SECTION	SUBJECT	PAGE
EDUCATION	Diabetes Targets in Long Term Care (Expectations and Outcomes) Original	1 of 4 YY 13 MM 01 DD 24

Purpose
To define reasonable expectations for diabetes control in the long-term care (LTC) population in Calgary, taking into account the advanced age and multiple-morbidities of the average LTC client.

The frail elderly, defined by patients who have an accumulation of multiple chronic illnesses with associated vulnerabilities such as dementia, functional decline, and geriatric syndrome such as falls, impaired mobility and polypharmacy[1], are much more susceptible to the complications for poor glycemic control. At the same time, reducing the risk of long-term complications may be less critical in LTC due to shortened life expectancy.

Existing CDA guidelines and Applicability to LTC[1,2]
For healthy population, the Canadian Diabetes Association (CDA) recommends a fasting blood glucose of between 4-7 mmol/L and HgA1C below 7.0 %. As the frail elderly both may not benefit from long-term reduction in complications and are more susceptible to adverse effects of treatment, it is advisable to review therapeutic targets for the elderly with diabetes. As shown in the below table, it is questionable that the average Calgary LTC client (with an average length of stay of approximately 1.5 to 2 years) will realize the limited benefits that intensive control of diabetes will confer.

Trial Summary of Intensive vs. less-Intensive diabetes treatment

Trial	Mean Age (note: no trial included frail elderly) + # of participants	Trial Duration (years)	HgA1C Attained (%)		Summary
			Trial	Control	
UKPDS[1-33]	54 years N = 3867 with newly diagnosed type 2 diabetes	10	7.0	7.9	- Intensive target: FBS < 6mmol/L, ac meals 4-7 mmol/L - Decreased incidence of retinopathy and decreased urinary albuminuria - No difference clinical outcome (visual acuity, renal failure, death, CV disease, stroke) - More hypoglycemic episodes in intensive group - A follow-up (**UKPDS-34**) using metformin in obese patients **did** find a decrease in death (NNT = 14) and stroke (NNT =48), but both those outcomes were after an additional 10 years (20 years followed) - No difference in **any** outcome after 3 years
ADVANCE[2]	66 years N = 11,140 with type 2 diabetes	5	6.5	7.3	- Intensive target: HgA1C < 6.5% - baseline HgA1C 7.5%, 32% cardiac or cerebrovascular disease - Decreased microvascular end points (NNT = 67) – mostly albuminuria - No difference in renal failure, death, CV disease - Increased serious hypoglycemia (NNH = 83)
VADT[3]	60 years	5.6	6.9	8.4	- Intensive target = HgA1C < 6.0 - Baseline HgA1C 8.5%, 40% prior CVD,

	N = 1792 with type 2 diabetes				- diabetes duration of 12 years - No significant difference in CVD or microvascular disease
ACCORD [4]	62 years N = 10,251 with CVD or CVD risk factors	3.5	6.4	7.5	- Intensive target = HgA1C < 6.0 - Baseline HgA1C 8.4%, 35% had previously had a CV event - **Stopped after 3.5 years (18 months early)** - Significantly increased relative risk of death (NNH = 95), increase in serious hypoglycemia (NNH = 9)

UKPDS = United Kingdom Prospective Diabetes Study
ADVANCE = Action in Diabetes and Vascular Disease
VADT = Veterans Affairs Diabetes Trial
ACCORD = Action to Control Cardiovascular Risk in Diabetes

While the CDA does not have a firm recommendation on HgA1C in spite of this evidence, the American Diabetes Association (ADA) remarks that less stringent A1C goals (such as <8% or slightly higher) may be appropriate for some patients, including those with limited life expectancy and extensive comorbid conditions[3]. As well, the Department of Veterans Affairs (VA) in the US provides a more concrete target for the LTC population, as outlined below.[4]

Major Comorbidity[d] Or Physiologic Age	Microvascular Complications		
	Absent or Mild[a]	Moderate[b]	Advanced[c]
Absent >10 yrs life expectancy	<7%	<8%	8-9%*
Present[e] >5-10 yrs life expectancy	<8%	<8%	8-9%*
Marked[f] <5 yrs life expectancy	8-9%*	8-9%*	8-9%*

(a) mild microvascular disease defined by early background retinopathy, and/or microalbuminuria, and/or mild neuropathy
(b) moderate microvascular disease defined by pre-proliferative retinopathy or persistent, fixed proteinuria and/or demonstratable peripheral neuropathy
(c) advanced microvascular disease defined by severe non-proliferative or proliferative retinopathy and/or renal insufficiency, and/or insensate extremities or autonomic neuropathy
(d) major co-morbidity includes but is not limited to any or several of the following: CV disease, chronic kidney disease, COPD, chronic liver disease, recent stroke, life-threatening malignancy
(e) major co-morbidity is present but is not end-stage and management is achievable
(f) major co-morbidity is present and is either end-stage or management is significantly challenging
*further reductions may be appropriate, balancing safety and tolerability of therapy

Hemoglobin A1C and the Relationship to Blood Glucose Level[2]

The mathematical relationship of HgA1C to blood glucose is as follows:

- Mean BG (mmol/L) = (1.98 x HgA1C) – 4.29

HgA1C	Mean Blood Glucose
6.0	7.59
6.5	8.58
7.0	9.57
7.5	10.56
8.0	11.55
8.5	12.54
9.0	13.53

HgA1C values are affected by rate of red cell turnover, which is a significant variable in LTC given the variety of states of anemia, renal function, and treatments for anemia.

HgA1C May Be Falsely[5,6]….	
High	- When red blood cell turnover is low - E.g. iron, B12, folate deficiency anemia - May also be higher in patients with higher urea levels (which can affect the Hg assay)
Low	- When red blood cell turnover is high - E.g. patients being *treated* for anemia (iron, B12, folate), and patients being treated with erythropoeitin - May also be lower in dialysis patients

Hypoglycemia in the Elderly[7]

Hypoglycemia, typically defined as blood glucose level under 4.0mmol/L, is a more serious consequence in the LTC population than in the healthy adult. The symptoms and potential management options are listed in the below table:

Hypoglycemic Symptoms		**Treatment Options**
Mild	tremor, palpitations, sweating, hunger	15g carbohydrates (should ↑ BG 2.1mmol/L in 20 min), repeat again in 15min if BG still < 4 15g carbs = 3 teaspoons of sugar, ¾ cup (175mL) of juice or soft drink, 6 life savers (1 = 2.5g), 15g glucose in tablet form
Moderate	headache,mood, irritability, attentiveness, parathesias, visual disturbance	
Severe	unresponsiveness, unconciousness, seizures, coma	if conscious, give 20g carbs If unconcious, give **glucagon** May ↑ from 3-12 mmol/L within 60 min. Still need to give fast carbs after pt becomes alert and a snack afterwards (to prevent recurrence)
Post hypoglycemic Episode		- Assess possible risk factors, e.g. inadequate dietary intake, increased physical activity, too much insulin or hypoglycemic medication - If severe hypoglycemia, may be reasonable to adjust target BG range for several weeks to assess cause

Hyperglycemia in the Elderly[8]

Due to the adjusted HgA1C targets in the elderly (see above), hyperglycemia in LTC may be redefined to a range higher than for a normal, healthy adult. So long as there are no overt symptoms of hyperglycemia, such as polyuria and nocturia, random blood glucoses in the 7-14 mmol/L range may be considered acceptable. These levels of hyperglycemia should only be concerning if they may possibly be contributing to other adverse incidents, such as falls or infections.

References

1. Laubscher, T. *Diabetes in the Frail Elderly: Individualization of Glycemic Management.* Can. Fam. Phy. Vol. 58. 543-546
2. Regier L, Barejam J., *Individualization Glycemic Targets for the Frail Elderly with T2DM.* RxFiles. April 2012Rohlfing CL,
3. American Diabetes Association. Executive Summary: Standards of medical care in diabetes – 2012. Diabetes Care 2012;35:S4-S10. http://care.diabetesjournals.org/content/35/Supplement_1/S4.full
4. VA/DoD Clinical Practice Guidelines for the Management of Diabetes Mellitus. August 2010. Accessed online at : http://www.healthquality.va.gov/diabetes/DM2010_SUM-v4.pdf
5. Wiedmeyer HM, Little RR, et al. Defining the relationship between plasma glucose and HbA(1c): analysis of glucose profiles and HbA(1c) in the Diabetes Control and Complications Trial. *Diabetes Care* 2002;25(2):275-8.
6. Kuenen JC, Borg R, Kuik DJ, et al. ADAG Study Group. Does glucose variability influence the relationship between mean plasma glucose and HbA1c levels in type 1 and type 2 diabetic patients? Diabetes Care. 2011 Aug;34(8):1843-7
7. Jin, M., Regier, L. *Insulin Management: Evidence, Tips and Pearls.* RxFiles, August 2012 Accessed online http://www.rxfiles.ca/rxfiles/uploads/documents/members/CHT-Diabetes-Insulin-ManagmentTool.pdf
8. McCulloch, D. *Estimation of Blood Glucose Control in Diabetes Mellitus*. UpToDate, Basow, DS (Ed) Waltham, MA, 2012