates or inhibits the process.
- Describe briefly insulin's effect on cellular glucose uptake in the following organs/tissues: brain, liver, muscle, fat.
- Describe how obesity in individuals without diabetes may alter normal insulin secretion.
- Name the potential metabolic effects of hyperinsulinemia.
- Describe the metabolic effects of an absolute lack of insulin.

Hormonal Regulation of Blood Glucose in the Individual without Diabetes

Blood glucose (BG) levels are constantly monitored by the alpha and beta cells of the Islet of Langerhans in the endocrine pancreas. If glucose levels are dropping, the alpha cells are stimulated to secrete glucagon which stimulates certain metabolic processes (glycogenolysis in the liver primarily) which modulate the blood glucose and keep it in the normal range. If glucose levels are rising, the beta cells secrete insulin which stimulates certain metabolic processes (glycogenesis, lipogenesis, cellular glucose uptake) which modulate the BG and keep it in the normal range.

Other hormones stimulated by dropping BG values are epinephrine, cortisol, and growth hormone. These hormones and glucagon are termed 'counter-regulatory' in that they all have 'anti-insulin' action in raising BG values. Insulin secretion is also stimulated by ingestion of protein because insulin is required for protein synthesis. Average daily insulin secretion by the pancreas is about 30 units.

Metabolic Process	Definition	Stimulated or Inhibited by Insulin
Glycogenesis	The formation of glycogen from glucose. Glycogen is stored in the liver and muscles.	Stimulated
Lipogenesis	The formation of fat from its substrates, glycerol and fatty acids.	Stimulated
Gluconeogenesis	The breakdown of fat and protein to form glucose and by products.	Inhibited
Glycogenolysis	The breakdown of glycogen into glucose.	Inhibited

Insulin's Effect on Cellular Glucose Uptake

- Insulin is not required for glucose uptake by brain cells.
- Insulin facilitates glucose uptake by liver cells.
- Insulin facilitates glucose uptake by muscle cells.
- Insulin facilitates glucose uptake by fat cells.

How Obesity Alters Normal Insulin Secretion in the Person Without Diabetes

Obese individuals may have abnormal insulin secretion, often resulting in:

- higher circulating insulin levels.
- abnormal timing of post-prandial insulin secretion.

In addition, obese individuals without diabetes have been shown to have a decreased number of insulin receptors and decreased sensitivity of receptors to insulin, resulting in a resistance to the action of insulin.

Potential Metabolic Effects of Hyperinsulinemia

- Glycogenesis often resulting in a glycogen saturated liver.
- Excessive lipogenesis often resulting in increased adipocyte deposition of lipid.
- Inhibition of lipolysis and glycogenolysis.

Hypoglycemia may develop post-prandially as a result of the above processes. Eventually there will be pancreatic 'burnout' and insulin levels will drop.

Metabolic Effects of Lack of Insulin

An absolute insulin deficiency will cause:

- decreased glucose uptake by liver, muscle, fat cells.
- excessive glycogenolysis, lipolysis, gluconeogenesis.
- inhibited glycogenesis and lipogenesis resulting in hyperglycemia and hyperosmolar diuresis.
- nearly exclusive cellular utilization of fatty acids for energy production results in accumulation of ketone bodies in the blood causing ketoacidosis.

These metabolic changes eventually lead to either type 1 or type 2 diabetes. With type 2 diabetes, there is often a broader underlying disorder known as metabolic syndrome. Metabolic syndrome is characterized by several abnormalities including: abdominal obesity, hypertension, dyslipidemia, insulin resistance and dysglycemia.

B. Exogenous Insulin

Learning Objectives

Upon completion of this section you will be able to:

- List the sources, manufacturers, and trade names of commercially available insulins in Canada.
- Identify principles of using rapid-acting insulin analogues.
- Identify principles of using a concentrated rapid-acting insulin analogue.
- Identify principles of using a long-acting basal insulin analogue.
- Identify principles of using a concentrated long-acting basal insulin analogue.
- Describe the action time of the various insulins available in Canada including onset, peak, and duration of action.
- Describe best practice in injection technique for subcutaneous use.
- Describe the potential adverse effects of subcutaneous insulin use.
- Describe other medications which affect insulin action.
- Describe insulin requirements in type 1 and type 2 diabetes.

Insulins Approved for Use in Canada

The following table includes the insulin types currently available in Canada. It is based on content in the CDA 2013 Clinical Practice Guidelines (Table 1, Chapter 12) and may need periodic updating by users of this module.

TYPES OF INSULIN			
Insulin type(trade name)	Onset	Peak	Duration
Prandial (bolus) insulins			
Rapid-acting analogues (clear) • Insulin Aspart (NovoRapid®) • Insulin Lispro (Humalog®) • Insulin Glulisine (Apidra®) • Insulin Lispro (Humalog ®200 KwikPen)	 10-15 min 10-15 min 10-15 min	 1-1.5 h 1-2 h 1-1.5 h	 3-5 h 3.5-3.75 h 3-5 h
Short-acting insulins (clear) • Humulin®-R • Novolin ®ge Toronto	30 min	2-3 h	6.5 h
Basal Insulins			
Intermediate-acting (cloudy) • Humulin®-N • Novolin ®ge NPH	1-3 h	5-8 h	Up to 18 h
Long-acting basal insulin analogues (clear) • Insulin Detemir (Levemir®) • Insulin Glargine (Lantus®/Basaglar) • Insulin Glargine (Toujeo®300 SoloStar)	90 min	Not applicable	Up to 24 h (glargine 24 h, detemir 16-24 h)

Premixed Insulins	
Premixed regular insulin – NPH (cloudy) • Humulin ® 30/70 • Novolin ® ge 30/70, 40/60, 50/50	A single vial or cartridge contains a fixed ratio of insulin (% of rapid acting-acting or short-acting insulin to % of intermediate-acting insulin)
Premixed insulin analogues (cloudy) • Biphasic insulin aspart (NovoMix ® 30) • Insulin lispro/lispro protamine (Humalog ® Mix 25 and Mix 50)	

NOTE:
The 2013 CPGs recommend reference to the most current edition of the Compendium of Pharmaceuticals and Specialties (CPS: Canadian Pharmacists Association; Ottawa, Ontario, Canada and product monographs for detailed information).

Learning Activity

1. Review Chapter 6 "Treatment Modalities/Pharmacological Therapies in *Building Competencies - The Essentials*, 2014
2. Using the above table, draw sample diagrams to use with clients to illustrate the onset, peak and duration for insulins commonly used in your practice.
3. Read Chapters 12 and 13 in the CDA CPGs and do the associated exercises.

Rapid-Acting Insulin Analogues

Rapid-acting insulin analogues closely duplicate the action of the body's endogenous insulin in response to food ingestion. The rapid onset and short duration, as compared to short-acting insulin, benefit people with diabetes by providing:

- "inject and eat" convenience
- improved post-prandial glucose control
- less risk of hypoglycemia between meals and overnight.

Rapid-acting insulin analogues are suited to people who want improved glycemic control and more flexibility in their schedule. It is beneficial for individuals with type 1 or type 2 diabetes, including children, those new to insulin as well as those already using insulin. It is particularly suitable for people on MDI, i.e. TID or QID regimens or insulin pumps.

- Inject rapid-acting insulin within 15 minutes of a meal.
- Monitor BG regularly. It is helpful to assess BG before the meal and then 2 hours following to assess the meal/insulin balance. Trends allow for insulin doses to be tailored accordingly. A BG excursion of 2-3 mmol/L two hours after a meal represents a reasonable balance of insulin to carbohydrate consumed. Advise your client to plan accordingly if partaking in strenuous exercise within two hours after taking a rapid-acting insulin analogue. If a person must exercise in that timeframe, recommend a reduction in the rapid-acting analogue dose by 50%. Exercising two - four hours after injection of a rapid-acting analogue presents a lower risk for hypoglycemia.

- People with gastroparesis should use a rapid-acting analogue with caution. Extra BG monitoring is needed to determine the timing of injection with the rise of BG after food is absorbed. Insulin may need to be administered after the meal to match the rise in BG.
- If transitioning from short to rapid acting insulin, the same dose may be used assuming that dose is effective and safe.
- Your client may feel more secure taking about 10 to 20% less initially until the effect can be gauged.
- Basal insulin needs are important to ensure BG is managed between meals and overnight. Short-acting insulin has a trailing effect which tends to provide some coverage longer after the meal. A rapid-acting insulin analogue has a shorter duration which can result in rising BG prior to the next meal if basal needs are not met.
- Refrigerate insulin that is not in use.
- Follow the manufacturer's current product monograph for usage guidelines and other details.

While most insulins are administered through an insulin pen there may be instances where you may need to teach administration with a syringe.

- When mixing insulins, combine only the same brand of insulins; for example, do not mix a NovoNordisk brand insulin with an Eli Lilly brand insulin.
- If the rapid-acting analogue is mixed with intermediate-acting insulin, inject immediately to prevent blunting of the rapid insulin action after mixing.
- Do not mix any insulin with a long-acting basal insulin analogue.

Concentrated Rapid-Acting Insulin Analogue (Humalog® 200units/mL KwikPen®)
Indications for Use:

- Can be used to manage either type 1 or type 2 diabetes where a rapid-acting insulin is required.
- Used for treatment when clients require > 20 units of rapid-acting insulin per day.
- No dose adjustment required when transferring from Humalog 100units/mL to Humalog 200 units/mL.
- **Cannot** be used in a subcutaneous infusion pump.
- Less volume per injection resulting in more comfort and ease of injection.

Precaution for Use

- **Concentrated insulin cannot be transferred from original pre-filled pen to any other injection devices; e.g. a syringe.**
- Refrigerate insulin that is not in use.
- Follow the manufacturer's current product monograph for usage guidelines and other details.

Learning Activity

1. Discuss special considerations with an experienced diabetes practitioner who has recently had experience with this transfer to concentrated rapid-acting insulin analogue.
2. Review from Lilly's Humalog® 200 units/mL KwikPen® consumer information sheet at the following website: http://www.lilly.can/en/pdf/consumer-information/14_humalog-u-200-ci_30mar2015.pdf

Long-Acting Basal Insulin Analogues

Three brands of long-acting basal insulin analogues are available in Canada: Lantus® (insulin glargine), Levemir® (insulin detemir) and Basaglar™ KwikPen (insulin glargine). Basal insulin provides background insulin coverage between meals and overnight.

- Can be used with either type 1 or type 2 diabetes where a basal insulin is required. Do not mix with any other insulin (if using a syringe).
- As with all insulins, long-acting insulin analogues may cause hypoglycemia.
- For persons with renal or hepatic dysfunction, insulin requirement may be lower due to increased insulin sensitivity and decreased insulin metabolism. Extra BG monitoring may be required until an individualized management plan can be established.
- Long-acting insulin analogues are clear and should not be used if cloudy.
- Long-acting insulin should be stored in a refrigerator, 2ºC to 8ºC. It should not be allowed to freeze. If refrigeration is impossible, the insulin in use can be kept unrefrigerated up to 28 days (42 days for Levemir) away from direct heat and light as long as the temperature is not ≥ 30ºC. Discard after 28 or 42 days if unrefrigerated.
- As the insulin is acidic, there may be mild discomfort at the injection site.
- Usual education related to insulin use should be provided.
- Follow the manufacturer's current product monograph for usage guidelines and other details.

Long-Acting Concentrated Basal Insulin Analogue

In Canada there is currently one product available: TOUJEO® SoloStar (Insulin Glargine 300 U/mL).

- Can be used with either type 1 or type 2 adults with diabetes where basal insulin is required.
- Follow same indications and precautions as with other long acting basal insulins.
- Less volume per injection results in more comfort and ease of injection.
- No dose adjustment is needed when switching from Lantus® 100 U/mL to Toujeo® 300 U/mL.
- **Concentrated insulin cannot be transferred from the original pre-filled pen to other injection devices; e.g. a syringe. This insulin cannot be mixed.**
- A Toujeo® prefilled pen holds 450 units of insulin.

Long-acting insulin should be stored in a refrigerator, 2ºC to 8ºC. It should not be allowed to freeze. If refrigeration is impossible, the prefilled pen can be kept unrefrigerated up to 42 days away from direct heat and light as long as the temperature is not ≥30ºC. Discard after 42 days if unrefrigerated.

- As the insulin is acidic, there may be mild discomfort at the injection site.
- Usual education related to insulin use should be provided.
- Follow the manufacturer's current product monograph for usage guidelines and other details.

Dosage and Administration

- For "insulin naïve" clients with type 2 diabetes already treated with oral anti-hyperglycemic agents, the recommended starting dose is 10 units once daily with subsequent adjustment according to client needs.
- Change over to a long-acting insulin analogue from intermediate acting insulin:
  - in clinical studies when the transfer was from once daily NPH human insulin the initial dose was not changed.
  - in studies where the transfer was from twice daily NPH to once daily long-acting insulin analogue at bedtime, the initial dose was reduced by a minimum of 20% of the previous total daily dose of intermediate or long-acting insulin.

Learning Activity

1. Discuss special considerations with an experienced diabetes practitioner who has recently had experience with this transfer to concentrated long-acting insulin analogue.
2. Review from Sanofi Aventis website www.sanofi.ca/l/ca/index.jsp TOUJEO SoloStar (Insulin Glargine 300U/mL) product monograph. http://products.sanofi.ca/en/lantus.pdf

C. Insulin Regimens

Learning Objectives

Upon completion of this section you will be able to:

- Describe current common insulin regimens.
- Describe principles and methods of carbohydrate management, including carbohydrate counting.
- Describe and implement the procedures listed below:
  - Initiating an insulin regimen and establishing client goals
  - Pattern management
  - Variable insulin doses
  - Correction factor for low/high glucose readings
  - Use of insulin:carbohydrate (insulin:carb) ratios.

Insulin regimens must be planned to meet the metabolic requirements of the individual while being able to control the BG level throughout the 24 hour day. Commencing insulin and stabilizing the BG levels calls for different insulin regimes depending on individual requirements, the "intensity" of therapy, and a consideration of the client's lifestyle and routines.

Type 1 Diabetes

- Basal-bolus insulin regimens (e.g. multiple daily injections or continuous subcutaneous insulin infusion) are the insulin regimes of choice for all adults with type 1 diabetes.
- Insulin regimens should be tailored to the individual's treatment goals, lifestyle, diet, age, general health, motivation, hypoglycemia awareness status and ability for self-management.
- All individuals with type 1 diabetes should be counseled about the risk, prevention and treatment of insulin-induced hypoglycemia.

The DCCT has shown that individuals with type 1 diabetes will benefit from metabolic control as close to normal glucose levels as possible. This level of BG control appears to slow the auto-immune destruction of beta cells thus leaving well controlled individuals with greater beta cell reserve one year following diagnosis than individuals with higher BG levels. Therefore, individuals newly diagnosed with type 1 may benefit from two to four injections of insulin per day aimed at keeping pre-prandial glucose levels < 7 mmol/L. To achieve glycemic targets in adults with type 1 diabetes, basal-bolus insulin regimens or Continuous Subcutaneous Insulin Infusion (CSII) as part of an intensive diabetes management regimen is the treatment of choice.

Basal insulin, also known as background insulin, is the insulin required to counteract hormonal and other variables potentially causing hyperglycemia between meals and overnight.

Bolus insulin, commonly known as meal-time insulin, is the insulin used to cover glucose rise as a result of food intake. Typically this can range from 40-60% of the total daily requirement for insulin.

The 2013 CPG recommend a basal/bolus regimen with:

- Rapid-acting insulin analogues (aspart/ lispro/ glulisine), should be used in adults with type 1 diabetes.
- A long-acting insulin analogue (detemir, glargine) may be used as the basal insulin to reduce the risk of hypoglycemia, including nocturnal hypoglycemia.

A total daily dose of 0.5 - 1.0 units/Kg of body weight is usually required. The total daily dose is distributed according to the type of insulin regimen initiated.

- It is the physician/RN(NP)'s responsibility to determine the initial type, dose and regimen.
- Any subsequent change to insulin type remains the responsibility of the physician /RN(NP).

- If the RN feels that regimen changes should be made, i.e. number of injections or type of insulin, she/he must do so in collaboration with the physician/RN(NP).
- Timing of insulin injection is recognized as a function of the RN.

Insulin action times must be taken into account when deciding which insulin to adjust for a particular blood glucose problem at one time of day.

Glucose toxicity can happen when BG is above target and results in impairing the ability of the pancreas to generate insulin. As glucose toxicity is overcome for those newly diagnosed with type 1 diabetes, beta cell function improves and may synergistically work with injected insulin to cause hypoglycemia i.e. the honeymoon period has begun. Caution must be observed once euglycemia is attained. Be prepared to reduce the injected dosage quickly in these individuals as indicated by BG results. Requirements may drop to < 0.5 units/kg body weight/day.

Type 2 Diabetes

The individual with type 2 diabetes may benefit from several types of insulin regimens which may or may not be used in conjunction with anti-hyperglycemic agents (AHAs).

Basal only – once or twice daily
Basal once/twice daily plus bolus (1-3 times per day)
Bolus only – 1-3 times per day with meals
Bolus – for correction of BG outside of target range

When basal insulin is added to AHAs, long-acting analogues (detemir or glargine) may be used instead of intermediate-acting (NPH/N) to reduce the risk of nocturnal hypoglycemia.

When bolus insulin is added, rapid-acting analogues may be used instead of regular insulin to improve glycemic control and to reduce the risk of hypoglycemia.

If adding basal insulin to daytime oral AHA, increase the dosage regularly (every 1-4 days) until the fasting glucose reaches the target range. Because of insulin resistance, the dosage requirement will vary widely between clients. If glycemic targets are not reached despite increasing doses of insulin, further assessment is warranted.
If, based on clinical assessment, the client is willing and capable, and has received proper education and support, they can then be taught self-titration.

When using daytime insulin for the individual with type 2 diabetes, consider insulin action profiles in deciding which insulin to adjust or whether to suggest the addition/change to another type of insulin to improve glucose control at a particular problem time of day. In addition, people with type 2 diabetes and insulin resistance, larger insulin doses or use of concentrated doses may be required to achieve the glycemic target range.

Insulin action times may vary from individual to individual. Use insulin action times as a guideline to adjust your client's insulin based on their unique pattern management. Assess how each insulin is working in each client and make adjustments accordingly.

Drugs That May Inhibit or Potentiate Insulin Action

Inhibit Insulin	Potentiate Insulin
Thiazide diuretics	Non-selective beta blockers
Glucagon	Alcohol
Prednisone/steroids	MAO inhibitors
Thyroid Hormone	Salicylates (1.5-6 g/day)

Use of Beta Blocking Drugs

Non-selective beta blocking agents such as propranolol (Inderal®) potentiate the action of insulin by reducing glycogenolysis from the liver. While all beta blockers block the sympathetic nervous system response to epinephrine secreted during a hypoglycemic episode, certain beta blocking drugs are dangerous as they block the early warning signs of hypoglycemia that are mediated by the sympathetic nervous system.

Learning Activity

1. Review the above medications and be familiar with the effects for insulin users.

Insulin Requirements

Insulin requirements will vary with each individual. The next section provides information on the options for insulin regimens and the use of insulin with oral anti-hyperglycemic agents. General guidelines suggest:

- For type 1 diabetes, when weight is within 20% of normal, usual insulin requirements are 0.5 to 0.7 units/kg of body weight per day. These requirements will be lower during the "honeymoon" phase (0.2-0.6 u/kg).
- For type 2 diabetes the insulin requirement will be individualized depending on the degree of insulin deficiency and insulin resistance. At the low end requirements may be only 5-10 unit/day. At the high end insulin requirements may be hundreds of units per day. Insulin dose is usually >0.5 units/kg/day.

D. Practical Aspects of Insulin Management

Learning Objectives

Upon completion of this section you will be able to:

- Identify factors influencing BG.
- Understand the use of insulin and oral antihyperglycemic agents (AHA).
- Identify prevention and treatment of hypoglycemia.
- Describe 3 common causes of fasting hyperglycemia.
- Identify principles of using rapid-acting insulin analogues.
- Identify principles of using a concentrated rapid acting insulin analogue.
- Identify principles of using a long-acting basal insulin analogue.
- Identify principles of using a concentrated long-acting basal insulin analogue.

Factors which can influence blood glucose. All of these need to be assessed prior to initiating or changing an insulin dose:

- diet: carbohydrate content, timing and delayed gastric emptying
- activity – type, timing, frequency, intensity
- BG monitoring technique/meter accuracy
- concurrent illness/infection
- pain including pain management
- concurrent medications for other health issues – recent changes to meds, missed doses
- other meds for diabetes (oral or injectable)
- unusual stresses – mental/physical
- sleep quantity/quality
- cognition issues
- dexterity issues/limitations
- visual impairment/corrective lenses
- injection site problems:
  - variable absorption
  - lipodystrophies
- insulin administration problems
- inaccurate dose
- missed doses, extra doses
- timing of dose
- IM vs subcutaneous injections
- storage and handling of insulin
- expiry dates
- weight changes (gaining or losing)
- menstrual cycle/ hormonal influences
- length of time between carbohydrate intake and blood glucose monitoring
- pregnancy
- insulin antibodies
- abnormal glucose counter-regulation
- alcohol use

Learning Activity

1. Review Chapter 12 Intensive Insulin Therapy *Building Competencies - The Essentials*, 2014.

The Use of Insulin and Oral Antihyperglycemic Agents (AHA)

The 2013 CPGs recommend the timely addition of anti-hyperglycemic agents (either orally or with insulin) if:

- Glycemic targets are not achieved within 2-3 months of lifestyle management.
- Current agents are not successful in achieving glycemic targets. This may require medication adjustment and/or additional medications to attain target A1C within 3-6 months.
- There is marked hyperglycemia (A1C > 8.5%), antihyperglycemic agents need to be initiated concomitantly with lifestyle management and consideration needs to be given to initiating combination therapy with two AHAs, one of which may be insulin.

Learning Activity

1. Read Chapter 13 in CDA CPGs, Review Table 1. http://guidelines.diabetes.ca/cdacpg_resources/Ch13_Table1_Antihyperglycemic_agents_type_2_2016.pdf
2. Use the current version of the compendium of pharmaceuticals (CPS) to investigate each medication.
3. Discuss the table with other diabetes practitioners and your physician/RN(NP) leader to gain local consensus on current practice, safety issues and important points for client education when combining insulin with other AHA.
4. Review the RX Files. **www.RxFiles.ca**

Prevention and Treatment of Hypoglycemia

Hypoglycemia is defined as:

1. the development of autonomic and neuroglycopenic symptoms
2. a low plasma glucose level (< 4.0 mmol/L) when treated with insulin or an insulin secretagogue
3. symptoms responding to the administration of carbohydrates
4. severity is defined by clinical manifestations

Drug induced Hypoglycemia

Diabetes medications that can cause hypoglycemia must be used with caution. Hypoglycemia is possible when using a medication that causes the pancreas to produce more insulin *or* if insulin is being injected. These oral medications (alone or in combination) include: Glyburide, Gliclazide, Repaglinide, Glimepiride. The other classes

of medications for diabetes rarely cause lows unless combined with the above listed medications &/or insulin.

Signs and Symptoms

The signs and symptoms typically become more pronounced as BG levels continue to drop. Symptoms can be very individual from one person to another. Over time, if a person has frequent hypoglycemic episodes the signs and symptoms may change and become less noticeable. This is called hypoglycemia unawareness. It can result in unconsciousness, seizures and death. Restoring the counter-regulatory response and retraining of symptoms is possible in some cases.

Restoring Blood Glucose Levels

The goals of treatment are to detect and treat a low BG level promptly by using an intervention that provides the fastest rise in BG to a safe level, to eliminate the risk of injury and to relieve symptoms quickly. It is also important to avoid overtreatment, since this can result in rebound hyperglycemia and weight gain.

Mild/Moderate hypoglycemia should be treated with 15 grams of rapid absorbing carbohydrate (glucose tablets, 3 teaspoons sugar, ¾ cup regular pop or juice, 1 tablespoon honey). Glucose must be swallowed to be effective. Buccal absorption is minimal. After 15 minutes if BG is still <4 mmol/L retreat. Once BG is restored to >4.0 mmol/L then a snack or meal may be provided.

Severe hypoglycemia episode should be treated with 20 grams rapid absorbing carbohydrate. If unconscious or unable to swallow safely Glucagon 1mg sc or Im may be administered and Emergency Medical Services (EMS) notified. If clients are using alpha-glucosidase inhibitors, treatment must be dextrose tabs or honey, because table sugar will not work due to its inability to absorb efficiently.

Other Considerations:

- SMBG is required when adjusting insulin so that hypoglycemia can be avoided/ minimized. Monitoring also allows clients to recognize their own symptoms as BG may approach lower values.
- Clients need to be aware of the hypoglycemia risk that comes with changes in lifestyle including late or missed meals, changes in exercise routines, as well as changes in insulin or medication dosages.
- Family members, friends and support people need to be aware of the risk for hypoglycemia and prepared to provide assistance if needed.
- The person with diabetes should be wearing medic alert identification.
- Remind the client to carry a fast-acting carbohydrate with them at all times to prevent and treat a potential low BG.

If possible, identify with the client:

- her/his earliest perception/sensation that BG may be dropping and the usual BG at that time.

- the history of hypoglycemia, including the frequency, severity, usual treatment and usual prevention strategies.
- if she/he has hypoglycemia unawareness, assess how they usually manage the episode and counsel as needed.

Given improvements in medications and insulin options, every effort is made to achieve glycemic targets while minimizing the risks of hypoglycemia.

Learning Activity

Read the following resources:
1. Read Chapter 13 in the 2013 CDA Clinical Practice Guidelines section on hypoglycemia (S69-S71) and read the related guidelines on driving and diabetes. http://www.diabetes.ca/getmedia/b960981b-a494-497e-ae5a-37c73d3261ab/2015-cda-recommendations-for-private-and-commercial-drivers.pdf.aspx
2. Know your organization's protocols related to hypoglycemia.

Fasting Hyperglycemia

Overnight BG Management
Overnight BG control is often the hardest to achieve. The correct basal insulin dose should maintain the BG between 4.0 – 7.0 mmol/l with no nocturnal hypoglycemia.

Fasting hyperglycemia can occur for a variety of reasons including:
- Somogyi phenomenon - also known as rebound hyperglycemia. This is hyperglycemia (not caused by excessive dietary intake) following a hypoglycemic episode. The etiology is believed to be increased production of counter-regulatory hormones in response to hypoglycemia.
- Waning Insulin - The current edition of Joslin's Diabetes Desk book (2014) notes the waning effect of the insulin dose given the previous evening can also be a factor. The duration of action of the overnight insulin is insufficient and leads to a gradual rise in BG level from bedtime to morning. This can be related to the type and/or timing of the basal insulin used.
- Dawn Phenomenon - to the increased production of glucose by the liver and decreased sensitivity to insulin that occurs between 0400 and 0800 hours in people with and without diabetes. Therefore, higher levels of insulin are required to maintain euglycemia during these hours.
- Lifestyle factors - carb intake through the evening, including the hs snack, physical activity and stress levels.
- Medication factors – type of insulin, timing of injection and technique.

Nocturnal hypoglycemia may be difficult to detect as often the individual sleeps through the reaction. It can be caused by a variety of reasons, including:

- Lifestyle factors - carb intake through the evening, including the hs snack, physical activity, alcohol consumption, and stress levels.
- Medication factors – type of insulin, timing of injection and technique.

The best way to determine the cause of fasting hyperglycemia and/or nocturnal hypoglycemia (and thus the appropriate corrective action) is to have the individual check the BG level at bedtime, in the middle of the night (usually 0300 to 0400 h) and upon rising for several days. This will allow the RN to determine what the BG levels are doing and determine if there is a pattern to the BG changes. This information, along with assessment of the other relevant factors should allow the RN to determine the likely cause of the fasting hyperglycemia and potential corrective actions, (which may or may not include IDA) to discuss with the client.

Injection Technique for Subcutaneous Use

The Fit Forum for Injection Technique (FIT Canada) provides evidence-based best practice information for all those with diabetes using injectable therapies to achieve the best possible health outcomes by ensuring that the dose is delivered in the right injection site, using the right technique, every time. The FIT Forum resources are comprehensive and nurses performing IDA need to practice according to this best practice guide. The guide explores detail within the following areas:

- Preparing for injection
- The correct use of devices (syringes & pens)
- Disposal of injecting material
- Physical aspects of insulin
- Factors affecting absorption from different sites
- Factors affecting general absorption of insulin
- Injection sites
- Lipohypertrophy
- Rotation of sites
- Bruising and bleeding
- Pregnancy
- Elderly
- Pediatrics
- Institutions
- 10 best practice recommendations

Potential Adverse Effects of Subcutaneous Insulin Use

Adverse effects of exogenous insulin use may include hypoglycemia, lipoatrophy (the localized loss of fat tissue), lipohypertrophy (evidence of fatty lumps or hardened areas under the surface of skin), weight gain, insulin resistance (presence of IgG antibodies), and in rare cases localized insulin allergy (presence of IgE antibodies).

Lipohypertrophy is associated with incorrect insulin injection technique. It is most commonly associated with re-use of needles, over use of injection area, poor rotation within a site as well as from one site to another. Some people tend to be more prone to “lipo” areas. Lipohypertrophy may be visible or palpable with fingertips as thickened

or rubbery lesions under the skin. Clients may also notice resistance when trying to insert the needle into a "lipo" area as well as resistance when trying to actually inject the insulin in.

Improper injection technique can result in an intramuscular injection rather than subcutaneous and as a result the insulin can metabolized quicker than expected and effects on BG can be unpredictable.

Learning Activity

1. Read FIT Forum for Injection Technique in Canada for Best Practice in Canada website: www.Fit4diabetes.com and view client handouts and educator resources.

Establishing Client Goals

Target BG Levels – the following can serve as standard reference points (for most clients).

Recommended targets for glycemic control			
	A1C (%)	**FPG/preprandial PG (mmol/L)**	**2-hour postprandial PG (mmol/L)**
Target for most clients (if safely achievable)	≤ 7.0	4.0 – 7.0	5.0 – 10.0 (5.0 to 8.0 if A1C targets not being met)

NOTE: treatment goals and strategies must be tailored to the individual with consideration given to individual risk factors. A target A1C of ≤6.5% may be considered in type 2 diabetes to further lower the risk of nephropathy and retinopathy but this must be balanced against the risk of hypoglycemia.

Individualized Goals: Individualized goals for BG control will be specified in the client's chart and will be determined collaboratively with the physician/RN(NP), the Registered Nurse, the client, significant others and other health care providers. Factors which may be considered in setting goals include the age of the client as well as health status and safety concerns.

Some special situations which may require individualization of goals include:

Frail elderly or ill clients: The same glycemic targets apply to otherwise healthy elderly individuals as to younger people. In persons with multiple co-morbidities, a high level of functional dependency and/or limited life expectancy the goal should be less stringent. Try to avoid symptoms of hyperglycemia and prevent hypoglycemia. Quality of life measures are more of a priority than prevention of long term complications for these clients.

Women planning a pregnancy must strive for tighter glucose control (A1C ≤ 7% (or as close to normal as can safely be achieved) to decrease the risk of congenital abnormalities and further problems in pregnancy.

Hypoglycemia unawareness (failure to sense hypoglycemia) may place clients at risk of life-threatening hypoglycemia. Glycemic targets for these clients should be adjusted upward. The goal is to avoid severe or unrecognized hypoglycemia.

Learning Activity

1. Read Chapter 8, Targets for Glycemic Control of the CPGs.
2. Review and practice using the "Individualizing your patients A1C Level" with various client scenarios. http://guidelines.diabetes.ca/bloodglucoselowering/a1ctarget

Initiating Insulin Therapy

A written (in-person or by fax), verbal or telephone order is required from the family physician/RN(NP) prior to the initiation of insulin therapy. The order must specify the type, dose and time of insulin. This order will be discussed with the Registered Nurse and client prior to the initiation of insulin therapy. Verbal/telephone orders must be signed according to SRNA policy within 24 hours.

Physician/RN(NP) orders will be documented in the client's chart.

Subsequent alteration in the type of insulin or significant changes in insulin will be discussed with the physician/RN(NP) and the client, and receive an appropriate order requesting these changes.

Considerations When Adjusting Insulin:

- Make IDA to usual insulin dose based on BG patterns.
- Initially, adjust to eliminate low BG readings. Night time hypoglycemia may be reported as nightmares, poor sleep, tossing and turning or perspiration.
- There may be several possible reasons for fasting hyperglycemia.
- Adjust only one insulin dose at a time (unless this will cause a low BG level at a later time). Consider that when one insulin is increased, another may need to be decreased.
- Increase insulin when there is a pattern of repeating high glucose results. DO NOT increase insulin on the basis of sporadic or single high readings.
- Wait 1-4 test days between each IDA, depending on individual client variables, to have sufficient data to determine a pattern. If there is more urgency to get BG down then adjustment steps may be higher and more frequent. This also involves frequent BG monitoring and attention to hypoglycemia. Interim BG targets are useful and when reached, a new titration plan can be established. It is critical to have a mutually agreed upon BG target so that insulin can be adjusted with that target in mind.
- Use a combination of pre-prandial and post-prandial BG levels to guide adjustments.

- IDA in most circumstances will be by 10% increments. For example:
  - Usual dose of < 10 units, adjust by 1 unit
  - Usual dose of 10-20 units, adjust by 1 - 2 units and so on
- Patterns are consistent trends in BG that occur at the same time of day for three to four days in a row with no change in diet or exercise.
- Modifications in insulin are based on BG patterns.
- This method pre-supposes that the person has a somewhat consistent pattern of meals, carbohydrate intake and activities, has no concurrent illness and is free from unusual stress.
- Assess frequency and timing of any hypoglycemia, including nocturnal hypoglycemia and possible rebound hyperglycemia.
- Ensure clients are familiar with strategies to prevent and treat hypoglycemia.
- Provide guidelines to monitor ketones (in those who are high risk) during periods of hyperglycemia or illness.
- Provide the client with guidelines for when to notify the RN or physician/RN(NP). They also need direction when to seek emergency care.
- Ensure the client is aware of the need to contact the physician/RN(NP) when any of the following occurs:
  - Hyperglycemia with ketones (moderate or large) and/or illness
  - Recurrent hypoglycemia with no apparent cause or severe hypoglycemia requiring assistance to treat
  - Unable to eat or drink (for any reason)
  - Vomiting or persistent nausea
  - BG target levels are not being achieved.

E. Nutritional Considerations

To do IDA, the RN must be familiar with the carbohydrate content of common foods and various carbohydrate management methods, including carbohydrate counting. Ideally, the client will be referred to a Registered Dietitian (RD) to learn about carbohydrate counting. Both the RD and RN can support the client in the learning process and provide reinforcement in preparation for IDA by the client.

There are several criteria to consider when suggesting a client use carbohydrate counting to adjust insulin:

- the person's motivation to learn a new skill.
- ability to perform simple math skills.
- the person's willingness and ability to use resources (nutrient information, food labels and tools (measuring cups, weigh scales)) to accurately determine carbohydrate content of meals and snacks. For those who have been frustrated by fluctuating blood glucose levels, it may be helpful for them to use nutritional scales.
- accurate and detailed food records will enhance the process and help assess the client's ability to carbohydrate count and support client skill development.

If the client is capable and has demonstrated accurate carbohydrate counting then you may choose to dose insulin using insulin to carbohydrate ratio.

Learning Activity

1. Ensure you are familiar with the CDA resource, *Beyond the Basics* and basic carbohydrate counting resources. You can review the background information at
2. http://www.diabetes.ca/clinical-practice-education/professional-resources/diet-nutrition-beyond-the-basics
3. Learn how to read "Nutrition Facts" labels, see http://www.hc-sc.gc.ca/fn-an/label-etiquet/nutrition/index-eng.php
4. Obtain a resource for carbohydrate values of common foods such as:
   a. Nutrient Value of Some Common Foods (2002). Health Canada. http://www.publications.gc.ca/pub?id=316070&sl=0 Available free.
   b. Holzmeister L. The Diabetes Carbohydrate and Fat Gram Guide, 4th edition. American Diabetes Association. www.diabetes.org
   c. Netzer, CT. The Complete Book of Food Counts, 9th edition. 2012; New York:Dell Publishing. ~ $10 in paperback.
   d. Borushek, Allan. The Calorie King Calorie, Fat and Carbohydrate Counter, 2014. ~ $10 in paperback.
   e. For fast foods, treats, etc see http://www.calorieking.com/foods/calories-in-fast-food-chains-restaurants_c-Y2lkPTIx.html
   f. United States Department of Agriculture (USDA) on line nutrient data base: http://www.nal.usda.gov/fnic/foodcomp/search/
   g. http://www.elook.org/nutrition/search/
5. Complete the exercises with a resource from selection above.
6. Keep a food record for three days, being as specific as you can with amounts and calculate your carbohydrate intake for each meal. Consult with a dietitian colleague to get some feedback or answers to your questions.

Insulin to Carbohydrate Ratio and Correction Factors

These methods can be introduced to allow flexibility and variety for your client without sacrificing BG control:

A. Insulin to Carbohydrate Ratio – This tells you how many grams of carbohydrate one unit of insulin will cover. This allows for adjustment of the insulin dose in advance of carbohydrate intake based on the carbohydrate content of the meal or snack.

B. Correction Factor – This is a number that estimates how much one unit of rapid or short-acting insulin will lower blood glucose. This allows for adjustment of the insulin dose to correct for a high or low blood glucose level.

Insulin to Carbohydrate Ratio

If a person is planning to eat a variable amount of carbohydrate at meals s/he can "anticipate" the resulting variability in BG. The client could minimize this by decreasing or increasing the pre-meal dose of short or rapid-acting insulin.

Remember insulin to carb ratios vary from person to person and may differ from meal to meal. For example, some individuals are more insulin resistant at breakfast than at supper. An insulin resistant person may require 1 unit of insulin for every 5 gms of carbohydrate as compared to a thin or fit person or a child needing 1 unit of insulin for every 20 gms of carbohydrate. Experimenting to get the right ratio requires some time and effort involving frequent BG monitoring, including ac/pc testing and documentation of food intake.

The advantages of using this method include:
- greater flexibility and quality of life.
- decreased risk for disordered eating.
- reflects more normal eating practices where people gauge how much food they are hungry for, rather than a set amount they have to eat.
- ability to match more closely insulin to food/drink consumed.

The disadvantages of this method are:
- possible hypoglycemia if the anticipated rise in BG does not occur.
- weight gain if a person frequently takes additional insulin to allow for extra food.

This method does allow for flexibility but it is not designed to justify unhealthy or over-eating. While it is possible to match insulin to carbs eaten, it can result in weight gain and other health issues if they are using their insulin to compensate for poor choices.

NOTE: Initially, it is suggested that carbohydrate content at meals and snacks remain consistent when establishing insulin to carbohydrate ratios. Once a baseline is established, greater flexibility and variability of carbohydrate intake will be possible.

There are three methods to determine the insulin to carbohydrate ratio:

1. Pattern Management

This method can be used when the amount of insulin taken provides adequate control based on changes in pre versus post-meal BG of no more than 3 mmol/L at 2 hours pc.

Divide the number of grams of carbohydrate taken at a meal by the number of units of insulin given at the meal. The result will yield: 1 unit of insulin per xx grams of carbohydrate.

EXAMPLE:
Meal time carbohydrate = 66 grams
Meal time insulin = 7 units
66/7 = **9.4**
Therefore, 1 unit of insulin would be taken for every **9** grams of carbohydrate.

2. Rule of 500

In this method 500 is divided by the total daily dose (TDD).

This method will yield the same insulin to carbohydrate ratio for all meals. The method provides a starting point or "ball park" insulin to carb ratio. IDA may be needed based on actual results, observations of "what works" and use of method #1.

EXAMPLE:
TDD = 63 units
500/63 = 7.9
Therefore, 1 unit of insulin would be taken for every **8** grams of carbohydrate.

3. Averages of Daily Pre-meal Insulin and Carbohydrate Intake

In this method:

- the bolus or pre-meal insulin doses are added for the full day
- the amount of carbohydrate average/day is determined
- the carbohydrate/day is divided by the total pre-meal or bolus insulin

EXAMPLE:
Total pre-meal or bolus insulin/day = 28 units

Average total grams of carbohydrate eaten/day = 140 grams
140/28 = 5.0
Therefore, 1 unit of insulin would be taken for every **5** grams of carbohydrate.

Correction Factors

Bolus (short or rapid-acting) insulin may be given according to a correction factor to compensate for a pre-meal BG above or below target. In some literature this is also referred to as the insulin sensitivity factor (ISF), insulin grid or scale, or an algorithm. A correction factor reflects the impact of 1 unit of insulin on the person's BG. This is unique to each person but gives the opportunity to correct a BG that is beyond their glycemic target range. Correction doses of insulin are typically added to the pre meal dose of bolus insulin.

For those who count carbohydrate, the pre-meal dose of bolus (short or rapid-acting) insulin is determined by use of both the correction factor for glucose levels above or below the target AND the amount of carbohydrate to be consumed at the meal.

Correction factors must be designed on an individual basis taking into consideration the person's:

- target BG range
- sensitivity to insulin
- total daily dose of insulin
- insulin type – short or rapid acting insulin

The base insulin dose should not be adjusted when a person has a concurrent illness or is experiencing stress. This is an opportunity to use a corrective dose to compensate for the interim insulin needs.

Use of bolus (rapid or short-acting) insulin at bedtime is not typically recommended related to the risk of nocturnal hypoglycemia. Use of bolus insulin at bedtime should be discussed with the physician/RN(NP).

Consider the individual's target range for glucose control and willingness to supplement for values out of the target range. Teach your client to adjust the appropriate basal dose of insulin or the insulin to carbohydrate ratio if they have to correct regularly. If your client has not seen a dietitian in some time and you suspect inconsistency in carbohydrate intake or difficulties with counting carbohydrates, refer the client to a dietitian.

Consider how sensitive your client is to rapid or short-acting insulin when developing the correction factor. Construct the factor conservatively (that is, err on the side of hyperglycemia initially), evaluate for effectiveness, and revise if necessary. A correction factor is effective when the blood glucose returns to the pre-meal target range (ideally 4-7 mmol/L) prior to the next meal/snack (4 to 6 hours).

Developing a Correction Factor

The Rule Method

Divide either 100 (for rapid-acting insulin) or 85 (for short-acting insulin) by the person's TDD. The resulting number represents the drop in blood glucose for each unit of insulin.

Note: It may be appropriate to use the rule of 85 for those who are insulin resistant no matter which type of insulin is being used.

EXAMPLE:
TDD = 48 units
100/48 = 2.08, rounded to 2 mmol/L

This means 1 unit of rapid-acting insulin will drop the blood glucose by 2 mmol/L.

Using the Correction Factor

Once a correction factor has been determined, the client can use it in two ways. Clients who find math a challenge will likely prefer the second method.

1. Calculation for each BG reading

To use this method the individual:

- does a pre-meal BG test
- subtracts the target BG from the result
- divides by the correction factor

EXAMPLE:
Current BG level pre-noon = 11.9 mmol/L
Target BG level = 7 mmol/L
Correction factor = 2 [one unit of insulin lowers glucose by 2 mmol/L.]
(11.9 – 7)/2 = 2.4 units, rounded to 2 units

This amount of insulin will be added to the usual pre-meal dose of bolus insulin. If not eating a meal a correction dose alone can be used to simply correct a BG that is above target. This must be done cautiously and with an understanding of the complete insulin picture as to prevent insulin doses stacking upon one another (which can result in hypoglycemia).

2. Written grid or scale for IDA

Using this method the educator will create a grid for the client to use based on the correction factor. The grid indicates the number of units to be added to or subtracted from the base dose.

Target BG is 4.0 to 7.0. Base doses are 6, 10 & 12U of rapid with B, D & S respectively.

EXAMPLE:
The TDD is 50 units. 100/50 = 2 [rule method]
1 unit will change blood glucose by 2 mmol/L
The scale therefore represents 2 mmol/L increments.

For some clients it will be necessary to write in the actual dose rather than the amount to be added to the usual dose. In this situation the values in the morning column would read: 5, 6 (usual dose), 7, 8, 9, 10, and 11 respectively.

	Dose of rapid or short-acting insulin			Intermediate or Long-Acting Insulin
BLOOD GLUCOSE	Morning	Noon	Supper	
< 4.0	-1	-1	-1	Lantus 22 units at bedtime
4.1 - 7.0 (base dose)	6	10	12	TARGET RANGE *Usual doses*
7.1 - 9.0	+1	+1	+1	
9.1 - 11.0	+2	+2	+2	
11.1 - 13.0	+3	+3	+3	
13.1 - 15.0	+4	+4	+4	
>15.1	+5	+5	+5	

Two more rows can be added to the grid for clients who are carbohydrate counting:
- A line for the usual carbohydrate at the meal
- A line for the insulin to carbohydrate ratio

NOTE: If the client is always having to use the correction factor, a reassessment of basal and bolus insulin requirements is needed.

Learning Activity

Suggested readings:

Using Insulin - Everything You Need for Success with Insulin. Walsh, J., Roberts, R., Varma, C. & Bailey, T. Torrey Pines Press, San Diego, California (2003).

Think Like A Pancreas, A Practical Guide to managing diabetes with insulin. Gary Scheiner, Da Capo Press (revised 2011).

F. IDA for Exercise or Increased Physical Activity

IDA for exercise or increased physical activity depends heavily on your client's response to insulin, the intended activity and its timing in relation to food and insulin. Thus, BG monitoring is required to ensure safe and effective IDA. Physical activity may enhance the effect of exogenous insulin by increasing glucose uptake by muscle cells and intracellular glucose metabolism. The temporal effect on BG levels will vary depending on the person and intensity and duration of activity. Depletion of glycogen stores may occur with moderate to intense exercise and may result in hypoglycemia many hours after exercise. For some this can be as long as 24 hours. It is important to note that recognition of hypoglycemia may be delayed during vigorous exercise due to the masking of early warning signs.

Guidelines for IDA for Exercise

In clients with type 1 diabetes, if capillary glucose is >16.7 and the individual does not feel well, blood or urine ketones should be tested. If ketone levels are elevated, it is suggested that vigorous exercise be postponed and the patient take additional insulin. If ketones are negative and the client feels well, it is not necessary to defer exercise due to hyperglycemia. Individuals with type 2 diabetes generally do not need to postpone exercise because of high blood glucose, provided they feel well. If capillary glucose levels are elevated >16.7 mmol/L, it is important to ensure proper hydration. BG monitoring should be employed initially before, during and after new exercise routines to determine its effect on glycemic levels for the individual.

Exercise at consistent times of the day will facilitate more reliable IDA.

Compensatory food intake may be used to prevent hypoglycemia without IDA or as an adjunct. The client should have a source of short-acting glucose available during exercise. See accompanying table. Adequate hydration is also important. Anticipatory IDA for exercise without compensatory carbohydrate intake may be recommended as follows. These are guidelines and will need to be evaluated with each individual.

Insulin injection into an exercising limb may speed insulin absorption and action. If possible, insulin should be injected into a non-exercised part of the body prior to exercise; for example, inject in the abdomen rather the leg before running.

Following prolonged exercise, subsequent meal doses of rapid or short-acting insulin may need to be reduced by 20-50%.

Basal insulin dose(s) may also need to be adjusted. The bedtime basal insulin may need to be decreased by 10-30% following prolonged endurance exercise, particularly if this has happened during the evening.

Other information to give clients for exercise:

- When exercising, always carry some form of sugar, such as glucose tablets, juice, lifesavers or hard candy.
- Never drink alcohol around the time you exercise as it can result in low BG.
- Dehydration, especially in hot weather, can be very serious if your diabetes is in poor control. Prevent dehydration by drinking water before, during and after exercise.
- If you reduce your insulin and are unable to exercise, your BG will be high that day.

These are only initial conservative recommendations to be evaluated by blood glucose monitoring and should be revised as necessary.

The following table was developed based on information in Chapter 12, Building Competency in Diabetes Education: The Essentials 4th Edition.

<table>
<tr><td>Exercise Time →</td><td>Immediately post-meal</td><td>Morning or Afternoon</td><td>Very early in morning</td><td>Post Prolonged activity*</td></tr>
<tr><td>Insulin Type →</td><td>Pre-meal Bolus</td><td>Morning Basal</td><td>Previous evening basal</td><td>Meal or Basal</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Intensity of Exercise ↓</td><td colspan="4"></td></tr>
<tr><td>Mild</td><td></td><td rowspan="4">30-50%
Adjust with exercise intensity.
Trained athletes may require up to 80% reduction.</td><td rowspan="4">No more than 50% reduction.

Adjust with exercise intensity</td><td rowspan="4">Post activity pre-meal doses, may reduce by 20-50%.
Bedtime basal insulin, may reduce by 10-30%.</td></tr>
<tr><td>Moderate</td><td>20-50%</td></tr>
<tr><td>Strenuous</td><td>50%</td></tr>
<tr><td>Prolonged ≥ 3 hours*</td><td>Up to 80%</td></tr>
</table>

* Prolonged activity may have a delayed glucose lowering effect.

Extra Food for Extra Exercise -- Adult Guidelines

(This example of a client handout can be found in a printable format in Chapter 5)

(You may have already taken less insulin. However, you may need to eat extra food depending on your blood glucose results before you start exercising – always test!) The following table tells you how much food to eat. Remember, these are only guidelines.

Exercise	Blood Glucose Levels	Carbohydrate Amount
Light for one hour (Walking, Bowling)	< 6 mmol/L	15 grams
Moderate for one hour (Tennis, Cycling, Swimming, Sexual Intercourse, House Cleaning, Golfing)	< 6 mmol/L	30 grams of carbohydrate before exercise. An additional 10–15 grams of carbohydrate is required for each additional hour.
	6 – 10 mmol/L	15 grams of carbohydrate
	11 – 17 mmol/L	Food intake should not be increased.
	Moderate urine ketones > 8 mmol/L or blood ketones > 3 mmol/L are present	Do not exercise until diabetes control improves.
Strenuous for one hour (Hockey, Racquetball, Football, Competitive Sports) NB. *Small amounts at frequent intervals are preferable for prolonged activity*	< 6 mmol/L	45 grams of carbohydrate before exercise. An additional 10-15 grams of carbohydrate is required for each additional hour.
	6 – 10 mmol/L	30 grams of carbohydrate
	11 – 17 mmol/L [no ketones]	15 grams of carbohydrate
	Moderate urine ketones > 8 mmol/L or blood ketones > 3 mmol/L are present	Do not exercise until diabetes control improves.

*The original table was found in “Learning to Live With Diabetes” developed by the Nova Scotia Diabetes Centre.

G. IDA for Tests/Procedures When Fasting is Required

These guidelines apply to clients who are known to the RN and have been seen in a face-to-face consult. Calls may be received from individuals unknown to the RN on how to adjust insulin for an upcoming test/procedure. In this situation, the RN should assess and provide general information only, and recommend the individual consult with their primary care provider for specific directions regarding IDA and other medications.
An assessment form template for health professionals titled "IDA for Tests/Procedures When Fasting is Required Assessment Form" is available in Chapter 5.

It is recommended that written direction detailing specific instructions be given to the client. A sample form titled "Managing Your Diet & Insulin for a Test/Procedure" can be found in Chapter 5.

Client assessment:
- What is the current insulin regimen and what are the flexibilities e.g. MDI versus pre-mixed insulin?
- What is the usual pattern of BG across the day?
- What is the current frequency and timing of hypoglycemia? Does this person have hypoglycemia unawareness?
- Is the client able and willing to do extra BG monitoring possibly before, during and after the test/procedure?
- How independent is the client now in IDA so she/he can adapt the instructions given by the RN, if needed?
- Does the client know how to convert carbohydrate to liquids?
- What support person(s) are available to assist with care?
- Does the client have previous experience with this type of fasting? How was it handled in the past and how did the changes work?
- If the client provides sufficient notice, suggest she/he request the procedure be done as early as possible in the day to minimize BG and insulin issues.
- Ask client if she/he has been given instructions by any other care provider.

Test/Procedure:
- What are the test/procedure instructions already given to the client?
- What length of time will likely be required for fasting?
- Does the procedure require clear fluids for a period of time prior to the test?
- What will be the impact on ability to eat solids or drink liquids post-procedure?
- Are there any expected outcomes from the procedure which may affect BG monitoring, diet or ability for self-care?

Making the Decisions for Insulin Dose Adjustment for Basal/Bolus Insulin

Prior to giving client guidelines**,** request, if possible, daily BG monitoring and recording for at least 3 days pre-visit. This will help to determine the usual patterns.
Assess usual BG levels.
Adjusting insulin for overnight fasting prior to procedure:

- If using long-acting basal insulin: no adjustment is needed unless there has been recent unexplained hypoglycemia or the usual fasting BG is below 5.
- If using an intermediate-acting insulin: if usual fasting BG is below 10, or there are concerns about overnight or early morning hypoglycemia, reduce the intermediate at supper or in the evening prior to the fast. Reduce by a minimum of 10-20% depending on the results of the assessment. The percent reduction needs to be tailored to the individual client.
- Consider whether or not a bedtime snack is needed. Many procedures will allow food/drink consumption until late evening. If only fluids can be taken see the Regina Qu'Appelle Health Region (RQHR) Fluid Diet handout in Chapter 5.

Adjusting insulin for fasting day of procedure/test:

- Adjust the first injection of rapid or short-acting insulin on the day of the procedure.
  - Usually this insulin dose would be eliminated or delayed, depending on the timing of the procedure.
- Adjust the morning intermediate or long-acting basal insulin analogue.
  - If the procedure time is relatively short, the probability of eating afterwards is high and the client does not usually have problems with morning hypoglycemia, no change in dose may be necessary or a minor reduction of 10-20% could be made.
  - If the length of the procedure is more than 2 hours or is unknown, or there are concerns for hypoglycemia, the client needs to either delay the intermediate-acting insulin injection until after the procedure is completed or reduce the long-acting basal insulin by 10%.

Adjusting insulin post-procedure/test:

- If the intermediate-acting insulin analogue injection must be delayed, then the formula below can be used <u>as a guide</u>. If the basal insulin is reduced, there may be an impact later in the day.

  Formula:
  Number of hours injection delayed divided by 24 (number of hours in a day) and then multiplied by 100 = the percent to reduce the usual dose of intermediate-acting insulin.

  Example:
  Usual morning dose of NPH 20 units is delayed by 4 hours.
  4/24 = 0.167 x 100 = 16.7%
  20 units x 16.7% = 3.34 – rounded to 3
  Reduce NPH dose from 20 to 17 units.

- Consider the results of the calculation against the usual BG readings and client's ability and confidence in adapting the result to the situation he finds at the time a dose decision needs to be made. Some clients may need to call a care provider to get advice depending on number of hours without insulin, ability to eat/drink and current blood glucose reading.

- Once the individual is back to usual eating, a correction of rapid/short-acting insulin may be necessary as well as rapid/short-acting insulin to cover any food or drink taken.
- Clients who are not used to adjusting their own insulin may need a grid to guide them or may need to call a care provider for specific advice.

Making Insulin Dose Adjustments for Pre-mixed Insulin

Prior to giving client guidelines, request, if possible, daily BG monitoring and recording for at least 3 days pre-visit. This will help to determine the usual patterns.

Assess usual BG levels.

Adjusting insulin for overnight fasting prior to procedure:

- If usual fasting BG is below 10, or the usual pattern shows the BG drops overnight or, if there are concerns about overnight or early morning hypoglycemia; reduce the pre-mix supper dose prior to the fast. Reduce by a minimum of 10-20% depending on the results of the assessment. The percent reduction needs to be tailored to the individual client.

Adjusting insulin for fasting day of procedure/test:

- This am insulin dose may be eliminated or delayed, depending on the timing and/or length of the procedure. Some clients may benefit from using basal NPH only on the morning of the procedure, at or below the usual dose provided by the pre-mixed insulin.

Adjusting insulin post-procedure/test:

- If the fasting time has been relatively short and the client will be able to eat/drink post-procedure, she/he could test BG and take the usual or a slightly reduced insulin dose and then eat.
- To account for the delay in injection time and the possibility of overlapping insulin peaks later in the day, use the following formula to recommend an insulin dose.
  Formula:
  Number of hours injection delayed divided by 24 (number of hours in a day) and then multiplied by 100 = the percent to reduce the usual dose.

  Example:
  - Usual morning dose of Humalog Mix 25, 20 units is delayed by 4 hours.
  - 4/24 = 0.167 x 100 = 16.7%
  - 20 units x 16.7% = 3.34 – rounded to 3
  - Reduce dose from 20 to 17 units
  - As there is less flexibility to fine-tune the insulin dose to correct a high BG, the client needs to understand that BG levels may be higher for a couple of days.

Management of Hypoglycemia While Fasting

The possibility of hypoglycemia during fasting needs to be discussed with the client. Encourage the client to test to confirm hypoglycemia if signs/symptoms are experienced.

Glucose tablets are the preferred treatment method as they are quickly absorbed and are not liquid. The treatment needs to be reported prior to the start of the procedure and it is possible the procedure may be delayed.

Fluid Diet

A fluid diet is used short-term to prepare clients for certain medical tests, procedures, or surgery. If a clear fluid diet is requested, the client will need to consume only fluids that can be seen through. It can also be used when clients are not able to eat solid foods because of nausea, vomiting or dental procedures.

While following a fluid diet the client will need to use a combination of sugar free and sugar-containing fluids. The RN must be familiar with how to convert the client's typical carbohydrate (carb) intake into fluids. Clients may convert their usual meal carb intake into fluid and/or adjust their carb intake based on their BG level.

Learning Activity

1. Review the client handout "Diabetes Management on a Fluid Diet" developed by the Regina Qu'Appelle Health Region (RQHR) 2016. The handout is found in Chapter 5.
2. Practice converting common carbohydrate intakes. E.g. 30g, 45g, 60g "meals" into fluids. If possible, review your suggestion with a RD.

Suggested Additional Learning Activity

1. Research different pharmaceutical company website resources.
2. Ensure client education resources are current.
3. Contact resource personnel from pharmaceutical company representative and obtain current educational and research materials.
4. Consult with colleagues regarding preferred resources.

CHAPTER 3 - PRACTICE CASES

The following cases are to be completed after reviewing the Learning Package and other self-study as needed. It is expected that the cases will be discussed with an experienced colleague confident with IDA. Answers are provided at the end of each case.

Review each of the following cases and provide an answer with rationale. Also consider what questions you might ask a client in each of these situations.

CASE #1

Sarah is 60 years old with type 2 diabetes. She has been using insulin for about one year and has had diabetes for 8 years. Her eating and activity patterns were recently assessed and are relatively consistent from day to day. Her last A1C reading was 7.2%. She weighs 165 lbs. (75 kg). She is on Humulin N 15 units at hs. She is also taking Metformin 1g bid as well as DiamicronMR 30 mg a.m.

Date	Before Breakfast	Post Breakfast	Post Noon	Post Supper	Bedtime
June 10	7.6	9.8	7.5	8.1	
June 13	8.6	8.6	5.0	5.2	6.0
June 16	7.2	8.8	9.1	9.9	
June 20	7.8	7.8	6.9	4.7	6.3

Eating pattern as assessed by a dietitian:
Carbohydrate distribution:

- breakfast – 50 grams
- lunch - 60 grams
- pm snack – 15 grams
- supper – 65 grams
- hs snack – 30 grams

What variables would you consider in client assessment?

What insulin dose adjustments would you consider?

ANSWER – CASE #1

Client assessment:

- Check injection sites and rotation patterns. Ensure insulin is being absorbed well into the subcutaneous fat layer. Consider - needle length, disposal, storage of insulin, and expiry date.
- Any missed or forgotten doses (insulin or pills) and how this is handled?
- Any hypoglycemia episodes or disrupted sleep?

- Is she aware of how to handle a low BG?
- Has there been a recent change to either insulin or pills? Any new medications added for other conditions?
- Any illness/infection/stress (short term or long term)?
- Is she interested in better BG control?
- Does she always have the snack at bedtime (30 grams)?
- Accuracy of blood glucose monitoring?

IDA:

Once hypoglycemia overnight has been ruled out you can be more confident in knowing that insulin needs to be increased rather than decreased. It is reasonable to aim for an A1C target of <7% given the detail we know of Sarah. She is in a routine of checking BG in the morning then following her meals. Her post prandial BG results are consistently within the target of <10 mmol/L. Her FBG however is consistently above the target of 4-7 mmol/L. This is the priority for insulin adjustment. Once FBG settles into the 4-7 mmol/L target range her A1C will also likely drop into the target of <7%.

For a more consistent background insulin you may consider recommending a long-acting basal analogue such as Lantus or Levemir in place of her Humulin N. No dosage reduction is necessary as Sarah has been using a once daily Humulin N. You could consider Lantus or Levemir 15 units at hs. An order from her physician/RN(NP) is required for this change.

If she is not willing or ready to make a change in her insulin type you could consider adjusting her dose of Humulin N at hs. Because the peak of this insulin is positioned close to morning it is reasonable that an increase would target the FBG without a significant impact on other times of the day. She would need to be aware that the risk for a low during the night would be more likely with a higher N dose at bedtime. Ensure she is aware of signs and symptoms of hypoglycemia as well as treatment strategies. If she does develop lows during the night (or any other time of the day) she should contact someone in her primary care team who can help prevent lows.

Consider increasing the bedtime N gradually until FBG reaches target of 6-7 mmol/L most often. It is recommended that you adjust by ~10% or 1-2 unit increments every 1-3 days until FBG target is reached without hypoglycemia other times of the day. The speed of dose titration can be negotiated with the person and set based on their comfort and skill level. If Sarah is not comfortable or capable of making self-adjustments you can arrange for follow up to discuss progress and provide guidance for subsequent adjustments until target is reached. This process allows for the opportunity to discuss BG results and associated response to insulin dose. She will likely build confidence and skill and be more capable in the future for insulin dose self-adjustment.

CASE #2

This continues the story with Sarah from Case #1, now 6 months later. She has decided to switch to Lantus and is now taking 22 units hs with good results. She has continued with her oral agents as well. Her fasting BG levels are consistently below 7 mmol/L. She has been checking BG pre-meals and hs and the following pattern has emerged over the past four weeks.

INSULIN DOSE: Lantus 22 units at bedtime

Date	Before Breakfast	Before Lunch	Before Supper	Bedtime	Other
Jan 10	6.7	5.0	4.5	9.5	
Jan 13	6.8	5.0	5.2	10.0	
Jan 16	5.2	5.3	6.0	10.2	
Jan 20	5.8	6.9	4.7	9.9	

What variables would you consider in client assessment?

What insulin dose adjustments would you consider?

ANSWER - CASE #2:

Client assessment:

- Assess insulin injection technique and potential errors
- Overuse of sites?
- Any possible errors in BG monitoring?
- Any changes to her eating habits – particularly at supper or in the evening?
- Is she still counting carbs accurately?
- Any changes to medications?
- Changes in overall well-being (physical health or mental health)?
- Any lows after supper needing treatment and causing higher BG later?
- Any changes in her activity level particularly less active in evening?
- Has activity level had an impact on her BG control in the past?
- Encourage changes in lifestyle specific to the time between supper and bedtime. Determine if changes in diet would be suitable and realistic. If she is able to incorporate more activity after supper she may be able to prevent the higher BG at hs. Lifestyle change must be both realistic and safe. You also need to set a timeline in order to evaluate the effectiveness of these lifestyle strategies. If BG remains elevated then insulin adjustment is the next step.

IDA:

BG is within the 4-7 mmol/L target range for before meals. She does have a pattern emerge that reflects BG consistently above target at hs. The challenge is to remedy this pattern without causing lows at other times of the day.

By choosing a rapid-acting insulin to be used prior to the supper meal, it would have its effect in the time between supper and bedtime preventing the BG rise at hs. It also does not have a trailing effect beyond ~ 5hrs, therefore decreases the risk of hypoglycemia through the night. You must be cautious of the ripple effect of getting the hs readings into target. It is possible that the FBG could also drop somewhat therefore monitoring of BG is essential in order to safely make these insulin adjustments. If The FBG dips too low you may need to consider a decrease in the Lantus dose (~10% increments) until FBG settles back into target. (An order from her physician/RN(NP) is required for starting a rapid-acting insulin.)

CASE #3

Continuing with Sarah from cases 1 and 2, you have reviewed the variables suggested in the answer for Case 2 and found she will not be able to decrease the evening glucose level through changes in eating or activity. You have requested a physician order for pre-supper rapid-acting insulin. The physician agrees and asks you for your suggestion for an amount of insulin.

You know that Sarah usually eats about 65 grams of carbohydrate at supper and works hard to be consistent with this amount. She is not physically active in the evening as she does not want to drive in the evening and has other interests to keep her occupied.

What would you recommend and what would be your rationale for this recommendation?

What follow-up plan would you make with Sarah for ongoing IDA to the pre-supper rapid-acting insulin?

ANSWER - CASE #3

As Sarah has not taken rapid-acting insulin pre-meal before, her sensitivity to this insulin is not known. To get a "ball park" idea the amount of insulin you could use the Rule of 500.

At present her Total Daily Dose (TDD) is 22 units:
500 ÷ 22 = 22.7, rounded to 23
Therefore, according to the calculation, Sarah would take 1 unit of insulin for every 23 grams of carbohydrate.
Her supper carbohydrate is 65 grams:
65 ÷ 23 = 2.8
Therefore, you could recommend 2-3 units as the initial dose of rapid-acting insulin pre-supper.

The follow-up plan with Sarah could include the following:

- Record food or grams of carbohydrate eaten at supper for a few days on the new insulin dose.
- Aim for consistency with food and activity while making insulin dose adjustments.
- Test BG pre-supper, 2 hours post-supper and at bedtime to assess the new insulin's effectiveness.
- If after 3 days the hs BG level is not dropping to 4-7 mmol/L, increase the dose of rapid-acting insulin by 1 unit every 1-3 days until target BG is reached at hs.
- If hs glucose levels are too low or she has symptoms of hypoglycemia, reduce the pre-supper dose of rapid-acting insulin by 1 or more units depending on the BG.

CASE #4

John is 50 years old and works as a mechanic. He has been on insulin for 10 years and has had diabetes for 12 years. His BMI is 30 and has been increasing gradually over the past 5 years.

INSULIN DOSES:

- Novolin NPH 60 units a.m. and 80 units hs
- NovoRapid 25 units noon and 25 units supper

The following values represent typical log book entries:

Date	Before Breakfast	Before Lunch	Before Supper	Bedtime	Other
Oct 24	2.0	4.8	4.8	6.8	
Oct 25	16.9	12.2	8.1	5.4	Low during the night
Oct 26	7.1	7.6	5.9	6.2	

His doctor would like to switch him to Toujeo once a day and asks you to recommend a dose. John says he prefers taking the long-acting insulin at bedtime.

What variables would you consider in client assessment?

State the dose you would recommend and your reasons.

What advice will you give John in terms of what he might expect to see in his glucose readings when he makes the switch?

ANSWER - CASE #4

Client assessment:

- Assess injection areas for lipohypertrophy and other absorption issues. Erratic BG readings might be directly related to unpredictable absorption of insulin doses.

- If he has "lipo" areas encourage injection into fresh sites for better absorption. In doing this he may need a decrease in his usual dose given the likelihood that his full dose was not being utilized before. The usual dose has the potential to cause hypoglycemia. A decrease of 10-20% is reasonable and then can be titrated back up if needed.
- Assess injection technique including needle length, rotation of sites, needle re-use, sharps disposal, storage of insulin as well as expiry dates.
- When switching from BID intermediate-acting to Toujeo you reduce the total daily dose of background insulin by 20% and then titrate accordingly. (If he had already been on Lantus and BG was reasonably well controlled you could transfer unit for unit). If BG is tending to run too low at the time of the switch then you may choose to decrease the dose of Toujeo even further based on your clinical judgement and then increase gradually back up if needed.
- Once daily long-acting insulin can be given at any time of the day therefore needs to be positioned at a time of day that is quite routine to ensure missed doses will be minimized.
- Some routine BG monitoring will be necessary to titrate the insulin dosages accordingly.

IDA:

- Currently using NPH 60+80 = 140 units.
- There are no absorption issues but there is evidence of some hypoglycemia therefore a reduction of 20% is in order plus another 10% to account for the hypoglycemia.
- I.e. 140 x 0.3 (30%) = 42 units therefore 140 – 42 = 98 units which could be rounded to 100 units once daily for ease of transition.
- You could recommend switching to Toujeo 100 units @ hs (on the day of transition he could omit his a.m. dose of NPH and start the Toujeo dose that evening).

Advice to John:

- Monitor BG across the day and during the night to capture the effect of the new transition.
- If he continues to have lows then his insulin regime will need to be reviewed and specific insulin adjusted.
- Negotiate a titration plan together. Establish goals together.
  - i.e. Reduce hypoglycemia; achieve FBG in 4-7 mmol/L range, etc. Parameters may be given that could include: increase by 5-10 units (5-10%) of Toujeo every other day until FBG reaches the range of 4-7 mmol/L most days.
- Arrange for a follow up plan either over the phone or in person to work together to ensure insulin doses are adjusted strategically and safely.
- It is possible that another BG trend may emerge that needs attention. Be open to responding to the ripple effect of correcting BG. Help the client anticipate this and problem solve together to remedy the BG while building capacity in the individual.
- It is ok to start at a lower dose and slowly increase especially if there is apprehension or if there is a fear of hypoglycemia. Titration speed needs to be customized to the abilities of the client.

CASE #5

This case continues with John from Case #4. He is now using Toujeo 115 units at bedtime, no longer has night-time or fasting hypoglycemia and his fasting glucose levels are usually between 5-6 mmol/L.

However, his pre-supper BG levels are slowly rising. He has omitted his afternoon snack to help compensate, but the glucose readings at supper remain elevated. Prior to the insulin change, they were usually below the target of 7, now they are usually 8-9 mmol/L and occasionally higher. His noon carbohydrate varies from 60-80 grams.

Current insulin:
Toujeo 115 units hs
NovoRapid 25 units at noon and 25 units at supper

What variables would you consider in client assessment?

What advice would you give about the amount of NovoRapid to use at noon? Explain your recommendation.

ANSWER - CASE #5

Client assessment:

- Does he understand carb counting, insulin to carb ratios or correction factors?
- Is there an interest to learn?
- Does he have reasonable numeracy and literacy skills?
- What is his usual food/drink intake like across the day?
- Does he skip meals or snacks other days? Does his activity level vary from one day to another?
- Does he eat breakfast? If so, should there be mealtime insulin associated with this meal?
- Is he interested in a consistent or a flexible strategy for carb intake?
- Are there any issues with injections?
- Any changes in health status, meds, stress level?

IDA:

By having John do some purposeful paired testing of his BG it helps identify the rise and fall of his BG in response to food and other variables. If the post-meal BG excursion is >3mmol/L above the pre-meal BG reading, then there is a mismatch of carbs to active insulin. With his pre and post-meal BG data available you can explore together the possible variables contributing to the BG spike after his meal(s). It may be reasonable to manage the food within that meal, do exercise after the meal to offset the spike or the dose of mealtime insulin adjusted. He may need to increase the dose gradually until the postprandial BG levels are <3 mmol/L above the pre-meal base. He could start by increasing his noon dose of NovoRapid (by 10% increments) to 28 units (from 25) and determine if there is a BG response. He could increase by 3 units every 1-3

days as he is comfortable until pre-supper BG reaches his target of 4-7 mmol/L without hypoglycemia.

CASE #6

Brian is 45 years old and has type 2 diabetes and is well managed on Apidra with each meal and a single dose of Lantus before bed. He also uses Metformin 500mg TID.

Current insulin:
Breakfast – Apidra 7 units
Noon – Apidra 8 units
Supper – Apidra 10 units
HS – Lantus 32 units

He occasionally changes his carbohydrate intake, but adjusts his insulin accordingly. He does not snack between meals.

He now says he would like to be able to "fix" the high BG levels which he gets from time to time. Usually he cannot explain them and he finds this frustrating.

Use the "rule method" to calculate the correction factor.

Create a grid for Brian's breakfast insulin dose.

If Brian does not want to carry around a grid, write down the calculation he would use if his pre breakfast BG reading is 12.6 mmol/L.

ANSWER - CASE #6

First calculate Brian's total daily dose.
TDD = 7+10+8+32 = 57 units
Use the rule of 100 as he is using rapid-acting insulin.
100 ÷ 57 = 1.75
This means 1 unit of insulin will drop his BG approximately 1.75 mmol/L.
To create a grid, the 1.75 could be rounded to up to 2 mmol/L. If Brian has a history of severe low BG levels, hypoglycemia unawareness or is nervous about being "too low" you could use a larger range for the dose changes; e.g., 3 mmol/L steps. Or, you could set the target glucose level higher; e.g., to 8 mmol/L.

The grid using 1 unit will yield a decrease of approximately 2 mmol/L for morning insulin. The grid would be as follows:

BG Range	Insulin Dose
≤ 4.0*	6
4.1 – 7.0	7
7.1 – 9.0	8
9.1 – 11.0	9
11.1 – 13.0	10
13.1 – 15.0	11
> 15.1	12

- Note: As part of client education, advise treatment of hypoglycemia and stabilization of BG level before taking insulin and before deciding on the dose. Some clients may need < the lowest amount on the grid.

If Brian does not want to use a written grid, he would proceed as follows:
BG = 12.6
Target glucose = 7
Difference = 12.6 - 7 = 5.6
Divide the difference by his correction factor: 5.6/1.75 = 3.2, rounded to 3
Add 3 units to his base dose of 7 = 10 units Apidra to be taken pre-breakfast
OR
He could use the rounded correction factor of 2 mmol/L drop for 1 unit of insulin
5.6 ÷ 2 = 2.8, round up to 3 additional units added to the base dose of Apidra.

CASE #7

Jose is 39 years old with type 2 diabetes. In the past two months Jose says that whatever he tries, he is unable to get his BG levels under control. He has gone back to his meal plan of carb choices and follows it fairly faithfully. This is confirmed by a visit to the dietitian. He walks in the evening 2-3 days per week. His weight is 165 lbs. (75 kg); height is 71 inches (180.3 cm). His A1C one month ago was 10.5%. He denies hypoglycemia.

INSULIN DOSES
- a.m. Levemir 30 units
- hs Levemir 18 units

Carb choice per meal (1 carb choice = 15 grams of carb)
Breakfast: 3 choices
Lunch: 5 choices
Supper: 5 choices
Occasional Snacks: 1-2 choices

Date	Before Breakfast	Before Lunch	Before Supper	Bedtime	Other
Monday	10.9	8.9	8.4	12.3	
Tues	17.2	12.6	9.1	9.9	
Wed	15.8	13.2	8.7	14.5	

What variables need to be considered and what insulin changes would you recommend to this gentleman?

ANSWER - CASE #7

Jose is currently using a TDD of 48 units of insulin. This is about 0.6 units per kg and it is all basal insulin with no insulin for coverage of his meals. As an estimate for his needs you can expect his insulin requirement to be about 0.5 to 1.0 units/kg, but this is only an estimate. His BMI is 23 so it is a reasonable dose given his weight however, if not adequately controlling his BG then his regimen needs to be reviewed.

Recommend an assessment of his injection technique, rotation of sites, any needle re-use, lipohypertrophy areas, missed doses, storage of insulin, etc. and rule out other possible issues. Explore the things he has tried already to try to get his BG down as well as any ideas that he has moving forward. Has his weight changed recently? Unintended weight loss can happen as a result of hyperglycemia. Is he experiencing any other symptoms associated with hyperglycemia that needs immediate attention (thirst, dehydration, blurred vision, etc.)?

He could start by increasing his doses of Levemir by ~10% as his pre-meal BG readings are consistently above target. This could look like Levemir 33 units a.m. and Levemir 20 at hs. You could titrate the basal insulin up gradually until FBG reaches the negotiated target range most often. It is possible that by fixing the fasting BG that the remainder of the day may follow suit.

While an increase in background insulin should help bring down his BG overall, it will not target a BG spike after meals which is likely contributing to the elevated A1C. The addition of a rapid-acting insulin with one or more meals would be a logical next step. BG monitoring pre and post meals can help to determine where rapid-acting insulin should be added. You must also negotiate with him his schedule and the practical aspects of having to take insulin more often during the day. His limited data above reflects the highest jump between supper and hs therefore adding rapid-acting insulin to supper meal would be a great option. If the hs readings improve, there may be a ripple effect through the night resulting in an improvement in the FBG.

To start a rapid-acting insulin you will need to get an order from the client's physician/RN(NP).

You could use the rule of 500 whereby 500 is divided by the total daily dose of insulin. Eg. 500 divided by 48 = 10.4 therefore 1 unit of insulin should be used to cover ~10 grams of carbohydrate.

Therefore a supper of 5 carb choices (5 x 15 grams per choice = 45 grams carb total) would be 75 grams divided by 10 = 7.5 units of insulin – which could be rounded either up or down depending on current BG and activity to follow supper. He may choose to

continue using this calculation method or he may adopt a routine dose and adjust it up or down as he evaluates his BG.

The starting dose should be lower than what the anticipated therapeutic dose might be in order to prevent hypoglycemia and allow for room to titrate dose up to the therapeutic dose.

To titrate a rapid-acting insulin he can check BG ac and 2 hour pc meal(s) where rapid acting insulin is added. If post meal BG is >3 mmol/L above pre-meal BG with consistent food intake then rapid-acting insulin can be increased by 1-2 unit increments. If he is willing to learn carbohydrate counting and wants flexibility with meals then you can help him establish insulin to carb ratios to match his carb content in his meal with an appropriate insulin dose.

You will need to discuss the action profiles of each of his insulins in order to anticipate where his insulin is having action. With his activity some evenings after supper you will need to discuss BG in response to the exercise. Some additional testing can help him see his personal reaction to the exercise and make accommodations accordingly. While it is best to not 'feed' insulin in response to lower BG with exercise, you will need to explore his options. If he develops hypoglycemia the evenings that he walks, he could decrease his pre supper rapid-acting insulin or have a snack to prevent the low (as weight loss is not one of his goals).

With any hypoglycemia episodes while adjusting insulin it is important to reassess his full situation and make adjustments to insulin &/or lifestyle in order to prevent lows while aiming for the safest BG targets possible for each person.

CASE #8

Kelsey is a 41 year old aboriginal lady with type 2 diabetes. She has a history of GDM with her last 2 pregnancies. She was able to maintain better BG control while pregnant but finds that her BG control has been climbing and she is struggling to stay motivated. Current A1C is 11% and her log book reveals sporadic testing but most readings before meals are between 14 and 18 mmol/L. No hypoglycemia. She does experience thirst, tiredness, dizziness and recurrent yeast infections that are difficult to clear. She is knowledgeable about healthy eating and exercise but is struggling with the motivation to tackle changes in either area.

Her routine with her family and her work create some barriers for remembering her insulin or taking it on time. She is interested in getting back on track with her insulin so that she has a therapeutic dose working for her. She feels she just isn't getting enough insulin.

Current diabetes medications:
Metformin 1g bid

Lantus 50 units hs – has been prescribed but she stopped using it as felt it wasn't helping
Humalog 50 units tid – but admits to using it routinely at supper and 3-4 days per week with her noon meal.

What variables need to be considered and what would you recommend for insulin therapy?

ANSWER - CASE #8

Her A1C is significantly elevated so efforts to improve glycemic control are essential. You must assess her full situation, exploring opportunities as well as barriers and seek to find what motivates her. Any improvement toward target is progress but helpful to negotiate a timeline and small achievable steps that will move her toward her larger goal. Tackling too many strategies or imposing what we feel she should be doing is not helpful. Lifestyle change requires on-going assessment and coaching and celebrating even small successes. Establishing a rapport with this client is essential as routine visits will provide opportunities to assess progress and take more steps forward (or evaluate what might be getting in the way of progress). With her interest in getting on track with her insulin it is a great opportunity to provide an overview again of the roles of background and mealtime insulin and that both are important. Explore ideas to overcome the obstacle of not taking insulin at noon when at work. This might include having a second pen at work so that Kelsey could take her Humalog there if needed. Her current TDD of insulin varies each day. There is a need to go back to a combination of both background and mealtime insulin coverage.

Because Kelsey had been prescribed Lantus 50 units @ hs it is reasonable to use this as a benchmark. She reported that she was still having highs when she had been using this dose of Lantus. You could also explore the new concentrated Lantus which is 300 units per ml and called Toujeo. With a larger Lantus dose it would be a reasonable option with a smaller volume injected and therefore more comfortable injection. She also may be interested in a change as she seems to be frustrated with most aspects of her diabetes.

Whether restarting Lantus or moving to Toujeo, suggest a 20% reduction from her original dose and then once she is aware of the effect she can increase the dose up gradually until a negotiated FBG target is reached most days. With original dose of Lantus being 50 units minus 20% (50 x .20 = 10 units), the new starting dose would be 40 units at hs (or at a time that she feels she could be more consistent with).

You will need to get an order from her physician/RN(NP) as this is restarting an insulin. With the addition of background insulin, it is reasonable to expect that the insulin required to cover meals would be lower. As the background insulin reaches a therapeutic dose where the FBG comes into target it becomes more obvious what the mealtime insulin doses should be at.

For a safe transition it is wise to redistribute the Humalog across the day to provide some coverage with each of her meals. She has been using 100 units of Humalog many days so dividing that across 3 meals could look like 35 units TID ac meals. This also has been rounded up given the fact that her A1C is high and she reports high BG with symptoms. By encouraging insulin to be paired more closely with meals it tends to prevent the need for a larger dose later to correct BG.

It is important to discuss the potential ripple effect of changing insulin doses. Review the scenarios that are likely to happen and explore how she would handle them. This gives you an opportunity to assess her understanding of her insulin and her ability to problem solve. Arrange for a time to follow up either in person or over the phone.

Be specific with which BG test is a priority to properly assess insulin dosing and allow for timely insulin adjustments.

CASE #9

Milly Smith is 55 and has had diabetes for 22 years. She has been on insulin for the past 15 years. She has had high fasting readings for a few weeks. In the last week she has been increasing her pre-supper intermediate-acting insulin, but the high readings continue in the morning. She also has been having restless sleeps and morning headaches the last few days.

INSULIN DOSES:

- pre-breakfast: short-acting insulin 6 units and intermediate-acting insulin 24 units
- pre-supper: short-acting insulin 3 units and intermediate-acting insulin 12 units

Does Milly need any insulin adjustment?

ANSWER - CASE #9

Two things suggest that Milly may be having nocturnal hypoglycemia: the restlessness during the night with morning headache and high fasting readings. The peak action of intermediate acting insulin taken at supper time puts her at risk for a low BG at 3:00 – 4:00 a.m. (vs. taking the intermediate-acting insulin at hs or a long-acting basal analogue).

Alternatively, the intermediate-acting insulin may not be lasting long enough to counteract a strong dawn phenomenon, thus resulting in high FBG.

It would be useful for Milly to do glucose readings at bedtime, at 3:00 a.m., and fasting for 3 nights to see if there is a trend of lower BG overnight followed by a rise in BG towards morning. It is essential to see what her BG is doing between 3:00 - 4:00 a.m. and 7:00 a.m.

In your assessment also consider:

Insulin Admin Issues
- Ask about needles length, injection device (syringe or pens), technique
- Inspect her injection sites - check for lipodystrophy

Nutrition & Overall Eating Plan
- Bedtime snack? – if she does snack
    - How much carbohydrate does she eat?
    - Is the amount of carbohydrate consistent?
    - Does she use a combination of protein and carbohydrate?
    - Does she sometimes miss her evening snack?
    - Do any of these variables correlate with the symptoms or high fasting readings?

Activity
- Is Milly physically active in the later afternoon or evenings? Is anything different on the nights when Milly is active in the day/evenings – lower pre-bedtime readings, different fasting glucose levels the following mornings, correlation between evening activity and night-time symptoms? Does she adjust food and/or insulin when she is more active?

Dosing
- How much has Milly increased her supper time intermediate dose in the past week?
- Is the increase reasonable or has she been overly aggressive with the self-adjustment?

Recommendations:
The suspected nocturnal hypoglycemia needs to be prevented.
Given her current insulin regimen, emphasize the importance of a carb/protein bedtime snack. Develop a plan with her for suitable snack options that she can eat each evening.

For safety reasons, you may choose to reduce her pre-supper intermediate insulin by 1 to 2 units to see if the night-time symptoms disappear.
Recommend she test at bedtime, 3:00 am and 7:00 am for three days and contact you with the results.

If SMBG results confirm nocturnal hypoglycemia improves with less insulin but she continues to have elevated FBG, she may benefit from moving her intermediate insulin from supper to bedtime. This shifts the peak action to align with FBG rather than peaking during the middle of the night, minimizing the risk for lows while sleeping. If she does move the injection time to bedtime, she may need to decrease her dose. You will need to consider the ripple/domino effect that can happen after FBG is corrected. This could result in lower BG readings during the day.

You may also discuss with Milly the pros/cons of switching to a long-acting insulin. The change would require an order from her physician/RN(NP). Long-acting insulins have

longer duration and a flatter action profile, therefore reducing the risk for nocturnal hypoglycemia.

CASE # 10

Fred is a 58 year old lean male (70 kg.). He has a 6 year history of type 2 diabetes. He tests regularly and has regular contact with the dietitian who confirms that he has a consistent carbohydrate intake. It has been 1 year since initiation of insulin therapy. He admits that he hates insulin injections. He has several complaints when he comes to see you:

- fasting hyperglycemia
- mid-afternoon hypoglycemia
- frequent nocturia, resulting in poor sleep

INSULIN DOSE:

- single injection of intermediate-acting insulin - 80 units before breakfast

What changes would you consider?

ANSWER - CASE #10

Consider as you have your discussion with Fred:

- What is he willing to do? What are his goals for himself? Is he happy with what is happening? Does he have some ideas on what he could do?
- Explore Fred's concerns around insulin injections as the options for improving control will likely involve different insulin and/or more injections/day. What are his fears/concerns? Does he see more injections as a sign of worsening diabetes or failure on his part?
- Assess his injection technique – is he using syringes or a pen? Needle length? Injection sites? Injection technique?

The large single morning injection may be causing some or all of Fred's complaints.

- The intermediate-acting insulin peaks in the afternoon and could be causing mid-afternoon hypoglycemia. Review his usual food intake and activity habits. Is he eating an afternoon snack? If not, does he want to eat one consistently?
- Even though his TDD is large (> 1 u/kg), the once daily dose is not lasting long enough to control BG levels through the night and early morning. This would be responsible for the nocturia and the high FBG levels.

While he may need 80 units for background coverage, he is not getting 24 hour coverage with one injection of intermediate-acting insulin. He has mentioned that he hates insulin injections so he may be more willing to move to a flatter 24 hour insulin that remains a single daily injection. It is important to review all of the insulin options available to him presenting pros and cons for each. By showing the action profiles visually he will be able to see that his current insulin is peaking during the time of his

hypoglycemia and then wearing off leaving him with very little insulin coverage through the night and in the morning.

Some options for Fred to consider:
The first priority is to reduce the frequency of lows in the afternoon and ideally his change would address the hyperglycemia through the night and morning. If he is agreeable to switching to a once daily long-acting insulin he could choose either a U100 concentrate such as Lantus, Levemir or Basaglar. Given his larger dose of 80 units he may also consider a concentrated long-acting insulin such as Toujeo (Glargine 300 units per ml). Use of Toujeo may result in better absorption, longer duration and more comfortable injections for Fred. You will need to contact his physician/RN(NP) to get an order to switch him to a new type of insulin. Fred can decide what time of day he wants to take it. The starting dose of a once daily long acting insulin should be a 20% reduction from his current TDD.

For example if he was willing to transition to Toujeo you would calculate the new dose as follows:

80 units x 0.20 = 16, thus 80 – 16 = 64 units
New starting dose of Toujeo is 64 units once daily.

Alternatively if Fred prefers to continue with intermediate-acting insulin but is willing to take 2 injections – you could split his a.m. intermediate dose into 2 injections eg. 2/3 in the a.m. and 1/3 at hs:

- 80 x 0.67 (2/3) = 53.6 U 80 x 0.33 (1/3) = 26.4
- New starting doses - 54 units at breakfast and 26 units at hs

If he chooses to continue with one shot of intermediate-acting insulin at breakfast it will not be possible to remedy both of his BG issues with dosage adjustment. Priority would be to remedy the lows in the afternoon while being aware that the a.m. hyperglycemia will likely worsen. It is possible to increase intake of carbs at noon and/or mid-afternoon to feed the morning dose of insulin to prevent hypoglycemia. This will have an implication on body weight.

- reduce his morning intermediate-acting insulin dose by 10% increments until hypoglycemia resolves (80 x 0.10 = 8 units. New dose is 80 – 8 = 72 units).
- have Fred continue to lower the morning intermediate-acting insulin by 10% every 3-4 days until unexplained afternoon low BG levels are eliminated. You will need to work together to strategize around the hyperglycemia happening overnight.

It may be enlightening for Fred to do some ac/pc SMBG to see his variability in BG readings. This may inspire him to move to a more physiologic regime to meet his insulin needs. There may be evidence to support the addition of mealtime insulin in conjunction with his improved basal insulin needs.

If his concerns regarding self-injecting insulin have been addressed and he is feeling better, he may be willing to take more injections to achieve his goals.

CASE # 11

Joe is a 36 year old sedentary Assistant Manager in a meat packing plant and has had diabetes since age 24. His sister also has diabetes and was recently diagnosed with retinopathy and he is anxious to learn more about his diabetes and improve his control. He has no complaints and feels well other than "feeling tired a lot".

He is 8 kg above his healthy weight and would like to lose some weight. He is on no specific diet and can recall no dietitian contact, but he says that he eats "regular" meals and quantities.

He is taking:

- Short-acting 10 units and intermediate-acting 35 units each morning
- Intermediate-acting 25 units at supper.

Glucose patterns on a three day per week before meal and bedtime snack testing routine are as follows:

Date	Before Breakfast	Before Lunch	Before Supper	Bedtime	Other
	4.4	11.1	7.8	8.9	
	4.4	16.7	7.9	11.1	
	6.7	15.8	8.9	6.7	
	4.4	16.7	6.8	11.7	
	2.2	16.7	9.1	16.7	
	6.7	11.1	11.1	16.7	

What would you discuss with him and what possible recommendations might you make regarding his insulin dose?

ANSWER CASE - #11

Explore Joe's interest and motivation to take more interest in his diabetes self-care. Identify the opportunities to facilitate positive self-management skills.

Explore any concerns around his sister's experience and what this has meant for him. Reinforce the opportunity that he has to reduce his risk for complications while improving his overall health.
Identify his readiness for change and provide direction and guidance based on his stage of change.

If having personal concerns with his own vision, assess accordingly and remind of appropriate screening and follow up care.

Identify mutual targets for BG control (ideally 4-7 before meals).

Explore what has worked for him in the past and what hasn't and what his priorities are. If seeking support to optimize his glycemic control establish a plan together.

Review his BG pattern together. The trends that emerge include FBG in and below target (2.2-6.7 mmol/L), well above target before lunch (11-16 mmol/L), slightly above target most often before supper with a rise between supper and bedtime most days.

Priority is to deal with hypoglycemia first therefore FBG is the first challenge. There may be multiple lifestyle variables as well as his current insulin that is responsible for his BG trends.

Explore and discuss variables including:

- Changes in usual eating habits (meals, snacks, beverages, timing of food/drink).
- Changes in his daily routine; any shift work.
- Changes in activity level, any new exercise.
- Change in sleep quantity/quality.
- General health, illness, stress.
- Other issues that he feels may have contributed to the BG patterns that he has.
- Has he ever used metformin as part of his diabetes management plan r/t insulin resistance/weight loss and adjunct therapy with insulin?
- How does he handle hypoglycemia; symptoms, treatment, patterns?
- Has he done any pre and post meal BG checks to determine variability within his BG across the day?

Before he changes his insulin, it would be beneficial for Joe to see a dietitian. He can decide whether or not he wants to use an approach of consistent carbohydrate or learn carbohydrate counting. The dietitian can also help him identify areas to reduce fat and overall energy intake to support his weight loss goals when he has a meal planning method, the pattern of the glucose levels can be reviewed again.
Next, assessing and addressing his activity would be beneficial, again to identify if increased activity could also help him reach his weight loss goals and improve his BG control.

Complete a thorough assessment of his injection sites, site rotation, injection technique, etc. Is lipodystrophy or poor site rotation contributing to his variable BG levels?

If Joe is interested in changes to his current insulin regime you can present a variety of options.

- He could consider moving his supper intermediate-acting insulin to bedtime for the peak to align closer to morning/late morning or he may appreciate the benefits of a once daily extended long-acting insulin analogue where you no longer need to strategize around the peaks of background insulin. By correcting the basal insulin needs first it becomes much more apparent what the mealtime insulin needs are. A flatter profile acting insulin helps this pattern emerge more

clearly. If moving Intermediate to bedtime, an order is not required as this falls within the RN clinical nursing protocol scope of practice. If switching to a different type of insulin then an order is required from the physician or RN(NP).

If moving from intermediate-acting insulin bid to long-acting acting insulin once daily:

- 35+25 = 60 units total intermediate-acting insulin. This can be transitioned into a once daily long-acting insulin injection starting at a dose that is 20% less.
- Therefore, 60 x .20 = 12 units less; 60-12 = 48 units long-acting once daily to start.

Joe may also want to consider mealtime insulin to cover each of his meals in a more strategic way. While he is using a short-acting insulin with breakfast he could consider moving to a rapid-acting insulin with one or more of his meals. Rapid-acting insulin allows for more flexibility with timing of meals with the 'inject and eat' convenience. You can explore with him his own practice of giving the short-acting insulin 30 minutes prior to eating. Many struggle with this and end up giving it far closer to the meal creating a mismatch in the peak of the insulin compared to the digesting meal. If he prefers his short insulin it can also be used with each meal if given 30 minutes in advance of the meal. He will need to be aware of the trailing effect as it can still have an impact on BG 8 hours after each injection. This does create a higher risk of hypoglycemia between meals. Additional doses or a new kind of insulin requires an order from his physician or RN(NP).

If there continues to be a jump in BG between breakfast and lunch then he will likely need an increase in his pre-breakfast bolus insulin (once food and activity variables are ruled out). As one change is made there will be a ripple effect with BG response so assessment needs to happen following each change and decisions made accordingly. Insulin dose adjustments need to happen in a stepwise fashion rather than making several changes at once.

CASE # 12

This continues the story of Joe from Case 11. Joe has decided to do carbohydrate counting and has made some dietary changes to reduce his weight.

Review his food records and calculate the total carbohydrate intake for each meal.

As a reference use *Beyond the Basics* (2015).

MEAL	FOOD EATEN	# grams of carbs	TOTAL Carbohydrate PER MEAL/SNACK
Breakfast Time: *0615 hrs.* BG: *4.4*	*2 toast, whole wheat* *2 tsp. jam (regular)* *6 ounces unsweetened orange juice*		
Two hour BG:			
Activity	*At work – sitting*		

Snack Time: BG:	*Orange*		
Lunch Time: 1200 hrs. BG:	*Sandwich:* *2 slices of bread, whole grain* *2 slices cheese or ½ cup salmon* *2 tsp. margarine* *lettuce and tomato slice* *Apple or orange, medium* *1 cup skim milk*		
Snack Time: BG:	*Oatmeal granola bar*		
Supper Time: BG:	*Meat or fish about 3 ounces* *1 cup potatoes* *Broccoli , 1 cup* *1 slice bread, whole grain* *¾ cup yogurt, skim with artificial sweetener,* *1 cup strawberries*		

Note: answers are included in the following table.

ANSWER – CASE#12

MEAL	FOOD EATEN	# grams of carbs	TOTAL CARBOHYDRATE PER MEAL/SNACK
Breakfast Time: *0615 hrs.* BG: *4.4*	*2 toast, whole wheat* *2 tsp. jam (regular)* *6 ounces unsweetened orange juice*	30 10 22.5	62.5
Two hour BG:			
Activity	*At work – sitting*		
Snack Time: BG:	*Orange*	15	15
Lunch Time: 1200 hrs. BG:	*Sandwich:* *2 slices of bread, whole grain* *2 slices cheese or ½ cup salmon* *2 tsp. margarine* *lettuce and tomato slice* *Apple or orange , medium* *1 cup skim milk*	30 15 15	60
Snack Time: BG:	*Oatmeal granola bar*	28	28
Supper Time: BG:	*Meat or fish about 3 ounces* *1 cup potatoes* *Broccoli , 1 cup*	0g 30g 0g	67.5

	1 slice bread, whole grain *¾ cup yogurt, skim with artificial sweetener* *1 cup strawberries*	15g 15g 7.5g	

CASE #13

Joe, from cases 11 & 12, is now comfortable with carbohydrate counting and has started using some pre-meal rapid-acting insulin based on the amount of carbohydrate he eats. He is now using Lantus at 10 pm as his basal insulin.

- **For each meal calculate the insulin to carbohydrate ratio using the food record below [see bottom] and then fill in the insulin to be taken at the meal.**

- **Comment on the appropriateness of the calculated ratio. Assume the single BG values given here represent the usual pattern of BG results.**

MEAL	FOOD EATEN	# grams of carbs	INSULIN TAKEN
Basal Insulin			0
Breakfast Time: *0615 hrs.* BG: *4.4*	*2 toast,* *2 tsp. jam (regular)* *½ grapefruit*		Rapid 12 units
Two hour BG: 7.8			
Activity	*At work – sitting*		
Snack Time: BG:	*1 cup carrot & celery sticks* *2 tbsp. low fat dip*		
Lunch Time: 1200 hrs BG: 5.3	*Sandwich:* *2 slices of bread* *2 slices cheese or ½ cup salmon* *2 tsp. margarine* *lettuce and tomato* *Apple or orange, medium* *1 cup chocolate milk*		Rapid 10 units
Snack Time: BG 12.3			
Supper Time: BG: 10.8	*Meat or fish about 3 ounces* *1 cup potato salad* *corn, 1 cup* *1 slice bread* *¾ cup yogurt, skim with artificial sweetener* *1 cup strawberries*		Rapid 10 units
2 hour BG: 13.6			

Basal Insulin			Lantus 32 units
Bedtime Time: 10 p.m. BG: 6.7	*1 apple*		

Insulin:carb ratio is ___ units for ___ grams of carbohydrate or ____units (breakfast)
Insulin:carb ratio is ___ units for ___ grams of carbohydrate or ____ units (lunch)
Insulin:carb ratio is ___ units for ___ grams of carbohydrate or ___ units (supper)

ANSWER – CASE #13

MEAL	FOOD EATEN	# grams of carbs	INSULIN TAKEN
Breakfast Time: *0615 hrs.* BG: *4.4*	*2 toast,* *2 tsp. jam (regular)* *½ grapefruit*	30 10 15 55	Meal Bolus: 12 Correction: TOTAL Taken: 12
Two hour BG: 7.8			
Activity	*At work – sitting*		
Snack Time: BG:	*1 cup carrot & celery sticks* *2 tbsp. low fat dip*	15	
Lunch Time: 1200 hrs. BG: 5.3	*Sandwich:* *2 slices of bread* *2 slices cheese or ½ cup salmon* *2 tsp. margarine* *lettuce and tomato* *Apple or orange* *1 cup chocolate milk*	 30 15 30 75	Meal Bolus: 10 Correction: TOTAL Taken: 10
Snack Time: BG: 12.3			
Supper Time: BG: 13.6	*Meat or fish about 3 ounces* *1 cup potatoes* *corn, 1 cup* *1 slice bread* *¾ cup yogurt, skim with artificial sweetener* *1 cup strawberries*	0 30 30 15 15 7.5 97.5	Meal Bolus: 10 Correction: TOTAL Taken: 10
2 hour BG: 13.6			
Basal Insulin			Lantus 32 units
Bedtime Time: 10 p.m. BG: 6.7	*1 apple*	15	0

Insulin:carb ratio is 12 units for 55 grams of carbohydrate or 1:5 (breakfast)
Insulin:carb ratio is 10 units for 75 grams of carbohydrate or 1:7.5 (lunch)
Insulin:carb ratio is 10 units for 97.5 grams of carbohydrate or 1: 9.7 (supper)

Assessment:
The insulin:carb ratio seems appropriate for breakfast as the pc reading is 7.8 mmol/L. While slightly more than 3 mmol/L higher, it does fall within the recommended 5 to 10 post meals.

The insulin:carb ratio seems wrong for noon as his pc reading is 12.3 mmol/L and is well above target. The ratio may need to be lowered to 1:5. He needs to make this change for a few days and assess the impact on his pc lunch and ac supper BG levels.

The insulin:carb ratio at supper cannot be accurately assessed at present as his post-lunch & pre-supper readings are elevated:
- First he needs to lower the pc dinner/ac supper reading.
- Once the pc noon and pre-supper readings are at target, but the pc supper BG remains above target, he may need to adjust the insulin:carb ratio to 1:8 or 1:5.

Sometimes you may need to calculate a starting/ball park insulin:carb ratio for your client. If so, use the Rule of 500. For example Joe's TDD is 500 units/day:

TDD = 12 + 10 + 10 + 32= 64
500/64 = 7.8
Therefore, take 1 unit of insulin for every 8g of carb eaten.
This is just a "ball park" and would be adjusted overtime, based on BG results. Often clients have different insulin:carb ratios for each meal.

Note:
The relationship between the ratio and insulin dosage is an inverse one.
When you decrease the insulin:carb ratio, you are actually increasing the amount of insulin to be taken e.g. 1:9 ratio – would take 5 units for 45g carb, while a lower insulin:carb ratio of 1:5, you would take 9 units of insulin for that same 45g of carb.

When you increase the ratio the person will take less insulin. e.g. ratio of 1:5 take 9 units for 45g carb, higher ratio of 1:9, take only 5 units of insulin.

CASE #14
Continuing with Joe from cases #11, 12 and 13. Joe is getting very good at counting carbohydrates and deciding how much insulin to take. He is disappointed with some of his pre-supper glucose levels. He asks you what he can do to correct some of the high pre-meal levels. Assume his:
- target glucose level is 7
- insulin:carb ratio for supper is now 1:10
- TDD is usually ~ 68 units/day (34 basal + 12 + 12 + 10 for boluses most often)

What is his correction factor?

Write in any correction insulin doses you would recommend using the same chart below.

MEAL	FOOD EATEN	# grams of carbs	INSULIN TAKEN
Supper Time: BG: 10.8	*Meat or fish about 3 ounces* *1 cup rice* *salad* *corn, ½ cup* *1 slice bread* *¾ cup* *yogurt, skim with artificial sweetener* *1 cup strawberries*		Meal Bolus: Correction: TOTAL Taken:
2 hour BG:			
Basal Insulin			Lantus 38 units
Bedtime Time: 10 p.m. BG: 6.7			

ANSWER – CASE #14

His TDD is 68 units. The rule of 100 applies to use of rapid-acting insulin.
100 ÷ 68 = 1.4. This means that 1 unit of insulin will lower the blood glucose by 1.4 mmol/L.

For the pre-supper reading of 10.8 mmol/L, he would calculate the correction by subtracting his target glucose level (7.0) from his current reading and then dividing by the correction factor (1.4).

10.8 – 7 = 3.8 mmol/L above target
3.8 ÷ 1.4 = 2.7 additional units – this could be rounded to 3 extra units.

MEAL	FOOD EATEN	# grams of carbs	INSULIN TAKEN
Supper Time: BG: 10.8	*Meat or fish about 3 ounces* *1 cup rice, brown, cooked* *salad* *corn, ½ cup* *1 slice bread* *¾ cup yogurt, skim with artificial sweetener* *½ small banana*	0 45 0 15 15 15 7.5 97.5	Meal Bolus: 10 Correction: 3 TOTAL Taken: 13
2 hour BG:			
Basal Insulin			Lantus 38 units
Bedtime Time: 10 p.m. BG:	*1 apple*	15	0

CASE # 15

Quan, a 30 year old salesman, has had type 1 diabetes for 10 years. He is moderately obese at approximately 8 kg overweight notes his weight is slowing increasing despite being fairly active. He would like to drop a few pounds. Quan typically eats three meals and three snacks a day.

INSULIN DOSES: (Novolin)

Breakfast:	Novorapid 10 units
Noon:	Novorapid 6 units
Supper:	Novorapid 12 units
Bedtime:	Levemir 26 units

90% of his BG values are in the 4-8 range and exceptions are usually explained by food and activity variations. His last A1C was 6.9%.

He plans to take up his old school sport of basketball – two hour practice on Monday from 7:00 – 9:00 p.m. and weekly game 2:30 - 4:30 p.m. on Saturdays.

What advice does he need to leave him safe for the new exercise pattern?

ANSWER – CASE # 15

Discuss impact of extra activity on BG and that each person's response to exercise is individual. Review variables and considerations to safely enjoy exercise while not sacrificing BG control. Discuss choice of injection site prior to exercise and the implications. Review hypoglycemia and being prepared in the event that he does dip low. Reinforce proper hydration, footwear, warm up/cool down and other issues you deem necessary.

Monday evening practices:

The practices will occur during the action time of supper dose of Novorapid. As he wants to lose weight, it would be preferable to decrease insulin instead of eating extra food. Because the activity is 120 minutes, he could drop his pre-supper Novorapid by 50% or 6 units.

It would be advisable for him to carry extra carbohydrate such as juice and a choice from grains/starches food group.

He should be advised to check his BG levels:

- Pre-supper
- Pre-practice (this will tell him if his BG is stable, rising or falling before the exercise)
- Mid-point in the practice
- Post-practice
- Bedtime
- Following morning

Adjust based on his patterns & response to exercise.
As there is the possibility of a carryover BG lowering effect of the evening physical activity, he should also consider reducing his bedtime Levemir (the evening of the exercise), initially by 20% (mid-point in the suggested reduction range of 10-30%). Depending on his bedtime glucose reading, he may need additional carbohydrate at bedtime and he may need to consider also checking his BG at 3:00 a.m. until he learns more about the effects of the practice on his night-time glucose.

Saturday afternoon game, 2:30 to 4:30 p.m.:
If Quan takes his Novorapid at noon, he will be past the peak action time by game time. He could make a modest reduction in the pre-noon Novorapid, about 20% or 2 units for the first game. He would check his BG level at the same times as he did for practices, beginning at pre-noon. Depending on the pre-game level he may need extra carbohydrate at that time and/or at the mid-point in the game. If he needs extra carbohydrate pre or mid-game, he should take a fast acting carbohydrate choice. Post-game he will need to consider reducing his pre-supper Novorapid because of the carry over effect of the exercise. He could begin with a 20% reduction, assuming a pre-supper BG target of 4-7 mmol/L. Depending on his experience with post-activity glucose levels, he many also need to reduce his bedtime Levemir.

CASE # 16

Louise is 78 years old, lives alone and has had type 2 diabetes for 12 years. Her weight is ~151 lbs. (68.5 kg) and height is 61" (155 cm). She has had no problems with hypoglycemia recently. In the past she has had mild hypoglycemia and 6 months ago she had an unrecognized low blood glucose level. Her neighbour called 911. She has seen a dietitian recently and her carbohydrate intake is usually consistent from day to day. A daily afternoon snack has been recommended. In addition to diabetes she has had a myocardial infarct 2 years ago, has hypertension (now controlled) and dyslipidemia (now controlled).

Present Medications:

- Metformin 1000 mg bid
- NovoMix 30, 28 units, pre-breakfast
- NovoMix 30, 16 units, pre-supper
- She uses a Novolin Pen 4 to deliver her insulin and likes the pen.

Recent BG readings:

Date	Before Breakfast	Before Lunch	Before Supper	Bedtime	Other
	10.5	7.8	3.4	8.0	
	9.2	8.3	4.0	7.2	
	11.1	7.1	2.8	6.9	

Carbohydrate intake distribution (as assessed by the dietitian):

- Breakfast - 30 grams
- Lunch - 60 grams

- Snack - 0 - 15 grams
- Supper - 45 grams
- HS - 30 grams

What target BG level would you set with Louise and her physician?

What does the current dose of 28 units of NovoMix 30 represent in terms of types of insulins and how many units of each insulin does this dose represent?

What changes, if any, would you recommend to her current medications?

What might you consider if the first issue or problem you identify is resolved?

ANSWER – CASE #16

What target BG level would you set with Louise and her physician?

Due to her age, living alone, experience with unrecognized hypoglycemia and previous medical history (MI), the recommended target pre-meal glucose level could be raised from 4-7 mmol/L to, for example; 6-8 mmol/L or slightly higher depending on your assessment of her ability to manage diabetes, and recognize and respond to hypoglycemia. Assessment will be discussed under the third question.

What does the current dose of NovoMix 30 represent in terms of types of insulins and how many units of each insulin does this dose represent?

NovoMix30 insulin represents a mixture of 30% NovoRapid (Aspart) and 70% aspart protamine crystal. The aspart protamine crystal has an activity profile similar to NPH (intermediate-acting).

28 units of NovoMix30 insulin pre-breakfast is:

- 28 x 30% = 8.4 units of rapid-acting insulin
- 28 x 70% = 19.6 units of intermediate-acting insulin

16 units of NovoMix30 insulin pre-supper is:

- 16 x 30% = 5 units of rapid-acting insulin
- 16 x 70% = 11 units of intermediate-acting insulin

What changes, if any, would you recommend to her current medications?

Current glucose pattern shows:

- Fasting – above target
- Noon – at or close to target
- Supper – too low
- Bedtime – at target

Before you do any insulin adjustments you need to do a thorough assessment:

- First assess if Louise feels all or any of her low BG reactions, whether she has some unawareness going on, or does her BG need to be quite low before she feels any signs of lows.
- Has there been a change in cognitive or functional abilities or other change in health status?
- Determine if she has been mixing her insulin properly prior to each injection. If a premixed insulin is not adequately reconstituted then the ratio of each insulin becomes distorted and thereby impacting the dose of each that she thinks she is getting.
- Her injection technique needs to be assessed. Is she able to manage each of the steps required to perform an injection properly. She may be using only one small area for injections therefore, may be injecting into lipodystrophy area. She needs to rotate her sites with a recommendation to primarily using her abdomen and legs and avoidance of the old injection site.
- Assess the length of pen needle she is using, she may be using too long of needle or applying too much pressure with injection and therefore injecting the insulin into muscle tissue and causing a change in the action profile of insulin.
- The delivery device needs to be assessed. Have Louise bring her pen to the appointment and have her demonstrate how she gives an injection. There is a possibility the technique is incorrect, for example not priming the pen, or an improper skin lift technique if one is even warranted. Assess that she is able to visually see the correct dose to assure accuracy of dosing.
- When hypoglycemia has been reported with a person this age, assess the kidney function. If her EGFR is deteriorating, Louise is at increased risk for hypoglycemia. Individuals with declining renal function may be prone to low blood glucose reactions especially during the night.
- If she had not been re-assessed by a dietitian, definitely this should be repeated and explore meal preparation, spacing of meals, and adequate content.

If the previous assessment suggests she has no problems in the above mentioned areas, the first consideration is always prevention of obvious hypoglycemia which is occurring pre-supper. It would be recommended to do a 10% minimum reduction in the 28 units pre-breakfast NovoMix30.

Therefore, 28 x 10% = 2.8. Round up to 3 units. The new dose would be 28 – 3 = 25 units of NovoMix30.

Reinforce the consistency of her afternoon snack.

If the above change corrects the pre-supper readings to target, continue to assess any other patterns occurring in her SMBG.

What might you consider if the first issue or problem you identify is resolved? (hypoglycemia before supper)

- In some cases, consideration may need to be given to splitting the insulins into their individual components and possibly switching the aspart protamine crystal to a long-acting analogue to again minimize the risk of hypoglycemia, and to be able to adjust one type of insulin without affecting the other. While there are advantages you must also consider the potential limitations for this client. There is a simplicity with having only one pen to deal with and there is a risk of mixing them up if she was to have 2 kinds to manage. The routine in lifestyle that it takes for a premix to work well may be natural for her. If she is looking for more flexibility with her lifestyle then she may prefer 2 pens each with a different insulin type. All decisions must be evaluated in terms of the risk for error and overall safety.
- This could be recognized as a teaching moment for the client. Take time to explain to her that her premix contains 2 types of insulin, and teach her the action profile of the two types of insulin. By keeping these insulins combined, any subsequent adjustment results in adjusting both insulins together. When the insulins are split into their separate components, they now can be adjusted individually or moved to a different time more appropriate to the action profile of that insulin.
- In order to decide the best action you will need to consider the client's ability and willingness to manage the proposed changes (having 2 different insulin pens and a different regimen), target BG levels for her age, overall health and symptoms of hypo or hyperglycemia.

CASE #17

Louise has taken care of the first problem you identified in Case #16. All other circumstances remain unchanged.

Her current medications are:

- 25 units of NovoMix30 pre-breakfast
- 16 units of NovoMix30 pre-supper
- Metformin 1000 mg bid
- She continues to use the Novolin Pen 4 for delivery of her insulin and she still likes it.

See the current blood glucose pattern below:

Date	Before Breakfast	Before Lunch	Before Supper	Bedtime	Other
	10.5	7.8	7.4	8.0	
	9.2	8.3	7.0	7.2	
	11.1	7.1	7.8	6.9	

What suggestions do you have to help Louise achieve target BG levels?

ANSWER CASE #17

The current BG pattern reveals high FBG while BG at other times of the day is within target.

Before making any changes to insulin:

- Again reassess all the areas suggested in Case 16, hypoglycemia awareness, injection site, technique and length of needle, and recent blood work, indicating a change in kidney functions.
- Do another nutritional assessment including a review of the amount and type of food she is eating at bedtime.
- Ask her to test her blood glucose level at 3:00 a.m. a few times to ensure hypoglycemia is not being missed. Ask her about any disruptions in her sleep: waking for no reason, nightmares, sweating, etc. If the BF results at 3:00 a.m. reveal BG <4mmol/L (without waking up with symptoms) we can assume hypoglycemia awareness. This can also cause a Somogyi Phenomenon which is defined by rebound hyperglycemia, following a hypoglycemic event.
- While at a glance it could look like pre-supper insulin was needing to be increased to correct high FBG, the complete opposite is true.

If the only concern is hypoglycemia during the night, a lower dose of NovoMix30 at supper will help the BG through the night come up (to prevent lows) but may also result in a higher hs reading related to less insulin coverage between supper and bedtime.

Presuming she is willing and able to manage the insulins separated into their individual components each with its own pen, she could transition to a long-acting insulin for basal needs and a rapid-acting insulin to provide mealtime coverage.

25 units of NovoMix30 insulin pre-breakfast separated is:

- 25 x 30% = 7.5 units of rapid-acting insulin
- 26 x 70% = 17.5 units of intermediate-acting insulin

16 units of NovoMix30 insulin pre-supper is:

- 16 x 30% = 5 units of rapid-acting insulin
- 16 x 70% = 11 units of intermediate-acting insulin

To convert intermediate-acting insulin bid to once a day long-acting analogue insulin. You take the TDD of intermediate-acting insulin which in this case would be 17.5 +11 = 28.5 total daily dose of intermediate-acting insulin. You then take that total and reduce it by 20% and give that as a long-acting insulin once per day at a time that she deems most convenient and practical for her. Consider the potential change in pen device. Review the similarities and differences and ensure that she is able to manage her new pens without problems. There can be an advantage in using two completely different pens to highlight the 2 different kinds of insulin in order to prevent mixing them up accidently.

The calculation for the a.m. dose of long-acting insulin will look like this:

- 28.5 units total daily dose of intermediate-acting insulin reduced by 20%
- 28.5 x 20% = 5.7

The reduction would be 28.5 - 5.7= 22.8 units or rounded up to 23 units of long-acting insulin given once daily (often either pre breakfast or hs).

Louise's rapid-acting insulin dose would remain the same as before:
- With 7.5 units of rapid-acting insulin pre-breakfast rounded up to 8 units of NovoRapid given prior to breakfast.
- Her supper rapid-acting will also remain the same, which will be 5 units of NovoRapid prior to supper.

NOTE: a physician/RN(NP) order would be needed to implement any of these changes as it is implementing new insulin types.

CASE #18

Louise has had no changes in her insulin for the last 3 months. She comes in for a reassessment and reports that in the last month she has been very ill. She was hospitalized and diagnosed with a stroke, and this has left her with right sided weakness. She reacted to an antibiotic given for a urinary tract infection while in hospital which affected her kidney function. Her kidney function deteriorated rapidly and she was required to do dialysis for one week while in hospital; for the past two weeks there has been no dialysis and her kidney function is slowly improving.

Her SMBG results are inconsistent.
- A.M. - 5 to 12 mmol/L
- Noon – 4 to 14 mmol/L
- Supper – 4 to14 mmol/L
- Bedtime – 12 to 16 mmol/L

Current medications:
Lantus pre-breakfast 23 units
NovoRapid 8 units pre-breakfast
NovoRapid 5 units pre-supper
Her Metformin 1000 mg bid was discontinued while in hospital

What assessment would you do?

What recommendation would you give Louise about her insulin?

ANSWER CASE # 18

Since Louise's condition has changed drastically in the last month, and is no longer considered medically stable, you need to reassess her situation.
Assess her general capacity including any limitations. Is she able to live independently and manage her activities of daily living? Does she require help and if so how much and for which activities? Can she monitor her BG, administer her own insulin, sense

and react to hypoglycemia? Has she had any hypoglycemia? Does she have any memory or cognitive limitations? Any dexterity issues? Vision changes? Changes in appetite or ability to eat and swallow? Energy level/fatigue? Risk for falls? Any new medications involving potential for errors plus side effects? What is her new capacity for self-management?

Depending on what your assessment reveals you will need to coordinate care with other support services to ensure she has the care she requires, you may coordinate care with her physician/RN(NP), Home Care, RD (especially with changes in her kidney function), meal services such as 'Meals on Wheels', mental health as well as her support system of friends and family.

Recommendations for Louise's insulin:

- At this point, because of the deterioration of Louise's metabolic condition, ask her to see her physician/RN(NP) as soon as possible so that she/he can make recommendations on her insulin and medication.
- Inform her that the physician/RN(NP) should be involved in adjusting her insulin because of the change in her health recently.
- Communicate with the physician/RN(NP) advising that you feel they should resume responsibility for adjusting Louise's insulin, and that you would resume making adjustments only if her health stabilizes.

CASE # 19

Stan is a 36 year old lean male, weight 147 lbs. (67.0 kg), height 68½" (174 cm). He has had type 1 diabetes for two years. His carbohydrate intake is consistent at each meal. He has seen a dietitian recently.

Meal plan with the following carbohydrate intake:

- Breakfast - 115 grams
- Lunch – 105 grams
- Pm snack – 30 grams
- Supper – 75 grams
- HS - 45 grams

Stan prefers not to have a mid-morning snack, but likes having one in the afternoon and a more substantial one in the evening.

Insulin regime:
Lantus 35 units at hs

Apidra at each meal:

- 11 units at breakfast
- 7 units at noon
- 13 units at supper

He uses a correction dose of Apidra 1 unit to lower his BG 2 mmol/L.

Stan's present BG pattern is:

AC breakfast	2 hrs after breakfast	AC noon (lunch)	2 hrs after Lunch	AC supper	2hrs after supper	2 hrs pc hs snack
12	3.5	6.2	8	5.5	7.8	14
11.3	5	4.5	7	6.2	9	15.9
14.2	2.9	6.5	9	5.7	8.2	13.5

He monitors his BG closely and frequently makes insulin changes based on meal pattern and activity levels aiming for a pre-meal target of 4-7 mmol/L and a two hr post-meal target of <10 mmol/L. He usually works long hours at a physically demanding job.

What changes would you recommend?

ANSWER CASE #19

Stan's BG patterns reveal:

- FBG above target
- Post-breakfast below target
- Post-hs snack above target

Assess potential food, activity, injection technique variables that may be contributing to current issues. Is he over correcting the FBG resulting in a BG low mid-morning? Is his correction factor correct or does it need to be modified at that time of day? Assess injection technique. Could it be an intramuscular injection rather than subcutaneous? Does he incorporate a balance of foods into his breakfast or could his carbs be processed too quickly leaving him stranded mid-morning with insulin still working on it? Keep in mind that in response to a high pre-meal reading, some people do a combination of eating less plus applying a corrective insulin dose. Applying one or the other might be enough but both can result in hypoglycemia.
The first priority will be to eliminate the lows after breakfast. If these are not related to food or activity changes, then his pre-breakfast Apidra insulin could be reduced by 10%-20%. This is taking into consideration that he is content with his current eating habits and does not plan to change morning food or drink.

The calculations for reducing his Apidra 10% are as follows:
11 x 10% = 1.1. Therefore the reduction of Apidra would be 11 - 1.1= 9.9. Round the 9.9 up to 10. Then the new Apidra dose in the morning would be 10 units pre-breakfast.

The calculation for reducing his Apidra 20% is as follows:
11 x 20% = 2.2. Therefore the reduction of Apidra would be 11 - 2.2= 8.8. Round the 8.8 up to 9. Then the new Apidra dose in the morning would be 9 units pre-breakfast.

Depending on Stan's comfort level and prediction of what the one unit difference will make, he can choose either 8 or 9 units of Apidra pre-breakfast. Adjustments by 1 unit increments can be used every 2-3 days as he is comfortable until the mid-morning BG returns to target range.

The next BG issue needing attention (now that his mid-morning BG has been corrected) is his 2 hr post hs snack BG readings which can also be impacting his FBG the following morning.

Options to consider:

- Is Stan's Lantus dose waning by this time? It is plausible that it is not quite lasting 24 hours? Is he hitting muscle with this injection resulting in quicker metabolism of the insulin? May he benefit from Toujeo for full 24 hour basal coverage?
- Decrease carbs with hs snack, increase non carb food options (if not satisfied with a smaller snack).
- Ensure a balance of carbs along with protein, fibre &/or fat to slow absorption of carbs and stabilize BG.
- Evaluate the insulin coverage with his supper meal. He mentions working long hours so discuss if his supper involves eating out (which often equates to larger portions and higher fat). Is it possible that he is having a high fat supper meal resulting in higher BG several hours later? Experiment with different meals to see if BG responds any differently.
- Under the direction of his physician/RN(NP) he could consider the addition of a small dose of Apidra to cover his hs snack. This is beyond the basic IDA responsibility for RNs. It is critical to monitor for hypoglycemia during the night if bolus insulin is used at hs. Extreme caution must be used and helping clients understand the risks is within the responsibility of the RN.

If FBG remains elevated, despite the other issues being corrected, strategies targeting the FBG must be explored.

- Have Stan do some 3:00 a.m. SMBG to rule out the Somogyi Phenomenon. Once you are confident that there is no hypoglycemia during the night you can consider increasing the basal insulin gradually until FBG reaches target of 4-7 mmol/L.
- The improvement in FBG could result in hypoglycemia during the day as basal influence is across 24 hours. As a result the mealtime insulin may need to be decreased. Ensure Stan is prepared for this ripple effect and have a plan for titration of his Apidra if needed.

CASE #20

Ruth is a 65 yr. old homemaker. She has type 2 diabetes and has been on insulin for five years. She is having some health issues and requires a biopsy of her liver and pancreas. She has been advised to fast from midnight the night before the procedure and to report to the hospital at 6:30 a.m. The exact time of the procedure is unknown. In the last month Ruth has had no hypoglycemia and is satisfied with her BG control. Present insulin dose is:

- AM - 12 units of NPH given before breakfast
- AM - 4 units of NovoRapid given with breakfast ~ 0730 – 0800 hrs.
- PM - 4 units of NovoRapid at supper ~ 1700 – 1730 hrs.
- HS - 27 units of NPH at bedtime ~ 2200 hrs.

Ruth eats consistent carbohydrate at meals and at regular times and she routinely has a bedtime snack.

Glucose Patterns on 3 days prior to seeing the educator:

Date	Before Breakfast	Before Lunch	Before Supper	Bedtime	Other
	6.3	8.3	6.2	9.3	
	6.1	6.6	8.5	7.3	
	7.2	7.5	6.2	9.0	

What would you advise Ruth to do with her insulin dosages in preparation for the test and the morning of the test?

ANSWER - CASE #20

First explain what "fasting" means. Explain that she could still experience a low BG during this time. Discuss hypoglycemia and review proper treatment involving glucose tablets in the event she has to treat a low BG. She should inform the personnel doing the procedure about the episode and the treatment taken.

Recommend that she monitor her BG regularly and, if she is up at night, do a middle of the night test.

Bedtime Insulin Night Prior to the Test

At her usual bedtime (2200 hrs), encourage her to have a snack containing at least 30-45 gms of carbohydrate combined with a protein source. She should not take any NovoRapid insulin to cover this food.

Reduce the bedtime NPH dose by 10% as she will not be eating in the morning for an unknown length of time and you want to prevent hypoglycemia.

Usual dose: 27 units of NPH at 2200 hrs.
27 x 10% = 2.7 units.
27 - 2.7 = 24.3 units, new dose – round this down to NPH 24 units hs.

Morning Insulin Dose Day of the Test

Her usual morning dose is 12 units of NPH and 4 units of NovoRapid. This is a combination of intermediate and rapid-acting insulins. The specific timing of the procedure is unknown. As she will not be eating, the safest action will be to delay both of her insulins until the procedure is completed and she is able to eat. Ruth can be given a chart to follow, basing the NPH insulin dose on the number of hours her breakfast meal has been delayed. Since the test has no schedule time, prepare her for a long wait before she gets to eat the morning of the test.

Use the formula: number of hours the NPH injection is delayed divided by 24 (number of hours in a day) and then multiplied by 100 = the percentage to reduce the usual NPH dose.

Example: usual morning dose of NPH 12 units is delayed by 4 hours
4/24 = .167 x 100 = 16.7%
12 units x 16.7%= 2.004, round down to 2 units. Reduce the dose from 12 units to 10 units of NPH with a 4 hour delay.

The following is a suggested guide which could be given to Ruth:

- Arrival time for procedure - 0630 hrs.
- Monitor BG; if test is completed within the 2 hours of her usual injection time and she is able to eat something, she can take her usual dose of NPH 12 units.

If test completed within 3 hrs of arrival and able to eat	Take 11 units of NPH and eat carbohydrate
If test completed within 4 hrs of arrival and able to eat	Take 10 units of NPH and eat carbohydrate
If test completed within 5 hrs of arrival and able to eat	Take 9 units of NPH and eat carbohydrate
If test completed within 6 hrs of arrival and able to eat	Take 8 units of NPH and eat carbohydrate

Although this chart could be extended, it is likely best to advise the client that if the delay is longer than 6 hours, consult the physician.

Her mealtime NovoRapid dose will not change however, it will get delayed until she eats for the first time after the procedure. Advise her to take her usual NovoRapid dose presuming she is eating her usual amount of food. If she is unable to eat as usual and only wants sips of juice, advise her to omit her NovoRapid, until she eats a regular meal. Advise Ruth to monitor her BG throughout the remainder of the day and following day as BG may be disrupted due to the stress involved as well as the change in her routine.

Provide the client with written instructions for the insulin dose changes and treating low blood glucose.

Advise her to take the instructions with her to the test location.

Provide her with your contact information in case of questions and reinforce physician contact if she has concerns.

CASE # 21

John, 24, has type 1 diabetes. He comes to see you a day before the procedure. He says he will be fasting overnight in order to have his knee scoped, he is having a spinal for anesthesia. His procedure is booked for 8:00 a.m. and is expected to last until 9:30 a.m. His usual BG results are listed below. In the last two weeks he has had two early morning episodes of hypoglycemia with readings of 2.2 and 1.9 mmol/L. These were unexplained. He has not changed his insulin dose following these low readings.

His present insulin types and doses are:
Levemir 12 units a.m. and 16 units at bedtime
Humalog with each meal using a ratio of 1:8 and a correction factor of 2.

	Fasting	pc	Noon	pc	Supper	pc	Bedtime
Day 1	4.1	6.9	5.9	8.9	7.1	13.4	6.3
Day 2	4.2	7.5	5.9	7.8	6.9	12.5	5.9
Day 3	4.9	6.9		8.2	6.4	11.8	6.2

Given these results, what recommendations would make for IDA the day prior to the procedure?

What recommendations would you make for the IDA for the morning of the procedure? He is booked for 0800 hrs and expects to be finished by 0930 hrs at the latest.

It is now 11:30 a.m. and he is brought a light meal. He estimates he will be eating 60 grams carbohydrate. His current BG is 11.8 mmol/L and his usual target BG pre-meal is 6 mmol/L. What advice would you give?

ANSWER - CASE #21

Given these results, what recommendations would make for IDA the day prior to the procedure?

As he has had recent hypoglycemia and FBG is at the lower end of target BG, reduce the Levemir by 20%. So 16 x 20% = 3.2, round to 3 units less Levemir or 13 units. He likely requires a permanent reduction in the evening dose of Levemir and this should be discussed with John. Review the insulin dose adjustment principles of reducing a dose with unexplained low BG readings.

If he had not had the unexplained low readings, after assessment, it may have been appropriate to leave the evening Levemir dose unchanged the evening prior to the procedure.

What recommendations would you make for the IDA for the morning of the procedure? He is booked for 0800 hrs and expects to be finished by 0930 hrs at the latest.

To omit NovoRapid at the time of his usual a.m. insulin as he will not be eating breakfast at his usual time.
Encourage him to take his NovoRapid with him so that he can take his dose later that morning.

As the procedure is short he has the option of taking his usual morning dose of Levemir. As this is a long-acting insulin analogue, it would be expected to sustain the FBG during the procedure.

John is brought some food at 1130. He estimates he will be eating 60 grams carbohydrate. His current BG is 11.8 mmol/L and his usual target BG pre-meal is 6 mmol/L. What advice would you give?

For the NovoRapid he would use 1 unit for every 8 grams carbohydrate = 60/8 = 7.5 units.

To correct the high BG value he would need to use a correction dose:
11.8 mmol/L – 6 mmol/L (target) = 5.8 / 2 (correction factor) = 2.9 units.
Dose of NovoRapid would be 7.5 + 2.9 = 10.4 = 10 units (rounded down).

Then John should just resume his normal schedule.
Because John had some hypoglycemia happening for 2 weeks prior to the procedure, you now need to see him right away and review options on how to eliminate this. Book an appointment with him a few days after his procedure. This is also a good time to assess how things went for his procedure.

END of CASES

CHAPTER 4 - Historical Development

History of the document (this is an excerpt from the previous documents):

In April 2000, the Saskatchewan Advisory Committee on Diabetes presented its report, *Diabetes 2000*, to the Chief Medical Health Officer and the Deputy Minister of Health.

To action Goal 5, Objective 5.4 a working group was formed in 2000. The membership of the group was voluntary and consisted of Certified Diabetes Educators from northern and southern Saskatchewan, representing both urban and rural diabetes education programs. The Canadian Diabetes Association (CDA) facilitated the process. A member of the Saskatchewan Pharmaceutical Association audited the process in 2001.

The following steps were completed in the preparation of the original provincial template (2001):

1. Review of the Saskatchewan Registered Nurses' Association (SRNA) Registered Nurse Scope of Practice documents: Special Nursing Procedures and Nursing Procedures by Transfer of Medical Functions (1993) and Guidelines for Nurses Prescribing and/or Distributing Drugs by Transfer of Function (1997). Review of existing policies and procedures from Saskatchewan and other provinces, and review of selected literature and web sites.
2. Development of draft policies and procedures.
3. Review of policies and procedures by
    - Membership of the Diabetes Educator Section in Saskatchewan
    - Saskatchewan Registered Nurses' Association
    - Dr. M. Boctor, Endocrinologist and Professor of Medicine, University of Saskatchewan

As a result of above, the Working Group made decisions about both the policies and the procedures. These decisions have been reviewed and affirmed for the 2009 edition of the template. A few of the most significant decisions are outlined below:

Experience: IDA requires clinical experience beyond that of most RNs. Particularly, IDA requires that the RN already have a sound foundation in the basics as a diabetes educator. In the 2009, edition of the Module more detailed competencies were provided.

The policy template recommends an RN have direct diabetes education experience of a minimum of 2,000 hours of practice as a diabetes educator for the Basic IDA Module for competence and confidence in implementation of the Transfer of Medical Function specific to basic diabetes, more clinical practice and experience are needed for the advanced competencies. Therefore, we have retained our original recommendation of 2,000 hours of practice as a diabetes educator.

Basic Competencies: For the template to apply in most/all areas of the province, it was decided to define both basic and advanced competencies. This package only applies to the basic competencies.
Not all diabetes educators will have sufficient exposure to or experience with some of the specialty areas such as pediatrics, insulin pumps or pregnancy to make advanced competencies an option.

Situations considered "advanced" and not covered by this module include:
- pediatric diabetes
- insulin pumps
- sick day management
- pregnancy in women with pre-existing diabetes (type 1 or type 2)
- gestational diabetes mellitus
- special circumstances (travel, shift work).

Region Decisions: A critical aspect of this clinical protocol to adjust insulin is a process that needs to be customized by each Health Region. There are several options for the actual process. RNs and physicians/RN(NP)s in each Region must agree and be comfortable with the parameters that are Region specific.

The policy, as currently written, applies only for clients whom the RN assesses, teaches and reviews directly. The Transfer of Function for Insulin Dose Adjustment does not include the RN doing IDA for clients of other health care providers such as Home Care Nurses, Registered Dietitians, Pharmacists, etc.

MODIFICATIONS

2009:

The template was revised in 2009. The definition of "basic" IDA has been modified to address issues encountered by RNs who practiced under the transfer of medical function.

In the policy, "basic" continues to refer to IDA for adults with either type 1 or type 2 diabetes. The RN, who has met the basic competencies, will consider IDA for:
- routine situations when the person with diabetes is in the community setting and well.
- any insulin schedule including intensive therapy/multiple injections, carbohydrate counting and development of carbohydrate to insulin ratios.
- management of insulin for exercise.

2010:

The module was modified in 2010 to add the section: Insulin Dose Adjustment for Tests/Procedures When Fasting is Required. Additional case studies were added in 2010.

2013:
The module was further revised in 2013 to be congruent with the 2013 CDA Clinical Practice Guidelines and current diabetes care practices.

2016:
The module has been revised to reflect the SRNA scope in practice changes. The Transfer of Medical Function delegation no longer exists therefore the RN scope of practice to perform IDA has evolved into RN Clinical Nursing Protocol. This module continues to reflect only basic IDA only and does not cover advanced competencies. Changes in current practices, CPGs and medications are also reflected.

CHAPTER 5 - PRINTABLE RESOURCES

The following section includes printable clinical and client resources.

- RN Clinical Nursing Protocol for Insulin Dose Adjustment (Basic Competency)
- Extra Food for Extra Exercise (Adult Guidelines)
- Diabetes Management on a Fluid Diet – Refer to Attached PDF
- Client Assessment for Insulin Adjustment for Fasting for a Test/Procedure (Team Worksheet)
- Managing Your Diet and Insulin for a Test or Procedure

RN Clinical Nursing Protocol for Insulin Dose Adjustment (Basic Competency)

Date effective:

Date to be reviewed:

Issuing authority:

Purpose: The purpose of this document is to provide direction to organizations and Registered Nurses (RN) implementing the RN Clinical Nursing Protocol for Basic Insulin Dose Adjustment (IDA). It provides the foundation for safe practice as well as parameters to guide insulin dose adjustment within diabetes self-management education. An RN qualified to perform basic IDA will follow the direction as outlined in the Saskatchewan Insulin Dose Adjustment Module for preparation and ongoing competence.

DEFINITIONS

Basic Competency: includes insulin dose adjustment using any insulin schedule including intensive therapy, management of insulin for exercise, and for tests and procedures involving fasting.

Advanced Competencies are not included in this protocol and may include some or all of the following specialty areas of insulin adjustment: pregnancy/gestational diabetes mellitus (GDM) (includes women with pre-existing type 1 or 2 diabetes and women with gestational diabetes), travel, shift work, sick day management, insulin pumps, and children with diabetes. Two other modules address some of these competencies.

CLIENT CONSIDERATIONS

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

For clients to be involved in safe IDA within diabetes self-management the following must be considered:

- Able and willing to frequently monitor blood glucose, record and report the results.
- Able and willing to contact the RN on a regular basis for assistance, guidance and further education regarding IDA.
- Not acutely or severely ill (examples: immediately post-op, end stage renal disease).
- Demonstrate an interest in self-management including follow-up as needed.
- Coordinated care opportunities with other health care providers to ensure broader learning needs are met and support systems are in place.

OBJECTIVE

The RN, who has demonstrated competence for adjusting insulin doses, may teach and assist clients to adjust insulin to support diabetes self-management. Insulin doses will be adjusted for the purposes of optimizing blood glucose levels, promotion of self-management and/or enhancing quality of life.

ASSESSMENT

When teaching clients to adjust insulin, consider the following:

- Initial assessment of the client's learning needs, style, barriers and resources.
- Provision of self-education materials appropriate to the individual needs of the client.
- Confirmation of the accuracy of the client's self-monitoring blood glucose results by means of an annual laboratory to meter comparison and periodic observation of the client's technique.
- Confirmation that the client is aware of the symptoms of hypoglycemia and demonstrates an understanding of the appropriate treatment and prevention of hypoglycemia.
- Confirmation that the client is aware of insulin action (onset, peak, duration).
- Client understands the relationship between the carbohydrate content in food and the impact on blood glucose.
- Client has the resources to perform enough blood glucose monitoring to guide insulin dose adjustments. Clients may be eligible for additional strips if they meet the outlined exception criteria by the Ministry of Health Drug Plan & Extended Benefits Branch.

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

HIGH ALERT SITUATIONS IN INSULIN ADJUSTMENT

Physician/RN(NP) must *be consulted and notified* regarding IDA in the following situations:

- Insulin doses dropping with no apparent cause.
- Recurrent or severe hypoglycemia with no apparent cause.
- Glycemic control is not improving or is deteriorating despite adjustments made to insulin or other components of the treatment plan.
- Total daily dose exceeds what is generally expected for age/body type.
- Client shows signs/symptoms of DKA, dehydration or other serious problems.
- Recurring/persistent vomiting or diarrhea.
- Disordered eating pattern.
- Significant error in dose or timing of insulin administered by person or caregiver.

- Situations requiring prolonged fasting (e.g. for religious or medical purposes).
- Change in brand or type of insulin.
- Change in frequency of injections; for example BID to Multiple Daily Injections (MDI).
- Change to different regimen; for example conventional therapy to basal-bolus with MDI or insulin pump (continuous subcutaneous insulin infusion, i.e. CSII).
- For clients with additional complex medical or endocrine conditions which may influence insulin requirements or client safety.
- In all situations that are beyond RN scope of practice and/or competency level.

PARAMETERS

IDA will be considered for specific clients under the care of a Physician/RN(NP) who is willing to be available to provide on-going consultation and support to the RN. Both parties must mutually agree to this. A physician must be designated to oversee the Health Service and provide consultation when required.

- Neither a Physician/RN(NP) nor an RN will be obliged to participate in the RN implementing a RN Clinical Protocol unless there is mutual agreement.
- Once an RN Clinical Protocol is agreed to by Nursing, Physicians and employers, the RN is responsible and accountable for competent performance and will practice in accordance with employer policy.
- The RN Clinical Protocol is applied only to clients whom the RN assesses, teaches and reviews directly.
- Clinical practice will reflect current best practice guidelines.
- Appropriate resources must exist to facilitate RN learning.
- The RN will perform on-going assessment of the client's metabolic status and refer a client to their physician/RN (NP) in all situations that are beyond their scope of practice, and/or situations where the client's metabolic control is deteriorating despite adjustments made to the insulin or other components of the treatment plan.
- Appropriate resources must exist to facilitate client learning.

COMMUNICATION & DOCUMENTATION

- The Physician/RN(NP) retains responsibility for the insulin initiation which includes the type, amount and timing of insulin(s).
- Any significant adjustment to the insulin regime would be done in consultation with the physician/RN(NP).
- The RN, Physician/RN(NP) and client will collaborate to establish the appropriateness for both RN involvement and client participation in IDA.

- The RN and Physician/RN(NP) will collaborate on a regular basis to assess and support client's diabetes self-management and IDA.
- Progress updates reflecting client status will be made available via electronic medical records or paper reports and will be available to health care providers involved in the client's care.

EDUCATION & REQUIREMENTS

A. Completion of learning package and practice cases within the Saskatchewan IDA Module, including completion of self-study components and other learning to ensure personal learning needs are met. Consultation with experienced colleagues is recommended. If RN's do not have RN's performing IDA within their clinic they must reach out to RN's outside of their clinic. RNs are expected to review the module every 2-3 years based on personal learning needs and to review changes in the updated versions.

B. RN self-evaluation by completion of the personal competency assessment is to be completed annually at time of SRNA RN license registration renewal. This identifies opportunities for learning in certain areas and also captures competencies where RN fully meets requirements.

C. RN must have a sound foundation as a diabetes educator with diabetes self-management education experience. S/he must also have 2,000 hours of direct diabetes related client care (~one year of full time work or two years if working half-time in diabetes). While achieving the Certified Diabetes Educator (CDE) status is valuable, it does not replace the RN's direct experience requirements. As there are advancements in diabetes care, including new insulin types, it is expected that RNs performing IDA will keep knowledge and skills current to reflect best practice.

D. Provincial exam – The exam can be obtained from Primary Health Services Branch, Saskatchewan Ministry of Health. The exam is issued by the Branch and written in a supervised situation. The completed exam is returned to the Branch, marked and the written results are sent to the candidate and their supervisor. A certificate is issued with a pass mark of 80%. The candidate, if unsuccessful, can re-write the exam in three months.

E. Completion of three supervised case studies with a colleague (physician/RN(NP)) knowledgeable in IDA. Ideally the three cases will represent a diversity of client situations which are likely to be encountered in practice. Through this practice supervision and discussion, the physician/RN(NP) will be able to ensure the RN demonstrates the required competencies. This review is to be completed every 2-3 years depending on the knowledge and experience of each individual RN. It may be needed more often for RNs working part time in this area or those with fewer years of experience. The documentation needs to be included with the organization's policy record for evidence of completion as well as the date it was completed.

There is no specific timeline to meet requirements however, all five steps are mandatory.

REFERENCES

- Saskatchewan Health (2016). *Insulin Dose Adjustment Module.* http://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/chronic-disease/diabetes-resources-for-health-providers

- SRNA (2016) at SRNA.org with the following documents:
  - Tool for Developing RN Specialty Practice in Standards and Foundations for Practice
  - Documentation Guidelines (2011)
  - Standards and Competencies for RN Specialty Practice (2016)

An RN Clinical Protocol outlines a series of registered nursing actions that are implemented in pre-determined situations to provide specialized client care in Saskatchewan. An RN who implements an RN Clinical Protocol must meet the criteria as outlined in the SRNA document*, Standards for RN Specialty Practices (2014)*. This RN Clinical Protocol contains evidenced-informed content that is used in conjunction with an RN's critical thinking and clinical judgment to determine when it is appropriate for it to be implemented according to the client's presenting health situation.

Extra Food for Extra Exercise - Adult Guidelines

You may have already taken less insulin. However, you may need to eat extra food depending on your blood glucose results before you start exercising – always test! The following table tells you how much food to eat. Remember, these are only guidelines.

Exercise	Blood Glucose Levels	Carbohydrate Amount
Light for one hour (Walking, Bowling)	< 6 mmol/L	15 grams
Moderate for one hour (Tennis, Cycling, Swimming, Sexual Intercourse, House Cleaning, Golfing)	< 6 mmol/L	30 grams of carbohydrate before exercise. An additional 10–15 grams of carbohydrate is required for each additional hour.
	6 – 10 mmol/L	15 grams of carbohydrate
	11 – 17 mmol/L	Food intake should not be increased.
	Moderate urine ketones > 8 mmol/L or blood ketones > 3 mmol/L are present	Do not exercise until diabetes control improves.
Strenuous for one hour (Hockey, Racquetball, Football, Competitive Sports) NB. *Small amounts at frequent intervals are preferable for prolonged activity*	< 6 mmol/L	45 grams of carbohydrate before exercise. An additional 10-15 grams of carbohydrate is required for each additional hour.
	6 – 10 mmol/L	30 grams of carbohydrate
	11 – 17 mmol/L [no ketones]	15 grams of carbohydrate
	Moderate urine ketones > 8 mmol/L or blood ketones > 3 mmol/L are present	Do not exercise until diabetes control improves.

Diabetes Management on a Fluid Diet

A fluid diet is used short term to prepare the bowel for certain medical tests, procedures, or surgery. A fluid diet may also be used for a short time while you are sick if you are not able to eat solid foods because of nausea and/or vomiting. If a clear fluid diet is requested, you will be asked to drink only fluids you can see through.

How to Manage Blood Sugars When on a Fluid Diet

- If you take insulin, advise the person booking your test that you have diabetes and take insulin.
- You still need to take some diabetes medication during this time. Some medications should not be taken when you are sick. Speak to your doctor, nurse practitioner, or pharmacist about the need to change your diabetes pills or insulin doses and what to do with your other medications while you are on a fluid diet.
- Drink plenty of fluids throughout the day to prevent dehydration and relieve your thirst.
- Whether you need a sugar free or sugar containing fluid depends on your blood sugar level.

Blood sugar level	Action
• Below 4 mmol/L	• Treat as hypoglycemia. See Hypoglycemia (Low Blood Sugar) section below.
• 4 to 10 mmol/L	• Drink 1 portion of sugar containing fluid each hour until next testing time. See next page for fluid suggestions. Test your blood sugar every 2 to 4 hours.
• Above 10 mmol/L	• Drink sugar free fluids. See next page for fluid suggestions. Test your blood sugar every 2 to 4 hours.

Hypoglycemia (Low Blood Sugar*)*

If blood sugar level is below 4.0 mmol/L or you feel weak, shaky, or dizzy:

- Take 15 g of fast acting carbohydrate right away, such as:
  - ½ cup (125 mL) of no pulp juice (e.g. apple juice) or
  - 1 tablespoon (15 mL) of sugar or honey or
  - 4 to 5 glucose tablets.
- Wait 15 minutes
- Retest blood sugar. If blood sugar is:
  - still below 4.0 mmol/L - repeat the treatment
  - above 4.0 mmol/L - drink 1 portion of sugar containing fluids to carry you through until your next testing time.

Fluid Choices

Sugar free fluids:

- water or sparkling water
- clear tea and coffee (decaffeinated preferred)
- Crystal Light®
- sugar free pop or sports drinks
- sugar free Jell-O or popsicles
- clear chicken or beef broth.

Sugar containing fluids: (each portion provides about 15 g of carbohydrate)

- juice with no pulp - 1/2 to 3/4 cup (125 to 175 mL)
- clear pop (lemon lime soda, gingerale) - 3/4 cup (175 mL)
- regular popsicle or freezie - 1 popsicle (60 to 75 mL) or 1 freezie (80 to 90 mL)
- regular Jell-O - 1/3 cup (75 mL)
- regular sports drinks - 1 cup (250 mL)
- meal replacement drinks (full and clear fluid options available)
  ie. Boost® and Ensure® - 1/3 cup (75 mL)
  Note: **Do not** use meal replacement drinks before surgery.

Note:
For certain tests, such as colonoscopy, you may be asked to

- eat/drink only things you can see through
- avoid fluids that are red, green or purple in colour.

Before Going to Bed

Test your blood sugar level at bedtime. If bedtime blood sugar is:

- 4.0 to 7.0 mmol/L, have 2 to 3 portions of sugar containing fluids
- above 7.0 mmol/L, have 1 to 2 portions of sugar containing fluids.

You may wish to set an alarm to 3:00 a.m. and check your blood sugar once through the night.

Seek medical help if:

- **blood sugar levels have been higher than 14 mmol/L for more than 24 hours**
- **blood sugar levels are not staying above 4 mmol/L**
- **you have type 1 diabetes and have moderate to large ketones in your urine or blood.**

Metabolic and Diabetes Education Centre (MEDEC)
Ph: (306) 766-4540 Email: MEDEC@rqhealth.ca

Client Assessment for Insulin Adjustment for Fasting for a Test/Procedure (Team Worksheet)

NAME: _____
PHN:_____

Requirements of the test/procedure for diet changes/fasting:

Support person(s) available to assist with care:

Insulin:

TIME	Morning		Noon		Supper		Evening		Other
BRAND									
AMOUNT									

Comments:

Usual Blood Glucose Pattern:

Morning	pc meal	Noon	pc meal	Supper	pc meal	Evening	Night

Client willing to do monitoring pre and post-test/procedure: ___ no ____ yes

Current Frequency/Timing of Hypoglycemia:
___ None ___Other, provide relevant details

Client is independent in insulin adjustment ___ yes ___no – who will assist if needed?

Can client convert carbohydrate to fluids? ___yes ___ no

Fluid Diet given: ___yes ___ no

Referral made to dietitian: ___yes ___ no

Relevant past experience with fasting: ___ none ____yes, comment:
Instructions given by another care provider ___ none ___ yes, comment:

Advice given (diet, insulin adjustment pre and post-test/procedure, contact for assistance):

1.

2.

3.

Date: _____

Signature: _____ _____
PRINT NAME SIGNED

Managing Your Diet and Insulin for a Test or Procedure

Client's Name: _____

PHN: _____ Type of diabetes: _____

Name of test: _____ Date/time: _____

MEAL PLAN

☐ No change is needed in your meal plan

☐ Use the fluid diet provided

Make the following changes in your insulin doses:

DATE	TIME	INSULIN

LOW BLOOD SUGARS

- If you think your blood sugar is low, try to do a test and write down the result.
- Treat the low sugar with glucose tablets. If you do not have them, use your usual treatment.
- You MUST tell the staff at the test/procedure you had a low sugar and how you treated it.

PROBLEMS - NOT SURE WHAT TO DO WITH FOOD OR INSULIN –
Who to call _____
Phone number _____

ON THE DAY OF THE TEST or PROCEDURE:

- **Take this sheet with you to the test/procedure**

- **Test your blood sugar when you first get up in the morning and write the result here _____**

- **Write down the dose of insulin which you took this morning.**
  - ___ **I did not take any insulin**
  - **This morning I took the following insulin:**

_____

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