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Nursing Best Practice Guideline

Shaping the future of Nursing

Best Practice Guideline for the Subcutaneous Administration of Insulin in Adults with Type 2 Diabetes

RNAO

Registered Nurses Association of Ontario

L'Association des infirmières et infirmiers autorisés de l'Ontario

RNAO Registered Nurses Association of Ontario L'Association des infirmières et infirmiers autorisés de l'Ontario

Greetings from Doris Grinspun
Executive Director
Registered Nurses Association of Ontario

It is with great excitement that the Registered Nurses Association of Ontario (RNAO) disseminates this nursing best practice guideline to you. Evidence-based practice supports the excellence in service that nurses are committed to deliver in our day-to-day practice.

We offer our endless thanks to the many institutions and individuals that are making RNAO's vision for Nursing Best Practice Guidelines (NBPGs) a reality. The Ontario Ministry of Health and Long-Term Care recognized RNAO's ability to lead this project and is providing multi-year funding. Tazim Virani – NBPG project director – with her fearless determination and skills, is moving the project forward faster and stronger than ever imagined. The nursing community, with its commitment and passion for excellence in nursing care, is providing the knowledge and countless hours essential to the creation and evaluation of each guideline. Employers have responded enthusiastically to the request for proposals (RFP), and are opening their organizations to pilot test the NBPGs.

Now comes the true test in this phenomenal journey: will nurses utilize the guidelines in their day-to-day practice?

Successful uptake of these NBPGs requires a concerted effort of four groups: nurses themselves, other healthcare colleagues, nurse educators in academic and practice settings, and employers. After lodging these guidelines into their minds and hearts, knowledgeable and skillful nurses and nursing students need healthy and supportive work environments to help bring these guidelines to life.

We ask that you share this NBPG, and others, with members of the interdisciplinary team. There is much to learn from one another. Together, we can ensure that Ontarians receive the best possible care every time they come in contact with us. Let's make them the real winners of this important effort!

RNAO will continue to work hard at developing and evaluating future guidelines. We wish you the best for a successful implementation!

Doris Grinspun, RN, MScN, PhD (candidate)

Executive Director
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How to Use this Document

This nursing best practice guideline is a comprehensive document providing resources necessary for the support of evidence-based nursing practice. The document needs to be reviewed and applied, based on the specific needs of the organization or practice setting/environment, as well as the needs and wishes of the client. Guidelines should not be applied in a "cookbook" fashion but used as a tool to assist in decision making for individualized client care, as well as ensuring that appropriate structures and supports are in place to provide the best possible care.

Nurses, other healthcare professionals and administrators who are leading and facilitating practice changes will find this document valuable for the development of policies, procedures, protocols, educational programs, assessments and documentation tools. It is recommended that the nursing best practice guidelines be used as a resource tool. Nurses providing direct client care will benefit from reviewing the recommendations, the evidence in support of the recommendations and the process that was used to develop the guidelines. However, it is highly recommended that practice settings/environments adapt these guidelines in formats that would be user-friendly for daily use. This guideline has some suggested formats for such local adaptation and tailoring.

Organizations wishing to use the guideline may decide to do so in a number of ways:

- Assess current nursing and healthcare practices using the recommendations in the guideline.
- Identify recommendations that will address identified needs or gaps in services.
- Systematically develop a plan to implement the recommendations using associated tools and resources.

RNAO is interested in hearing how you have implemented this guideline. Please contact us to share your story. Implementation resources will be made available through the RNAO website at www.rnao.org/bestpractices to assist individuals and organizations to implement best practice guidelines.

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Best Practice Guideline for the Subcutaneous Administration of Insulin in Adults with Type 2 Diabetes

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Acknowledgement

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Disclaimer

These best practice guidelines are related only to nursing practice and not intended to take into account fiscal efficiencies. These guidelines are not binding for nurses and their use should be flexible to accommodate client/family wishes and local circumstances. They neither constitute a liability or discharge from liability. While every effort has been made to ensure the accuracy of the contents at the time of publication, neither the authors nor the Registered Nurses Association of Ontario(RNAO) give any guarantee as to the accuracy of the information contained in them nor accept any liability, with respect to loss, damage, injury or expense arising from any such errors or omission in the contents of this work. Any reference throughout the document to specific pharmaceutical products as examples does not imply endorsement of any of these products.

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Summary of Recommendations

	RECOMMENDATION	*LEVEL OF EVIDENCE
Practice Recommendations	1. Nurses should assess psychosocial factors that may affect the individual's ability to successfully initiate insulin therapy. Assessment strategies that include the use of open-ended questions to assess barriers, stressors, self-efficacy, and beliefs about insulin initiation should be used.	III
	2. Education for administering insulin should be tailored in collaboration with the individual to address current knowledge, abilities, and needs.	Ia
	3. Nurses should provide and/or reinforce appropriate teaching regarding insulin preparation and administration. Topics to include are: ■ Insulin: type, action, stability, storage, and compatibility ■ Preparation and administration of insulin ■ Sharps disposal ■ Follow-up for medical and self-care support	IV
	4. Nurses should encourage blood glucose self-monitoring as an integral part of daily diabetes management for individuals taking insulin. The recommended frequency of testing will vary according to diabetes treatment and the individual's need and ability.	III
	5. Individuals who self-monitor blood glucose should receive initial instruction and periodic re-education regarding self-testing technique, meter maintenance, and verification of accuracy of self-testing results.	III
	6. Nurses should ensure clients taking insulin receive appropriate basic nutrition information.	IV
	7. Clients treated with insulin, and their caregivers, should be taught how to prevent, recognize and treat hypoglycemia.	IV
	8. Nurses must be aware of the effects of acute illness, surgery, and diagnostic procedures on blood glucose levels.	IV
	9. Nurses should provide basic education on blood glucose monitoring, dietary, and medication adjustments for periods of illness. This information should be given initially and reviewed periodically with the client.	IV

*See p.12 for details regarding "Interpretation of Evidence"

	RECOMMENDATION	*LEVEL OF EVIDENCE
Education Recommendation	10. Nursing curriculum should include education about the care and management of diabetes.	IV
Organization & Policy Recommendations	11. Healthcare organizations should facilitate ongoing diabetes education of nursing staff about diabetes care and management.	IV
	12. Organizations must ensure that individuals receiving insulin have ready access to an appropriate form of glucose at all times.	IV
	13. Organizations should develop and communicate appropriate policies and procedures to reduce the potential for medication errors related to insulin therapy.	IV
	14. Organizations should have a process for documentation to support nursing practice related to insulin therapy.	IV
	15. Nursing best practice guidelines can be successfully implemented only where there are adequate planning, resources, organizational, and administrative support. Organizations may wish to develop a plan for implementation that includes: ■ An assessment of organizational readiness and barriers to education. ■ Involvement of all members (whether in a direct or indirect supportive function) who will contribute to the implementation process. ■ Dedication of a qualified individual to provide the support needed for the education and implementation process. ■ Ongoing opportunities for discussion and education to reinforce the importance of best practices. ■ Opportunities for reflection on personal and organizational experience in implementing guidelines. In this regard, RNAO (through a panel of nurses, researchers, and administrators) has developed the *Toolkit: Implementation of Clinical Practice Guidelines*, based on available evidence, theoretical perspectives and consensus. The RNAO strongly recommends the use of this *Toolkit* for guiding the implementation of the best practice guideline on *Best Practice Guideline for the Subcutaneous Administration of Insulin in Adults with Type 2 Diabetes.*	IV

Interpretation of Evidence

LEVELS OF EVIDENCE

Ia -	Evidence obtained from meta-analysis or systematic review of randomized controlled trials.
Ib -	Evidence obtained from at least one randomized controlled trial.
IIa -	Evidence obtained from at least one well-designed controlled study without randomization.
IIb -	Evidence obtained from at least one other type of well-designed quasi-experimental study, without randomization.
III -	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies, and case studies.
IV -	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

Responsibility for Guideline Development

The Registered Nurses Association of Ontario (RNAO), with funding from the Ministry of Health and Long-Term Care (MOHLTC), has embarked on a multi-year project of nursing best practice guideline development, pilot implementation, evaluation, and dissemination. In this fourth cycle of the project, one of the areas of emphasis is on the subcutaneous administration of insulin in adults with type 2 diabetes. This guideline was developed by a panel of nurses convened by the RNAO, conducting its work independent of any bias or influence from the Ministry of Health and Long-Term Care.

Purpose and Scope

Best practice guidelines (BPG) are systematically developed statements to assist practitioners and clients in decision making about appropriate healthcare (Field and Lohr, 1990). The focus of this guideline is to support nurses, Registered Nurses (RNs) and Registered Practical Nurses (RPNs) in all practice settings, as they care for clients (18 years and older) with type 2 diabetes requiring subcutaneous insulin therapy. Specifically, this guideline would assist nurses who are not specialists in diabetes care to safely initiate and administer insulin, a "high-alert" medication. This guideline will provide answers to the question: What are the essential client self-care components to be addressed by nurses when caring for an adult with type 2 diabetes who requires subcutaneous insulin? Information will be discussed under the following topics:

- Psychological and psychosocial issues including the assessment and management of those with special needs
- Insulin preparation and administration
- Safe medication practice
- Blood glucose monitoring
- Hypoglycemia
- Sick day management
- Food choices

The BPG focuses its recommendations on four areas: (1) Practice Recommendations directed at the nurse; (2) Education Recommendations directed at the competencies required for practice; (3) Organization and Policy Recommendations directed at practice settings and the environment in order to facilitate nurses' practice; and (4) Evaluation and monitoring indicators.

It is acknowledged that individual competencies of nurses vary between nurses and across categories of nursing professionals (RNs and RPNs), and are based on knowledge, skills, attitudes and judgement enhanced over time by experience and education. It is expected that individual nurses will perform only those aspects of care for which they have obtained appropriate education and experience. Both RNs and RPNs should seek consultation in instances where the client's care needs surpass the individual nurse's ability to act independently.

Although this best practice guideline contains recommendations for RNs and RPNs, caring for clients with type 2 diabetes requiring insulin is an interdisciplinary endeavour. It is acknowledged that effective care depends on an intradisciplinary approach with ongoing communication between health professionals and clients. Individual preferences, unique needs and resources of each client must always be considered.

Guideline Development Process

In January of 2003, a panel of nurses with expertise in practice and education related to diabetes, from institutional and community settings, was established by the RNAO. At the onset, the panel discussed and came to consensus on the scope of the best practice guideline.

A search of the literature for systematic reviews, clinical practice guidelines, relevant articles and websites was conducted. See Appendix A for a detailed outline of the search strategy employed.

The panel identified a total of nine clinical practice guidelines related to diabetes management in adults. These guidelines were reviewed according to a set of initial inclusion criteria, which resulted in elimination of five guidelines. The inclusion criteria were:

- Guideline was in English, international in scope.
- Guideline was dated no earlier than 1998.
- Guideline was strictly about the topic area.
- Guideline was evidence-based, (e.g. contained references, description of evidence, sources of evidence).
- Guideline was available and accessible for retrieval.

The resulting four guidelines were critically appraised with the intent of identifying existing guidelines that were current, developed with rigour, evidenced-based and which addressed the scope identified by the panel for the best practice guideline. A quality appraisal was conducted on these four clinical practice guidelines using the *Appraisal of Guidelines for Research and Evaluation Instrument* (AGREE Collaboration, 2001). This process yielded a decision to work primarily with the four existing guidelines. These were:

American Diabetes Association (2003a). American Diabetes Association: Clinical practice recommendations 2003. *Diabetes Care, 26,* (Suppl), S1-S156.

*Meltzer, S., Leiter, L., Daneman, D., Gerstein, H. C., Lau, D., Ludwig, S. et al. (1998). 1998 clinical practice guidelines for the management of diabetes in Canada. Canadian Medical Association Journal. [On-line]. Available: www.cmaj.ca/cgi/data/159/8/DC1/1

Wolever, T., Barbeau, M. C., Charron, S., Harrigan, K., Leung, S., Madrick, B. et al. (1998). Guidelines for the nutritional management of diabetes mellitus in the new millennium: A position statement by the Canadian Diabetes Association. *Canadian Journal of Diabetes Care, 23*(3), 56-69.

Yale, J. F., Begg, I., Gerstein, H., Houlden, R., Jones, H., Maheux, P. et al. (2002). 2001 Canadian Diabetes Association clinical practice guidelines for the prevention and management of hypoglycemia in diabetes. *Canadian Journal of Diabetes, 26,* 22-35. [On-line].
Available: www.diabetes.ca/Files/CDAHypoglycemiaGuidelines.pdf

*The *1998 Clinical Practice Guidelines for the Management of Diabetes in Canada* were updated in 2003. Information obtained from the 1998 guidelines was updated to reflect the new information from the *2003 Clinical Practice Guidelines for the Management of Diabetes in Canada.*

It is acknowledged that diabetes care and management needs to be studied in a more clearly defined way, and that there are gaps in the research evidence. However, this guideline will enable nurses to apply the best available evidence to clinical practice, and to promote the most appropriate use of healthcare resources.

The panel members divided into subgroups to undergo specific activities using the short-listed guidelines, other literature and additional resources for the purpose of drafting recommendations for nursing interventions. This process yielded a draft set of recommendations. The panel members as a whole reviewed the recommendations, discussed gaps, available evidence, and came to consensus on a draft guideline.

This draft was submitted to a set of external stakeholders for review and feedback – an acknowledgement of these reviewers is provided at the front of this document. Stakeholders represented various healthcare disciplines, as well as professional associations. External stakeholders were provided with specific questions for comment, as well as the opportunity to give overall feedback and general impressions. The results were compiled and reviewed by the development panel. Discussion and consensus resulted in revisions to the draft document prior to publication and evaluation.

Definition of Terms

An additional Glossary of Terms related to clinical aspects of this document is located in Appendix B.

Clinical Practice Guidelines or Best Practice Guidelines: Systematically developed statements (based on best available evidence) to assist practitioner and client decisions about appropriate healthcare for specific clinical (practice) circumstances (Field & Lohr, 1990).

Consensus: A process for making policy decisions, not a scientific method for creating new knowledge. At its best, consensus development merely makes the best use of available information, be that of scientific data or the collective wisdom of the participants (Black et al., 1999).

Education Recommendations: Statements of educational requirements and educational approaches/strategies for the introduction, implementation and sustainability of the best practice guideline.

Evidence: "An observation, fact or organized body of information offered to support or justify inferences or beliefs in the demonstration of some proposition or matter at issue" (Madjar & Walton, 2001, p.28).

Meta-Analysis: The use of statistical methods to summarize the results of independent studies, thus providing more precise estimates of the effects of healthcare than those derived from the individual studies included in a review (Clarke & Oxman, 1999).

Organization & Policy Recommendations: Statements of conditions required for a practice setting that enable the successful implementation of the best practice guideline. The conditions for success are largely the responsibility of the organization, although they may have implications for policy at a broader government or societal level.

Practice Recommendations: Statements of best practice directed at the practice of healthcare professionals that are ideally evidence-based.

Randomized Controlled Trial: For the purposes of this guideline, a study in which subjects are assigned to conditions on the basis of chance, and where at least one of the conditions is a control or comparison condition.

Stakeholder: A stakeholder is an individual, group, or organization with a vested interest in the decisions and actions of organizations that may attempt to influence decisions and actions (Baker et al., 1999). Stakeholders include all individuals or groups who will be directly or indirectly affected by the change or solution to the problem. Stakeholders can be of various types, and can be divided into opponents, supporters, and neutrals (Ontario Public Health Association, 1996).

Systematic Review: Application of a rigorous scientific approach to the preparation of a review article (National Health and Medical Research Council, 1998). Systematic reviews establish where the effects of healthcare are consistent and research results can be applied across populations, settings, and differences in treatment (e.g., dose); and where effects may vary significantly. The use of explicit, systematic methods in reviews limits bias (systematic errors) and reduces chance effects, thus providing more reliable results upon which to draw conclusions and make decisions (Clarke & Oxman, 1999).

Background Context

Diabetes is a serious, life-long condition affecting many Canadians. With the current understanding of the importance of glucose management for complication prevention in type 2 diabetes, insulin therapy is being considered as an early treatment option. Insulin therapy is no longer the treatment of last resort, but may be a proactive choice for many people (Canadian Diabetes Association (CDA), 2003a; Meltzer et al., 1998).

This best practice guideline has been developed to assist nurses who do not specialize in diabetes education and care, to administer insulin safely and to teach basic self-management skills to clients who require insulin therapy. According to the Institute for Safe Medication Practice (ISMP) Canada, insulin is one of the top five "high-alert" medications (ISMP Canada, 2003). Errors in dosing and administration can cause severe adverse effects. Too much insulin can rapidly lead to hypoglycemia that may further progress to seizures and coma, while underdosing can lead to worsening of hyperglycemia (ISMP Canada, 2003). Insulin delivery errors must be reduced to ensure safe diabetes management and to avoid morbidity due to poor glycemic control (Grissinger & Lease, 2003).

The National Diabetes Surveillance System identified a 5.1% prevalence of diabetes among people over the age of 20 years in 1999/2000. In 1999/2000, 1,196,370 adult Canadians were living with diagnosed diabetes (Health Canada, 2003). In Ontario, rates are higher for those 65 years and older, where it approaches 20% (Institute for Clinical Evaluative Sciences (ICES), 2003). The prevalence of diabetes is increasing rapidly and is expected to reach 3 million in Canada by 2010 (Tan et al., 1995). The increasing prevalence of diabetes will likely have an impact on insulin usage. In Ontario, from1995 to 2001, there was a 27% increase in the number of people 65 years and older taking insulin (Shah, Mamdani & Kopp, 2003). Figures from the United States estimate a 26% increase of insulin use by people with type 2 diabetes by 2006 (Grissinger, Kroon & Penna, 2003).

There are three main forms of diabetes:

1. Type 1 diabetes affects approximately 10% of all people with diabetes and is primarily a result of an inability to produce insulin due to autoimmune destruction of the pancreatic beta cells. It is often diagnosed at a young age and requires insulin treatment. People with type 1 diabetes are susceptible to diabetic ketoacidosis if they do not take the required insulin.
2. Type 2 diabetes affects approximately 90% of those diagnosed with diabetes and results from a combination of insufficient insulin production and/or insulin resistance at the cell level.
3. Gestational diabetes (GDM) is diagnosed during pregnancy and affects 3.5 to 3.8% in the non-Aboriginal population (CDA, 2003a). Up to 40% of women who have had GDM will develop type 2 diabetes as they age (Health Canada, 2002).

Over time, failure to achieve optimal glycemic control can cause microvascular damage in both type 1 and type 2 diabetes. Diabetes is a major cause of coronary artery disease; it is the leading cause of new cases of blindness and kidney disease and non-traumatic amputations (CDA, 2003a). Two landmark randomized control trials highlight the importance of near normal glycemic control to prevent long-term complications. The Diabetes Control and Complications Trial (DCCT) 1982-1993, established without doubt that improved blood glucose management significantly reduced the microvascular complications in type 1 diabetes (DCCT Research Group, 1993). As well, the United Kingdom Prospective Diabetes Study (UKPDS) 1977-1997, demonstrated that improved glycemic control reduced the risk of microvascular complications in persons with type 2 diabetes (UKPDS Group 33, 1998).

Type 2 diabetes is considered to be a progressive condition. Many individuals develop secondary failure on oral antihyperglycemic agents, which means that eventually insulin is

required. Approximately 50% of all clients with type 2 diabetes eventually require insulin therapy to maintain optimal glycemic control (DeWitt & Hirsch, 2003; Grissinger & Lease, 2003; Turner, Cull, Frighi, Holman, & UKPDS Group, 1999).

Client education is essential for effective insulin treatment. Education should emphasize the effective use of medical nutrition, oral agent therapy and physical activity to increase insulin sensitivity. A specialized interdisciplinary team, often associated with a diabetes centre, can provide the most effective diabetes care and education. The interdisciplinary team works closely with clients and their families to address the complex lifestyle, self-care, and multiple treatment demands of diabetes. It is acknowledged that this level of care is not yet accessible to, or accessed by, most people with diabetes (Meltzer et al., 1998). Fewer than 40% of people with diabetes in Ontario receive formal education about their condition and its management (CDA, 1997). As a result, nurses in varied settings are often required to teach insulin administration and basic diabetes self-management skills.

Some elements are essential to any client starting insulin therapy. These include the ability to self-inject insulin safely using a syringe or insulin pen. They also include recognition of signs and symptoms of hypoglycemia and a basic knowledge of how to prevent and treat hypoglycemia. This guideline will not address the use of insulin pumps, as it is recognized that insulin pump therapy requires specialized training and certification.

Understanding diabetes and diabetes management among the elderly can be a complex process. The elderly, as a population, are a very heterogeneous group that includes a range of people from those who are functioning independently in society to those who are dependent on caregivers for their activities of daily living. Exploring the process of aging and its relationship to diabetes often involves discarding preconceived notions and stereotypical information. Although there are many factors that impact the ability of the elderly person with diabetes to prepare and administer insulin successfully, insulin should not be delayed based on age alone. In this document, any special considerations for the elderly will be included in the discussion of evidence under each recommendation.

The guideline development panel also recognizes the emotional needs of clients initiating self-injection. The initiation of insulin therapy is a significant event in the life of many individuals with diabetes and their families. Each person's response will be unique, dependent upon many factors including past experiences, culture, perceived abilities, resources, personality, coping styles, support networks, and duration of time living with diabetes. In type 2 diabetes, initiation of insulin may occur at

various points along the disease trajectory; at the time of diagnosis; when hospitalized for another reason such as surgery, a myocardial infarction, cancer treatment; or after years of treatment with diet or pills. It is important for nurses to understand and address the emotional issues associated with this intervention.

The guideline development panel also acknowledges the stressful conditions in which nurses work and the demands on nurses' time in various practice settings. For these reasons, tools and resources have been included in the Appendices (p. 71-91). It is hoped that these tools will assist nurses to feel more confident in teaching clients. In addition to the tools, ongoing education and learning opportunities need to be provided at the organizational level to ensure safe nursing practices.

Practice Recommendations

Recommendation • 1

Nurses should assess psychosocial factors that may affect the individual's ability to successfully initiate insulin therapy. Assessment strategies that include the use of open-ended questions to assess barriers, stressors, self-efficacy, and beliefs about insulin initiation should be used. *(Level of Evidence = III)*

Refer to Appendix C for questions that may be used to help determine psychosocial concerns related to initiation of insulin therapy.

Discussion of Evidence

For some individuals, diabetes management can negatively impact psychological and social functioning (Koopmanschap, 2002). Effective diabetes self-care can be stressful, costly and intrusive. On a daily basis, individuals who take insulin experience external or self-imposed guilt when considering the following: food choices, physical activity, social and family obligations, dealing with common illnesses, taking medications, and living with the fears and realities of long-term complications and daily hyper- or hypoglycemia. Symptoms of both depression and anxiety are more commonly found in people with diabetes than in the general population, however, it is not yet clear whether these conditions increase with the use of insulin therapy (CDA, 2003a; Rubin & Peyrot, 2001). Depression can interfere with concentration, energy levels, and the ability to learn new things and undertake new tasks. When present, treatment of these conditions with medication and/or counselling may increase the capacity for successful initiation and maintenance of insulin therapy and the related self-management activities such as monitoring and attending to food choices (CDA, 2003a; Snoek, 2002). When

psychosocial problems (depression or anxiety) are identified, the individual should be referred to the appropriate specialist (physician, psychologist, social worker) for formal assessment, treatment or support.

While people seek ways to normalize their lives and minimize the intrusiveness of diabetes, these choices are often associated with increased feelings of guilt and fear. People with diabetes strive to reach a balance between achieving blood glucose control, reducing their risk for immediate and long-term complications of diabetes, meeting the expectations of others ("being good"), and achieving a quality of life that is satisfactory to them considering their personal (psychosocial/physical) and financial resources. Several authors have identified common responses to the initiation of insulin therapy, aptly referred to as "psychological insulin resistance" by Snoek (2002). The following list represents some commonly held concerns about initiation of insulin therapy (Mollema, Snoek, Ader, & Heine, 2001; Rubin & Peyrot, 2001; Snoek, 2002; West & McDowell, 2002):

- Fear of injections, needle phobia
- Fear of pain
- Fear of giving the wrong insulin dose
- Anxiety about ability to perform injection preparation and administration
- Feeling guilty as a result of interpreting the need for insulin as a personal failure, or lack of willpower or determination
- Believing that insulin injections will make life more complicated
- Anticipation of weight gain on insulin
- Fear of increased hypoglycemia resulting in coma and death
- Concern that insulin therapy causes complications such as blindness, the need for dialysis, amputations, etc.
- Concern that others will worry more about someone taking insulin
- Concern that other people treat insulin-users differently
- Feeling loss of control over one's life

Although widely held, these concerns may not be freely expressed without careful assessment of the personal meaning associated with insulin initiation. Some of these concerns are myths, which can be clarified, while others represent potential barriers to treatment success that need to be actively addressed. Nurses should help individuals with diabetes identify and minimize barriers to treatment and seek opportunities to focus on the benefits of insulin therapy, accomplishments, and positive feelings related to changes in the diabetes treatment regimen.

While gaining knowledge and information is necessary to the undertaking of new tasks, such as taking insulin, it is often not sufficient for achieving and sustaining behaviour change. Personal attitudes and beliefs also have an important role to play. Self-efficacy, or a person's belief about the ability to carry out a specific behaviour, and perceived barriers to enacting the behaviour, have been strongly associated with successful diabetes self-management, including insulin adjustment (Aljasem, Peyrot, Wissow & Rubin, 2001; Krichbaum, Aarestad & Buethe, 2003).

Self-efficacy is increased when individuals have experienced past personal success or when they have observed others master a new skill. Healthcare practitioners who express confidence in the client's ability to succeed can also increase self-efficacy. Nurses should encourage clients to reflect on past successes and provide them with opportunities for practice and skill mastery. Nurses should also help clients identify perceived barriers to insulin therapy and assist them to minimize these barriers (Krichbaum et al., 2003).

Recommendation • 2

Education for administering insulin should be tailored in collaboration with the individual to address current knowledge, abilities, and needs. *(Level of Evidence = Ia)*

Discussion of Evidence

Health promotion, client empowerment, and facilitation of effective self-care education are essential elements of nursing. It is imperative that people taking insulin receive ongoing education, follow-up and support related to diabetes care. There is evidence that diabetes self-care behaviours influence diabetes outcomes (Krichbaum et al., 2003; Norris, Engelgau & Narayan, 2001). A systematic review conducted by Norris et al. (2001), found that educational interventions that involved client collaboration were more effective than didactic interventions in improving glycemic control, weight, and lipid profiles. Similarly, a systematic review by Krichbaum et al. (2003) concluded that education sessions need to involve fewer lectures and more practice and problem-solving exercises that focus on developing specific skills. Thus, nursing interventions should include educational strategies to support positive diabetes self-care behaviours and promote optimal glycemic control.

The education of clients should be based on a client-centred care approach (See the RNAO guideline [2002a] on *Client Centred Care* at www.rnao.org/bestpractices). The impact of socio-economic, cultural and psychosocial domains should be considered when planning all interventions. Personal attitudes and beliefs, level of literacy, age, and physical condition will all influence the individual's ability to carry out the recommended regimen (American Association of Diabetes Educators, 1999; Canadian Diabetes Association – Diabetes Educator Section, 2000).

Recommendation • 3

Nurses should provide and/or reinforce appropriate teaching regarding insulin preparation and administration. Topics to include are:

- **Insulin: type, action, stability, storage, and compatibility**
- **Preparation and administration of insulin**
- **Sharps disposal**
- **Follow-up for medical and self-care support**

(Level of Evidence = IV)

Discussion of Evidence

Individuals with type 2 diabetes may be treated with insulin alone or with insulin in combination with oral antihyperglycemic agents (CDA, 2003a). Improper use and care of insulin and insulin administration devices may lead to deterioration in glycemic control. It is crucial that the client and/or caregiver have a good understanding of the insulin regimen in order for insulin therapy to be successful and safe (Mudaliar & Edelman, 2001).

A. Insulin

In North America, insulin is available in concentrations of 100 or 500 units/ml (U-100, U-500). U-100 is the standard concentration. U-500 is rarely prescribed. In Europe and South America, a concentration of 40 units/ml (U-40) is also used (ADA, 2003a). To ensure accurate dosing, all U-100 insulin must be delivered using U-100 syringes. Tuberculin (TB)syringes should not be used for insulin administration. Use of a TB syringe instead of an insulin syringe is a significant cause of error. The fractional millilitre gradations of the TB syringe can result in 5 to 10-fold overdose errors (ISMP Canada, 2003; Institute for Safe Medication Practices, 2003).

In Canada, beef insulin was withdrawn in 1999 (CDA, 2001a) but can be bought from international sources. Pork insulin is still available in Canada from Eli Lilly (CDA, 2004). Recombinant DNA technology allows for insulin to be made biosynthetically. Insulin analogues are made by modifying

the aminoacid sequence of the insulin molecule (Owens, Zinman, & Bolli, 2001). Insulin is classified according to its time of onset and duration. See Appendix D for table of insulin types.

Variables that can affect insulin action include: injection site; changes in ambient temperature; insulin absorption; dosage; the individual's unique response to insulin; renal function; and human versus animal insulin (Haire-Joshu, 1996; Mudaliar et al., 1999; Owens et al., 2001).

To preserve its potency, proper storage of insulin is vital. Unopened vials and cartridges of insulin must be refrigerated (ADA, 2003a). To prevent loss of potency, clumping, frosting, or precipitation, excess agitation and extreme temperatures (less than 2 C [36^{0}F] or more than 30 C [86^{0}F] for Lilly insulins and more than 37 C [98.6^{0}F] for Novo Nordisk insulins) should be avoided (ADA, 2003a). It is recommended to follow the specific storage instructions provided by the manufacturer. These may differ according to the brand and whether a vial or cartridge is used. Insulin should never be stored in direct sunlight or put in the freezer (ADA, 2003a). Insulin pens should not be stored in the refrigerator. See Appendix E for insulin storage tips.

Insulin that is currently in use may be kept at room temperature for 28 days (Lilly, 1998; Novo Nordisk, 2000). Expiration dates must always be checked and clients should be reminded to also assess the appearance of insulin in the vial or cartridge prior to administering. If a change in colour or clarity, frosting, clumping, or precipitation is noted; the insulin should not be used and a new vial or cartridge should be used instead.

Most pre-filled syringes are stable for 30 days if refrigerated (ADA, 2003a). They should be stored vertically, with the needle tip pointing upwards to prevent suspended insulin particles from crystallizing in the needle (ADA, 2003a). To re-suspend the insulin, clients must roll the pre-filled syringes end-to-end before administering (ADA, 2003a). Lantus cannot be stored in a pre-filled syringe (Grajower et al., 2003).

Not all insulins are compatible for mixing in syringes. Physicochemical changes or blunting of insulin action may occur either immediately or over time when insulins are mixed together (ADA, 2003a). When mixing insulins, the brand name must be consistent. It is suggested that the companies' monographs be consulted, as insulin formulations may change (ADA, 2003a). General guidelines for preparation and injection of insulin and mixing insulin in a syringe are included in Appendix F and Appendix G.

B. Preparation and Administration of Insulin

A variety of insulin administration devices are available including syringes, pens, and insulin pumps (not discussed in this guideline). Each method has both advantages and disadvantages and delivery method should be selected based on individual client need (dexterity, strength and vision), cost and availability of equipment.

Syringes

Insulin syringes are marked in units and are available in different sizes: 1 cc (100 units); 1/2 cc (50 units) and 3/10 cc (30 units). To avoid insulin dose errors, the insulin syringe must match the concentration listed on the insulin vial or cartridge used. For example, only a U-100 insulin syringe should be used to administer U-100 insulin. To further ensure dose accuracy, dose amount should guide the size of syringe used. It is important to note that 1 cc syringes are marked in 2 unit increments, 1/2 cc syringes are marked in 1 unit increments, and 3/10 cc syringes are marked in 1 unit increments. A 3/10 cc syringe that measures in 1/2 unit increments, while not available at the time of publication, is expected to be available in the near future. The client's insulin dose, visual acuity, and manual dexterity must be considered when recommending an insulin syringe.

It is recommended that insulin pen users be taught how to use a syringe as a means of a backup delivery system.

All manufacturers recommend that syringes be used only once to ensure sterility and prevent tissue damage. If clients are going to reuse syringes, the following are general guidelines that should be individualized to the client (ADA, 2003a):

- Syringes should never be shared with another person due to the risk of acquiring blood-borne infections.
- The needle must be recapped after each use.
- The needle must be inspected prior to each use and discarded if it becomes dull, bent, or has been in contact with any surface other than the skin.
- Syringe reuse is not recommended for people with poor personal hygiene, acute concurrent illness, open wounds, or decreased resistance to infection for any reason.

Insulin Pens

Insulin pens provide clients with an alternate delivery system, which may be easier for some to learn, more convenient, and more portable. In a randomized cross-over study conducted

by Coscelli, Lostia, Lunetta, Nosari, & Coronel (1995), it was found that insulin injections using a vial and syringe versus a disposable, pre-filled insulin pen were associated with a high risk of error in elderly clients with diabetes who were over 60 years of age. However, disposable, pre-filled insulin pens may not be readily available to some clients and differ from the standard insulin pens.

Le Floch, Herbreteau, Lange, & Perlemuter (1998) noted that insulin pen delivery systems, (including cartridges and non-refillable pens), must not be shared between individuals in order to decrease the risk of contamination of the insulin by a variety of biological materials. Each client requiring insulin must have his or her own insulin pen.

The nurse should review the manufacturers' manual or booklet and be familiar with insulin pen use prior to teaching clients about insulin pens. If assessment indicates that a client might be a good candidate for insulin pen use and the nurse is unable to provide the instruction, a referral for insulin pen instruction should be made. This may be available through diabetes education centres, pharmacists with special diabetes training, or Community Care Access Centres. Local Canadian Diabetes Association (CDA) branch offices may be able to identify local training resources.

Needles

Most people are able to safely and comfortably use an 8mm (short) needle (Wood, Wilbourne, & Kyne, 2002). Very lean individuals may require an even shorter 5 or 6 mm length to avoid intramuscular (IM) injections. To prevent insulin from leaking at the injection site, obese individuals should use the 12 or 12.7 mm length needle. All manufacturers recommend that needles be used only once to ensure sterility, prevent tissue damage, and to minimize the risk of bent or broken needles.

Preparation of Injection

There has been much debate regarding which insulin to draw up first ("clear" vs. "cloudy"). Most textbooks suggest clear should be drawn up first. The ADA (2003a) supports clear insulin being drawn up first due to its action being blunted by the cloudy insulin if contamination of the vial occurs. However, Fleming (1999) concluded the likelihood of frequent or substantial contamination from one vial to another is minimal. The practice of instructing clients to draw clear first is primarily to establish a routine and reduce any possibility of a switch. The ADA clinical practice recommendation (2003a) suggests that clients who manage well on a particular mixed regimen should maintain their standard procedure for preparing their insulin doses.

For clients using cloudy insulin, it is important to re-suspend the insulin by rolling the vial or pen. Jehle, Micheler, Jehle, Breitig, & Boehm (1999) found only 9 % of clients adequately re-suspended their NPH cartridge prior to injection. The study showed that cycles of rolling and tipping the pen at least 20 times were required to completely re-suspend the insulin. See Appendix G for general guidelines for mixing insulin in a syringe.

Site Selection and Rotation

Insulin injections should be administered in areas of the body with the most subcutaneous tissue such as the abdomen (with the exception of a two-inch radius around the umbilicus), posterior upper arm, anterior and lateral thigh, and buttocks. It is important to avoid areas with lipohypertrophy, scars, stretch marks, edema, and other skin changes, due to their impact on the absorption of insulin. Research has demonstrated that insulin is absorbed quickest in the abdomen, then posterior upper arm, then anterior and lateral thigh, and slowest in the buttocks (McConnell, 1999; Wood et al., 2002). A study by Henriksen et al. (1993) confirmed that fast acting insulin (Regular [R] or Toronto) has a slower absorption subcutaneously in the thigh as compared to the abdomen. Many factors influence predictability of insulin absorption, including choice of injection site. Varying insulin injection sites within the same anatomic region rather than between different regions may diminish daily variations in insulin absorption and in metabolic control (Zehrer, Hansen, & Bantle, 1990). Advise client to rotate injections sites within one anatomic region, such as the right abdomen, for one to two weeks then move to another anatomic region, such as the left abdomen.

Injection Technique

Insulin should be injected into the subcutaneous tissue. This is accomplished by gently pinching the skin and injecting at 90 degrees unless a 5 or 6 mm needle is used, in which case no pinching is required. In very lean adults a 45 degree angle of injection may be required, especially if shorter needle lengths are not available (ADA, 2003a; Frid, Gunnarsson, Guntner, & Linde, 1988; Thow, Johnson, Fulcher, & Home, 1990). Routine aspiration (drawing back on the plunger) is not necessary (ADA, 2003a). It is cumbersome, rarely yields blood, and is not a reliable indicator of correct needle placement (Fleming, 1999).

Use of Alcohol at Injection Site

The use of alcohol to cleanse the injection site should be considered optional. While it was found that a five second cleansing reduced bacteria, injecting without an alcohol cleansing did not result in infection (Koivisto & Felig, 1978). Fleming (1999) reported that the incidence of infection from injections was linked more often to contaminated syringes, needles, or solutions than to lack of skin preparation.

Sharp Disposal

Sharps include: pen needles, syringes with needles attached and lancets. All sharps are for individual use only. They must never be shared due to the risk of blood-borne infectious disease, such as hepatitis or acquired immune deficiency syndrome (ADA, 2003a). All sharps need to be disposed of according to local regulations. They cannot be put directly in regular garbage. Used sharps should be placed in a puncture-resistant container that has a secure lid (e.g., bleach bottle, liquid detergent bottle, or sharps containers). Sharps containers may be purchased at local pharmacies.

To dispose of filled containers call the Household Hazardous Waste office, Public Health Department, or check with local disposal authorities. Containers should be stored in a safe location away from children and pets. Care must be taken not to dispose of filled containers in the general garbage or with items for recycling.

Needle Stick Injury Prevention

The Centres for Disease Control and Prevention (CDC) estimated that healthcare workers suffer between 600,000 and 1 million injuries from conventional needles and sharps annually (American Association of Diabetes Educators, 2002). Institutions have implemented safe practices for the disposal of sharps, which include no recapping of pen tips or syringes prior to disposal in a sharps container. Nurses should consult their organization's policy and procedure manual. In the home, sharps should be disposed in a sharps container without recapping. However, clients utilizing pens are instructed to recap using the larger outer cap prior to disposal. The nurse should assess the client's vision and dexterity to ensure safe use. An easy-to-use pen tip remover that does not require recapping prior to disposal is available from Novo Nordisk for removal of Novo Nordisk pentips.

Lipodystrophies

Lipodystrophy can occur with any insulin therapy. It can be categorized in two forms: lipoatrophy and lipohypertrophy. Lipodystrophies can delay insulin absorption, thus negatively affecting metabolic control. Lipodystrophic changes are more common when an animal source insulin is used (Partanen & Rissanen, 2000). However, the use of highly purified insulins and human insulin has not completely eliminated these changes.

Lipoatrophy is a concave or pitted appearance of the skin at the injection site (Anderson, Seitzman, & Haines, 1998). It is a rare skin reaction. There is a higher incidence of this problem in people who are not treated with highly purified pork or human insulins, and it is more common in females (White & Campbell, 1996). Switching to human insulin usually alleviates the condition.

Injecting human insulin in and around the affected area is also used as a treatment (Anderson et al., 1998). Steroids injected locally may also be considered (White & Campbell, 1996). Resolution may start to occur after two weeks, but usually requires 4 to 6 months for complete resolution (White & Campbell, 1996).

Lipohypertrophy is the development of soft fatty swellings underneath the skin (Anderson et al., 1998). The fat build up under the skin is related to the possible growth factor effect of insulin on cellular elements of subcutaneous tissue. In complex cases, the build up of fat leads to an injection site that is less painful, which in turn encourages the person to use the same site (Partanen & Rissanen, 2000). Prevalence rates vary between 20 to 53% (Partanen & Rissanen, 2000). Risk factors for development include: female gender; type 1 diabetes; high body mass index; and repeated use of same injection site (Partanen & Rissanen, 2000; Saez-de Ibarra & Gallego, 1998; Teft, 2002). Systematic site rotation, regular examination of injection sites, and client education regarding lipohypertrophy are key to its prevention and treatment.

Allergies

Allergic reactions to insulin are rare with the use of human insulin (Skyler, 1998). Three types of reactions have been described in the literature: local; systemic; and insulin resistance (see Appendix H). Some allergic-type reactions may result from the additives or preservatives found in insulin, skin preparation used, or improper injection technique. If burning, itching, and/or hives at the injection site occur, the client's injection technique must be assessed. Intradermal rather than subcutaneous injection or injection of cold insulin may be the cause. If symptoms do not resolve and the client's injection technique is satisfactory, a change from one brand of insulin or type to another is required. True anaphylaxis or severe asthma should be treated according to protocols.

To prevent bacterial growth and maintain a neutral pH level, all insulins have added ingredients. Intermediate and long-acting insulins (except glargine) contain additives that prolong their actions: protamine in NPH insulins and zinc in lente insulins. These added ingredients can on rare occasions cause an allergic reaction (ADA, 2003a). Approximately 40% of people treated with NPH insulins have protamine antibodies. Although protamine antibodies rarely cause an insulin allergy reaction, they are associated with anaphylaxis during the reversal of intra-operative heparin anticoagulation. Caution is required for clients with a history of NPH use. Heparin anticoagulation should ideally be allowed to spontaneously reverse. If protamine reversal is required, it must be accompanied with preparations for possible anaphylaxis. There are few cases of zinc-related insulin allergy, even though individuals may have a positive skin test to zinc acetate or zinc sulphate. There have also been rare cases of reactions to plasticizers, preservatives, or latex contaminants reported (Fineberg, 1998).

Recommendation • 4

Nurses should encourage blood glucose self-monitoring as an integral part of daily diabetes management for individuals taking insulin. The recommended frequency of testing will vary according to diabetes treatment and the individual's need and ability. *(Level of Evidence = III)*

Discussion of Evidence

Most people with diabetes benefit from self-monitoring of blood glucose levels (CDA, 2003a; Karter, Ackerson, & Darbinian, 2001). These benefits include improved blood glucose control and enhanced recognition and treatment of hypoglycemia, especially if the client experiences reduced awareness of the symptoms of low blood glucose. Monitoring helps individuals to assess the effects of diet choices, physical activity and changes to treatment on blood glucose control. The benefits of self-monitoring are greatest if the person with diabetes has learned how to self-manage diabetes, including how to interpret results, adjust insulin doses and how to correctly use and maintain the blood glucose meter (Franciosi et al., 2001; Norris et al., 2001). Basic information regarding "too high", "too low" and target blood glucose levels should be provided at the time of insulin initiation to assure safety.

The recommended targets for blood glucose control *(2003 Clinical Practice Guidelines for the Management of Diabetes in Canada)* are listed in Table 1.

Table 1:

	A1C	Fasting Glucose before meals	Glucose level 2-hours after eating
Target	≤ 7 %	4-7 mmol/L	5-10 mmol/L
Normal (consider in persons for whom it can be achieved safely – without severe hypoglycemia)	≤ 6 %	4-6 mmol/L	5-8 mmol/L

The goals and frequency of self-testing should be determined individually, based on the treatment prescribed, the type of diabetes, and the individual's ability to use the information from testing to modify behaviours or adjust medications (CDA, 2003a). Those with type 2 diabetes treated with insulin should test at least daily, however more frequent testing may be appropriate (Ellison et al., 2002). People who take multiple insulin injections each day, with the goal of near normalization of blood glucose, should test at least 3 or more times each day. Results of pre-meal and bedtime testing, as well as intermittent 2-hour post-meal tests can be used to guide insulin dose adjustments. Since overnight hypoglycemia may occur more frequently with multiple daily injections, periodic overnight testing at a time corresponding to peak insulin action should be performed (Beregszaszi et al., 1997; CDA, 2003a; DCCT Research Group, 1991; Gale & Tattersall, 1979; Jones et al., 1998; Vervoort, Goldschmidt, & Van Doorn, 1996).

Recommendation • 5

Individuals who self-monitor blood glucose should receive initial instruction and periodic re-education regarding self-testing technique, meter maintenance, and verification of accuracy of self-testing results. *(Level of Evidence = III)*

Discussion of Evidence

In order to assure accuracy of readings, meter results should be compared with simultaneous laboratory measurement of plasma glucose at least once a year. This should also be done when meter results do not reflect presenting symptoms of high or low blood glucose levels. A difference of up to 20% between meter reading and laboratory results is considered acceptable (CDA, 2003a; Sacks et al., 2002).

Errors in client-testing techniques are common, and periodic re-education about monitoring may improve the accuracy of self-testing results (Bergenstal et al., 2000; Norris et al., 2001). A wide variety of meters are available, including some that are designed for individuals with limited vision or manual dexterity. Clients should be encouraged to select a meter that meets their needs. If a client is unsure about meter selection, pharmacists and diabetes educators can provide advice regarding meter selection. See Appendix I for suggested questions for clients to ask when buying a blood glucose meter.

In rare situations, other treatments may interfere with the accuracy of meter results. An example of this is the false high blood glucose reading obtained in clients receiving Icodextrin-containing peritoneal dialysis solutions who use test strips that utilize glucose dehydrogenase methods to determine blood glucose. It is important for organizations to provide appropriate meters for clients with varying needs when testing capillary blood glucose levels in clinical settings.

Alternate site testing

Meters that allow self-monitoring using blood samples from sites other than the fingertips are now available. Forearms and the base of the thumb are currently the most frequently recommended alternate sampling sites. During periods of rapid change in blood glucose, fingertip testing may more accurately reflect actual blood glucose than forearm testing where changes in blood glucose levels may be delayed (Ellison et al., 2002; Jungheim & Koschinsky, 2002). Fingertip testing is advisable after meals, when medication action is peaking, or when hypoglycemia is suspected (CDA, 2003a).

Recommendation • 6

Nurses should ensure clients taking insulin receive appropriate basic nutrition information. *(Level of Evidence = IV)*

Discussion of Evidence

Nutrition management is one of the cornerstones of effective therapy in type 2 diabetes. Attention to food portions, physical activity, as well as balancing carbohydrate intake with the insulin available, is essential in promoting glycemic control.

Due to the complexity of nutrition issues, it is recommended that a registered dietitian, knowledgeable in diabetes nutrition therapy, be the team member providing medical nutrition therapy (ADA, 2003b; CDA, 2003a; Meltzer et al., 1998). There is evidence that nutrition counselling provided by a registered dietitian is beneficial in improving glycemic control (Franz et al., 1995; Kulkarni et al., 1998; UKPDS Group, 1990). In the interim when this is not available, the nurse should ensure that basic nutrition information is provided. See Appendix J and Appendix K for basic nutrition information.

Recommendation • 7

Clients treated with insulin, and their caregivers, should be taught how to prevent, recognize and treat hypoglycemia. *(Level of Evidence = IV)*

Discussion of Evidence

Hypoglycemia is the limiting factor in the glycemic management of diabetes. It is a barrier to quality of life in the short term and to good diabetes management in the long-term. The fear of hypoglycemia can be an impediment to optimal glycemic control, but there are strategies for helping clients to lower blood glucose levels while minimizing the risk of hypoglycemia (Cryer & Childs, 2002).

For the majority of people with diabetes, target blood glucose is 4.0 to 7.0 mmol/L before meals. Studies demonstrate that behaviours such as eating less than usual, taking too much insulin, and increased activity are associated with 85% of hypoglycemic episodes (Yale et al., 2002). The major risk factors for severe hypoglycemia include: a prior episode of severe hypoglycemia, a current low A1C (less than 6%), hypoglycemia unawareness, long duration of diabetes, and autonomic neuropathy (Cryer & Childs, 2002; Yale et al., 2002). In the elderly, the strongest predictor of hypoglycemia is being discharged from the hospital within the last 30 days. This finding may be related to inconsistent eating patterns at home and testing blood glucose less frequently after discharge (Shorr, Wayne, Daugherty, & Griffin, 1997). Additional insulin requirements decline as the stress and illness abates.

Prevention of hypoglycemia

Healthcare practitioners need to discuss hypoglycemia with insulin-using clients at every client contact (Cryer & Childs, 2002). Questions to ask include:

- how frequently hypoglycemic events occur.
- the time of the day they tend to occur.
- symptoms experienced.
- any patterns of hypoglycemia they may identify.

Discussions should include insulin actions, peak action times, prevention, recognition, and treatment measures for hypoglycemia. Clients should be advised to carry fast-acting carbohydrate with them at all times so that it is readily available if hypoglycemia symptoms occurs (Cryer & Childs, 2002).

Recognition of hypoglycemia

See Table 2 for the signs and symptoms of hypoglycemia (Yale et. al., 2002).

Table 2: Signs and symptoms of hypoglycemia

Neurogenic (Autonomic)	Neuroglycopenic
■ Sweating	■ Difficulty concentrating
■ Trembling	■ Weakness, drowsiness
■ Palpitations	■ Vision changes, headache
■ Hunger, pallor	■ Confusion
■ Tingling	■ Tiredness
■ Anxiety	■ Difficulty speaking
■ Nausea	■ Dizziness

Symptoms of hypoglycemia can be classified as mild, moderate or severe. Mild symptoms include autonomic symptoms, moderate symptoms include neuroglycopenic symptoms and severe symptoms include drowsiness or weakness and can result in loss of consciousness (Yale et al., 2002). Some people experience symptoms of hypoglycemia with blood glucose levels greater than 4.0 mmol/L or with rapidly descending blood glucose. Treatment of hypoglycemia may be necessary if symptomatic, even if blood glucose is greater than 4.0 mmol/L. Use fingertips (not alternate site) for blood glucose testing when experiencing hypoglycemia (Ellison et. al., 2002; Jungheim & Koschinksky, 2002).

Treatment of hypoglycemia

For mild to moderate hypoglycemia, treatment is 15 g of a fast-acting carbohydrate. See Appendix L for treatment choices to deliver 15 g or 20 g of fast-acting carbohydrate and Appendix M for client instruction on how to treat hypoglycemia. Blood glucose needs to be checked 15 minutes after treatment and clients should be treated with another 15 g of fast-

acting carbohydrate if blood glucose remains less than 4.0 mmol/L. Prevent reoccurrence of hypoglycemia by adding a snack of 15 g of starch and a protein source if the next meal is more than 60 minutes away. Glucose gels are no longer recommended for treatment as they have been demonstrated to be absorbed too slowly (Yale et al., 2002). There is no evidence to support the practice of administering glucose gel buccally since absorption through the mucosa is minimal, if at all (Yale et al., 2002). For individuals who take alpha-glucosidase inhibitors such as Acarbose (Prandase), which inhibit absorption of sucrose or starch by the gut, hypoglycemia needs to be treated with glucose tablets, milk or honey (Yale et al,. 2002). Clients on insulin should wear identification such as Medic Alert™.

Glucagon

With severe hypoglycemia, the client requires the assistance of another person or unconsciousness may occur. Glucagon is the treatment of choice for severe hypoglycemia at home and is administered by injection by another person when the client is unable to self-treat. Glucagon 1 mg. must be administered intramuscularly or subcutaneously by a support person who has received education on its preparation and administration. The expiration date on the glucagon must be checked prior to use. The support person should immediately call 911 for assistance in the recovery of the person with hypoglycemia and must be instructed to check blood glucose 15 minutes after glucagon administration. In hospital, severe hypoglycemia can be treated with 20 to 50 ml $D_{50}W$ IV or 1 mg. of glucagon by subcutaneous or intramuscular injection. A severe episode of hypoglycemia or hypoglycemia unawareness is an indication for referral to a diabetes centre or specialist physician for further education (Yale et al., 2002).

Hypoglycemia unawareness

Some clients may have hypoglycemia unawareness and not recognize the symptoms of hypoglycemia. With hypoglycemia unawareness, the first sign of hypoglycemia may be confusion or loss of consciousness (Cryer & Childs, 2002; Yale et al., 2002). For some clients, the symptoms of hypoglycemia may change or diminish over time (Yale et al., 2002) There are some circumstances when target blood glucose may need to be individualized to a higher level to prevent hypoglycemic events. It is necessary to test blood glucose more frequently. Studies have found that as little as 2 to 3 weeks of scrupulous avoidance of hypoglycemia reverses hypoglycemia unawareness and can improve symptom recognition (Cranston, Lomas, Maran, MacDonald, & Amiel, 1994; Dagogo-Jack, Rattarasarn, & Cryer, 1994; Fanelli et al, 1994).

Nocturnal hypoglycemia

Severe hypoglycemic episodes frequently occur at night and can be potentially serious (Yale et al., 2002). Individuals are less likely to detect hypoglycemia during sleep and may wake in the morning reporting headache, nightmares, or restless sleep (Cryer & Childs, 2002; Saleh & Grunberger, 2001). The *Canadian Diabetes Association Clinical Practice Guidelines for Hypoglycemia* (2001) identify a number of strategies for preventing nocturnal hypoglycemia. These include checking blood glucose at insulin peak times during the night to rule out nocturnal hypoglycemia. Other preventive measures include having a bedtime snack with at least 15 g of carbohydrate and protein if the bedtime blood glucose level is under 7.0 mmol/L (Yale et al., 2002). Insulin type or insulin injection times can be strategically adjusted to prevent nocturnal hypoglycemia. If intermediate-acting insulin (NPH/Lente) is given at dinner, it peaks during the night increasing the risk of nocturnal hypoglycemia. Moving the intermediate-acting (NPH/Lente) insulin to bedtime can reduce this risk (Cryer & Childs, 2002). For some clients, fast-acting (regular) insulin has a prolonged action and may increase the risk of nocturnal hypoglycemia. For these clients, using a rapid-acting insulin analogue (Humalog/NovoRapid) instead of regular insulin at dinner or the use of glargine (Lantus) may reduce nocturnal hypoglycemia (Cryer & Childs 2002; Dewitt & Dugdale, 2003; Owens et al., 2001; Saleh & Grunberger, 2001). (Glargine is a 24-hour insulin with no peak action. At the writing of these guidelines, glargine [Lantus] has been approved but not yet marketed for use in Canada.)

Physical activity and hypoglycemia

Increased physical activity generally lowers blood glucose. Self-monitoring of blood glucose before, during, and for up to 24-36 hours after exercise, may be important to establish individual response to exercise and guide insulin adjustment when exercising (Albright et al., 2000; Chipkin, Klugh, & Chasan-Taber, 2001; Yale et al., 2002). The client will need to discuss options of altering food intake and/or adjusting insulin with a diabetes health professional, particularly if undergoing intensive physical activity (Chipkin et al., 2001; Dewitt & Hisch, 2003).

Recommendations to reduce risk of activity-associated hypoglycemia include the following:

- Ingest 15 g of fast-acting carbohydrate before activity if pre-exercise blood glucose level is under 5.0 mmol/L (Yale et al., 2002).
- Administer insulin into a site away from the most actively exercising extremity (Albright et al., 2000; Yale et al., 2002).
- Fast-acting carbohydrate should always be readily available during and after physical activity (ADA, 2002a; 2003a, Chipkin et al., 2001).

For further tips on activity see Appendix N.

Driving and hypoglycemia:

The issue of driving and hypoglycemia and recommended safety precautions should be discussed when initiating a client on insulin. When appropriate, each person with diabetes has the right to be assessed for a license to drive a motor vehicle, but must ensure that he or she is able to drive safely (CDA, 2003b). Persons with diabetes should maintain accurate blood glucose monitoring logs and a calibrated blood glucose meter (Begg, Yale, Houlden, Rowe, & McSherry, 2003). Drivers should measure their blood glucose level immediately before and at least every 4 hours (more often in cases of hypoglycemia unawareness) during long drives. Blood glucose monitoring equipment and supplies of rapidly absorbable carbohydrates should always be within easy reach (e.g., attached to the visor). Individuals who require insulin can drive private vehicles if they are under regular medical supervision (minimum 2 clinic visits during the last year) (Begg et al., 2003).

Individuals should not drive when their blood glucose level is below 4.0 mmol/L. They should not start driving without prophylactic carbohydrate treatment when blood glucose level is in the 4.0 to 5.0 mmol/L range. Drivers should stop and treat themselves as soon as hypoglycemia and/or impaired driving are suspected. Individuals should not drive until at least 45 to 60 minutes after effective treatment (test blood glucose) of mild to moderate hypoglycemia (blood glucose level of 2.5 to 4.0 mmol/L) (Begg et al., 2003).

Commercial drivers

The supplies required to be carried at all times while driving a commercial vehicle include blood glucose testing equipment and a source of rapidly absorbable carbohydrate within easy reach. Blood glucose must be tested within 1 hour before driving and approximately every 4 hours while driving. Commercial drivers should not drive when their blood glucose level is below 6.0 mmol/L. They should not resume driving without prophylactic carbohydrate treatment and until the blood glucose level has risen to greater than 6.0 mmol after food ingestion (Begg et al., 2003). Provinces have different legislation regarding licenses for commercial drivers; consult Provincial legislation for specifics.

Recommendation • 8

Nurses must be aware of the effects of acute illness, surgery, and diagnostic procedures on blood glucose levels. *(Level of Evidence = IV)*

Discussion of Evidence

People with diabetes are frequently admitted to hospitals for surgery and other invasive procedures. There is a growing body of evidence to support the fact that critically ill, coronary, and surgical clients require tighter glycemic control. Hyperglycemia in the hospitalized person with diabetes is an important predictor of morbidity and mortality, particularly among those with myocardial infarction, stroke, coronary artery bypass surgery, wound and nosocomial infections (CDA, 2003a; 2003c; Levetan & Magee, 2000; Levetan & Sharma, 2002). Peri-operatively, people with type 2 diabetes are likely to have increased peripheral resistance and reduced insulin secretion. Often insulin needs are greater than anticipated (CDA, 2003c). Surgery and general anaesthesia cause a stress response that stimulates a counter-regulatory response. The degree of counter-regulatory response depends on the length of surgery, severity of the underlying condition, the type of diabetes, and any complications which may arise (Hirsch & Paauw, 1997). Insulin requirement will depend on the type of surgery (major, moderate, or minor), blood glucose levels, and length of time NPO (Cheng, 2002). Symptoms of hypoglycemia may be altered when a client is sedated, and absent if under general anaesthesia. Therefore, frequent blood glucose monitoring of the client with diabetes in the operating room is important (CDA, 2003c).

Special consideration needs to be given to diagnostic procedures that require the client to be on a clear fluid diet, NPO, or to increase their activity (e.g., stress test). Insulin adjustments will depend on the time of procedure, the duration, and when the person is expected to resume eating. Adjustments will also depend on blood glucose levels, type of insulin, and time of last injection. The adequacy of the client's current management skill needs to be assessed as well.

Recommendation • 9

Nurses should provide basic education on blood glucose monitoring, dietary, and medication adjustments for periods of illness. This information should be given initially and reviewed periodically with the client. *(Level of Evidence = IV)*

Discussion of Evidence

Sick day management is advocated during times of infection and at times when an individual is unable to ingest the usual amount of carbohydrate due to nausea or vomiting (ADA, 2003a; Kitabchi et al., 2001; Umpierrez, Murphy, & Kitabchi, 2002). Clients should be encouraged to continue to take their insulin when ill, even if eating less, as stressors of illness result in the release of counter-regulatory hormones (glucagon, catecholamines, cortisol, and growth hormone), which raise blood glucose (Booth, 2001). Insulin should not be omitted when ill (Kitabchi et al., 2001) but the dose may require adjustment. Appendix O provides information to offer clients with type 2 diabetes on how to deal with sick days.

While solid carbohydrates might not be tolerated during sick days, it is important that carbohydrate requirements still be met via substitution of easily-digested liquid-containing carbohydrates. If vomiting, diarrhea, or polyuria are present, the risk of developing dehydration and electrolyte imbalance is increased. As a result, it is important to consume salty liquids to promote the thirst mechanism, to replace lost electrolytes, and to consume additional sugar-free fluids to prevent dehydration (Kitabchi et al., 2001).

In individuals with type 2 diabetes, development of diabetic ketoacidosis (DKA) does not usually occur due to some remaining endogenous insulin. However, during times of acute stress, catecholamine secretion can severely suppress insulin release and precipitate ketoacidosis (Booth, 2001). African Americans, and Hispanic individuals with type 2 diabetes may be more prone to development of DKA (Booth, 2001).

Hyperosmolar hyperglycemic syndrome (HHS) is rare but one of the most serious acute metabolic complications of type 2 diabetes, and occurs predominantly in the elderly (Booth 2001; Kitabchi et al., 2001). The most common precipitating factors for HHS include infection, intercurrent illness, psychological stress, and inability to follow treatment recommendations (Umpierrez et al., 2002). Infection is the major precipitating factor for HHS occurring in 30 to 60 % of clients, with urinary tract infection (UTI) and pneumonia accounting for the majority of infections (Umpierrez et al., 2002) along with those of the skin and soft tissue (Booth & Fang, 2002). Fungal and bacterial infections are more common in clients with diabetes (Booth, 2001). The

basic underlying cause for HHS is a relative insulin deficiency as a result of insulin omission or the body's response to the stressors of illnesses such as myocardial infarction, gastrointestinal bleeding, surgery, or trauma (Booth, 2001; Umpierrez et al., 2002). Early detection is key to taking appropriate action in order to prevent the development of HHS (ADA, 2003a).

During periods of illness, blood glucose monitoring of at least every 4 to 8 hours is advocated due to the action profile of insulins, to determine if hyperglycemia is developing or worsening, or to detect hypoglycemia.

Education should include the importance of the following:

- Recognizing potential underlying causes of the illness
- Continuing insulin administration during illness, though dose may require adjustment
- Blood glucose monitoring every 4 to 8 hours, or more often if nauseous, vomiting, or unable to eat
- Contacting the healthcare provider for insulin adjustment if blood glucose is not in target range within 12 hours of adjusting insulin
- Ingesting easily digested liquid carbohydrates and salt (if no contraindications) especially if unable to tolerate usual meal plan
- Ingesting additional sugar-free fluids (if no contraindication) to prevent dehydration
- Speaking with pharmacist prior to use of over-the-counter preparations

Education Recommendation

Recommendation • 10

Nursing curriculum should include education about the care and management of diabetes.
(Level of Evidence = IV)

Discussion of Evidence

As the prevalence of diabetes is increasing, knowledge of this chronic condition needs to be highlighted in academic curricula. El-Deirawi and Zuraikat (2001) assessed the community and home healthcare agency nurses' actual and perceived knowledge of diabetes using the Diabetes Basic Knowledge Test (DBKT) and the Diabetes Self-Report Tool (DSRT). Their findings show that nurses' actual and perceived knowledge were positively correlated. Udding, Jackson and Hart (2002) compared the nurses' current knowledge about diabetes before and after a peer-developed diabetes management presentation. The results of the comparison reflected a need for improving diabetes knowledge and indicated that teaching interventions positively influenced post-intervention scores.

The guideline development panel suggests that nursing curriculum should include:

- Pathophysiology and diagnosis of diabetes
- Lifestyle management (physical activity, weight management, smoking cessation)
- Nutrition guidelines
- Comorbidities (e.g., hypertension, dislipidemia)
- Medications for diabetes
- Insulin injection technique
- Acute complications including hypoglycemia prevention, recognition, and management
- Prevention and management of long-term complications
- Sick day management
- Principles of blood glucose monitoring, including timing, site selection, calibration and correlation to lab results
- Coping with chronic illness
- Readiness to learn and principles of adult learning
- Prevention of diabetes

Nursing students should have opportunities to care for various clients with diabetes to gain experience in medication administration, educating individuals with diabetes, and when possible, blood glucose monitoring.

Refer to Appendix P for a list of resources for diabetes information.

Organization & Policy Recommendations

Recommendation • 11

Healthcare organizations should facilitate ongoing diabetes education of nursing staff about diabetes care and management. *(Level of Evidence = IV)*

Discussion of Evidence

The body of knowledge in diabetes is growing at an exponential rate. New treatments and modalities, such as insulin analogues, classes of oral antihyperglycemic agents, and devices for monitoring blood glucose, are being developed. As these new modalities appear and are integrated into the practice setting, it is essential for healthcare organizations to provide education for nursing staff. Provision of ongoing education is necessary for nurses to keep abreast of changes in diabetes care and management and to update their skills in order to deliver safe diabetes care.

Recommendation • 12

Organizations must ensure that individuals receiving insulin have ready access to an appropriate form of glucose at all times. *(Level of Evidence = IV)*

Discussion of Evidence

Each healthcare facility should ensure that clients have ready access to fast-acting carbohydrate foods. In institutionalized settings, efforts must be made to ensure that clients using insulin have ready access to an appropriate form of glucose at all times, particularly when NPO or during diagnostic procedures (CDA, 2003a). Prompt identification and treatment of hypoglycemia is necessary to prevent an acute crisis. In hospitalized individuals, a PRN order for glucagon should be considered for any client at risk for severe hypoglycemia (e.g., insulin requiring and hospitalized for concurrent illness) when intravenous access is not readily available (Yale et al., 2002). For severe hypoglycemia with unconsciousness, intravenous glucose of 10 to 25 g (20 to 50 ml of $D_{50}W$) administered over 1 to 3 minutes is the standard medical treatment (Yale et al., 2002).

Recommendation • 13

Organizations should develop and communicate appropriate policies and procedures to reduce the potential for medication errors related to insulin therapy. *(Level of Evidence = IV)*

Discussion of Evidence

Although there are no provincial statistics available regarding the number of medication errors made each year, international studies indicate drug errors are a significant problem of many healthcare systems (College of Nurses of Ontario, 2000). Approximately two of every 100 hospitalized clients experience a preventable adverse drug event (Kowiatek, Skledar, & Potoski, 2001). Studies from the Institute of Medicine report that preventable adverse drug events increase the mean length of hospital stay by almost 2 days, and medication errors lengthen hospital stays by approximately 5 days (Cohen, 1999; Kowiatek et al., 2001). This results in a $4,700 increase in the cost of individual client hospital admissions or an estimated $2.8 million per year for a 700-bed hospital (Kowiatek et al., 2001).

According to the Institute of Safe Medical Practice (ISMP) Canada (2003), insulin is one of the top five "high-alert" medications. Data from research, voluntary reporting programs, and technology used to automate the medication use process, identify that insulin errors happen often and cause significant client harm (Grissinger & Lease, 2003; ISMP, 2002a). The ISMP medication error benchmarking study found that over one-third of all medication errors involved six drug categories: insulin, heparin, opiates, patient controlled analgesia (PCA) devices, allergies, and potassium concentrates (Kowiatek et al., 2001). Insulin-related errors were identified as one of the most common types, comprising 11% of all nationally reported errors (Kowiatek et al., 2001). Another evaluation of medication errors found insulin to be the top drug in the "wrong dose/rate" group, accounting for 13% of the category. More than 70% of insulin-related errors were attributed to prescribing and transcribing (Kowiatek et al., 2001). The potential for error can occur in any or all of the following phases: prescription; transcription; preparation; and administration (ISMP Canada, 2003). The process of administering a single dose of a medication involves 10 to 15 steps, each of which offers the opportunity for error (Leape, 1999).

A landmark article on systems analysis of adverse drug events identified the underlying causes that resulted in medication errors to include:

- Lack of knowledge of the drug
- Lack of information about the client
- Transcription error

- Faulty identity checking
- Faulty dose checking
- Inadequate monitoring
- Drug stocking and delivery problems
- Preparation errors (Cohen, 1999)

Similar-sounding drug names, account for more than one-third of medication errors. Poor handwriting can exacerbate the problem when trying to distinguish between two drugs that have similar names (Cohen, 1999):

- Lente has been mistaken for Lantus.
- Humulin and Humalog have been confused.
- "Human Log" has been changed to Humulin L .
- Humalog has been substituted for Humalog Mix 25.

The use of the abbreviation of "U" for the word "units" is one of the greatest potential to cause harm. Misreading the "U" as a zero or the number 4 or 6 has led to serious insulin overdoses. Using "U" for "units" has frequently led to tenfold overdoses of insulin (ISMP Canada, 2003). For example, 41 units of regular insulin was administered to a client because the order for "Regular insulin 4 IU" was interpreted as "41" and not as intended "4 IU (international units)" (Cohen; 1999; ISMP, 1997). The use of symbols can also be problematic. The ampersand (&), and the plus sign (+), when written, have both been mistaken for the numbers "2" and "4" respectively (ISMP Canada, 2003). For example, "Insulin 30/70 10U q AM & 8U q PM" was administered as 10 units in the morning and 28 units in the evening (ISMP Canada, 2003).

To avoid errors, abbreviations should not be used in orders. "Units" should be written out in full, not as "U". Insulin names should be written in full. Specified meal time in orders should be clarified when orders include "a.m." or "p.m.", "morning" or "evening" or "twice a day (BID)".

A system of redundancy or check system is recommended as one safeguard to reduce medication errors (Cohen, 1999; Grissinger & Lease, 2003; ISMP Canada, 2003). It involves a second, independent check, whereby one person checks the work of another. This process increases the chance of making an error visible. Research demonstrates that double checks identify 95% of errors at each verification point (ISMP, 2003). Alert clients or family members can be used as the second independent check if available. The Medication Standards regarding administering medications from the College of Nurses of Ontario (2003) also state

double-checking as one way to reduce medication errors. However, there is no law or standard that requires a nurse to double-check prepared medications with another nurse prior to its administration (College of Nurses of Ontario, 2003). As a risk management precaution, some institutions have established a policy in which nurses must review another nurse's medication preparation. If policies do not exist, it is up to the individual nurse's discretion as to whether or not a double-check is necessary. According to the College of Nurses of Ontario (2003) regarding double-checking preparations, a nurse meets the standard by:

- "evaluating" her/his competence and deciding whether to ask a colleague to double-check a prepared medication;
- being aware of and meeting the facility's expectations regarding double-checking preparations; and
- advocating for written expectations when the practice setting requires double-checking preparations.

Client education is an important part of ensuring safe medication use (Cohen, 1999). Clients who know what their medication is for, how it should be taken, how it works, and what it looks like are in the position to reduce the likelihood of a medication error. Client education and counselling about medications should happen at all points of their care (Cohen, 1999).

Recommendation • 14

Organizations should have a process for documentation to support nursing practice related to insulin therapy. *(Level of Evidence = IV)*

Discussion of Evidence

Nursing documentation guides practice and provides information for all members of the interdisciplinary healthcare team and assists with continuity of care. It is also an essential component of quality improvement and risk management programs (Anderson, 2000) and a tool for measuring outcomes. Separate documentation related to insulin therapy is necessary in order to readily identify patterns in blood glucose readings and make appropriate treatment choices. It promotes efficient and effective diabetes management. Documentation should identify clients' learning needs and potential barriers to knowledge and skills acquisition.

Recommendation • 15

Nursing best practice guidelines can be successfully implemented only where there are adequate planning, resources, organizational, and administrative support. Organizations may wish to develop a plan for implementation that includes:

- **An assessment of organizational readiness and barriers to education.**
- **Involvement of all members (whether in a direct or indirect supportive function) who will contribute to the implementation process.**
- **Dedication of a qualified individual to provide the support needed for the education and implementation process.**
- **Ongoing opportunities for discussion and education to reinforce the importance of best practices.**
- **Opportunities for reflection on personal and organizational experience in implementing guidelines.**

In this regard, RNAO (through a panel of nurses, researchers and administrators) has developed the *Toolkit: Implementation of Clinical Practice Guidelines*, based on available evidence, theoretical perspectives and consensus. The RNAO strongly recommends the use of this *Toolkit* for guiding the implementation of the best practice guideline on *Best Practice Guideline for the Subcutaneous Administration of Insulin in Adults with Type 2 Diabetes*.

(Level of Evidence = IV)

Discussion of Evidence

The Registered Nurses Association of Ontario (through a panel of nurses, researchers and administrators) has developed the *Toolkit: Implementation of Clinical Practice Guidelines* (RNAO, 2002b), based on available evidence, theoretical perspectives and consensus. The *Toolkit* is recommended for guiding the implementation of the RNAO *Best Practice Guideline for the Subcutaneous Administration of Insulin in Adults with Type 2 Diabetes*. Successful implementation of best practice guidelines requires the use of a structured, systematic planning process and strong leadership from nurses who are able to transform the evidence-based recommendations into policies and procedures that impact on practice within the organization. The RNAO *Toolkit* (2002b) provides a structured model for implementing practice change. Please refer to Appendix Q for a description of the *Toolkit*.

Evaluation & Monitoring of Guideline

Organizations implementing the recommendations in this nursing best practice guideline are recommended to consider how the implementation and its impact will be monitored and evaluated. The following table, based on a framework outlined in the *RNAO Toolkit: Implementation of Clinical Practice Guidelines* (2002b), illustrates some indicators for monitoring and evaluation:

Level of Indicator	Structure	Process	Outcome
Objectives	To evaluate the supports available in the organization that allow for nurses to safely deliver diabetes care management.	To evaluate the changes in practice that lead towards safe administration of insulin.	To evaluate the impact of implementation of the recommendations.
Organization/Unit	• Presence of relevant policies and procedures. • Number and type of learning opportunities. • Resources for nurses. • Existence of appropriate cross-sectoral committees/networks. • Identification and provision of appropriate funds/personnel to support implementation and maintenance of practice change. • Availability of pre-printed forms to assist with documentation of assessment, intervention, evaluation of nursing interventions related to insulin therapy. • Availability of appropriate, accessible client teaching resources for nurses.	• Participation rates in: learning opportunities, committees, etc. • A process is in place to support cross-sectoral referral for ongoing client education.	• Staff satisfaction with the process/support provided. • Medication error/client incident rates (e.g., preventable hypoglycemia). • Impact of insulin therapy on length of stay/# visits or duration of visits (also for costing section).
Nurse		• Appropriate documentation of nursing interventions, client responses. • Teaching rates for eligible clients. • Awareness of and compliance with, relevant policies and procedures. • Documentation of appropriate treatment of hypoglycemia. • Referral rates to diabetes education programs.	• Changes in nurses' knowledge related to insulin therapy, community resources. • Changes in nurses' attitudes and beliefs about their role related to insulin therapy. • Changes in self-efficacy related to teaching clients with diabetes about insulin therapy. • Proportion of nurses engaged in teaching. • Preventable hypoglycemia rates. • Appropriate hypoglycemia treatment.

Level of Indicator	Structure	Process	Outcome
Client	• Barriers to access for required supplies (medications, meters and test strips, sharps containers, syringes, pens, etc).	• Rate of maintenance of insulin therapy post-discharge. • Attendance rates at follow-up or referred appointments. • Rates of self-monitoring of blood glucose.	• Demonstration of safe insulin administration technique. • Knowledge of key elements required for safe insulin therapy. • Knowledge of community resources. • Self-efficacy related to diabetes self-care. • Health beliefs about the importance of insulin therapy. • Satisfaction with treatment. • Satisfaction with education. • Quality of life.
Financial Costs	• Provision of adequate financial and human resourses for guideline implementation.	• Ability to pay for supplies. • Insurance utilization. • Costs of attendance at follow-up, continuing education (direct and indirect). • Changes in utilization of health services (MD visits, clinical visits, hospital).	• Change in supply costs (glucose tablets, syringes, insulin usage, test strips, glucagon). • Costs of client education materials (development, production, acquisition). • Costs of initial education, ongoing support. • Costs of monitoring practice.

An evaluation focusing on reviewing existing evaluation measures, identifying gaps and developing new tools has been designed to support the monitoring of the implementation of guideline recommendations. These tools will be published on the RNAO website at www.rnao.org/bestpractices as they become available.

Implementation Tips

The Registered Nurses Association of Ontario, and the guideline development panel have compiled a list of implementation tips to assist healthcare organizations or healthcare disciplines who are interested in implementing this guideline. A summary of these strategies follows:

- Have a dedicated person such as an advanced practice nurse or a clinical resource nurse who will provide support, clinical expertise and leadership. The individual should also have good interpersonal, facilitation and project management skills.

- Establish a steering committee comprised of key stakeholders and members who are committed to leading the initiative. Keep a work plan to track activities, responsibilities, and timelines.

- Provide educational sessions and ongoing support for implementation. The education sessions may consist of Power Point presentations, facilitator's guide, handouts, and case studies. Binders, posters and pocket cards may be used as ongoing reminders of the training. Plan education sessions that are interactive, include problem solving, address issues of immediate concern and offer opportunities to practice new skills (Davies & Edwards, 2004).

- Provide organizational support such as having the structures in place to facilitate the implementation. For example, hiring replacement staff so participants will not be distracted by concerns about work and having an organizational policy that reflects the value of best practices through policies and procedures. Develop new assessment and documentation tools (Davies & Edwards, 2004).

- Identify and support designated best practice champions on each unit to promote and support implementation. Celebrate milestones and achievements, acknowledging work well done (Davies & Edwards, 2004).

In addition to the tips mentioned above, the RNAO has developed resources that are available on the website. A *Toolkit* for implementing guidelines can be helpful if used appropriately. A brief description about this *Toolkit* can be found in Appendix Q. A full version of the document in pdf format is also available at the RNAO website, www.rnao.org/bestpractices.

Process for Update / Review of Guideline

The Registered Nurses Association of Ontario proposes to update the Best Practice Guidelines as follows:

1. Each nursing best practice guideline will be reviewed by a team of specialists (Review Team) in the topic area every three years following the last set of revisions.

2. During the three-year period between development and revision, RNAO Nursing Best Practice Guidelines project staff will regularly monitor for new systematic reviews and randomized controlled trials (RCTs) in the field.

3. Based on the results of the monitor, project staff will recommend an earlier revision period. Appropriate consultation with a team of members comprised of original panel members and other specialists in the field will help inform the decision to review and revise the BPG earlier than the three-year milestone.

4. Three months prior to the three year review milestone, the project staff will commence the planning of the review process by:
    a) Inviting specialists in the field to participate in the Review team. The Review Team will be comprised of members from the original panel as well as other recommended specialists.
    b) Compiling feedback received, questions encountered during the dissemination phase as well as other comments and experiences of implementation sites.
    c) Compiling new clinical practice guidelines in the field, systematic reviews, meta-analysis papers, technical reviews and randomized controlled trial research, and other relevant literature.
    d) Developing detailed work plan with target dates and deliverables.

The revised BPG will undergo dissemination based on established structures and processes.

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Appendix A: Search Strategy for Existing Evidence

STEP 1 – Database Search

A database search for existing guidelines was conducted by a university health sciences library. An initial search of the MEDLINE, Embase and CINAHL databases for guidelines and articles published from January 1, 1995 to December 2002 was conducted using the following search terms: "type 2 diabetes", "diabetes self-care education", "insulin initiation", "self-care", "self management", "systematic reviews", "practice guideline(s)", "clinical practice guideline(s)", "standards", "consensus statement(s)", "consensus", "evidence-based guidelines" and "best practice guidelines".

STEP 2 – Structured Website Search

One individual searched an established list of websites for content related to the topic area. This list of sites, reviewed and updated in October 2002, was compiled based on existing knowledge of evidence-based practice websites, known guideline developers, and recommendations from the literature. Presence or absence of guidelines was noted for each site searched as well as date searched. The websites at times did not house a guideline but directed to another website or source for guideline retrieval. Guidelines were either downloaded if full versions were available or were ordered by phone/e-mail.

- Agency for Healthcare Research and Quality: http://www.ahcpr.gov
- Alberta Heritage Foundation for Medical Research – Health Technology Assessment: http://www.ahfmr.ab.ca//hta
- Alberta Medical Association – Clinical Practice Guidelines: http://www.albertadoctors.org
- American College of Chest Physicians: http://www.chestnet.org/guidelines
- American Medical Association: http://www.ama-assn.org
- British Medical Journal – Clinical Evidence: http://www.clinicalevidence.com
- Canadian Coordinating Office for Health Technology Assessment: http://www.ccohta.ca
- Canadian Task Force on Preventive Healthcare: http://www.ctfphc.org
- Centers for Disease Control and Prevention: http://www.cdc.gov
- Centre for Evidence-Based Mental Health: http://www.cebmh.com
- Centre for Evidence-Based Pharmacotherapy: http://www.aston.ac.uk/lhs/teaching/pharmacy/cebp
- Centre for Health Evidence: http://www.cche.net/che/home.asp
- Centre for Health Services and Policy Research: http://www.chspr.ubc.ca

- Clinical Resource Efficiency Support Team (CREST): http://www.crestni.org.uk
- CMA Infobase: Clinical Practice Guidelines: http://mdm.ca/cpgsnew/cpgs/index.asp
- Cochrane Database of Systematic Reviews: http://www.update-software.com/cochrane
- Database of Abstracts of Reviews of Effectiveness: http://nhscrd.york.ac.uk/darehp.htm
- Evidence-Based On-Call: http://www.eboncall.org
- Government of British Columbia – Ministry of Health Services: http://www.hlth.gov.bc.ca/msp/protoguides/index.html
- Institute for Clinical Systems Improvement: http://www.icsi.org/index.asp
- Institute of Child Health: http://www.ich.ucl.ac.uk/ich
- Joanna Briggs Institute: http://www.joannabriggs.edu.au/about/home.php
- Medic8.com: http://www.medic8.com/ClinicalGuidelines.htm
- Medscape Women's Health: http://www.medscape.com/womenshealthhome
- Monash University Centre for Clinical Effectiveness: http://www.med.monash.edu.au/healthservices/cce/evidence
- National Guideline Clearinghouse: http://www.guidelines.gov
- National Institute for Clinical Excellence: http://www.nice.org.uk
- National Library of Medicine Health Services/Technology Assessment: http://hstat.nlm.nih.gov/hq/Hquest/screen/HquestHome/s/64139
- Netting the Evidence: A ScHARR Introduction to Evidence-Based Practice on the Internet: http://www.shef.ac.uk/scharr/ir/netting
- New Zealand Guidelines Group (NZGG): http://www.nzgg.org.nz
- NHS Centre for Reviews and Dissemination: http://www.york.ac.uk/inst/crd
- NHS Nursing & Midwifery Practice Development Unit: http://www.nmpdu.org
- NHS R & D Health Technology Assessment Programme: http://www.hta.nhsweb.nhs.uk/htapubs.htm
- PEDro: The Physiotherapy Evidence Database: http://www.pedro.fhs.usyd.edu.au/index.html
- Queen's University at Kingston: http://post.queensu.ca/~bhc/gim/cpgs.html
- Royal College of General Practitioners: http://www.rcgp.org.uk
- Royal College of Nursing: http://www.rcn.org.uk/index.php
- Royal College of Physicians: http://www.rcplondon.ac.uk
- Sarah Cole Hirsch Institute: http://fpb.cwru.edu/HirshInstitute
- Scottish Intercollegiate Guidelines Network (SIGN): http://www.sign.ac.uk
- Society of Obstetricians and Gynecologists of Canada Clinical Practice Guidelines: http://www.sogc.medical.org/sogcnet/index_e.shtml
- The Canadian Cochrane Network and Centre: http://cochrane.mcmaster.ca
- The Qualitative Report: http://www.nova.edu/ssss/QR

- Trent Research Information Access Gateway: http://www.shef.ac.uk/scharr/triage/TRIAGEindex.htm
- TRIP Database: http://www.tripdatabase.com
- U.S. Preventive Service Task Force: http://www.ahrq.gov/clinic/uspstfix.htm
- University of California, San Francisco: http://medicine.ucsf.edu/resources/guidelines/index.html
- University of Laval – Directory of Clinical Information Websites: http://132.203.128.28/medecine
- University of York – Centre for Evidence-Based Nursing: http://www.york.ac.uk/health-sciences/centres/evidence/cebn.htm

STEP 3 – Search Engine Web Search

A website search for existing diabetes guidelines was conducted via the search engine "Google", using the search terms identified above. One individual conducted this search, noting the search term results, the websites reviewed, date and a summary of the findings. The search results were further critiqued by a second individual who identified guidelines and literature not previously retrieved.

STEP 4 – Hand Search/Panel Contributions

Additionally, panel members were already in possession of a few of the identified guidelines. In some instances, a guideline was identified by panel members and not found through the previous search strategies. These were guidelines that were developed by local groups or specific professional associations.

STEP 5 – Core Screening Criteria

This above search method revealed nine guidelines, and numerous studies related to diabetes.

The final step in determining whether the clinical practice guideline would be critically appraised was to have two individuals screen the guidelines based on the following criteria. These criteria were determined by panel consensus:

- Guideline was in English, international in scope.
- Guideline dated no earlier than 1998.
- Guideline was strictly about the topic area.
- Guideline was evidence-based, e.g. contained references, description of evidence, sources of evidence.
- Guideline was available and accessible for retrieval.

Results of the search strategy

The results of the search strategy and the decision to critically appraise identified guidelines are detailed below. Four guidelines met the screening criteria and were critically appraised using the *Appraisal of Guidelines for Research and Evaluation* (2001) instrument.

TITLE OF THE PRACTICE GUIDELINES CRITICALLY APPRAISED

American Diabetes Association (2003a). American Diabetes Association: Clinical practice recommendations 2003. *Diabetes Care, 26,* (Suppl), S1-S156.

Meltzer, S., Leiter, L., Daneman, D., Gerstein, H. C., Lau, D., Ludwig, S. et al. (1998). 1998 clinical practice guidelines for the management of diabetes in Canada. Canadian Medical Association Journal. [On-line]. Available: www.cmaj.ca/cgi/data/159/8/DC1/1

Wolever, T., Barbeau, M. C., Charron, S., Harrigan, K., Leung, S., Madrick, B. et al. (1998). Guidelines for the nutritional management of diabetes mellitus in the new millennium: A position statement by the Canadian Diabetes Association. *Canadian Journal of Diabetes Care, 23*(3), 56-69.

Yale, J. F., Begg, I., Gerstein, H., Houlden, R., Jones, H., Maheux, P. et al. (2002). 2001 Canadian Diabetes Association clinical practice guidelines for the prevention and management of hypoglycemia in diabetes. *Canadian Journal of Diabetes, 26*, 22-35. [On-line]. Available: www.diabetes.ca/Files/CDAHypoglycemiaGuidelines.pdf

Appendix B: Glossary of Terms

A1C: (formerly referred to as **Glycosylated Hemoglobin or HBA1C**)
The A1C test measures the average glycemia over the preceding 2-3 months and, thus, assesses glycemic control. When the A1C is done every 3 months, it can detect whether glycemic control has been reached and maintained within the target range and also reflects departures from the target range.

The Canadian guidelines recommend that persons with diabetes lower their A1C to ≤ 7.0%. (This corresponds to a laboratory value of 0.070.) When it can be achieved safely, without significant hypoglycemia, lowering the A1C to ≤ 6.0% should be considered.

Correlation between A1C level and plasma glucose levels (based on DCCT levels – reference range 4-6%).

A1C%	Mean plasma glucose
6	7.5 mmol/l
7	9.5
8	11.5
9	13.5
10	15.5
11	17.5
12	19.5

The target A1C should be adjusted based on the specific reference range used by the laboratory that performed the test.
Note: Children and pregnant women differ from these targets.

Arthus reactions: Inflammatory response to the deposition of antigen-antibody complexes (Fineberg, 1998).

Atopy: A form of allergy in which there is a genetic predisposition to develop hypersensitivity reactions in response to allergens (Martin & Guidos, 2000).

Bolus insulin: An extra amount of insulin taken to cover an expected rise in blood glucose, often related to a meal or snack.

Catecholamines: One of a group of similar compounds having a sympatomimetic action such as norepinephrine and epinephrine.

Cortisol: An adrenocorticoid steroid hormone which promotes gluconeogenesis.

Counter-regulatory hormones: Hormones that raise blood glucose and include glucagon, catecholamines (epinephrine and norepinephrine), cortisol and growth hormone.

Counter-regulatory response: Counter-regulatory hormones that increase in the circulation during hypoglycemia and exercise and play an important role in raising the blood glucose after hypoglycemia and preventing the occurrence of hypoglycemia during fasting and exercise.

Gestational diabetes mellitus (GDM): Defined as any degree of glucose intolerance with onset or first recognition during pregnancy (ADA, 2003a). Pregnant women who have never had diabetes before but who have elevated blood glucose levels during pregnancy are said to have gestational diabetes.

Glargine: Glargine (trade name Lantus) is a peakless long-acting insulin. Its duration is 24 hours and its use is associated with a decreased incidence of nocturnal hypoglycemia.

Glucagon: A polypeptide hormone secreted by the alpha cells of the islets of Langerhans in response to hypoglycemia or to stimulation by growth hormone of the anterior pituitary; it stimulates glycogenolysis in the liver.

An injectable form of glucagon is available as a prescription and is used to treat severe hypoglycemia. The glucagon is injected and raises blood glucose levels in 20 minutes.

Glycosylated hemoglobin (HBA1C or A1C): See A1C.

High-alert medication: Although most medications have a wide margin of safety, a few drugs have a high risk of causing injury when they are misused. These may be termed 'high-alert medication'. Although errors may not be more common with these drugs than with others, their consequences may be more devastating (Cohen & Kilo, 1999). The five high alert medications are:

- insulin
- opiates & narcotics
- injectable potassium chloride or phosphate concentrate
- intravenous anticoagulants (heparin)
- sodium chloride solutions above 0.9 percent (Grissinger & Lease, 2003).

Hypoglycemia: Defined as blood glucose of less than 4.0 mmol/L in an individual treated with insulin or an insulin secretagogue (CDA, 2003a).

Hypoglycemia unawareness: A state in which a person does not feel or recognize the symptoms of hypoglycemia. People who have frequent episodes of hypoglycemia may no longer experience the usual warning signs and the first sign of hypoglycemia may be confusion or loss of consciousness (Yale et al., 2003).

Insulin analogues: Insulins made by modifying the aminoacid sequence of the insulin molecule.

Lipoatrophy: Loss of fatty tissue, either at or distant from the injection site. It is thought to be of immunologic origin and is usually associated with the use of animal source insulin (Haire-Joshu, 1996). Can be caused by repeated insulin injections in the same area (Lantus, 2000).

Lipohypertrophy: A fatty, tumor-like growth at or around the injection site, caused by an overgrowth of fat cells that is non-immunologically mediated (Haire-Joshu, 1996). It is caused by repeated insulin injections into a single area.

Appendix C: Questions to Assess Psychosocial Concerns Related to Insulin Therapy

Identifying supports and barriers:

- What does taking insulin mean/signify to you?
- What is it that concerns or worries you most about starting insulin?
- What will make taking insulin difficult for you? What might make it easier?
- What benefits (positive effects) do you think there might be to taking insulin?
- How do you think the people closest to you will respond/react to this?
- Can you think of ways for family/friends to make it easier for you to manage your diabetes? If so, what specific change would you like them to make so that you would feel more supported? How could you tell them this?

Assessing potential depression:

- **Over the past 2 weeks, have you felt down, depressed, or hopeless?**
- **Over the past 2 weeks, have you felt little interest or pleasure in doing things you usually enjoy?**

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Aljasem, L. I., Peyrot, M., Wissow, L., & Rubin, R. (2001). The impact of barriers and self-efficacy on self-care behaviours in type 2 diabetes. *The Diabetes Educator, 27*(3), 393-404.

Appendix D: Insulin Types

Insulin Type	Onset	Peak	Duration
Rapid-acting analogue (clear) Humalog (insulin lispro) NovoRapid (insulin aspart)	10 - 15 minutes	1-1.5 hours	4 - 5 hours
Fast-acting (clear) Regular Toronto	30 - 60 minutes	2 - 4 hours	5 - 8 hours
Intermediate-acting (cloudy) NPH N Lente	1 – 3 hours	5 - 8 hours	Up to 18 hours
Long - acting (cloudy) Ultralente	3 - 4 hours	8 - 15 hours	22 - 26 hours
Extended long-acting analogue (clear) Lantus (insulin glargine) *approved, but not yet marketed in Canada	90 minutes	none	24 hours
Premixed (cloudy) A single vial contains a fixed ratio of insulin (% rapid or fast-acting to % of intermediate acting insulin)	See rapid or fast	See intermediate	

**Action times are "estimates" only. Action times depend on the individual, the injection site & the type of insulin used. There can be approximately a 45% variation in daily absorption from the same site in the same person with intermediate-acting insulin (Weiland & White, 2002).

Pre-filled syringes should be stored in the fridge, with needle tips up. They are stable for 1 month and need to be re-suspended prior to use.

Considerations	Insulin Compatibility
Client should eat within 10–15 minutes of injection. Use of pre-filled syringes of Humalog alone or Humalog with an intermediate insulin is not recommended due to blunting of effect.	Rapid-acting insulin can be mixed with N, NPH, Lente, Ultralente.
Should be given 30 - 45 minutes prior to meals.	Mixing fast-acting & Lente or Ultralente insulin is not generally recommended except for the client already experiencing adequate control on this mixture. The time between mixing & injecting should be consistent. Zinc present in the Lente/ Ultralente binds with the short-acting insulin and delays its onset of action.
Must be adequately re-suspended before injecting.	N or NPH & fast-acting insulin may be mixed & used immediately or stored, refrigerated, for future use. Pre-filled syringes should be stored in the fridge, with needle tips up. They are stable for 1 month. NPH or N **cannot** be mixed with Lente or Ultralente insulin.
Must be adequately re-suspended before injecting.	See insulin compatibility for rapid-fast-& intermediate-acting insulins
Glargine is only available in vials & is clear. Clients must be alerted to the potential danger of confusing glargine with other clear insulins (rapid or short-acting insulins). Use of pre-filled syringes is not recommended.	Due to its pH, Glargine **cannot** be mixed with any other insulin or solution
Must be adequately re-suspended before injecting. If using a rapid-acting mixture, client must eat within 15 minutes of injecting. If using a fast-acting mixture, client should eat within 30 minutes of injecting.	Should not be mixed with any other insulin

References: American Diabetes Association (2002b). American Diabetes Association: Clinical practice recommendations 2002. *Diabetes Care, 25*(suppl 1), S1-S68.

Canadian Diabetes Association (CDA) (2003a). Canadian Diabetes Association 2003 clinical practice guidelines for the prevention and management of diabetes in Canada. *Canadian Journal of Diabetes, 27(Suppl 2)*, i-S152.

Canadian Diabetes Association (CDA) (2001b). *Developing competency in diabetes education: The essentials.* Toronto, Canada: Canadian Diabetes Association.

Grajower, M., Fraser, C., Holcombe, J., Daugherty, M., Harris, W., DeFillipis, M., et al. (2003). How long should insulin be used once a vial is started? *Diabetes Care, 26*(9), 2665-2669.

Appendix E: Insulin Storage Tips

- Insulin in use is stable at room temperature for one month (check company monograph for temperature range).
- Store insulin away from direct heat and sunlight.
- Keep extra cartridges or vials of insulin in the fridge. When refrigerated, unopened insulin is good until the expiry date.
- DO NOT FREEZE INSULIN.
- Always check the expiry dates.
- Do not use your insulin if:
  - Clear insulin is not clear.
  - Cloudy insulin clumps and/or does not mix properly.

Store pre-filled syringes in the fridge, with needle tips up. They are stable for 1 month. Roll end-to-end several times prior to use to re-suspend the insulin.

Appendix F: General Guidelines for Preparation and Injection of Insulin

- Check insulin brand and expiry date.
- Clean the top of the vial with alcohol swab (if desired).
- If the insulin is cloudy, gently roll cloudy insulin to re-suspend. It should look milky.
- Remove the cover from the needle.
- Pull the plunger down until the tip of the plunger is at the line for the number of units you need. Put the needle into the vial and push the air into the vial.
- Turn the vial upside down and slowly push plunger up and down to get rid of air bubbles and then pull plunger down until you have your dose of insulin.
- Check that you have the correct amount of insulin and that there are no large air bubbles in the syringe. Remove the syringe.
- Pinch skin gently and push needle into the skin at a 90° angle. Push plunger down to inject insulin.

Appendix G: General Guidelines for Mixing Insulin in a Syringe

To mix two kinds of insulin in the same syringe

- Pull the plunger down until the tip of the plunger is at the line for the number of units you need and inject air equal to the amount of insulin you require into the cloudy vial. Pull the needle out without taking insulin out then inject air into the clear vial.
- Turn the vial of clear insulin upside down. Slowly push plunger up and down and then pull plunger down until you have your correct dose of insulin. (N.B. If insulin is being withdrawn from a cartridge, air is not to be injected into the cartridge.)
- Check that you have the correct amount of insulin and that there are no large air bubbles in the syringe. Remove the syringe.
- Carefully insert needle into vial of cloudy insulin and turn the vial upside down.
- Slowly pull the plunger down until you have the right total dose (the clear plus the cloudy). _____units + _____units = ____units
- Remove syringe
- Pinch skin up gently and push needle into the skin at a 90° angle. Push the plunger down to inject insulin.

Appendix H: Allergic Reactions to Insulin

TYPE	
Local	■ Occurs in 2-3% of clients ■ Develops within the first 2 weeks of therapy ■ Approximately 90% of people with local allergy have spontaneous resolution within 2 months while on the same therapy. An additional 5% will improve within 6-12 months ■ May be associated with lipoatrophy if injection sites are not rotated
Isolated wheal & flare Biphasic	■ Develops within 30 minutes ■ Resolves within an hour ■ The late phase of a biphasic reaction is painful and erythematous. This peaks in 4-6 hours and lasts for 24 hours.
Arthus reactions	■ Are uncommon ■ They are localized small-vessel injuries with neutrophilic infiltrates ■ Develops over 4-6 hours and peaks in 12 hours
Delayed (tuberculinlike)	■ A nodule or "deep hive" develops in 8-12 hours and peaks in 24 hours **Treatment** ■ Oral or topical antihistamines ■ Switch insulin brand or type
Systemic	■ Very rare, but are more common in people with histories of atopy and/or intermittent insulin therapy
Urticaria to anaphylaxis	■ Anti-insulin IgG and IgE levels are significantly elevated ■ Occurs immediately **Treatment** ■ Anaphylaxis protocol ■ Insulin desensitization program
Insulin–antibody mediated Insulin Resistance	■ Extremely rare ■ Insulin molecule induces immunologic complications ■ Use of beef-containing insulins before the initiation resistance is usually always noted ■ Presence of these antibodies may increase insulin dose or alter insulin absorption **Treatment** ■ Use of steroid therapy ■ Use of U-500 insulin

Modified from: Fineberg, S. E. (1998). Therapy for diabetes mellitus and related disorders. In H. Lebovitz (Ed.), *Insulin Allergy and Insulin Resistance* (pp. 252-259). Alexandria, D.C.: American Diabetes Association.

Appendix I: Questions to Ask When Buying a Blood Glucose Meter

1) Ease of Use

- Can I perform a test?
- Am I able to see where to place blood sample?
- Can I read numbers on display?
- Am I able to open bottle of strips/foil packages?

2) Cost (Initial and ongoing)

- Does my private insurance cover the cost?
- Am I a candidate for financial assistance (e.g., drug benefits, meter, strips, lancets)?

3) Instruction should include:

- How to use lancing device?
- How to obtain correct blood sample?
- How to record blood glucose results?
- How to use memory, coding, cleaning, battery insertion?
- How to contact the company for technical problems?
  (Note: all meter companies have a toll free [1-800] numbers)
- Explanation of warranty in regard to meter.
- Current or upcoming meter promotions in the pharmacy.

4) Extra features:

_____

_____

_____

_____

_____

Appendix J: Just the Basics – Tips for Healthy Eating, Diabetes Management and Prevention

JUST THE BASICS

Tips for Healthy Eating, Diabetes Management and Prevention

Diabetes is a condition in which your body cannot properly store and use food for energy. The fuel that your body needs is called glucose, a form of sugar. Glucose comes from foods such as fruit, milk, some vegetables, starchy foods and sugar.

To control your blood glucose you will need to eat healthy foods, be active and you may need to take pills and/or insulin.

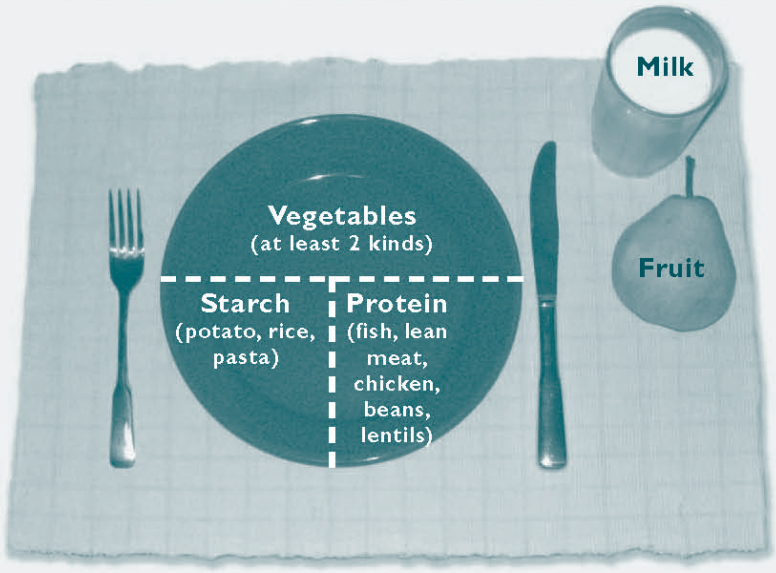
Here are some tips to help you until you see a registered dietitian.

TIPS	REASONS
1. Eat three meals per day at regular times and space meals no more than six hours apart. You may benefit from a healthy snack.	Eating at regular times helps your body control blood glucose levels.
2. Limit sugars and sweets such as sugar, regular pop, desserts, candies, jam and honey.	The more sugar you eat, the higher your blood glucose will be. Artificial sweeteners can be useful.
3. Limit the amount of high fat food you eat such as fried foods, chips and pastries.	High fat foods may cause you to gain weight. A healthy weight helps with blood glucose control and is healthier for your heart.
4. Eat more high fibre foods (whole grain breads and cereals, lentils, dried beans and peas, brown rice, fruits and vegetables).	Foods high in fibre may help you feel full and may lower blood glucose and cholesterol levels.
5. If you are thirsty, drink water.	Drinking regular pop and fruit juice will raise your blood glucose.
6. Add physical activity to your life.	Regular physical activity will improve your blood glucose control.

Know who to turn to

CANADIAN DIABETES ASSOCIATION | ASSOCIATION CANADIENNE DU DIABÈTE

To help you plan for healthy eating



- Eat more vegetables. These are very high in nutrients and low in calories.
- Choose starchy foods such as whole grain breads and cereals, rice, noodles, or potatoes at every meal. Starchy foods are broken down into glucose that your body needs for energy.
- Include fish, lean meats, low fat cheeses, eggs, or vegetarian protein choices as part of your meal.
- Have a glass of milk and a piece of fruit to complete your meal.
- Alcohol can affect blood glucose levels and cause you to gain weight. Talk to your healthcare professional about whether you can include alcohol in your meal plan and how much is safe.

It's natural to have questions about what food to eat. A registered dietitian can help you include your favourite foods in a personalized meal plan.

CANADIAN DIABETES ASSOCIATION FOOD CHOICE VALUES AND SYMBOLS

You may see these symbols on food packages or recipes. These symbols represent groupings of foods based mainly on their carbohydrate content. These symbols on food packages are not an endorsement by the Association.

STARCH FOODS
(whole grain breads, cereals, pasta, corn, rice, potato etc.)

FRUITS & VEGETABLES
(oranges, bananas, carrots, peas, etc.)

MILK
(plain yogurt, milk, etc.)

SUGARS
(jam, sugar, popsicle, etc.)

PROTEIN FOODS
(lean meats, poultry, fish, eggs, low fat cheese etc.)

FATS & OILS
(oil, margarine, butter, salad dressing, bacon, etc.)

EXTRAS
(vegetables such as lettuce, celery, herbs and spices, diet beverages, etc.)

JUST THE BASICS

Tips for Healthy Eating, Diabetes Management and Prevention

- The Canadian Diabetes Association recommends that all people with diabetes should receive advice on nutrition from a registered dietitian.
- Good management of diabetes includes healthy eating, staying active and taking required medication.
- Be sure to eat breakfast. It provides a good start to the day.

To increase your physical activity. . .

- build time for physical activity into your daily routine,
- try to be active most days of the week,
- walk whenever you can, instead of taking the car,
- start slowly and gradually increase the amount of effort; for instance progress from strolling to brisk walking,
- make family activities active; try swimming or skating instead of watching TV or a movie,
- try new activities; learn to dance, play basketball, or ride a bike,
- enjoy your improved sense of health and wellbeing.

SAMPLE MEAL PLANS

You may find it helpful to use a measuring cup at first to be sure your serving sizes are correct.

FOR SMALLER APPETITES

Breakfast:

Cereal (½ cup, 125 ml)
Toast (1 slice)
1 Orange
Milk (1 cup, 250 ml)
Peanut butter (1 tbsp, 15 ml)
Tea or coffee

Lunch:

1 Sandwich
- 2 slices of whole grain bread or 6" pita
- meat, chicken or fish (2 oz, 60 g)
- margarine or mayonnaise (1 tsp, 5 ml)

Carrot sticks, 10 small
Fruit yogurt (½ cup, 125 ml)
Tea or coffee

Dinner:

Potato (1 medium) or rice (⅔ cup, 150 ml)
Vegetables
Margarine or butter (1 tsp, 5 ml)
Lean meat, chicken, or fish (2 oz, 60 g)
¼ Cantaloupe
Milk (1 cup, 250 ml)
Tea or coffee

Evening Snack:

Low fat cheese (1oz, 30 g)
Soda crackers (6)

To help you manage or prevent diabetes

To follow a healthy lifestyle . . .

- have at least 3 out of the 4 key food groups at each meal:
  - starch foods
  - fruits & vegetables
  - protein foods
  - milk
- have portion sizes that will help you reach or maintain a healthy body weight;
- include high fibre foods such as whole grain breads and cereals, fresh fruits, vegetables and legumes, and grains (e.g. pasta, rice);
- make lower fat choices (e.g. use skim milk, lean ground beef, trim fat on meat, chicken etc., and use small amounts of added fat such as butter and salad dressings);
- healthy eating habits should be built around a healthy lifestyle – keep active every day.

FOR BIGGER APPETITES

Breakfast:

Cereal (½ cup, 125 ml)
Toast (2 slices) or 1 small bagel
1 Orange
Milk (1 cup, 250 ml)
Peanut butter (2 tbsp, 30 ml)
Tea or coffee

Lunch:

Soup (1 cup, 250 ml)
Sandwich
- 2 slices whole grain bread or 6" pita
- lean meat, chicken or fish (3 oz, 90 g)
- tomato slices
- margarine or mayonnaise (1 tsp, 5 ml)

Carrot sticks, 10 small
Fruit yogurt (½ cup, 125 ml)
Tea or coffee

Afternoon Snack:

1 Medium apple or banana

Dinner:

1 Large potato or cooked noodles (1½ cup, 375 ml)
Vegetables
Margarine or butter (1 tsp, 5 ml)
Green salad with lemon juice
Lean meat, chicken or fish (4 oz, 120 g)
1 Pear
Milk (1 cup, 250 ml)
Tea or coffee

Evening Snack:

Low fat cheese (2 oz, 60 g)
Melba toast (4)
Milk (1 cup, 250 ml)

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Know who to turn to

CANADIAN DIABETES ASSOCIATION | ASSOCIATION CANADIENNE DU DIABÈTE

Reference: Canadian Diabetes Association (2003a). Canadian Diabetes Association 2003 clinical practice guidelines for the prevention and management of diabetes in Canada. *Canadian Journal of Diabetes, 27*(Suppl 2), i-S152.

Appendix K: Starting a Client on Insulin? The Answers to Frequently Asked Questions

1) What are carbohydrates?

Carbohydrates are the body's major source of energy. Dietary sources of carbohydrates are sugars (fruit, some vegetables, milk, added sugars) and starches (breads, grains, cereals). Carbohydrates raise blood glucose levels after meals.

2) Can I still eat sugar?

It is important to clarify what the word sugar means to the client. "Sweet" foods and drinks like regular pop, juice, candy, cakes, etc., should be limited until a registered dietitian can be consulted.

3) Should I eat differently now that I am on insulin?

It is important that the client consult a registered dietitian as soon as possible to assess individual nutrition needs, but until that time there are a few things the client can do to ensure healthy blood glucose levels are maintained:

- Eat meals at regular times, no more than 6 hours apart. Three meals a day is usually recommended. Snacks are sometimes included depending on the individual's activity level and needs.
- Include carbohydrate-containing foods in each meal.
- Choose lower fat foods and high fibre foods more often.

4) Do I need to have a bedtime snack now that I am on insulin?

The need for a bedtime snack is individual and is dependent on:

- the type of insulin,
- timing and quantity of meals,
- activity level,
- time of sleep, and
- blood glucose level.

Consult a diabetes educator to determine individual needs. The client should have a bedtime snack if at risk for low blood glucose during the night. However, adjusting the insulin dose may be preferable for preventing nocturnal hypoglycemia rather than eating additional food for some individuals.

5) Can I still drink alcohol?

When the liver is processing alcohol it is not able to provide glucose to the blood when needed. Make sure that blood glucose is tested often. Remember that hypoglycemia can happen many hours after drinking and increases the risk of severe hypoglycemia.

Here are some guidelines to follow to prevent hypoglycemia when drinking alcoholic beverages:

- Moderation: limit to 1-2 drinks a day.
- Never drink on an empty stomach. Eat carbohydrate-containing foods when drinking.
- Never omit food to substitute for extra alcohol calories.
- Avoid liqueurs and mixes.
- Try to eat meals and snacks at regular times.
- Wear Medical identification and drink with friends who are aware of your risk for hypoglycemia and what to do if hypoglycemia occurs.
- Have a source of quick sugar on hand to treat hypoglycemia immediately.

6) Can I still sleep in?

A delay of approximately 1 hour should not be a problem in the morning routine. Generally, taking insulin within 1 hour of the usual time should not pose too much difficulty. It is best to eat or drink a carbohydrate-containing breakfast and have the scheduled medications within 1 hour of the individual's regular routine. The person may then return to bed.

References:

American Diabetes Association (2003b). Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications. *Diabetes Care, 26*, S51-S61.

Funnell, M. M., Hunt, C., Kulkarni, K., Rubin, R., & Yarborough, P. C. (1998). *A Core Curriculum for Diabetes Education.* (3rd ed). Chicago, Illinois: American Association of Diabetes Educators.

Meltzer, S., Leiter, L., Daneman, D., Gerstein, H. C., Lau, D., Ludwig, S. et al. (1998). 1998 clinical practice guidelines for the management of diabetes in Canada. Canadian Medical Association Journal. [On-line]. Available: www.cmaj.ca/cgi/data/159/8/DC1/1

Wolever, T., Barbeau, M. C., Charron, S., Harrigan, K., Leung, S., Madrick, B. et al. (1998). Guidelines for the nutritional management of diabetes mellitus in the new millennium: A position statement by the Canadian Diabetes Association. *Canadian Journal of Diabetes Care, 23*(3), 56-69.

Appendix L: Guidelines for Nurses on How to Manage Hypoglycemia

Mild and Moderate Lows (<4.0 mmol/L)	Severe Lows (<2.8 mmol/L or unable to swallow)
Individual is able to self-test and treat low blood glucose.	A support person is needed to help the individual treat hypoglycemia (in the community, call emergency personnel).
Test blood glucose level	Test blood glucose level
Treat with 15 g of fast-acting carbohydrate such as: ■ 5 dextrose tablets (3 g each)*, or ■ 3 glucose tablets (5 g each)*, or ■ 3/4 cup (175 ml) regular pop, or ■ 3/4 cup juice, or ■ 3 teaspoons sugar or honey, or ■ 6 lifesavers	If conscious and able to swallow, treat with 20 g fast-acting carbohydrate: ■ 7 dextrose tablets (3 g each)*, or ■ 4 glucose tablets (5 g each)*, or ■ 1 cup (250 ml) of regular pop, or ■ 1 cup (250 mL) juice, or ■ 4 teaspoons of sugar or honey, or ■ 8 lifesavers
If NPO or unable to swallow, an order for IV Dextrose or Glucagon should be obtained**.	If unconscious, NPO or unable to swallow, give 1 mg. Glucagon injection IM, or IV dextrose 20 to 50 ml $D_{50}W$ **.
Repeat blood glucose test again in 15 minutes. Treat again with another 15 g fast-acting carbohydrate if blood glucose remains less than 4.0 mmol/L.	Repeat blood glucose test again in 15 minutes. Treat again with 15 g fast-acting carbohydrate if blood glucose remains less than 4.0 mmol/L. Keep checking every 2 hours until glucose is stable. If glucagon has been used, follow with carbohydrate as soon as the individual is able to swallow.
If the next meal is more than 60 minutes away, have a snack of 15 g of a starch and include a protein source. For example: 1/2cheese sandwich.	If the next meal is more than 60 minutes away, provide a snack of 15 g of starch and a protein source. For example: 1/2cheese sandwich.

* Treatment required for hypoglycemia if on Prandase
**An order should be obtained in advance for all clients treated with insulin

Canadian Diabetes Association (2003a). Canadian Diabetes Association 2003 clinical practice guidelines for the prevention and management of diabetes in Canada. *Canadian Journal of Diabetics, 27* (Suppl 2), S43-S45.
Adapted with permission from Canadian Journal of Diabetes. 2003; 27 (Suppl 2): S43-S45.

Appendix M: Instructions for Clients on How to Treat Low Blood Glucose (Hypoglycemia) Less than 4.0 mmol/L

Step 1 If able, test blood glucose and record the results

Step 2 Have one of the following selections:

Mild to moderate low blood glucose Less than 4.0 mmol/L	Severe low blood glucose Less than 2.8 mmol/L
15 g Carbohydrate	**20 g Carbohydrate**
5 dextrose tablets or 3 glucose tablets	7 dextrose tablets or 4 glucose tablets
3/4 cup (175 ml) regular pop or juice	1 cup (250 ml) regular pop or unsweetened juice
6 lifesavers	8 lifesavers
3 teaspoons honey	4 teaspoons honey

Glucose/dextrose tablets must be used if you take Prandase (Acarbose)

Step 3 Wait 15 minutes. Test blood glucose again. If it is still under 4.0 mmol/L, take 15 g of fast-acting carbohydrate. Repeat Step 3 every 15 minutes, as necessary.

Step 4 If the next meal or snack is more than 1 hour away, or if planning to be active, eat a snack such as 1/2 sandwich **or** cheese and 6 crackers.

Step 5 Think about a possible reason for low blood glucose and how to possibly prevent this in the future.

Reprinted with permission from the Diabetes Centre – Nipissing District.

Reference: 2001 Clinical Practice Guidelines for the Prevention and Management of Hypoglycemia in Diabetes.

Appendix N: Activity Tips

- Self-monitor blood glucose prior, during and after exercise to identify effects on blood glucose and document hypoglycemia
- Wear identification bracelet/shoe tag
- When possible exercise at a consistent time of day
- Include warm up and adequate cooling down period
- Ensure adequate hydration
- Ensure that an exercise partner knows the signs, symptoms and treatment for low blood glucose
- Carry fast-acting carbohydrate

Proper foot care

- Wear appropriate shoes
- Inspect feet for blisters and calluses

Reference: Chipkin, S. R., Klugh, S. A., & Chasan-Taber, L. (2001). Exercise and diabetes. *Cardiology Clinics, 19,* 489-505.

Appendix O: Dealing with Sick Days for People with Type 2 Diabetes

When you are sick, blood glucose levels can change. Having a plan for sick days can help you keep your blood glucose controlled and prevent hospitalization. The following guidelines may help you if you have a fever, vomiting, nausea, diarrhea, cold, or other infection .

1. Monitor Blood Glucose

   It is recommended that you test your blood glucose at least every 4 to 8 hours.

2. Take Diabetes Medications

   It is usually recommended to continue taking your diabetes pills or insulin.
   Often blood glucose rises during stress such as illness, but occasionally low blood sugars can occur.
   Your usual dose of diabetes pills or insulin may need to be adjusted.
   Check with your healthcare provider.

3. Follow Meal Plan

   Try to follow your meal plan if possible. If unable to tolerate solid foods, take carbohydrate in liquid form. However, if unable to eat meals, try nibbling or sipping on a food choice that contains carbohydrate every hour while awake. This will help keep your blood glucose from going too low.

Examples of foods and liquids containing 15 g of carbohydrate include:

3/4 cup regular soft drink/pop	3/4 cup applesauce
1/2 cup sugar sweetened Kool-Aid®	6 soda crackers
3/4 cup orange juice	1 slice toast
1 1/2 Popsicles (1 1/2 stick)	2 digestive cookies
1/4 cup regular Jello®	1/3 cup sherbet
1/3 cup grape juice	1/2 cup vanilla ice cream
1/2 can of Glucerna®	

4. Keep Drinking

Drinking liquids is very important, especially if you are losing fluids due to fever, vomiting, or diarrhea. Let your blood glucose be your guide to choosing liquids. If your blood glucose is low, drink sugar-containing liquids like regular pop, milk or fruit juices. If your blood glucose is elevated, drink sugar-free liquids, such as water, diet pop, clear soups, or sugar-free Jello ®.

5. Call your doctor or healthcare team if:

- You've been sick for two days and aren't getting better
- You've vomited more than once in 4 hours or have had diarrhea for more than 6 hours
- Your blood glucose stays over 14.0 mmol/L
- You have chest pain, trouble breathing, breath that smells fruity, or dry and cracked lips
- You are unable to tolerate liquids
- You aren't sure what to do

Adapted with permission from *Sick Days for People with Type 2 Diabetes*. (Bayer Inc., Diagnostics Division, Toronto. www.Ascensia.ca, 1-800-268-7200)

Appendix P: Resources for Diabetes Information

The following websites provide information on diabetes. These are sample resources only, and are not intended to be a comprehensive listing.

Diabetes Information

Canadian Diabetes Association - www.diabetes.ca
American Diabetes Association - www.diabetes.org
for Latinos - www.diabetes.org/DAR
for African Americans - www.diabetes.org/africanamerican
or Native Americans - www.diabetes.org/awakening
Joslin Diabetes Centre – www.joslin.harvard.edu
International Diabetes Center – www.idicdiabetes.org
International Diabetes Federation – www.idf.org
Diabetes Mall – www.diabetesnet.com
Diabetes 123 – www.diabetes123.com
Diabetes Self-Management – www.DiabetesSelfManagement.com

Equipment

BD Diabetes.com – www.bddiabetes.com
Abbott Laboratories – www.abbott.com

Exercise

Diabetes, Exercise, and Sports Association (DESA) – www.diabetes-exercise.org

Hypoglycemia

University of Virginia Health System – www.hsc.virginia.edu/medcntr/centers/bmc/bgat/

Insulin

Novo Nordisk – www.novonordisk.com
Eli Lilly Canada Inc. – www.lilly.ca
Health Canada – www.hc-sc.gc.ca/english/iyh/insulins.html
Lantus – www.lantusconnection.com

Monitoring

Ascensia Health Support Program from Bayer – www.ascensia.ca
Medtronic Mimimed – www.minimed.com
Glucowatch – www.glucowatch.com
Therasence – www.therasense.com
One Touch – www.onetouch.ca
Roche – www.roche.com

Nutrition

Dietitians of Canada – www.dietitians.ca
Health Canada – www.hc-sc.gc.ca
Canadian Health Network – www.canadian-health-network.ca
Women's Health Matters – www.womenshealthmatters.ca
Becel Heart Health Information Bureau –www.becelcanada.com
Heart and Stroke Foundation of Canada – www.hsf.ca
Dial-a-Dietitian – www.dialadietitian.org
Calorieking.com – www.calorieking.com
World Health Organization – www.who.ch
American Dietetic Association/Diabetes Care & Education - www.eatright.org
National Institute of Nutrition – www.nin.ca
Centre for Science in the Public Interest - www.cspinet.org/canada/
USDA Nutrient Data Laboratory – www.nal.usda.gov/fnic/cgi-bin/nut-search.pl

Pharmaceutical

Epocrates – www.epocrates.com

Statistics

Institute for Clinical Evaluative Sciences – www.ices.on.ca

Appendix Q: Description of the Toolkit

Toolkit: Implementing Clinical Practice Guidelines

Best practice guidelines can only be successfully implemented if there are: adequate planning, resources, organizational and administrative support as well as appropriate facilitation. RNAO, through a panel of nurses, researchers and administrators has developed the *Toolkit: Implementation of Clinical Practice Guidelines* based on available evidence, theoretical perspectives and consensus. The *Toolkit* is recommended for guiding the implementation of any clinical practice guideline in a healthcare organization.

The *Toolkit* provides step-by-step directions to individuals and groups involved in planning, coordinating, and facilitating the guideline implementation. Specifically, the *Toolkit* addresses the following key steps in implementing a guideline:

1. Identifying a well-developed, evidence-based clinical practice guideline
2. Identification, assessment and engagement of stakeholders
3. Assessment of environmental readiness for guideline implementation
4. Identifying and planning evidence-based implementation strategies
5. Planning and implementing evaluation
6. Identifying and securing required resources for implementation

Implementing guidelines in practice that result in successful practice changes and positive clinical impact is a complex undertaking. The *Toolkit* is one key resource for managing this process.

The *Toolkit* is available through the Registered Nurses Association of Ontario. The document is available in a bound format for a nominal fee, and is also available free of charge from the RNAO website. For more information, an order form or to download the *Toolkit*, please visit the RNAO website at *www.rnao.org/bestpractices*.

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Best Practice Guideline

FOR THE SUBCUTANEOUS ADMINISTRATION OF INSULIN IN ADULTS WITH TYPE 2 DIABETES

Guideline supplement

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Supplement Integration

Similar to the original guideline publication, this document needs to be reviewed and applied, based on the specific needs of the organization or practice setting/environment, as well as the needs and wishes of the client. This supplement should be used in conjunction with the guideline as a tool to assist in decision making for individualized client care, as well as ensuring that appropriate structures and supports are in place to provide the best possible care.

Background

Approximately 1.9 million Canadians have diabetes. In 2005/2006, the National Diabetes Survey System identified that one in 17 Canadians (5.5% of all women and 6.2% of all men) were diagnosed and living with diabetes. The highest prevalence was among older Canadians, where 22% of men and women aged 75-79 years have been diagnosed with diabetes (Public Health Agency of Canada, 2008). The rise in the incidence of diabetes (mainly Type 2) has been attributed to an increase in obesity rates and aging of the population (Lipscombe & Hux, 2007).

In Ontario, 900,000 people live with diabetes. This represents 8.8% of the province's adult population. The number of people with diagnosed diabetes continues to grow and by 2010, it is expected that 1.2 million Ontarians (more than 10% of the adult population) will have diabetes (Lipscombe & Hux, 2007). Ninety percent of people with diabetes have Type 2 diabetes. By 2005, the prevalence of diabetes in Ontario had already exceeded the global rate that was predicted for 2030.

Revision Process

The Registered Nurses' Association of Ontario (RNAO) has made a commitment to ensure that this practice guideline is based on the best available evidence. In order to meet this commitment, a monitoring and revision process has been established for each guideline every three years.

RNAO
Registered Nurses' Association of Ontario
L'Association des infirmières et infirmiers autorisés de l'Ontario
NURSING BEST PRACTICE GUIDELINES PROGRAM

A panel of nurses and allied health professionals was assembled for this review, comprised of members from the original development panel as well as other recommended individuals with particular expertise in this practice area. A structured evidence review based on the scope of the original guidelines was conducted to capture the relevant literature and other guidelines published. Initial findings regarding the impact of the current evidence based on the original guideline were summarized and circulated to the review panel. The revision panel members were given a mandate to review the original guideline in light of the new evidence, specifically to ensure the validity, appropriateness and safety of the guideline recommendations as published in 2004.

Literature Review

One individual searched an established list of websites for guidelines and other relevant content. This list was compiled based on existing knowledge of evidence-based practice websites and recommendations from the literature.

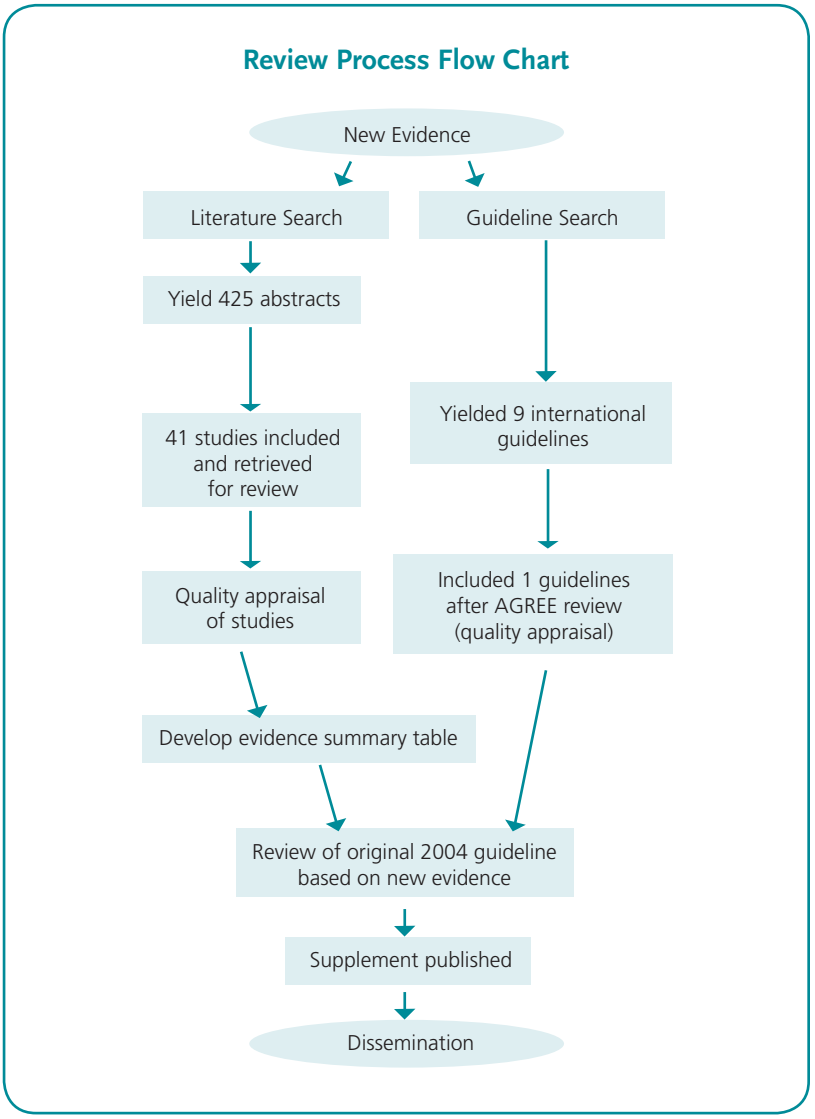
Members of the panel critically appraised nine international guidelines, published since 2003, using the "Appraisal of Guidelines for Research and Evaluation" instrument (The AGREE Collaboration, 2001). From this review, one guideline was identified to inform the review process:

- Canadian Diabetes Association Clinical Practice Guidelines Expert Committee (2008). Canadian Diabetes Association 2008 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. *Canadian Journal of Diabetes, 32*(Suppl 1), S1-S201.

Concurrent with the review of existing guidelines, a search for recent literature relevant to the scope of the guideline was conducted with guidance from the Team Leader. A search of electronic databases, CINALH, Medline, EMBASE, and the Cochrane library, was conducted by a health sciences librarian. A Research Assistant (Master's prepared nurse) completed the inclusion/exclusion review, quality appraisal and data extraction of the retrieved studies, and prepared a summary of the literature findings. The comprehensive data tables and references were provided to all panel members.

Review Findings

In June 2009, the panel was convened to achieve consensus on the need to revise the existing set of recommendations. A review of the most recent studies and relevant guidelines published since the original guideline does not support dramatic changes to the recommendations, but rather suggest some refinements and stronger evidence for our approach. A summary of the evidence is provided in the flow chart:



Summary of Evidence

The following content reflects the changes made to the original publication (2004) based on the consensus of the review panel. The literature review does not support dramatic changes to the recommendations, but rather suggest some refinements and stronger evidence for the approach.

✓ unchanged
✎ changed
\+ additional information

Practice Recommendations

Recommendation 1

Nurses should assess psychosocial factors that may affect the individual's ability to successfully initiate insulin therapy. Assessment strategies that include the use of open-ended questions to assess barriers, stressors, self-efficacy, and beliefs about insulin initiation should be used.

(Level of Evidence = III)

✓

Additional Literature Supports
Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008

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Recommendation 2

Education for administering insulin should be tailored in collaboration with the individual to address current knowledge, abilities, and needs.

(Level of Evidence = Ia)

✓

Recommendation 3

Nurses should provide and/or reinforce appropriate teaching regarding insulin preparation and administration. Topics to include are:

- Insulin: type, action, stability, storage, and compatibility
- Preparation and administration of insulin
- Sharps disposal
- Follow-up for medical and self-care support

(Level of Evidence = IV)

✓

The discussion of evidence for this recommendation found on pages 23 to 29 of the original guideline has been revised to reflect additional literature support and changes to products as reflected below:

✎

Discussion of Evidence:

Individuals with Type 2 diabetes may be treated with insulin alone or with insulin in combination with oral anti-hyperglycemic agents (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008). Improper use and care of insulin and insulin administration devices may lead to deterioration in glycemic control. It is crucial that the client and/or caregiver have a good understanding of the insulin regimen in order for insulin therapy to be successful and safe (Mudaliar & Edelman, 2001).

A. Insulin

In Canada, beef insulin was withdrawn in 1999 (Canadian Diabetes Association [CDA], 2001) and pork insulin in 2006. However, both can be bought from international sources (Health Canada, 2006). Recombinant DNA technology allows for insulin to be made biosynthetically. Insulin analogues are made by modifying the amino acid sequence of the insulin molecule (Owens, Zinman & Bolli, 2001). Insulin is classified according to its time of onset and duration. See Appendix D for table of insulin types.

To preserve its potency, proper storage of insulin is vital. Unopened vials and cartridges of insulin must be refrigerated (American Diabetes Association [ADA], 2003). To prevent loss of potency, clumping, frosting, or precipitation, excess agitation and extreme temperatures (less than 2° C [36° F] or more than 30° C [86° F] for Lilly insulins and Lantus: more than 37° C [98.6° F] for Novo Nordisk insulins, and more than 25° C for Apidra) should be avoided (ADA; Sanofi-Aventis Canada, 2009). It is recommended to follow the specific storage instructions provided by the manufacturer. These may differ according to the brand and whether a vial, pen, cartridge or prefilled disposable insulin pen is used. Insulin should never be stored in direct sunlight or put in the freezer (ADA). Insulin pens should not be stored in the refrigerator however prefilled ***disposable*** pens that are not in use should be stored in the refrigerator. See Appendix E for insulin storage tips.

B. Preparation and Administration of Insulin

Syringes

Insulin syringes are marked in units and are available in different sizes: 1 cc (100 units); 1/2 cc (50 units) and 3/10 cc (30 units). To avoid insulin dose errors, the insulin syringe must match the concentration listed on the insulin vial or cartridge used. For example, only a U-100 insulin syringe should be used to administer U-100 insulin. To further ensure dose accuracy, dose amount should guide the size of syringe used. It is important to note that 1 cc syringes are marked in 2 unit increments, 1/2 cc syringes are marked in both 1/2 and 1 unit increments, and 3/10 cc syringes are marked in 1/2 unit and 1 unit increments. The client's insulin dose, visual acuity and manual dexterity must be considered when recommending an insulin syringe. In Canada, U-100 insulin is the standard concentration available. Insulin other than U-100 would have to be specifically requested.

It is recommended that insulin pen users be taught how to use a syringe to provide an option as a backup delivery system.

Needles

Most people are able to safely and comfortably use a 6mm or 8mm (short) needle (Wood, Wilbourne & Kyne, 2002). Very lean individuals may require an even shorter 5 mm length to avoid intramuscular (IM) injections. The longer needle length of 12.7 mm is rarely used but is still available. All manufacturers recommend that needles be used only once to ensure sterility, prevent tissue damage, and to minimize the risk of bent or broken needles.

Sharp Disposal

Sharps include: pen needles, syringes with needles attached and lancets. All sharps are for individual use only. They must never be shared due to the risk of blood-borne infectious disease, such as hepatitis or acquired immune deficiency syndrome (ADA, 2003). All sharps need to be disposed of according to local regulations. They cannot be put directly in regular garbage as lancets and pen tips are not biodegradable. Used sharps should be placed in a puncture-resistant container that has a secure lid (e.g., bleach bottle, liquid detergent bottle, or sharps containers). Sharps containers may be purchased at local pharmacies. Some pharmacies have a sharps container program whereby containers are

given out and taken back without a fee.

To dispose of filled containers call the Household Hazardous Waste office or check with municipal disposal authorities. Containers should be stored in a safe location away from children and pets. Care must be taken not to dispose of filled containers in the general garbage or with items for recycling.

Needle Stick Injury Prevention

The Centres for Disease Control and Prevention (CDC) estimated that healthcare workers suffer between 600,000 and one million injuries from conventional needles and sharps annually (American Association of Diabetes Educators, 2002). Institutions have implemented safe practices for the disposal of sharps, which include no recapping of pen tips or syringes prior to disposal in a sharps container. Nurses should consult their organization's policy and procedure manual. Insulin syringes and insulin pen needles are now available as both standard and safety engineered devices. The safety engineered devices have an auto-capping system that offers needle-stick protection. With this type of insulin pen needle, the outer cover is removed, exposing a plastic needle shield that covers the needle. When insulin is injected, the shield retracts allowing the needle to be inserted in the skin. Confusion by clients who are taught with the safety engineered insulin pen needle while in hospital and then use a standard insulin pen needle after discharge has resulted in hyperglycemia, as they were unaware to remove the outer and inner needle covers. Clients who are switched from the safety engineered device to the standard pen needles must be educated about removing both the outer and inner needle cover of the standard pen needle (ISMP, 2009). In the home, sharps should be disposed in a sharps container without recapping. However, clients utilizing pens are instructed to recap using the larger outer cap prior to disposal. The nurse should assess the client's vision and dexterity to ensure safe use. Some companies have an easy-to-use pen tip remover that does not require recapping prior to disposal.

Lipodystrophies

Lipoatrophy is a concave or pitted appearance of the skin at the injection site (Anderson, Seitzman & Haines, 1998). It is a rare skin reaction. To alleviate this, steroids injected locally may be considered (White & Campbell, 1996). Resolution may start to occur after two weeks, but usually requires four to six months for complete resolution (White & Campbell).

Allergies

To prevent bacterial growth and maintain stability, all insulins have added ingredients. Intermediate insulin contains a protamine additive that prolongs its action. These added ingredients can on rare occasions cause an allergic reaction (ADA, 2003). Approximately forty percent of people treated with NPH insulins have protamine antibodies. Although protamine antibodies rarely cause an insulin allergy reaction, they are associated with anaphylaxis during the reversal of intra-operative heparin anticoagulation. Caution is required for clients with a history of NPH use. Heparin anticoagulation should ideally be allowed to spontaneously reverse. If protamine reversal is required, it must be accompanied with preparations for possible anaphylaxis. There have also been rare cases of reactions to plasticizers, preservatives, or latex contaminants reported (Fineberg, 1998).

Additional Literature Supports

Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008

Health Canada, 2006

ISMP, 2009

Sanofi-Aventis Canada, 2009

Recommendation 4

Nurses should encourage blood glucose self-monitoring as an integral part of daily diabetes management for individuals taking insulin. The recommended frequency of testing will vary according to diabetes treatment and the individual's need and ability.
(Level of Evidence = III)

✓

The following discussion of evidence found on page 30 of the original guideline has been updated to reflect the Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008:

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Most people with diabetes benefit from self-monitoring of blood glucose levels (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008; Karter, Ackerson & Darbinian, 2001). These benefits include improved blood glucose control and enhanced recognition and treatment of hypoglycemia, especially if the client experiences reduced awareness of the symptoms of low blood glucose. Monitoring helps individuals to assess the effects of diet choices, physical activity and changes to treatment on blood glucose control. The benefits of self-monitoring are greatest if the person has learned how to self-manage their diabetes, including how to interpret results, adjust insulin doses and how to correctly use and maintain the blood glucose meter (Franciosi, Pellegrini, De Berardis, Cavalieri, DiNardo, Greenfield, 2001; Norris, Engelgau, & Narayan, 2001). Basic information regarding "too high", "too low" and target blood glucose levels should be provided at the time of insulin initiation to assure safety.

The recommended targets for blood glucose control (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008) are listed in Table 1.

Table 1:

	A1C	Fasting Glucose before meals	Glucose level 2 hours after eating
Type 2 diabetes	≤ 7 % • Target A1C of ≤ 6.5% may be considered in some patients with Type 2 diabetes to further lower the risk of nephropathy but this must be balanced against the risk of hypoglycemia and increased risk of mortality inpatients who are at significantly elevated risk of cardiovascular disease (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008).	**4-7 mmol/L**	**5-10 mmol/L** (5.0 -8.0 if A1C targets not being met)

The goals and frequency of self-testing should be determined individually, based on the treatment prescribed, the type of diabetes, and the individual's ability to use the information from testing to modify behaviours or adjust medications (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee). Those with Type 2 diabetes treated with insulin should test at least daily, however more frequent testing may be appropriate (Ellison, Stegmann, Colner, Michael, Sharma, Ervin, et al., 2002). People who take multiple insulin injections each day, with the goal of near normalization of blood glucose, should test at least three or more times each day. Results of pre-meal and bedtime testing, as well as intermittent 2-hour post-meal tests can be used to guide insulin dose adjustments. Since overnight hypoglycemia may occur periodic overnight testing at a time corresponding to peak insulin action should be performed (Beregszaszi, Tubiana-Rufi, Benali, Noel, Block, & Czernichow, 1997; Canadian Diabetes Association Clinical Practice Guidelines Expert Committee; Diabetes Control and Complications Trial Research Group, 1991; Gale & Tattersall, 1979; Jones, Porter, Sherwin, Davis, O'Leary & Frazer 1998; Vervoort, Goldschmidt & Van Doorn, 1996).

Additional Literature Supports
Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008

Recommendation 5

Individuals who self-monitor blood glucose should receive initial instruction and periodic re-education regarding self-testing technique, meter maintenance, and verification of accuracy of self-testing results.

(Level of Evidence = III)

✓

The following paragraph in the discussion of evidence found on page 31 of the original guideline has been modified:

In order to assure accuracy of readings, meter results should be compared with simultaneous laboratory measurement of plasma glucose at least once a year. This should also be done when meter results do not reflect presenting symptoms of high or low blood glucose levels. A difference of less than 20% between meter reading and laboratory results is considered acceptable (CDA, 2003; Sacks, Bruns, Goldstein, Maclaren, McDonald, & Parrott, 2002).

Additional Literature Supports
Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008

Recommendation 6

Nurses should ensure clients taking insulin receive appropriate basic nutrition information.

(Level of Evidence = IV)

✓

Additional Literature Supports
Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008

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Recommendation 7

Clients treated with insulin, and their caregivers, should be taught how to prevent, recognize and treat hypoglycemia.

(Level of Evidence = IV)

✓

The following paragraphs found on pages 33 and 35 of the original guideline has been modified in the discussion of evidence:

Treatment of Hypoglycemia

For mild to moderate hypoglycemia, treatment is 15 g of a fast-acting carbohydrate. See Appendix L for treatment choices to deliver 15 g or 20 g of fast-acting carbohydrate and Appendix M for client instruction on how to treat hypoglycemia. Blood glucose needs to be checked 15 minutes after treatment and clients should be treated with another 15 g of fast-acting carbohydrate if blood glucose remains less than 4.0 mmol/L. Prevent recurrence of hypoglycemia by adding a snack of 15 g of starch and a protein source if the next meal is more than 60 minutes away. Glucose gels are no longer recommended for treatment as they have been demonstrated to be absorbed too slowly (Yale, Begg, Gerstein, Houlden, Jones, Maheux, 2002). There is no evidence to support the practice of administering glucose gel buccally since absorption through the mucosa is minimal, if any (Yale et al.). For individuals who take alpha-glucosidase inhibitors such as Acarbose (Glucobay), which inhibit absorption of sucrose or starch by the gut, hypoglycemia needs to be treated with glucose tablets, milk or honey (Yale et al.). Clients on insulin should wear identification such as Medic Alert™. For clients at risk of severe hypoglycemia, a family member or support person (if available) should be taught how to manage a hypoglycemic event. This includes being taught how to administer a glucagon injection (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008).

Nocturnal Hypoglycemia

Severe hypoglycemic episodes frequently occur at night and can be potentially serious (Yale et al., 2002). Individuals are less likely to detect hypoglycemia during sleep and may wake in the morning reporting headache, nightmares or restless sleep (Cryer & Childs, 2002; Saleh & Grunberger, 2001). The Canadian Diabetes Association Clinical Practice Guidelines for Hypoglycemia (2001) identify a number of strategies for preventing nocturnal hypoglycemia. These include checking blood glucose at insulin peak times during the night to rule out nocturnal hypoglycemia. Other preventive measures include having a bedtime snack with at least 15 g of carbohydrate and protein if the bedtime blood glucose level is under 7.0 mmol/L (Yale et al.). Insulin type or insulin injection times can be strategically adjusted to prevent nocturnal hypoglycemia. If intermediate-acting insulin (NPH/N) is given at dinner, it peaks during the night increasing the risk of nocturnal hypoglycemia. Moving the intermediate-acting (NPH/N) insulin to bedtime can reduce this risk (Cryer & Childs). For some clients, short-acting (regular) insulin has a prolonged action and may increase the risk of nocturnal hypoglycemia. For these clients, using a rapid-acting insulin analogue (Humalog/NovoRapid/Glulisine) instead of regular insulin at dinner or the use of basal analogues (Lantus or Levemir) instead of NPH/N may reduce nocturnal hypoglycemia (Cryer & Childs; DeVries, Nattrass, & Pieber, 2007; Dewitt & Dugdale, 2003; Oiknine, Bernaum, & Mooradian, 2005; Owens et al., 2001; Saleh & Grunberger).

Physical Activity and Hypoglycemia

Recommendations to reduce risk of activity-associated hypoglycemia include the following:

- Ingest 15 g of fast-acting carbohydrate before activity if pre-exercise blood glucose level is under 5.0 mmol/L (Yale et al., 2002).
- Administer insulin into a site away from the most actively exercising extremity (Albright et al., 2000; Yale et al., 2002).

• Fast-acting carbohydrate should always be readily available during and after physical activity (ADA, 2002; ADA, 2003; Chipkin, Klugh & Chasan-Taber, 2001). • Consult with diabetes health professional to determine insulin dose adjustment. Additional Literature Supports Canadian Diabetes Association Clinical Practice Guidelines Expert Committee (2008) DeVries, J.H., et al (2007) Oiknine, R. et al (2005)	
Recommendation 8 Nurses must be aware of the effects of acute illness, surgery, and diagnostic procedures on blood glucose levels. (Level of Evidence = IV)	✓
Recommendation 9 Nurses should provide basic education on blood glucose monitoring, dietary, and medication adjustments for periods of illness. This information should be given initially and reviewed periodically with the client. (Level of Evidence = IV)	✓

Education Recommendation

Recommendation 10 Nursing curriculum should include education about the care and management of diabetes. (Level of Evidence = IV)	✓
The following list has been expanded with the addition of the first bullet: The guideline development panel suggests that nursing curriculum should include: • Principles of self management support • Pathophysiology and diagnosis of diabetes • Lifestyle management (physical activity, weight management, smoking cessation) • Nutrition guidelines • Co morbidities (e.g., hypertension, dislipidemia) • Medications for diabetes • Insulin injection technique • Acute complications including hypoglycemia prevention, recognition, and management • Prevention and management of long-term complications • Sick day management	+

• Principles of blood glucose monitoring, including timing, site selection, calibration and correlation to lab results • Coping with chronic illness • Readiness to learn and principles of adult learning • Prevention of diabetes	

Organization and Policy Recommendations

Recommendation 11 Healthcare organizations should facilitate ongoing diabetes education of nursing staff about diabetes care and management. (Level of Evidence = IV)	✓
Recommendation 12 Organizations must ensure that individuals receiving insulin have ready access to an appropriate form of glucose at all times. (Level of Evidence = IV)	✓
Recommendation 13 Organizations should develop and communicate appropriate policies and procedures to reduce the potential for medication errors related to insulin therapy. (Level of Evidence = IV)	✓
The following paragraphs found on pages 42, 43 and 44 of the guideline has been updated: Similar-sounding drug names account for more than one-third of medication errors. Poor handwriting can exacerbate the problem when trying to distinguish between two drugs that have similar names (Cohen, 1999). • Humulin and Humalog have been confused; "Human Log" has been **accidentally or incorrectly** been changed to "Humulin L". • Humalog has been **accidentally or incorrectly** substituted for Humalog Mix 25. A system of redundancy or check system is recommended as one safeguard to reduce medication errors (Cohen, 1999; Grissinger & Lease, 2003; Institute for Safe Medication Practices [ISMP] Canada, 2003). It involves a second, independent check, whereby one person checks the work of another. This process increases the chance of making an error visible. Research demonstrates that double checks identify 95 percent of errors at each verification point (ISMP Canada). Alert clients or family members can be used as the second independent check if available. The Medication Standards regarding administering medications from the College of Nurses of Ontario (CNO) (2008) also state double-checking is one way to reduce medication errors. However, there is no law or standard that requires a nurse to	+

double-check prepared medications with another nurse prior to its administration (CNO). As a risk management precaution, some institutions have established a policy in which nurses must review another nurse's medication preparation. If policies do not exist, it is up to the individual nurse's discretion as to whether or not a double check is necessary. According to the CNO regarding double-checking preparations, a nurse meets the standard by:

- evaluating her/his competence and deciding whether to ask a colleague to double-check a prepared medication;
- being aware of and meeting the facility's expectations regarding double-checking preparations; and
- advocating for written expectations when the practice setting requires double-checking preparations.

Additional Literature Supports:
College of Nurses of Ontario, 2008

Recommendation 14

Organizations should have a process for documentation to support nursing practice related to insulin therapy.

(Level of Evidence = IV)

Recommendation 15

Nursing best practice guidelines can be successfully implemented only where there are adequate planning, resources, organizational, and administrative support. Organizations may wish to develop a plan for implementation that includes:

- An assessment of organizational readiness and barriers to implementation*.
- Involvement of all members (whether in a direct or indirect supportive function) who will contribute to the implementation process.
- Dedication of a qualified individual to provide the support needed for the implementation* and implementation process.
- Ongoing opportunities for discussion and education to reinforce the importance of best practices.
- Opportunities for reflection on personal and organizational experience in implementing guidelines.

In this regard, RNAO (through a panel of nurses, researchers and administrators) has developed the *Toolkit: Implementation of Clinical Practice Guidelines*, based on available evidence, theoretical perspectives and consensus. The RNAO strongly recommends the use of this Toolkit for guiding the implementation of the best practice guideline on *Best Practice Guideline for the Subcutaneous Administration of Insulin in Adults with Type 2 Diabetes*.

(Level of Evidence = IV)

*Note change to word

The Review Panel has identified updates to several appendices as follows:

Appendix B: Glossary of Terms

Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008

A1C: (formerly referred to as **Glycosylated Hemoglobin or HBA1C**)
The A1C test measures the average glycemia over the preceding 2-3 months and, thus, assesses glycemic control. When the A1C is done every three months, it can detect whether glycemic control has been reached and maintained within the target range and also reflects departures from the target range.

The Canadian Diabetes Association (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008) recommend that persons with diabetes lower their A1C to ≤ 7.0%, which corresponds to a laboratory value of 0.070. Consider <6.5% for some people with Type 2 diabetes to further lower the risk of nephropathy. Risk of hypoglycemia must also be considered.

Correlation between A1C level and plasma glucose levels (based on DCCT levels – reference range 4-6%).

A1C%	Mean plasma glucose
6	7.5 mmol/L
7	9.5
8	11.5
9	13.5
10	15.5
11	17.5
12	19.5

The target A1C should be adjusted based on the specific reference range used by the laboratory that performed the test.
Note: Children and pregnant women differ from these targets.
(Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008)

Arthus reactions: Inflammatory response to the deposition of antigen-antibody complexes (Fineberg, 1998).

Atopy: A form of allergy in which there is a genetic predisposition to develop hypersensitivity reactions in response to allergens (Martin & Guidos, 2000).

Bolus insulin: An extra amount of insulin taken to cover an expected rise in blood glucose, often related to a meal or snack.

Catecholamines: One of a group of similar compounds having a sympatomimetic action such as norepinephrine and epinephrine.

Cortisol: An adrenocorticoid steroid hormone which promotes gluconeogenesis.

Counter-regulatory hormones: Hormones that raise blood glucose and include glucagon, catecholamines (epinephrine and norepinephrine), cortisol and growth hormone.

Counter-regulatory response: Counter-regulatory hormones that increase in the circulation during hypoglycemia and exercise and play an important role in raising the blood glucose after hypoglycemia and preventing the occurrence of hypoglycemia during fasting and exercise.

Gestational diabetes mellitus (GDM): Defined as any degree of glucose intolerance with onset or first recognition during pregnancy (ADA, 2003). Pregnant women who have never had diabetes before but who have elevated blood glucose levels during pregnancy are said to have gestational diabetes.

Glucagon: A polypeptide hormone secreted by the alpha cells of the islets of Langerhans in response to hypoglycemia or to stimulation by growth hormone of the anterior pituitary; it stimulates glycogenolysis in the liver.

An injectable form of glucagon is available as a prescription and is used to treat severe hypoglycemia. The glucagon is injected and raises blood glucose levels in 20 minutes.

Glycosylated hemoglobin (HBA1C or A1C): See A1C.

High-alert medication: Although most medications have a wide margin of safety, a few drugs have a high risk of causing injury when they are misused. These may be termed 'high-alert medication'. Although errors may not be more common with these drugs than with others, their consequences may be more devastating (Cohen & Kilo, 1999). The five high alert medications are:

- insulin
- opiates & narcotics
- injectable potassium chloride or phosphate concentrate
- intravenous anticoagulants (heparin)
- sodium chloride solutions above 0.9 percent (Grissinger & Lease, 2003).

Hypoglycemia: Defined as blood glucose of less than 4.0 mmol/L in an individual treated with insulin or an insulin secretagogue (CDA, 2003).

Hypoglycemia unawareness: A state in which a person does not feel or recognize the symptoms of hypoglycemia. People who have frequent episodes of hypoglycemia may no longer experience the usual warning signs and the first sign of hypoglycemia may be confusion or loss of consciousness (Yale et al., 2002).

Insulin analogues: Insulins made by modifying the amino acid sequence of the insulin molecule.

Lipoatrophy: Loss of fatty tissue, either at or distant from the injection site. It is thought to be of immunologic origin and is usually associated with the use of animal source insulin (Haire-Joshu, 1996) and can be caused by repeated insulin injections in the same area (Sanofi-Aventis Canada Inc, 2007).

Lipohypertrophy: A fatty, tumor-like growth at or around the injection site, caused by an overgrowth of fat cells that is non-immunologically mediated (Haire-Joshu, 1996). It is caused by repeated insulin injections into a single area.

Appendix D: Insulin Types

This chart has been updated and replaces the chart on pages 72 and 73 of the original guideline.

Insulin Type (trade name)	Onset	Peak	Duration	Considerations	Insulin Compatibility
Rapid-acting analogue (clear) Humalog (insulin lispro) NovoRapid (insulin Aspart) Apidra (insulin glulisine)	 10 –15 min 10 –15 min 10 –15 min	 1 – 2 h 1 – 1.5 h 1 – 1.5 h	 3.5 – 4.75 h 3 – 5 h 3 – 5 h	Client should eat within 10–15 minutes of injection.	Rapid-acting insulin can be mixed with N, NPH. Mixture should be given within 15 minutes of a meal.
Short-acting (clear) Humulin R Novolin ge Toronto	30 min	2-3 h	6.5 h	Should be given 30 to 45 minutes prior to meals	
Intermediate-acting (Cloudy) Humulin N Novolin ge NPH	1 – 3 h	5 – 8 h	Up to 18 h	Must be adequately re-suspended before injecting	N or NPH & short-acting insulin may be mixed & used immediately or stored, refrigerated, for future use. Pre-filled syringes should be stored in the fridge, with needle tips up. They are stable for 1 month. NPH or N cannot be mixed with Lantus or Levemir insulin.
Long-acting analogues (Clear) Lantus (insulin glargine) Levemir (insulin detemir)	90 min	Not applicable	Up to 24 h (glargine 24 h, detemir 16 – 24 h)	Lantus is available in vials, cartridges & pre-filled disposable pens (SoloStar). Levemir is only available in cartridges. Both Lantus and Levemir are clear. Clients must be alerted to the potential danger of confusing Lantus or Levemir with other clear insulins (rapid or short-acting insulins). **Use of pre-filled syringes are not recommended**	Glargine and Levemir **cannot** be mixed with any other insulin or solution.
Premixed (cloudy) A single vial contains a Fixed ratio of insulin (% rapid or short-acting to % of intermediate acting insulin)	See rapid or short	See intermediate		Must be adequately re-suspended before injecting. If using a rapid-acting mixture, client must eat within 15 minutes of injecting. If using a short acting mixture, client should eat within 30 minutes of injecting.	Should not be mixed with any other insulin

**Action times are "estimates" only. Action times depend on the individual, the injection site & the type of insulin used. There can be approximately a 45% variation in daily absorption from the same site in the same person with intermediate- acting insulin (Weiland & White, 2002).

Pre-filled syringes should be stored in the fridge, with needle tips up. They are stable for one month and need to be re-suspended prior to use. Allow insulin to get to room temperature prior to injecting to avoid a "cold" sensation.

Additional Literature:

Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008
Novo Nordisk Canada Inc., 2008
Sanofi-Aventis Canada, 2009

Appendix J: Just the Basics – Tips for Healthy Eating, Diabetes Management and Prevention

This information has been updated and replaces the information on pages 80 and 81 of the original guideline. Visit www.diabetes.ca to download the complete resource.

This document reflects our CPG Clinical Practice Guidelines

Just *the* Basics

Diabetes is a condition in which your body cannot properly use and store food for energy. The fuel that your body needs is called glucose, a form of sugar. Glucose comes from foods such as fruit, milk, some vegetables, starchy foods and sugar.

To control your blood glucose you will need to eat healthy foods, be active and you may need to take pills and/or insulin.

TIPS FOR HEALTHY EATING, DIABETES PREVENTION AND MANAGEMENT

Here are some tips to help you until you see a registered dietitian.

TIPS	REASONS
Eat three meals per day at regular times and space meals no more than six hours apart. You may benefit from a healthy snack.	Eating at regular times helps your body control blood glucose levels.
Limit sugars and sweets such as sugar, regular pop, desserts, candies, jam and honey.	The more sugar you eat, the higher your blood glucose will be. Artificial sweeteners can be useful.
Limit the amount of high fat food you eat such as fried foods, chips and pastries.	High fat foods may cause you to gain weight. A healthy weight helps with blood glucose control and is healthier for your heart.
Eat more high fibre foods (whole grain breads and cereals, lentils, dried beans and peas, brown rice, vegetables and fruits).	Foods high in fibre may help you feel full and may lower blood glucose and cholesterol levels.
If you are thirsty, drink water.	Drinking regular pop and fruit juice will raise your blood glucose.
Add physical activity to your life.	Regular physical activity will improve your blood glucose control.

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Appendix L: Guidelines for Nurses on How to Manage Hypoglycemia

This information has been updated and replaces the information provided on pages 84 of the original guideline.

Mild and Moderate Lows (<4.0 mmol/L) Individual is able to self-test and treat low blood glucose	Severe Lows (<2.8 mmol/L or unable to swallow) Individual is not able to treat self and requires assistance with treatment of hypoglycemia
Test blood glucose level	Test blood glucose level
Treat with 15 g of fast-acting carbohydrate such as: • **5 dextrose tablets (3 g each)***, **or** • **3 glucose tablets (5 g each)***, **or** • ¾ cup (175 ml) regular pop **or** • ¾ cup juice, **or** • 3 teaspoons sugar or honey, **or** • 6 lifesavers	If conscious and able to swallow treat with 20 g fast-acting carbohydrate: • **7 dextrose tablets (3 g each)***, **or** • **4 glucose tablets (5 g each)***, **or** • 1 cup (250 ml) of regular pop **or** • 1 cup juice, **or** • 4 teaspoons of sugar or honey, **or** • 8 lifesavers
Pre planning for hypoglycemia should occur if individual is NPO or unable to swallow; an order for IV Dextrose or IM Glucagon should be obtained**.	If unconscious, NPO or unable to swallow give 1 mg Glucagon injection IM (if ordered**) **or** IV dextrose 20 to 50 ml D50W (if ordered**) **and/or** call 911 prn. Inform your diabetes team of the event
Repeat blood glucose test again in 15 minutes. Treat again with another 15 g fast-acting carbohydrate if blood glucose remains less than 4.0 mmol/L. Retest in 15 minutes. Continue to retreat and retest until blood glucose is above 4.0 mmol/L	Repeat blood glucose test again in 15 minutes. If blood glucose is less than 4.0 mmol/L, continue to retreat with 15 g fast-acting carbohydrate and retest every 15 minutes until blood glucose is above 4.0 mmol/L If glucagon has been used, follow with carbohydrate as soon as the individual is able to swallow.
If the next meal is more than 60 minutes away, have a snack of 15 g of a starch and include a protein source. For example: ½ cheese sandwich. Explore possible causes of hypoglycemia.	If the next meal is more than 60 minutes away, provide a snack of 15 g of starch and a protein source. For example: ½ cheese sandwich. Explore possible causes of hypoglycemia.

* Treatment required for hypoglycemia if on Glucobay

**An order should be obtained in advance for all clients treated with insulin

Canadian Diabetes Association Clinical Practice Guidelines Expert Committee (2003a). Canadian Diabetes Association 2003 clinical practice guidelines for the prevention and management of diabetes in Canada. *Canadian Journal of Diabetes*, *27*(Suppl 2), S43-S45.

Adapted with permission from Canadian Journal of Diabetes. 2003; *27*(Suppl 2):S43-S45.

Appendix P: Resources for Diabetes Information

The following websites have been updated and replaces the information provided on pages 89 and 90 of the original guideline. These are sample resources only, and are not intended to be a comprehensive listing.

Diabetes Information

American Diabetes Association – www.diabetes.org
American Diabetes Association -for Latinos – www.diabetes.org/espanol
Canadian Diabetes Association – www.diabetes.ca
Diabetes Mall – www.diabetesnet.com
Diabetes Self-Management – www.DiabetesSelfManagement.com
International Diabetes Federation – www.idf.org
Joslin Diabetes Centre – www.joslin.harvard.edu

Equipment

BD Diabetes.com – www.bddiabetes.com

Exercise

Diabetes, Exercise, and Sports Association (DESA) – www.diabetes-exercise.org

Insulin

Eli Lilly Canada Inc. – www.lilly.ca
Lantus – www.lantusconnection.com
Novo Nordisk – www.novonordisk.com
Sanofi-aventis – www.sanofi-aventis.ca

Monitoring

Abbott – www.abbott.ca
Ascensia Health Support Program from Bayer – www.ascensia.ca
Medtronic Mimimed (glucose sensor) – www.minimed.com
One Touch – www.onetouch.ca
Roche – www.roche.com

Nutrition

American Dietetic Association/Diabetes Care & Education – www.eatright.org
Becel Heart Health Information Bureau – www.becelcanada.com
Calorieking.com – www.calorieking.com
Centre for Science in the Public Interest – www.cspinet.org/canada/
Dial-a-Dietitian – www.dialadietitian.org
Dietitians of Canada – www.dietitians.ca
Eat right Ontario – www.eatrightontario.ca
Health Canada – www.hc-sc.gc.ca
Heart and Stroke Foundation of Canada – www.hsf.ca
National Institute of Nutrition – www.nin.ca
Public Health Agency of canada – www.public health.gc.ca
USDA Nutrient Data Laboratory – http://www.ars.usda.gov/ba/bhnrc/ndl
Women's Health Matters – www.womenshealthmatters.ca
World Health Organization – www.who.int

Statistics

Institute for Clinical Evaluative Sciences – www.ices.on.ca

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Notes

Notes

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Nursing Best Practice Guideline

Best Practice Guideline for the Subcutaneous Administration of Insulin in Adults with Type 2 Diabetes

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