Using Self-monitoring of blood glucose in non-insulin treated type 2 dm

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Agenda

- Discuss literature related to SMBG in non-insulin (NI) treated T2DM
- Relate issues to clinical practice
- Identify strategies for using SMBG in NI treated T2DM
- Integrate adult learning principles in SMBG
- Develop SMBG schedule that guides treatment & education

A Goal of SMBG

- Prepare Individuals to
  - Make informed decisions
  - Engage in effective diabetes self-management
  - Implement self-care behaviors that allow individuals to maximize their physical and psychological well-being.

AADE, The Diabetes Educator, Sept/Oct 2003

Issues relating to SMBG

- Patient desire
- Physical ability (dexterity, vision)
- Benefit/Risk
- Timing
- Interpretation of results
- Costs

Potential Issues relating to SMBG: Accuracy

- Humidity
- Temperature
- High Altitude

- Hematocrit-Low (BG overestimated)
  high (BG underestimated)
- High O2-underestimate
- Sugars (ose)-overestimate
- High Triglycerides-under

Lajara & Magwire, Practical Diabetology, 2013

Should non-insulin treated patients with type 2 dm monitor their glucose?

NO

Meta-analysis: not convincing for a clinically meaningful effect of clinical management of non-insulin treated type 2 diabetes by SMBG Farmer et al BMJ 2012

Review: has a minimal effect in improving glucose control at 6 mos, disappears after 12 months follow-up. -Malanda et al,Cochrane Rev, 2012

Review clinical practice guidelines: more in favor of SMBG use than the systematic reviews that were cited. The citation practice was non-systematic and industry funding seemingly led to a more positive attitude towards SMBG- Aakre et al. Diab Med 2012

Neither SMBG testing nor its frequency was associated with glycemic benefit . Davis et al. Diab Care, 2006.

Should non-insulin treated patients with type 2 dm monitor their glucose? YES

- Rev. Evidence **suggests the usefulness of SMBG in improving glycemic control in NI treated T2**: reduction of HbA_{1c} levels. In particular, SMBG proved to be useful in the subgroup of patients whose baseline HbA_{1c} was ≥8%- **Poolsup et** Diabetes Technol Ther, 2009

- Rev. SMBG is as **effective as increasing the dosage of oral antidiabetic therapy in improving the glycaemic control in NIT-T2DM** previous poor control even without a detailed training for interpreting the results-Madeo et al, Ab Endocrine Rev 2011

- RT**SMBG use and medication adherence were associated with similar degrees of A1C reduction (retrosp)** controlling for baseline A1C, suggesting that both factors may be important for attaining glycemic control.-Virdi et al. Diabetes Technol Ther. 2012

- **SMBG in NI T2DM resulted in better dietary adherence, weight loss and improved A1C.** McAndrew et al. Diab Ed 2012

Should non-insulin treated patients with type 2 dm monitor their glucose? YES

- RC pilot study: Compared self monitoring bg disease management strategy vs. 'usual' care.

  6 mos. 62% Intervention group and 20% of C group reached A1C <7%

RCT

Franciosi et al. Diabet Med 2011

What do you think?

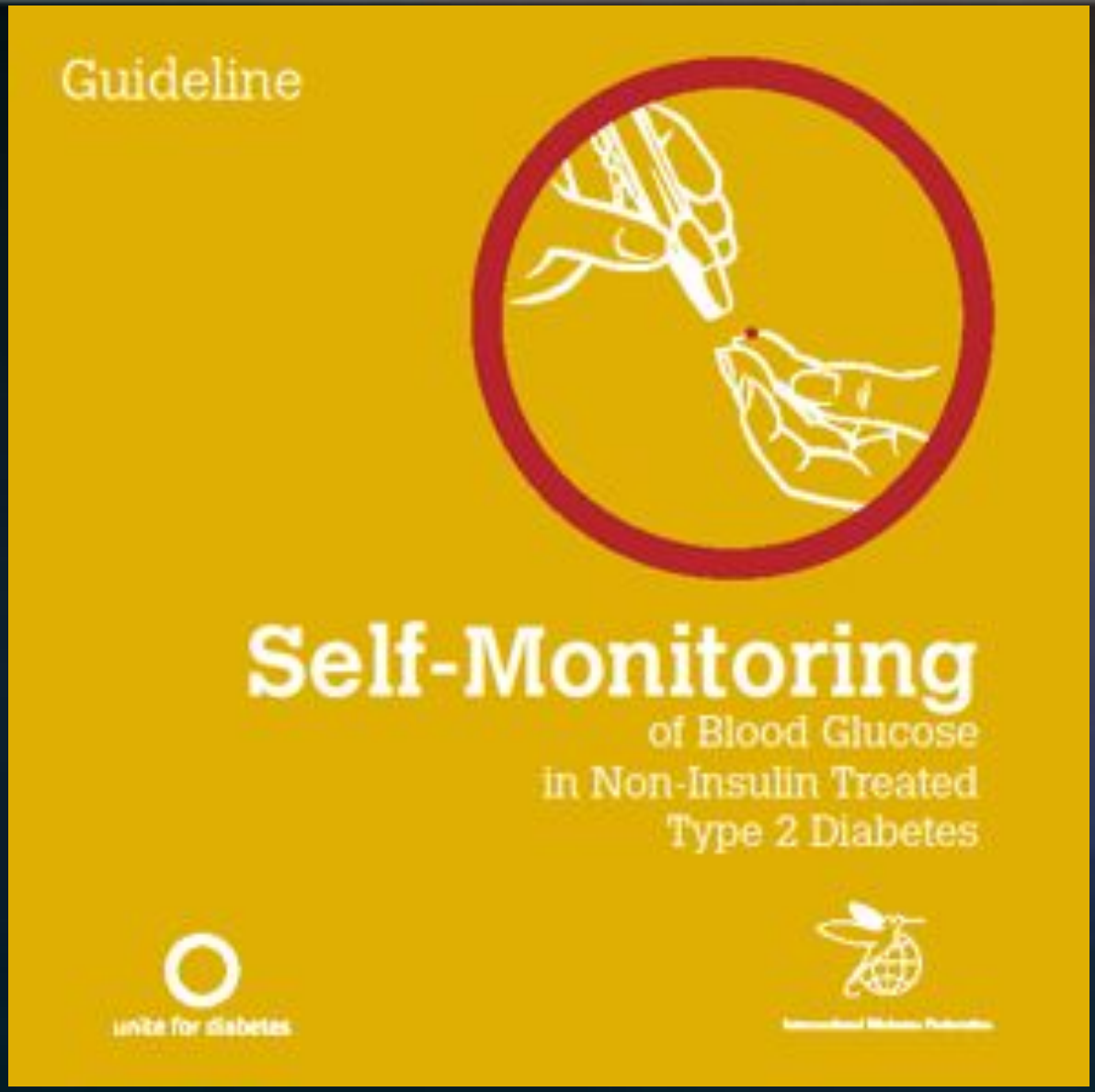
- Must have DSME along with SMBG

  Appropriate use of structured SMBG significantly improves glycemic control and facilitates more timely/aggressive treatment changes in NIT2 without decreasing general well being-Polonsky et al, DM Care 2011

- Patients reported poor problem-solving skills when detecting hyperglycemia and hypoglycemia via SMBG.

  Patients need to learn problem-solving skills along with SMBG training to achieve glycemic control Wang et al. Diab Ed 2012

What do others leaders in DM think?



www.idf.org and at www.smbg-iwg.com

IDF Recommendations on SMBG in NI treated T2DM

1. Only when PWD (and/or their care-givers) and/or HCP have knowledge, skills and willingness to incorporate SMBG & therapy adjustment into their diabetes care plan

2. Consider at the time of diagnosis-enhance understanding of diabetes as part of individuals' education, & facilitate treatment initiation & titration

IDF Recommendations

3. Considered as part of DSME to better understand disease. provide for pt participation in control & treatment, modify behavioural & pharmacological interventions

4. Individualize SMBG protocols (intensity and frequency) to address each individual's specific needs & requirements for data on glycaemic patterns, & monitor impact of therapeutic decision making

IDF Recommendations

5. Purpose of performing & using SMBG data should be agreed between PWD & HCP. Agreed-upon purposes/goals and actual review of SMBG data should be documented

6. SMBG use requires an easy procedure for patients to regularly monitor the performance and accuracy of their glucose meter

SMBG: American Diabetes Association

- When prescribed as part of a broader educational context, SMBG results may be helpful to guide treatment decisions and/or patient self-management for patients using… noninsulin therapies. (E)

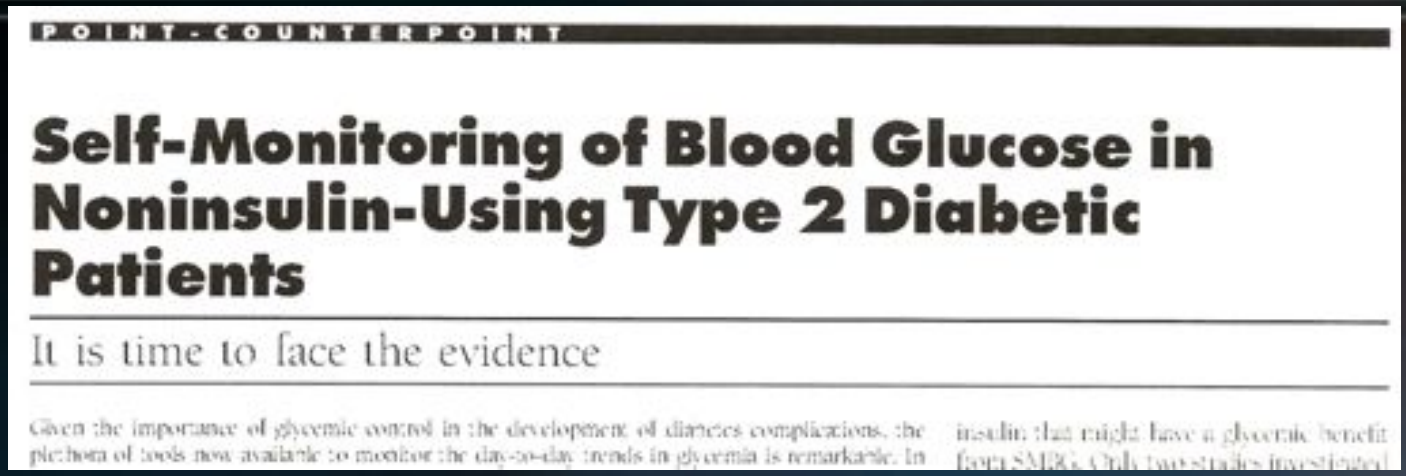
- When prescribing SMBG, ensure that patients receive ongoing instruction and regular evaluation of SMBG technique and SMBG results, as well as their ability to use SMBG data to adjust therapy. (E)

Cost Benefit?: Cost of supplies Type 2 non insulin treated

- US 2002: Medicare Part B $465 million
  > 50% of medical costs declared on ICD9

- Canada $247 million
- Netherlands 2006, $88 million
  - ~ 10% total costs for treatment

Is it worth it????? OR…Are we doing something wrong?

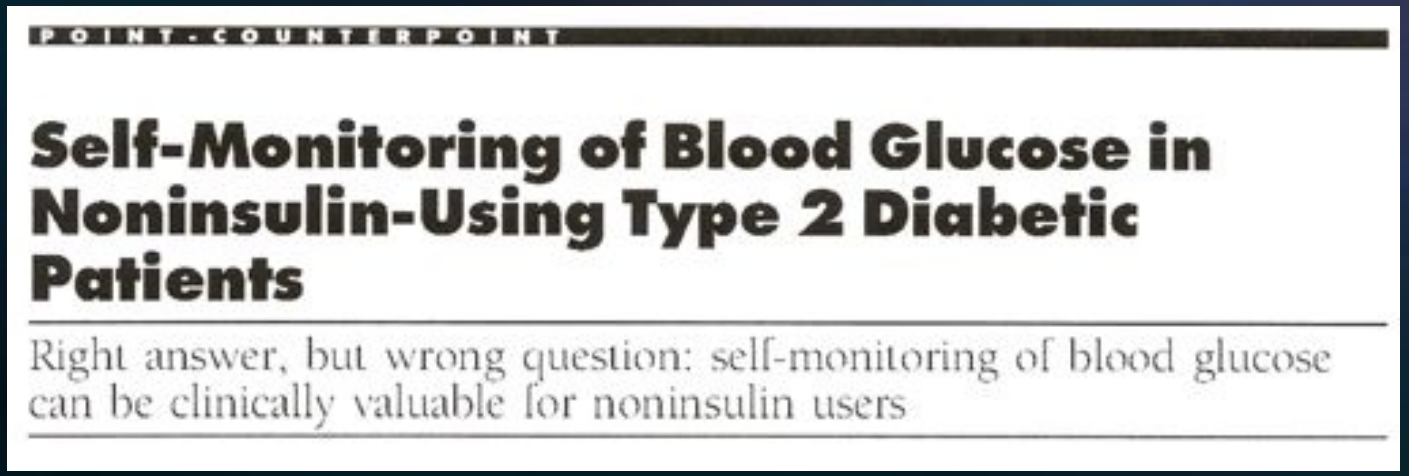


POINT-COUNTERPOINT

Self-Monitoring of Blood Glucose in Noninsulin-Using Type 2 Diabetic Patients

It is time to face the evidence

Malanda, Bot, Nijpels. Diab Care Jan 2013



POINT-COUNTERPOINT

Self-Monitoring of Blood Glucose in Noninsulin-Using Type 2 Diabetic Patients

Right answer, but wrong question: self-monitoring of blood glucose can be clinically valuable for noninsulin users

Polonsky, Fischer. Diab Care Jan 2013

SMBG in non insulin treated t2dm?

- Trials show 0.1% -0.3% improvement A1C
- Flawed studies?
  - A1C too low at baseline
  - Only pts randomized, same clinician
  - Poor adherence to SMBG
  - Inconsistent education
- Need structured SMBG
  - Frequency & timing
  - Pt related and clinician related knowledge and skills
  - Access to display of results

What’s appropriate use?

Ten best reasons of why I forgot my blood sugar readings?

1. YOU told me not to bring them
2. I don't know what to do if they're high or low
3. I forgot, I'm just too stressed
4. I was supposed to bring them? No one told me
5. My dog chewed on my meter
6. My grandchildren dropped my meter in the toilet
7. I lost my meter
8. I get depressed looking at them
9. They are all high
10. I left my meter on the kitchen table

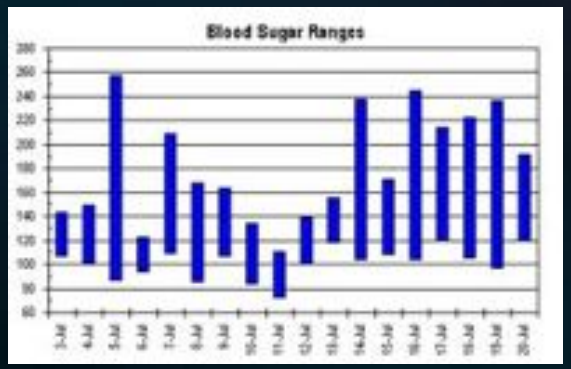
Reflections from clinical practice

- Don’t know target range
- No one ever looks at them
- Don’t understand what the results mean
- What actions to take

Downloading vs. Record Keeping

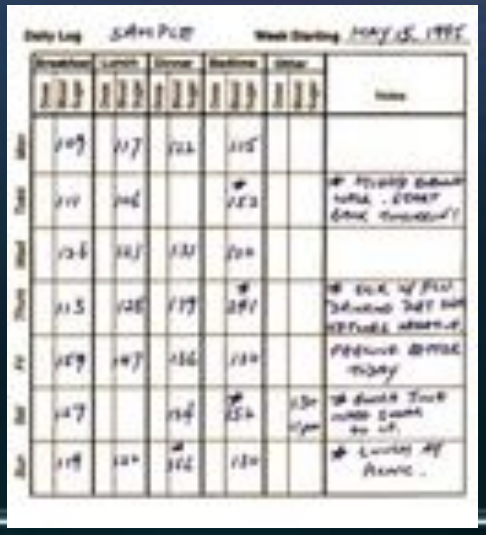
Downloading

- See all readings
- Is time/date correct
- Patient doesn't look at results
- Can't recall why a glucose was high or low



Record Keeping

- People don't like it
- May not write down all the results
- May help with problem solving
- More information



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Logbook

12 weeks up to 11.09.2013

Logbook

	Date	05:30 - 07:59	08:00 - 10:59	11:00 - 12:29	12:30 - 16:59	17:00 - 18:29	18:30 - 21:29	21:30 - 23:59	00:00 - 05:29
Wednesday	11.09.2013	-	159	-	-	-	-	-	-
Tuesday	10.09.2013	-	78	-	228	-	-	-	-
Monday	09.09.2013	-	180	-	180	-	-	-	-
Sunday	08.09.2013	-	146	-	243	-	-	-	-
Saturday	07.09.2013	-	68	-	-	241	-	-	126
Friday	06.09.2013	-	136	-	166	-	-	-	-
Thursday	05.09.2013	-	166	-	61	385	-	-	-
Wednesday	04.09.2013	373	-	-	-	395	-	123	-
Tuesday	03.09.2013	-	210	-	138	-	-	-	-
Monday	02.09.2013	-	56 H	-	254	249	-	-	-
Sunday	01.09.2013	-	73	-	294	119	-	-	104
Saturday	31.08.2013	-	-	213	-	-	427	-	-
Friday	30.08.2013	-	-	270	-	-	295	-	-
Thursday	29.08.2013	-	-	85	-	-	139	74	-
Wednesday	28.08.2013	-	85	-	-	196	-	146	-
Tuesday	27.08.2013	-	-	121	287	-	86	-	-
Monday	26.08.2013	-	102	-	-	321	-	-	-
Sunday	25.08.2013	-	-	65	-	279	-	-	-
Saturday	24.08.2013	-	-	212	-	-	340	-	-
Friday	23.08.2013	-	115	-	288	-	-	-	-
Thursday	22.08.2013	-	124	-	-	313	-	-	-
Wednesday	21.08.2013	-	69	-	152	-	-	-	-
Tuesday	20.08.2013	-	84	-	243	158	-	-	-
Monday	19.08.2013	55 H	220	-	-	146	-	-	-
Sunday	18.08.2013	-	65	-	164	-	122	-	-
Saturday	17.08.2013	-	82	-	113	-	-	-	-
Friday	16.08.2013	-	132	-	-	355	-	-	214
Thursday	15.08.2013	-	-	107	-	-	331	-	-
Wednesday	14.08.2013	-	69	-	226	-	-	325	-

Adult Learning Principles

- Self Directed/Internally motivated
- Bring life experiences & knowledge
- Goal oriented
- Relevancy oriented
- Practical
- Like to be respected

Knowles, M. M. S. (1970). *The modern practice of adult education* (Vol. 41). New York: Association Press.

Adult Learning:
Self directed/internally motivated

- Imposing plan
- "Shoulds"

- Ask questions, be curious…..Listen

Adult Learning:
Bring life experience & Knowledge

- Questions during assessment
  - Have you ever done this before?
  - Do you know anyone who…..
- Step by step information[1]
- Build upon prior knowledge[1]
- Familiar to new information[1]
- Incorporate into REAL experience[1]

[1] Zull, JE (2004) The art of the changing brain. *Educational Leadership*

Adult Learning: Goal Oriented

- Knowledge is a means to an end rather than an end in itself
- Useful knowledge is knowledge that helps individuals better manage and/or live with their diabetes
- Knowledge which does not contribute to a higher goal is not worth teaching, nor does it help change behavior

Problem based learning

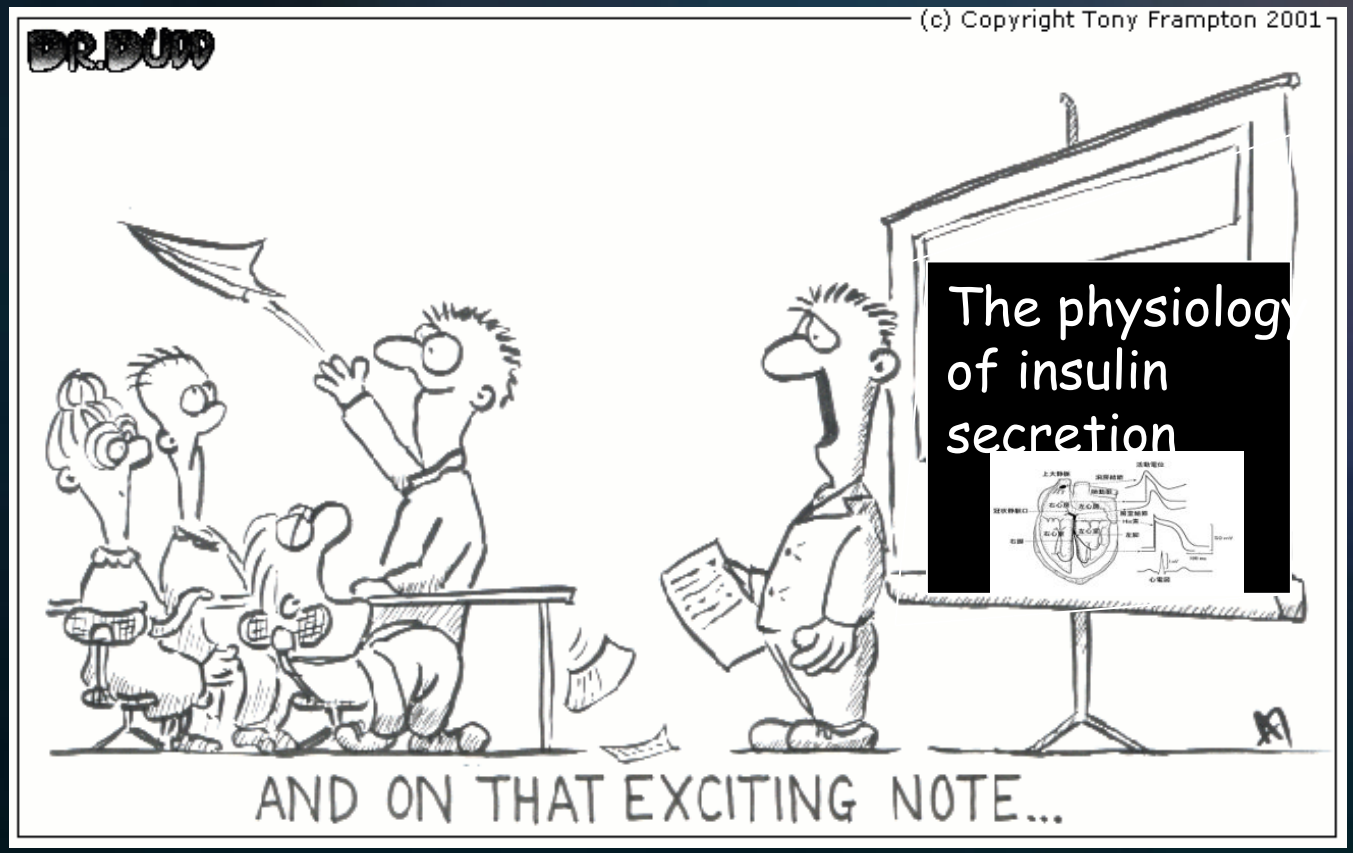
What is the goal? (target)How do I get there

Brain friendly teaching/ learning: Keep it in context

- Context driven learning is brain friendly

Adult Learning: Relevancy Oriented

- Teach what is meaningful



The Brain and learning

- We remember what WE believe is significant
- Biological depression, extended stress and chronic illness can cause cognitive deterioration

Zull, JE (2004) The art of the changing brain. *Educational Leadership*

Adult Learning: Adults are Practical

- Explain clinical reasons
- Promote partnership
- Give choices for schedules
- Promote active participation

Adult Learning: **R-E-S-P-E-C-T**

- Take an interest
- Partnership
- Positive feedback
- Encourage expression of ideas, reasoning, feedback
- What do you think would happen if …?

No Judging

Learning Styles: SBGM

- Visual- Show me
- Auditory- “Explain it to me”
- Kinesthetic- “Let me do it”

Learning

- Visual-use graphs, pictures
- Auditory-listening to why things happen & applying problem solving approaches
- Kinesthetic-give assignments to record BG results, food diary, etc.

Components of SMBG program

McAndrews et al, TDE, 2007

1) Instruction on how to use the glucose meter
2) Interpretation of SMBG results
3) Identification of target ranges
4) Determination through problem solving (the connection between a glucose value and prior behavior
5) Determination of Action Plan based on results to bring into target range
6) Explain that symptoms are poor indicator of BG value
7) Create regimen that fits with lifestyle
8) Nonjudgmental evaluation

Patient Centered Assessment & SMBG

- Physical and Emotional issues
- Wake/Sleep Cycle
- Eating schedule
- Medication schedule
- Activities daytime/nighttime
- Perceptions of diabetes
- Personal goals
- Numeracy and Literacy

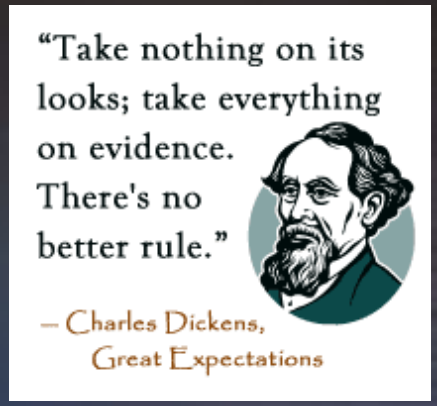
Using SMBG to enhance DSME and change behavior

- Provides immediate feedback
- Self-regulation
- Increase knowledge and application
- "Scientific experiment"
  - Data gathering
  - Analyzing
  - Making changes to reach target

Creating a teachable moment

- "Guessing" blood glucose based on symptoms
- Random BG check in office
  - "Its never that high"
  - "well I just finished eating"

Using SMBG to enhance DSME and change behavior



- Structured glucose monitoring
  What do you need to know?

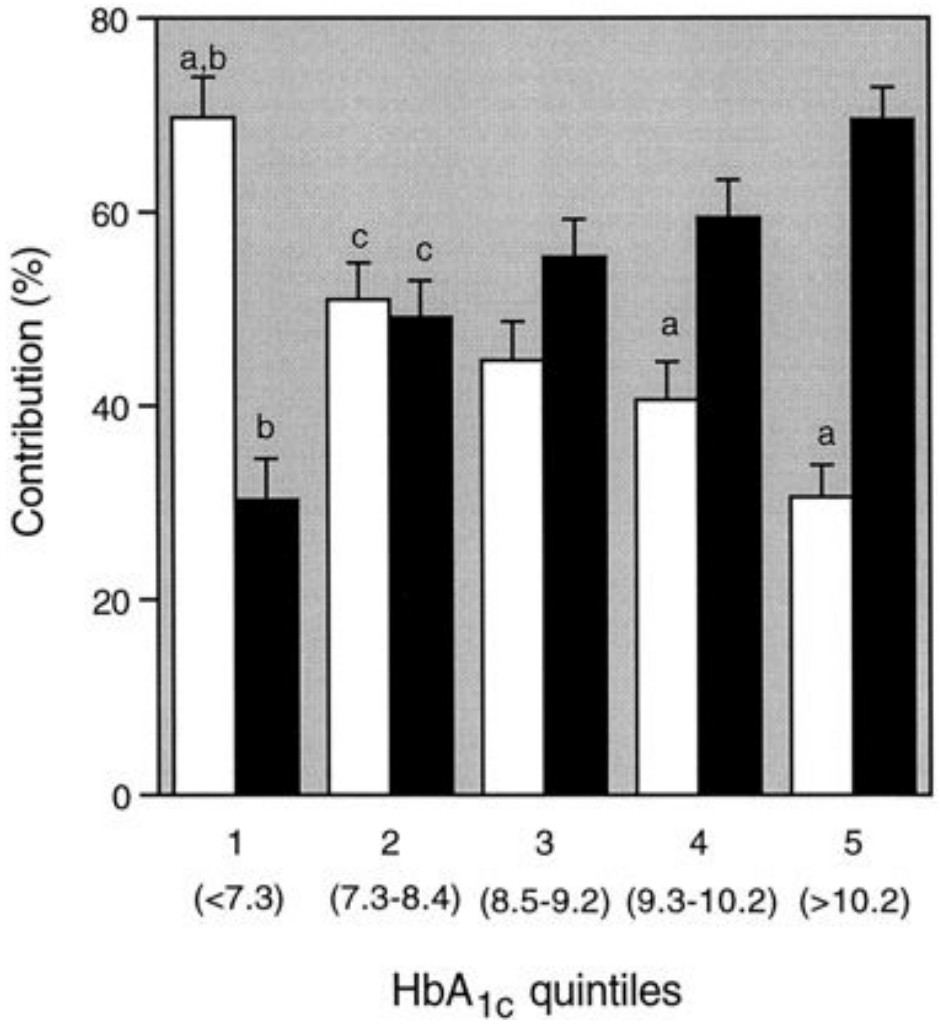
  A1C <7.3 % target PP (70% contribution)

  A1C > 10.2% target FBG (70% contribution)

  Monnier, Diab Care 26:881-885. 2003

"…fasting hyperglycemia plays a major role as soon as the HbA_{1c} level rises above 8.4%"

Relative contributions of postprandial (□) and fasting (▪) hyperglycemia (%) to the overall diurnal hyperglycemia over quintiles of HbA1c. a, significant difference was observed between fasting and postprandial plasma glucose (paired t test); b, significantly different from all other quintiles (ANOVA); c, significantly different from quintile 5 (ANOVA).



Monnier L et al. Dia Care 2003;26:881-885

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American Diabetes Association.

Using SMBG to change behavior

Many Options

- ✓ Paired glucose readings: check 2x a day
- ✓ Pre meal glucose readings: check 3 x a day?
- ✓ Iterations of before/after/bedtime
- ✓ Pre/Post and Bedtime: 7 x daily for 3 days
- ✓ ?????

Examples-paired meals

	Pre Bkst	After bkst	Before lunch	After lunch	Pre supper	Post supper	bedtime
Monday	x	x					
Tues							
Wed			x	x			
Thurs							
Friday							
Sat					x	x	
Sun							

IDF, Guideline: Self monitoring of blood glucose in non-ins treated type 2 DM 2009

Examples-detect fasting hyperglycemia

	Pre Bkst	After bkst	Before lunch	After lunch	Pre supper	Post supper	bedtime
Monday							X
Tues	X						
Wed							X
Thurs	X						
Friday							X
Sat	X						
Sun							

IDF, Guideline: Self monitoring of blood glucose in non-ins treated type 2 DM 2009

Examples-detect fasting hyperglycemia

	Pre Bkst	After bkst	Before lunch	After lunch	Pre supper	Post supper	bedtime
Monday							X
Tues	X						
Wed							X
Thurs	X						
Friday							X
Sat	X						
Sun							

IDF, Guideline: Self monitoring of blood glucose in non-ins treated type 2 DM 2009

Using SMBG to Guide Pharmacological Therapy

Matching Pharmacology to Pathophysiology

↑ PP

GLP-1
GIP

Glucose Influx

↑ PP

AGI

Secretagogues
Insulin; Sulfonylureas

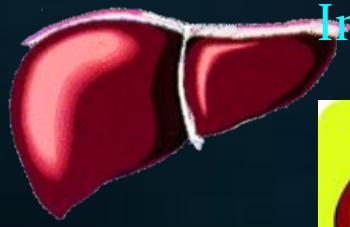
↑ Hepatic Glucose Output

Biguanides
TZD
Insulin

Hyperglycemia

↓ Insulin Secretion

TZD
Biguanides
Insulin



SGLT2 inhibitors

↓ Peripheral Glucose Uptake

↑ Renal glucose Reabsorp.

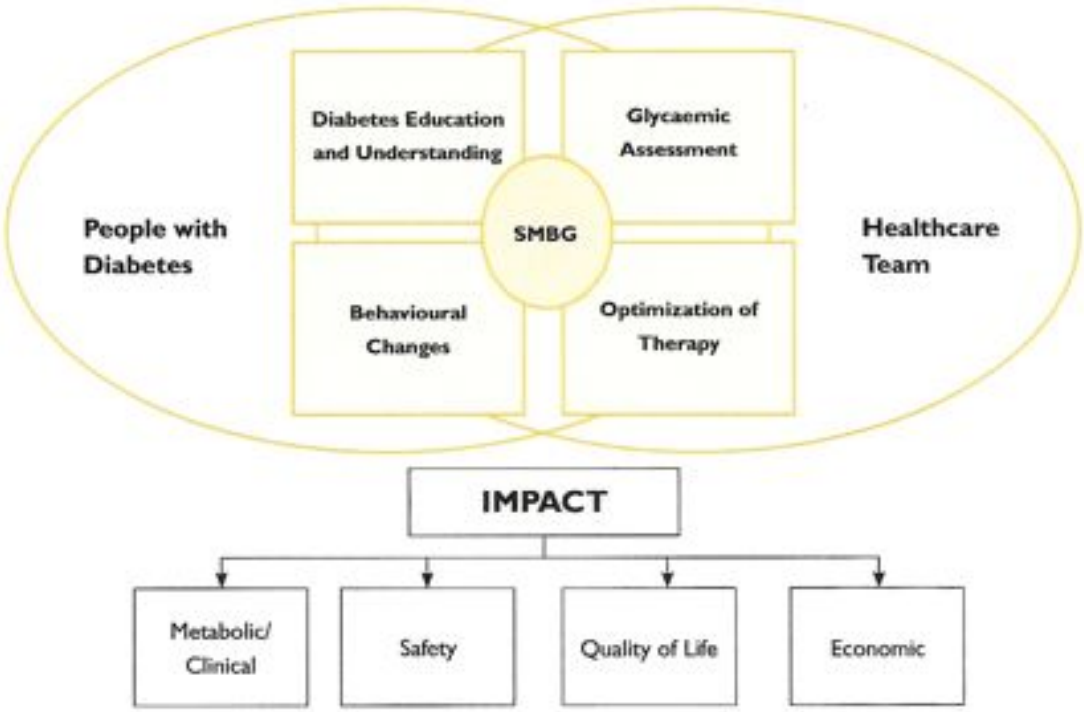
Medication	Mechanism of action	Effect on glucose	Fasting	Post prandial
Biguanides metformin (Glucophage, Forteo)	suppress hepatic glucose production and minor effect at increasing glucose uptake at skeletal tissues.	Lowers fasting glucose; minor effect at increasing insulin sensitivity at level of	X	X- occasional only
Insulin secretagogues Sulfonylureas glimepiride (Amaryl glipizide (Glucotrol) Meglitinides nateglinide (Starlix) repaglinide Prandin)	Sulfonylureas enhance insulin secretion by stimulating β cells to secreting insulin throughout the day. Meglitinides are short acting insulin secretagogues and stimulate insulin from β cells.taken before a meal	Lower both fasting and post prandial Lower post prandial glucose	X	X X
Alpha glucosidase inhibitors acarbose (Precose) miglitol (Glyset)	Alpha glucosidase inhibitors inhibit the enzyme that breaks down carbohydrate in the gut.	Lower post prandial		X

Thiazolidinediones pioglitazone	Increase insulin sensitivity in skeletal, adipose and liver tissues.	Lowers fasting glucose and post prandial	X	X
Sodium-glucose co-transporter 2 inhibitors canofloxacin	Inhibits glucose reabsorption by the proximal tubule in the kidney. Increases glucose excretion from the body	Lowers both fasting glucose and post prandial glucose	X	X

Incretin mimetics ***GLP1 agonists** **exenatide (Byetta, Bydureon)** **liraglutinide (Victoza)** *****	**.** **GLP 1 agonists stimulate insulin release from β cells in a glucose dependent manner, suppress glucose mediated glucagon secretion, helps to decrease hepatic glucose production. Also decrease gastric emptying and increase satiety.**	**Lowers post prandial glucose, but may affect pre-meal glucose**		**X**
Amylin **Pramlintide (Symlin)**	**Pramlintide is an analogue of amylin and its effect is similar to the action of GLP1 agonists except for nonappearance of insulin secretion.**	**Lowers post prandial glucose**		**X**
DPP4 inhibitors **sitagliptin (Januvia)** **vildagliptin (Onglyza)** **linagliptin (Tradjenta)**	**DPP4 is a hormone that breaks down GLP-1. By inhibiting the DPP4 hormone, GLP-1 is more available and reduces post prandial glucose levels by stimulating insulin release and decreasing glucagon levels to reduce hepatic glucose release after meals**	**Lowers post prandial glucose**	**X**	**X**

Guideline on Self-Monitoring of Blood Glucose
in Non-Insulin Treated Type 2 Diabetes

SMBG as a Component of the Education/Treatment Programme



Summary

- SMBG is only beneficial when incorporated into DSME and diabetes management
- Use information to promote behavior change
- Structure SMBG so it makes sense to the patient and the results are useful to you AND the patient
- If data do not assist in self-management, no reason to do it
- Utilize adult learning principles
- SMBG when used appropriately can help guide therapy


That's all Folks!

Cases

- MK is a 58 year old woman with pre-dm
  FBG: 100-125 past several years
  A1C 6.2%-6.4%
  Refuses metformin
  Exercises daily
  Eats healthy

Do you recommend SBGM?

GS

- 32 yr old
- A1C 9.1% August 2013
- Pioglitazone 30 mg qd. & glipizide 10mg b.i.d.
- BMI 38.7
- Non adherent to meds
- SMBG?

BB	AB	BL	AL	BS	AS	BT
X	X					
		X	X			
				X		X

MB 28 yr old

- Newly diagnosed on routine check
- A1C 8.9%
- Getting married in 1 month, wants children
- Started on metformin 500mg b.i.d.
- PCP did not recommend SMBG and specifically said not to see a nutritionist
- Pt self referred
- SMBG??