



Optimising Peri-Operative Glycaemic Management for the Diabetic Foot

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Conflicts of Interest

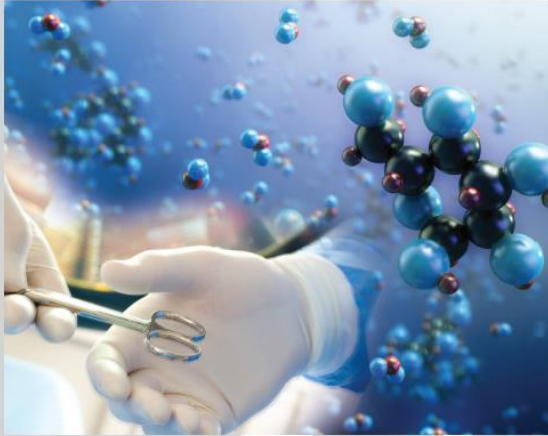
Who is This Strange Man?

- I qualified in 1991
- I trained in D&E and G(I)M in London
- I did general practice for 2 years
- I did ITU / anaesthetics for a year
- I did research at Mayo Clinic for 2 years
- I have been in Norwich since 2004
- Currently my other roles include
 - Chair of the Specialist Clinical Exam in D&E and the European Board Exam in Endocrinology, Diabetes and Metabolism
 - President-Elect of the Endocrine Section of the Royal Society of Medicine
 - On the Steering group for the Joint British Diabetes Societies for Inpatient Care



Highs and Lows

A review of the quality of care provided to patients over the age of 16 who had diabetes and underwent a surgical procedure



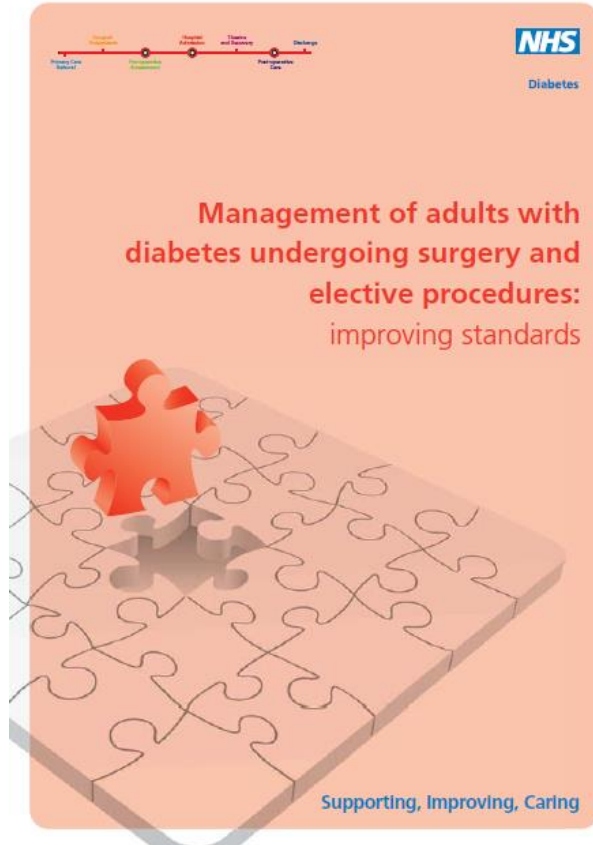
National Confidential Enquiry into Patient Outcome and Death – NCEPOD Report 2018

13 Recommendations

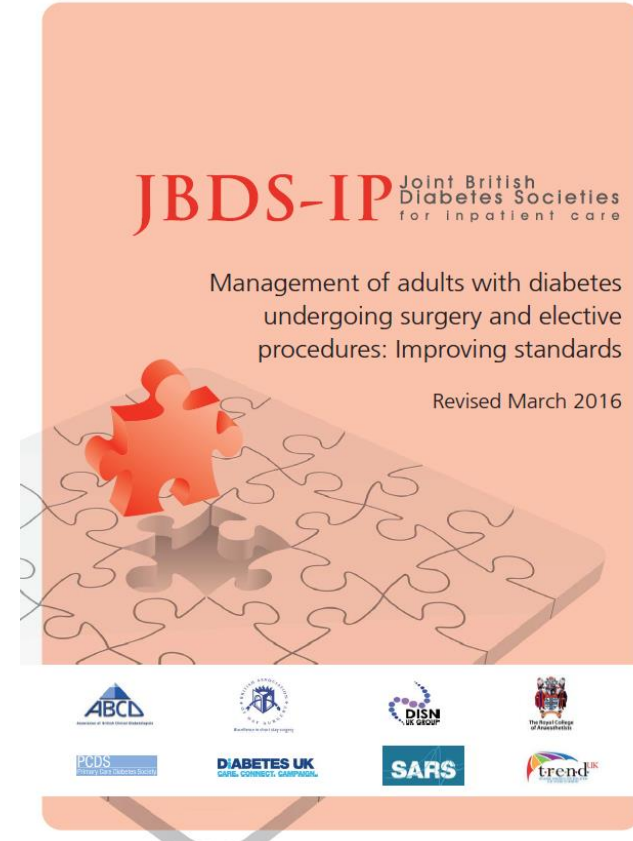
1	Write and implement a national joint policy for the multidisciplinary management of patients with diabetes who require surgery. In	5	Ensure a safe handover of patients with theatre recovery to ward, this should be the case notes and include: a. Medications given in theatre b. Glucose level on leaving the recovery	9	Cancellation of elective surgery in patients with diabetes should be avoided, particularly for known clinical reasons. Cancellation rates should be audited locally and the results acted upon.
2	Appoint a clinical lead for perioperative diabetes care in hospitals where surgical services are provided. This person will be responsible for developing policies and processes to: a. Ensure diabetes management is optimised for surgery	6	Develop a pre-operative assessment clinic and standards for the management of diabetes. These should be developed by an anaesthetist* and the clinical lead for	10	Develop and implement referral criteria for surgical inpatients with diabetes to:
3	Use a standardised referral process for elective surgery to ensure appropriate assessment and optimisation of diabetes. This should include: a. Satisfactory HbA1c levels within 3 months of referral	7	Ensure that patients with diabetes attend pre-operative assessment clinic prior to elective surgery	11	Record and monitor the time at which a patient begins fasting (for surgery or clinical reasons). If a
4	Ensure that patients with diabetes undergoing surgery are closely monitored and their glucose levels managed accordingly. Glucose monitoring should be included: a. at sign-in and sign-out stages of the surgical safety checklist (e.g. WHO safety checklist) b. in anaesthetic charts c. in theatre recovery d. in early warning scoring systems System markers and alerts should be used to raise awareness of glucose levels, e.g. tagging of electronic medical records, use of a patient passport or unique stickers in paper based case notes. <i>(Clinical Lead for Perioperative Diabetes Management, Lead Anaesthetist for Pre-Operative Assessment, Clinical Directors, Medical Directors, Directors of Nursing)</i>	8	A clinical lead for day surgery* should be appointed at all hospitals providing day surgery services. The clinical lead for day surgery should work along with the clinical lead for perioperative diabetes management and be responsible for ensuring that all patients with diabetes are considered where appropriate. Policies should be developed to ensure patients with diabetes have effective care during day surgery. <i>(Clinical Lead for Day Surgery, Clinical Lead for Perioperative Diabetes Management, Clinical Directors)</i>	12	Prioritise patients with diabetes on the operating list to avoid prolonged starvation.* Prioritisation of patients with diabetes on operating lists should be subject to local clinical audit and the results acted upon. <i>(Lead Anaesthetist for Pre-operative Assessment, Clinical Directors)</i>
				13	Provide patients with diabetes with education and information about their diabetes management at discharge from hospital as part of the discharge planning process. <i>(Diabetes Specialist Nurses, Clinical Lead for Perioperative Diabetes Management)</i>

Guidance

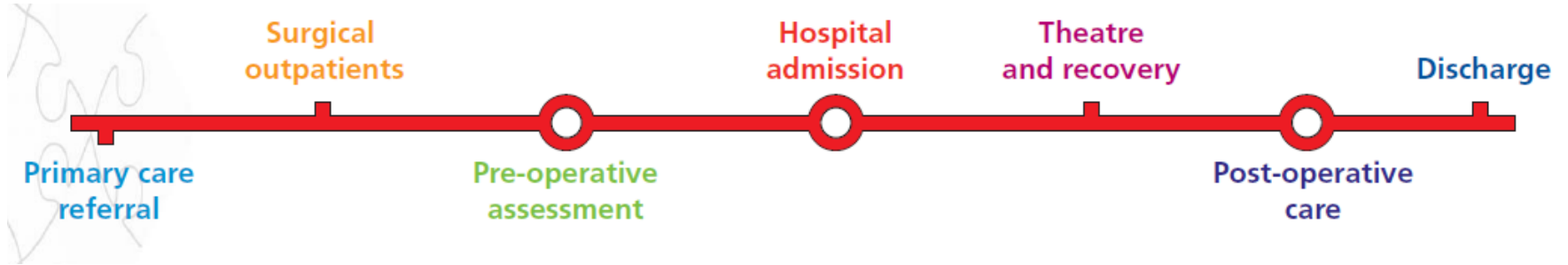
In 2011 Along
Came This.....



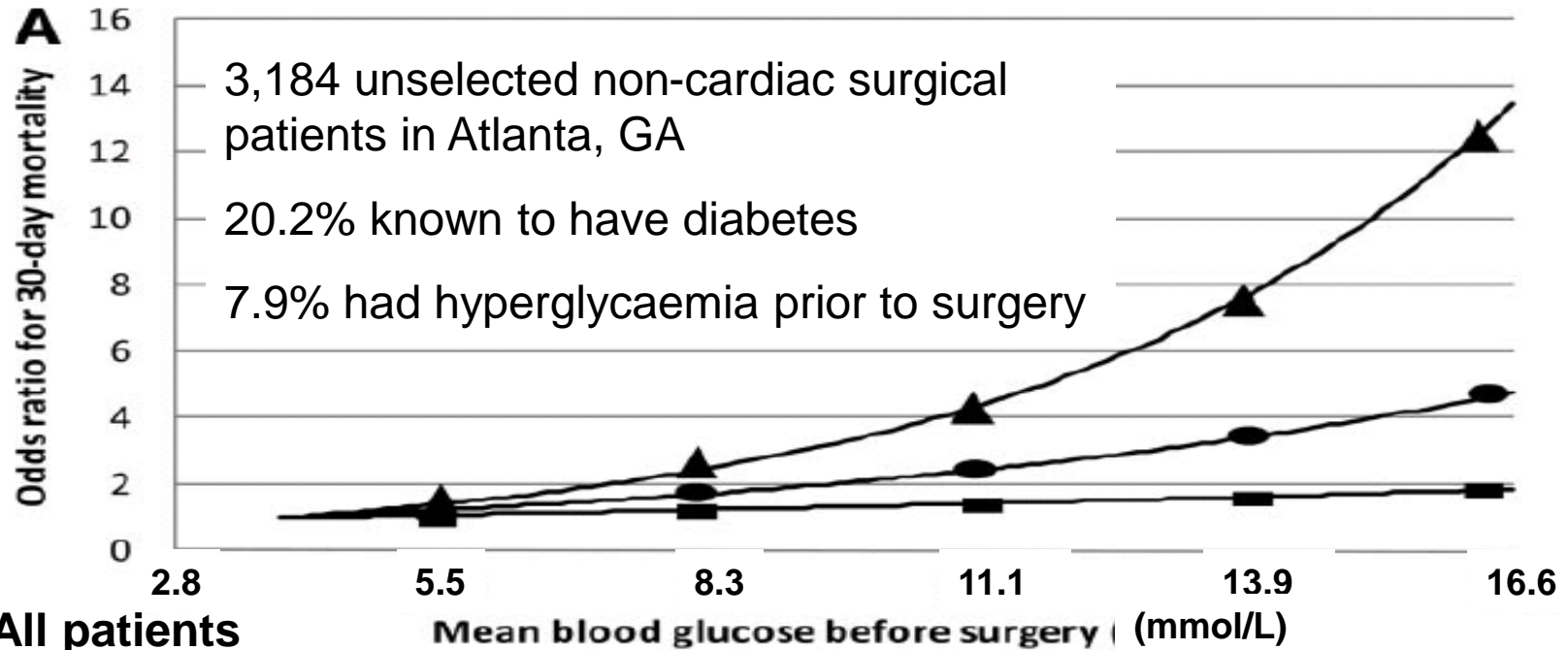
Revised in
2016.....



The Patient Journey



Do High Glucose Levels Cause Harm?

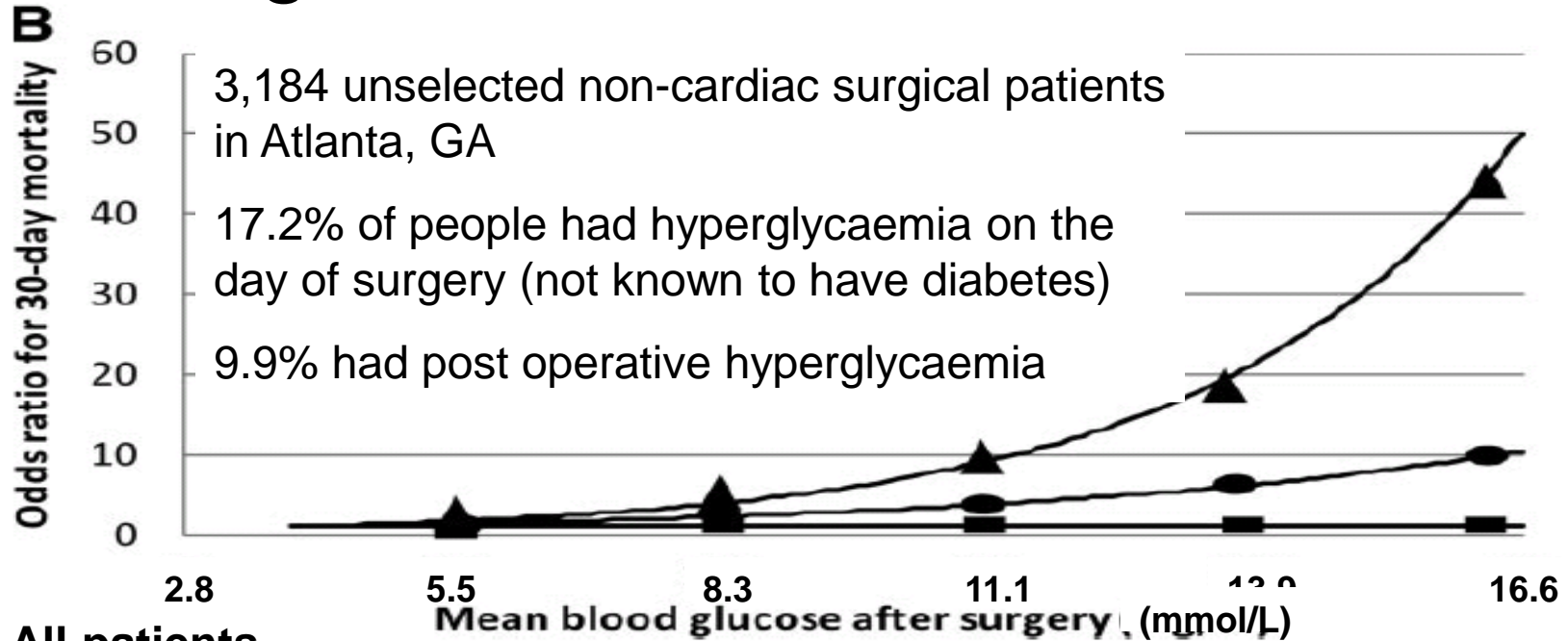


● All patients

■ Patients with diabetes

▲ Patients without diabetes

Do High Glucose Levels Cause Harm?

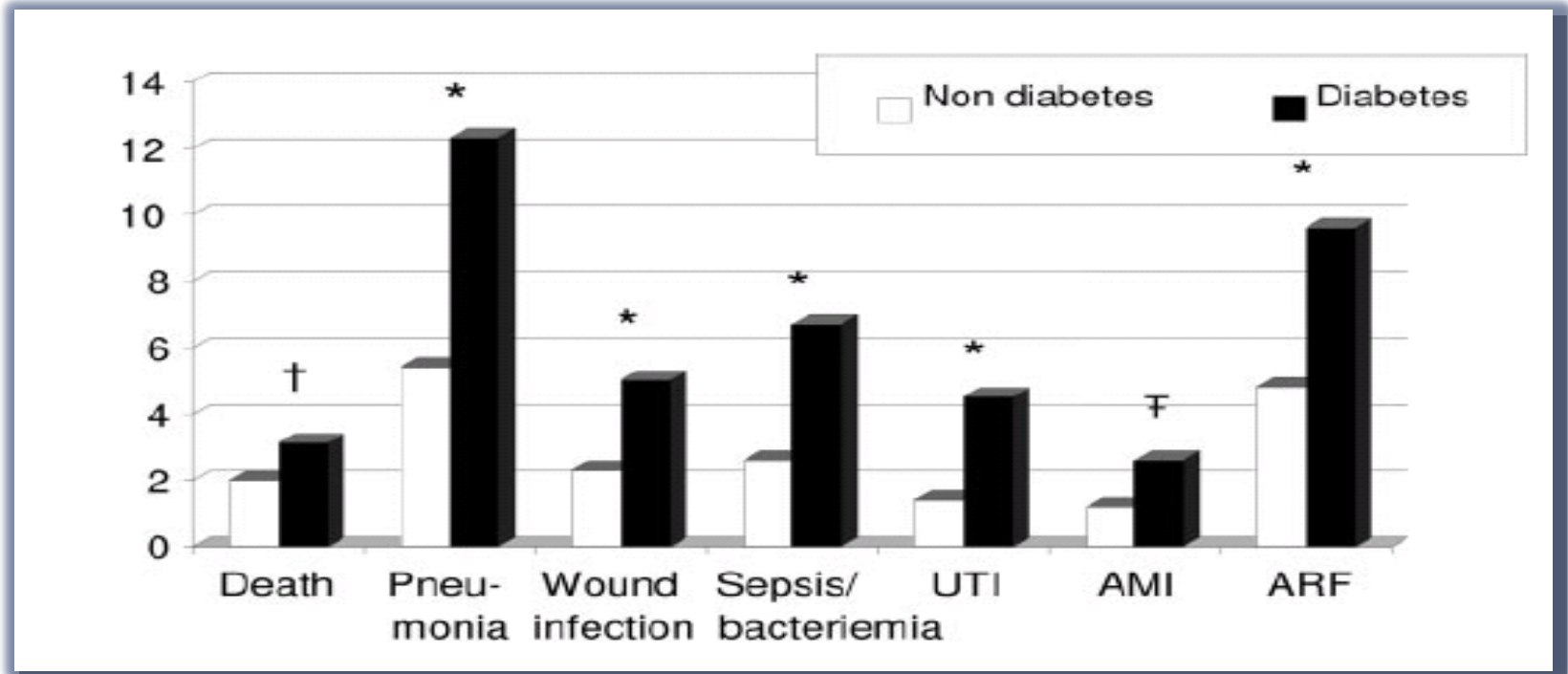


● All patients

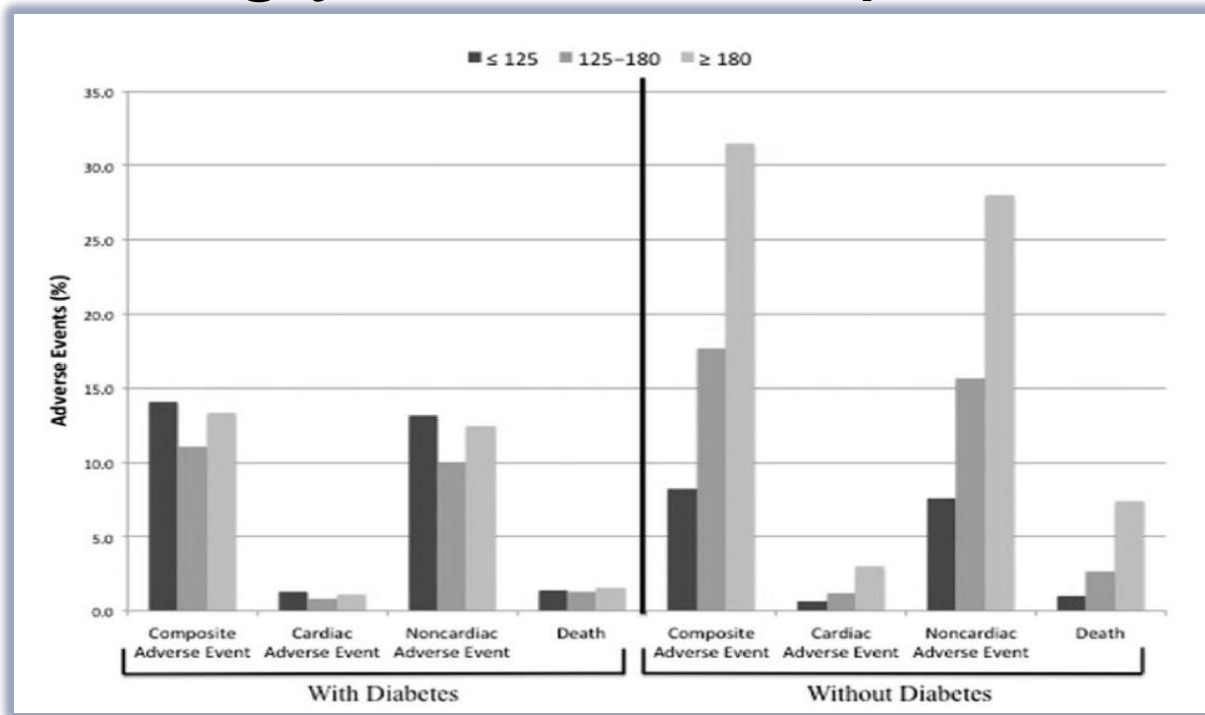
■ Patients with diabetes

▲ Patients without diabetes

Do High Glucose Levels Cause Harm?

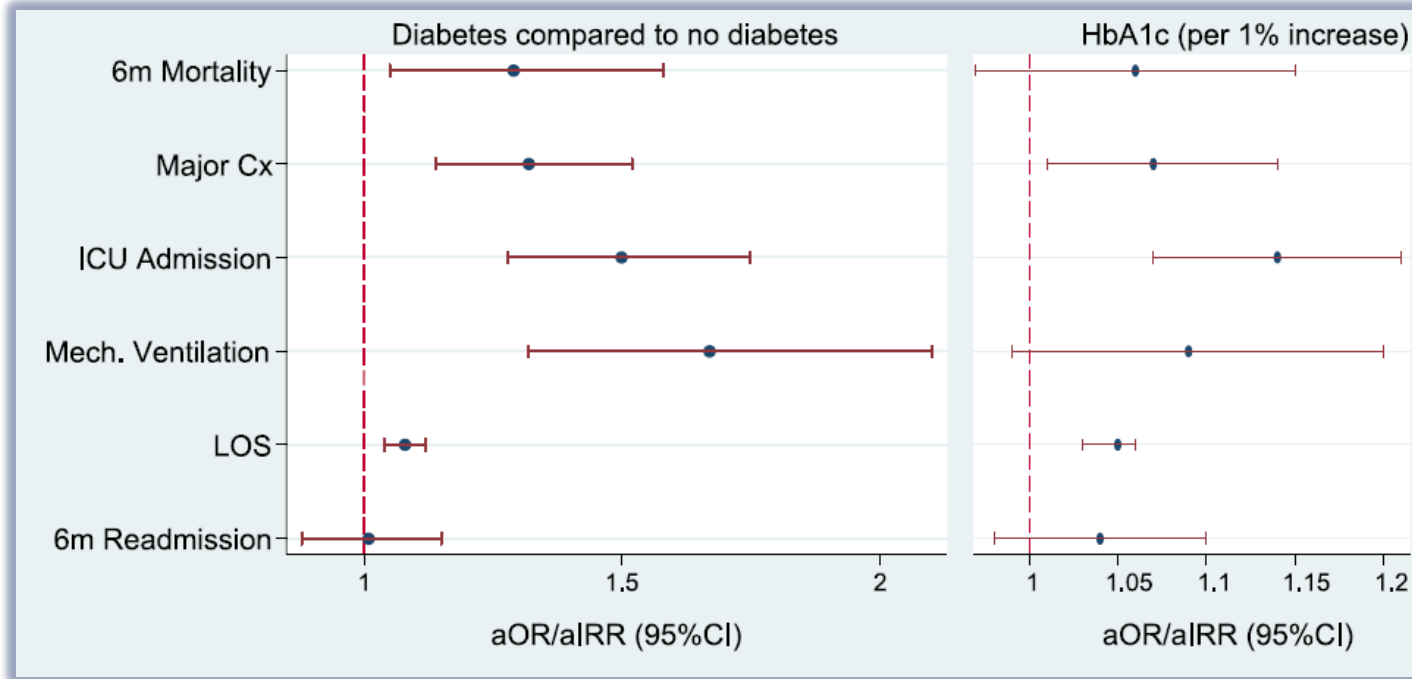


Hyperglycaemia in Previously Normoglycaemic People is Bad



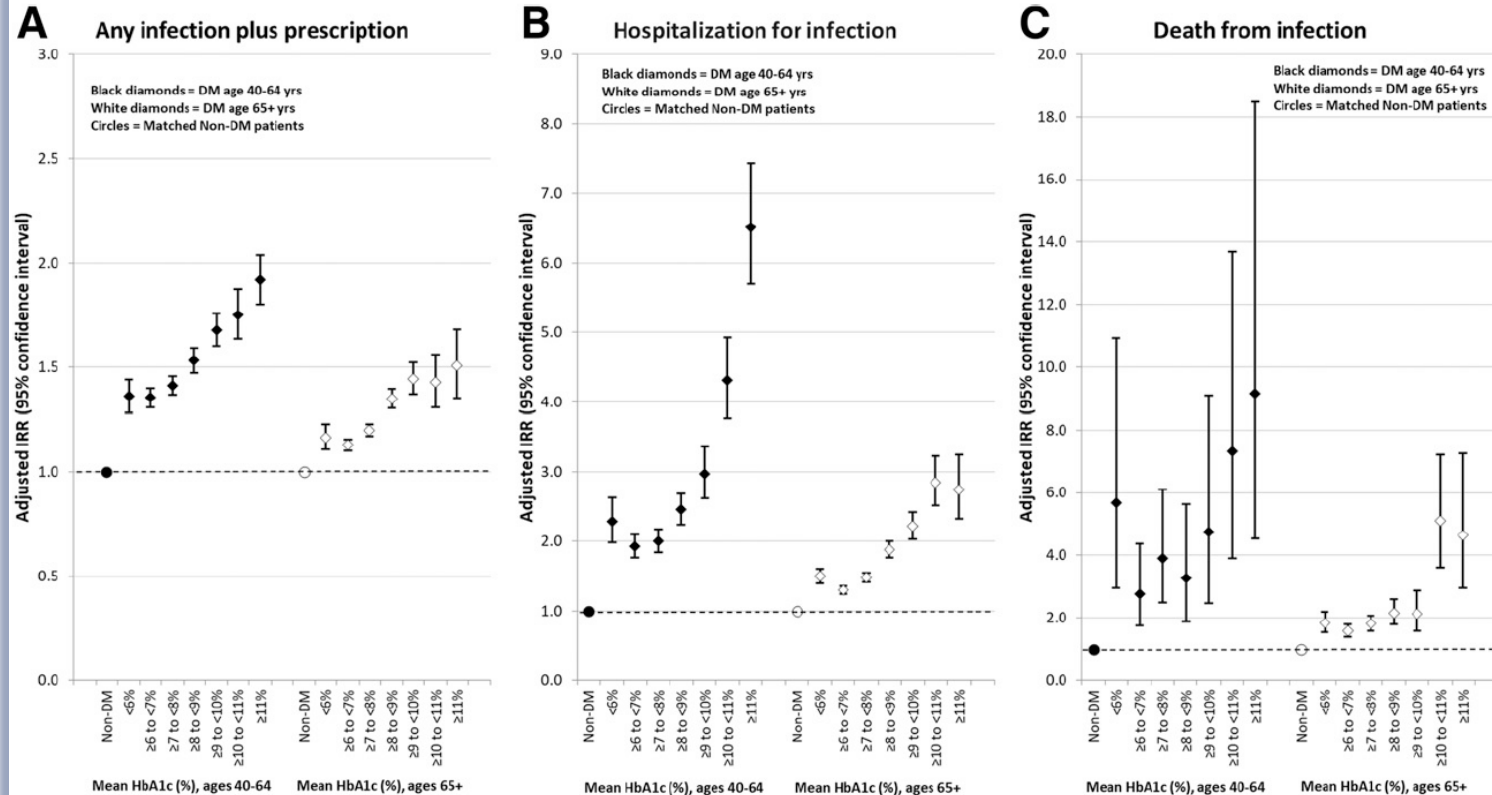
Composite endpoint = readmission; ITU; falls; any infection; debridement; AKI; re-operation

7,565 Canadians From 1 Hospital



Prospective (May 2013-January 2016), observational, adjusted, aged ≥ 54

Infections



Glucose and SSI – A Variety of Specialities

Author	Year	Gynecologic	ES (95% CI)	% Weight	Author	Year	Breast	ES (95% CI)	% Weight
Chapman	2015		1.80 (0.85, 3.85)	9.82	Bertin	1998		2.36 (0.38, 14.40)	3.44

Author	Year	Colorectal	ES (95% CI)
Anthony	2011		0.84 (0.41, 1.67)
Coakley	2012		2.20 (1.32, 4.27)
Deierhoi	2013		1.20 (1.00, 1.44)

Author	Year	Cardiac	ES (95% CI)
Bundy	2006		2.15 (1.67, 2.75)
Fakih	2007		2.31 (1.44, 3.71)
Fowler	2005		1.43 (1.38, 1.49)
Haas	2005		1.45 (0.31, 5.64)
Haley	2012		2.48 (1.67, 3.67)
Haley	2012		2.98 (2.02, 4.41)
Haley	2012		1.87 (1.22, 2.87)
Harbarth	2000		2.20 (1.70, 2.90)
Latham	2001		2.76 (1.64, 4.66)
Marschall	2007		1.80 (0.60, 5.40)
Nash	2011		1.30 (1.07, 1.59)
Olsen	2002		2.85 (1.42, 5.70)
Sharma	2009		2.45 (1.56, 3.84)
Townsend	1993		2.07 (1.24, 3.46)
Trick	2000		2.60 (1.00, 6.70)
Trussell	2008		4.71 (2.39, 9.28)
Wilson	2003		1.77 (0.80, 3.93)
Overall			2.14 (1.78, 2.56) (1.13, 4.05)

Overall (I-squared = 78.2%, p = 0.000) with estimated predictive interval

Author	Year	Multiple / Other	ES (95% CI)	% Weight
Anaya	2012		1.12 (0.58, 2.09)	2.10
Bachoura	2011		2.10 (1.20, 3.80)	2.51
Bykowski	2011		2.80 (1.20, 6.50)	1.30
Cannon	2012		1.24 (1.09, 1.41)	10.76
Chaichana	2015		6.09 (1.38, 9.35)	1.04
Chen	2010		1.20 (0.67, 2.16)	2.44
Chiang	2014		0.90 (0.50, 1.80)	2.11
Chopra	2012		1.80 (1.09, 2.96)	3.14
Chu	2015		1.22 (0.36, 4.20)	0.65
Davies	2012		3.51 (1.23, 10.04)	0.87
Elfenbein	2014		1.95 (1.34, 2.82)	4.74
Farrow	2008		1.34 (0.46, 3.59)	0.91
George	2011		3.21 (0.82, 10.96)	0.59
Hardy	2010		1.40 (0.44, 4.41)	0.73
Harness	2010		1.69 (0.45, 6.40)	0.56
Kaafarani	2010		3.16 (0.54, 18.40)	0.32
Kalra	2013		1.45 (0.61, 3.24)	1.33
Koutsoumbelis	2011		3.20 (1.22, 8.40)	1.02
Kuy	2014		1.34 (0.52, 3.44)	1.06
Lynch	2009		1.34 (0.91, 1.97)	4.51
Mahajan	2013		2.10 (1.70, 3.40)	5.17
Neumayer	2007		1.33 (1.22, 1.45)	11.89
Park	2009		1.13 (0.61, 2.00)	2.39
Paryavi	2013		1.25 (0.33, 4.70)	0.56
Shields	2013		3.03 (1.32, 6.98)	1.33
Shuman	2012		2.57 (0.55, 12.00)	0.42
Singh	2012		2.67 (0.94, 7.62)	0.88
Spaniolas	2014		1.18 (1.09, 1.27)	12.11
Suzuki	2010		2.08 (0.04, 16.72)	0.11
Talbot	2004		3.65 (1.42, 9.36)	1.07
Trinh	2009		2.25 (1.02, 4.94)	1.47
Tserenpuntsag	2014		1.13 (0.91, 1.39)	8.26
Walcott	2014		3.43 (0.71, 14.76)	0.43
Woodridge	2013		1.83 (0.39, 8.64)	0.42
deFreitas	2012		1.21 (1.07, 1.38)	10.80
			1.46 (1.32, 1.62)	100.00
Overall			1.12 (0.97, 1.28) (1.07, 2.00)	

Overall (I-squared = 48.1%, p = 0.001) with estimated predictive interval

Author	Year	Spinal	ES (95% CI)	% Weight
			1.42 (0.93, 2.18)	20.25
			2.54 (0.61, 10.56)	2.35
			0.79 (0.28, 2.20)	4.38
			2.11 (1.37, 3.21)	20.27
			4.20 (1.10, 16.30)	2.62
			0.85 (0.42, 1.69)	9.01

Author	Year	Arthroplasty	ES (95% CI)	% Weight
			1.83 (1.02, 3.27)	6.80
			1.28 (1.03, 1.60)	47.59
			1.25 (0.85, 1.83)	15.70
			1.21 (0.91, 1.62)	28.05
			1.89 (0.62, 5.75)	1.86
			1.30 (1.11, 1.51)	100.00
Overall			1.30 (1.11, 1.51) (1.01, 1.66)	

Overall (I-squared = 72.8%, p = 0.000) with estimated predictive interval

More Observational Data

- Observational data from 55 US hospitals
- Over 5 years
- Outcomes of 18,278 patients
 - 11,633 of whom who had a BG measured pre op, on day 1 post op or day 2 post op

Outcomes

TABLE 2. Adjusted Multivariate Logistic Regression Analysis on the Effect of Perioperative Hyperglycemia (>180 mg/dL at Any Point on the Day of Surgery, Postoperative Day 1, or Postoperative Day 2) on Outcomes Presented as Odds Ratio and 95% Confidence Intervals (Within Parenthesis)

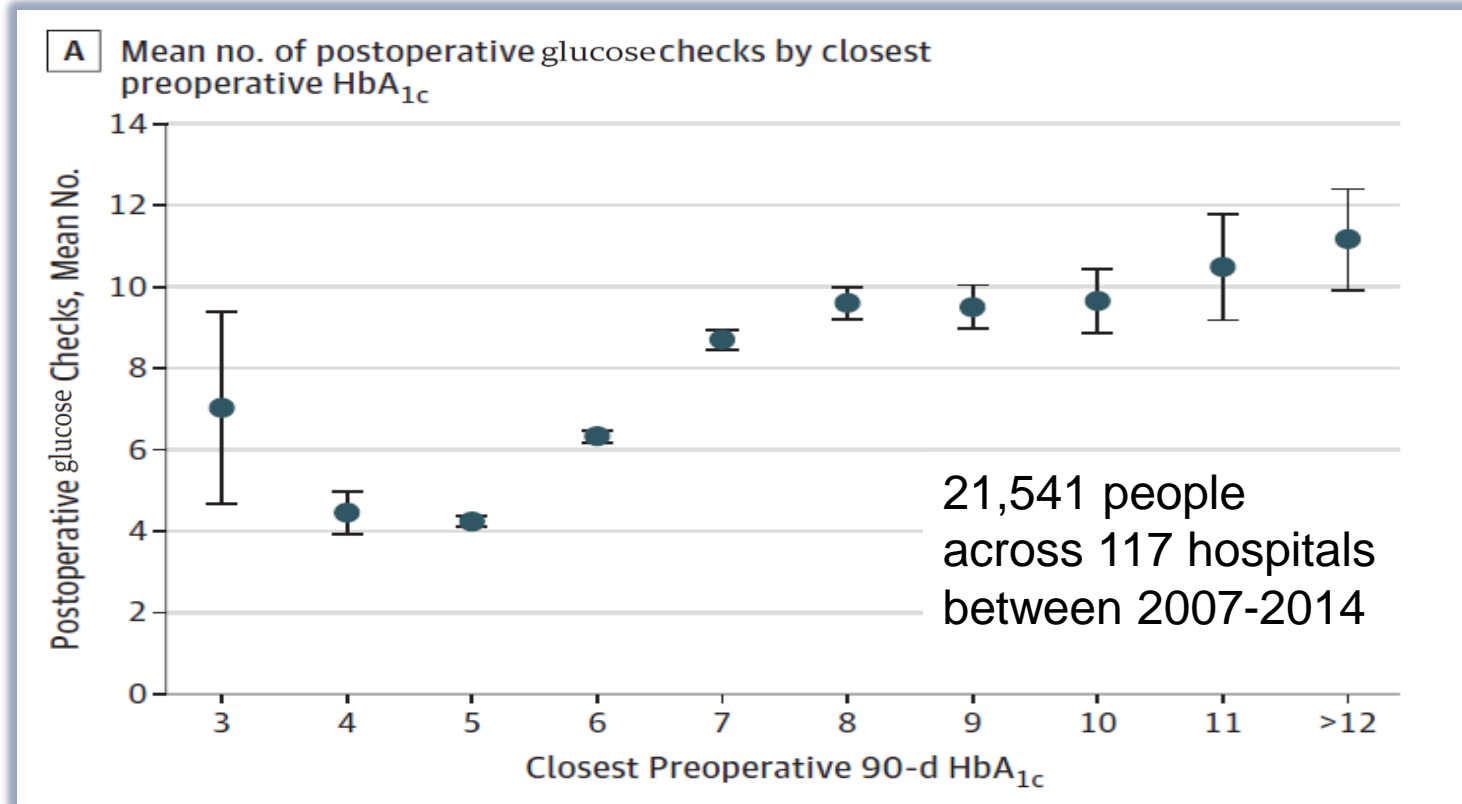
	Composite Infections (n = 491)	Deaths (n = 48)	Reoperative Interventions (n = 257)	Anastomotic Failures (n = 43)	Myocardial Infarctions (n = 13)
Hyperglycemia	2.0 (1.63–2.44)	2.71 (1.72–4.28)	1.8 (1.41–2.3)	2.43 (1.38–4.28)	1.15 (0.43–3.1)

High glucose levels were associated with poor outcomes

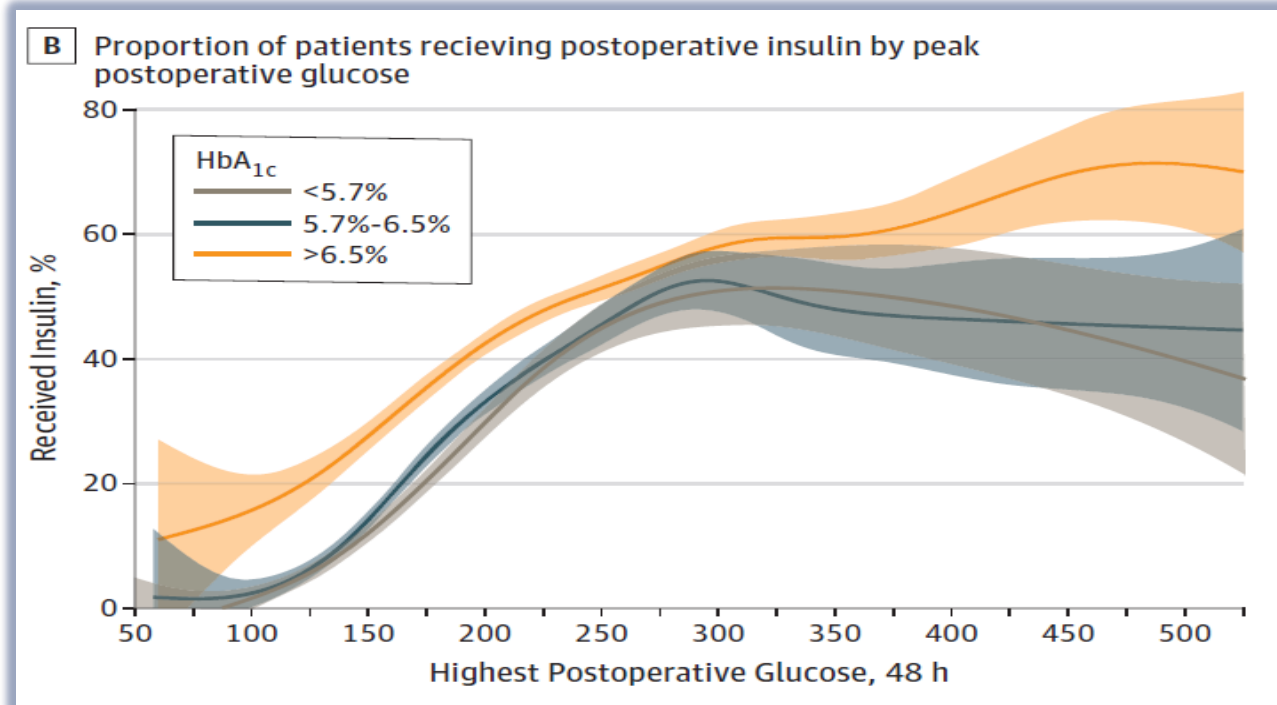
Diabetes [§]	Composite Infections (n = 491)	Deaths (n = 48)	Reoperative Interventions (n = 257)	Anastomotic Failures (n = 43)	Myocardial Infarctions (n = 13)
Noninsulin-dependent	0.51 (0.37–0.69)	0.48 (0.25–0.93)	0.63 (0.44–0.9)	0.45 (0.21–0.99)	0.77 (0.15–4.08)
Insulin-dependent	0.52 (0.35–0.76)	0.78 (0.36–1.68)	0.54 (0.35–0.85)	0.49 (0.18–1.32)	1.66 (0.26–10.71)

But – **knowing** that someone had diabetes was protective (?increased vigilance)

Probably



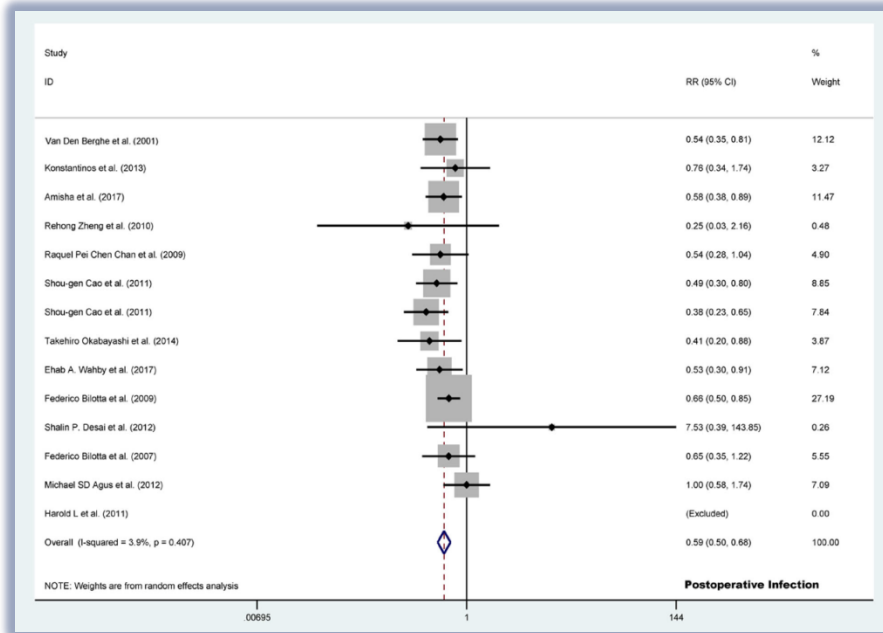
The Highest Pre-op HbA1c Were Most Likely to go onto Insulin Post-op



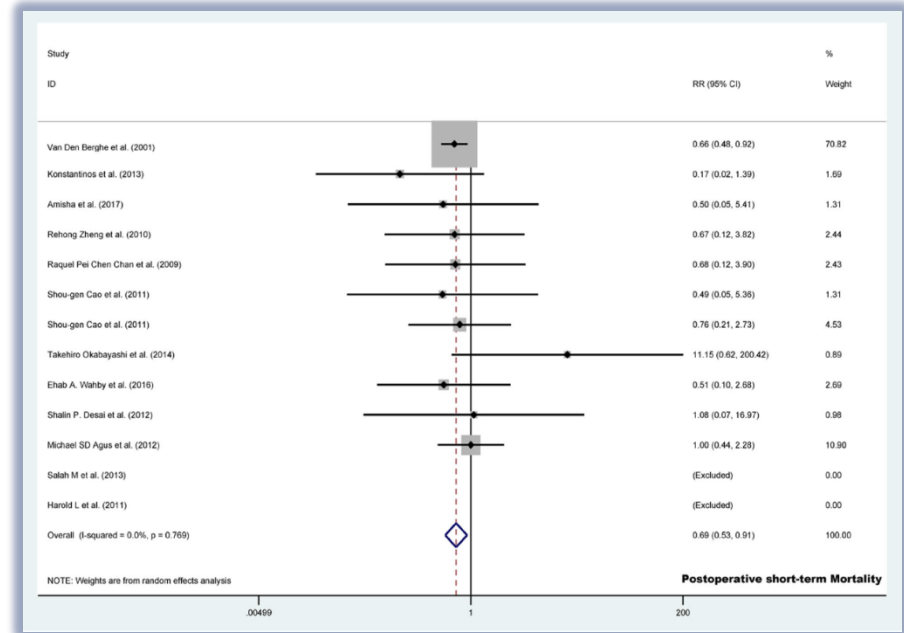
There is a Trend Emerging

- Data from the 2010-2012 Surgical Care and Outcomes Assessment Programme across 55 hospitals in the US
- 40,836 patients, of whom 19% had DM, and of whom 47% had a peri-operative BG test
- Those who had **not been identified as having diabetes** or those who developed post-operative hyperglycaemia had the worst outcomes

But Are There Any Data Showing That Improving Control Makes a Difference?



Infection



Mortality

But Implementation is Hard Work!

Perioperative diabetes care: room for improving the person centredness

I. Hommel¹, P. J. van Gorp², C. J. Tack², J. Liefers¹, J. Mulder¹, H. Wollersheim¹ and M. E. J. L. Hulscher¹

Impact of a multifaceted strategy to improve perioperative diabetes care

I. Hommel¹, H. Wollersheim¹, C. J. Tack², J. Mulder¹, P. J. van Gorp² and M. E. J. L. Hulscher¹

Who Do I think Should Have Glycaemic Assessment by Preoperative HbA1c

- Anyone at risk!
 - Over 40 years old (?30 in South Asians)
 - FH of DM
 - Personal history of GDM
 - Hyperlipidaemia
 - Hypertensive
 - BMI $>27\text{Kg/m}^2$



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