Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Peri-operative Management of the Diabetic Foot

or Peri-operative Glucose Control - Is it Important?

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Surgery in People with Diabetes

- People with diabetes are
  - Less likely to be offered day case surgery
  - More likely to have emergency surgery
  - Have a longer LOS following surgery
  - Have higher rates of 28-day readmissions following surgery

Do Peri-Operative High Glucose Levels Cause Harm?

- High pre-operative glucose or HbA1c has been related to adverse outcomes following
  - spinal surgery
  - vascular surgery
  - colorectal surgery
  - cardiac surgery
  - trauma
  - mastectomies
  - foot and ankle
  - neurosurgery
  - emergency surgery
  - transplant surgery
  - HBP surgery
  - cholecystectomy
  - cardiac surgery

Walid MS et al J Hosp Med 2010;5:E10-E14
O'Sullivan CJ et al Europ J of Vasc Endovasc Surg 2006;32:188-197
Gustafsson UO et al Brit J Surg 2009;96:1358-1364
Halkos ME et al Ann of Thorac Surg 2008;86:1431-1437
Kreutziger J et al J Trauma 2009;67(4):704-8
Vilar-Compte et al Am J Infect Control 2008;36(3):192-198
Park C et al Transplantation 2009;87(7):1031-1036
Ambiru S et al J Hosp Infect 2008;68(3):230-233
Chaung SC et al J Formos Med Ass 2004;103(8):607-612
Shibuya N et al J Foot Ankle Surg 2013;52(2):207-211
Sadoskas D et al Foot Ankle Spec 2016;9(1):24-30
Domek N et al J Foot Ank Surg 2016;55(5):939-943
Jehan F et al J Trauma Acute Care Surg 2018;84(1):112-117

Excess Mean Length of Stay in Diabetes Inpatients Aged 18 – 60 Years

269,265 Diabetes Discharges and 4,411,593 Matched Controls

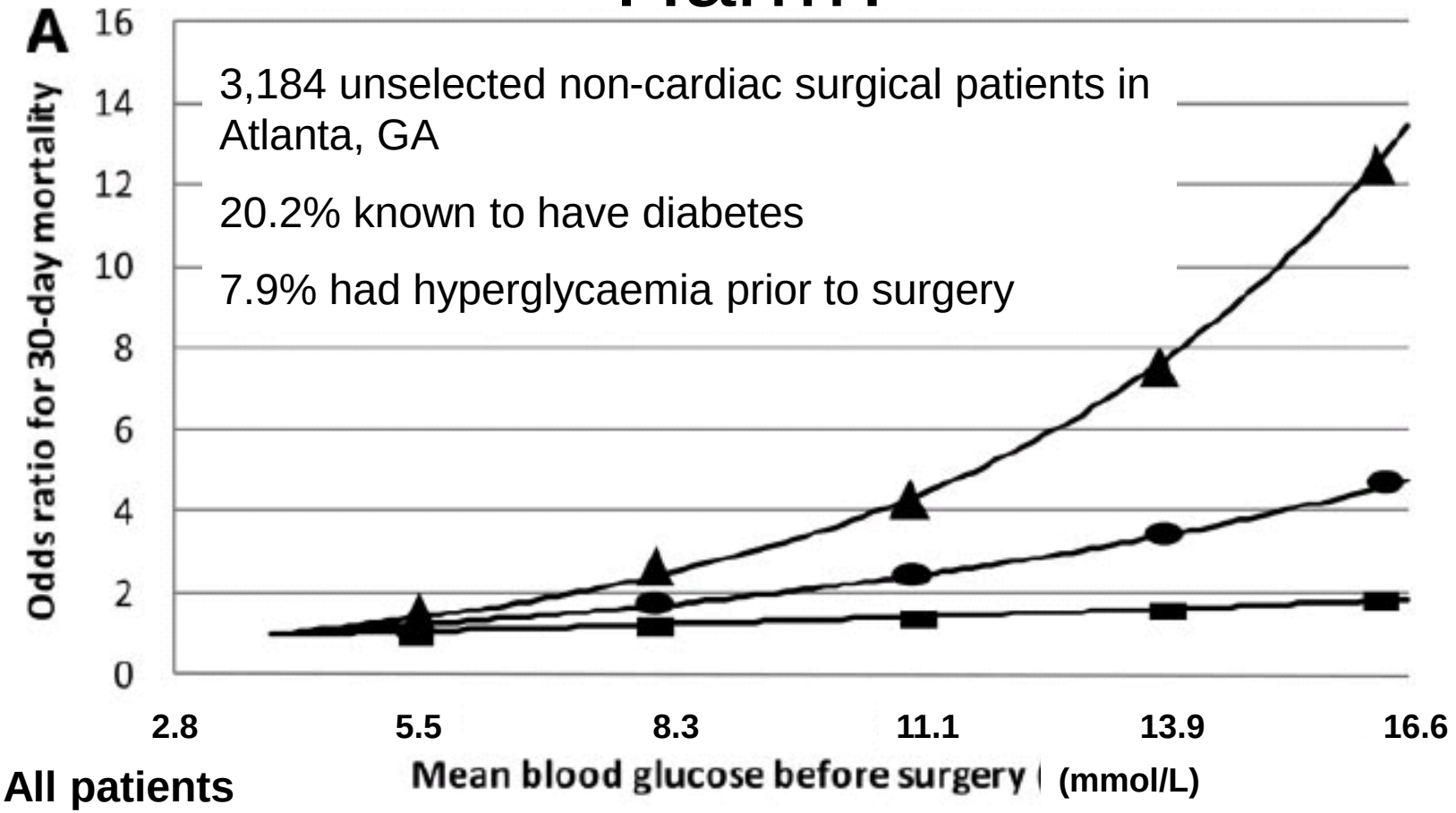
	Mean LOS (days)			Excess LOS (days)		n		
	E10	E11	C	E10	E11	E10	E11	C
Surg.	5.4 (0.1)	5.1 (0.1)	4.2 (0.2)	1.2	0.9	18,032	32,135	1,501,453
T &O	4.8 (0.1)	5.3 (0.2)	4.6 (0.1)	0.2	0.7	8,178	12,203	885,606
GM	4.8 (0.2)	5.4 (0.2)	4.4 (0.1)	0.4	1.0	70,988	82,446	1,709,553
Card.	4.2 (0.1)	4.2 (0.1)	3.8 (0.1)	0.4	0.4	5,307	15,009	229,784
MFE	4.8 (0.2)	5.6 (0.2)	4.7 (0.1)	0.1	0.1	2,444	4,549	85,197

E10 = Type 1 diabetes E11 = Type 2 diabetes c = controls

English Hospitals, 4 consecutive years of discharges 2000-2004

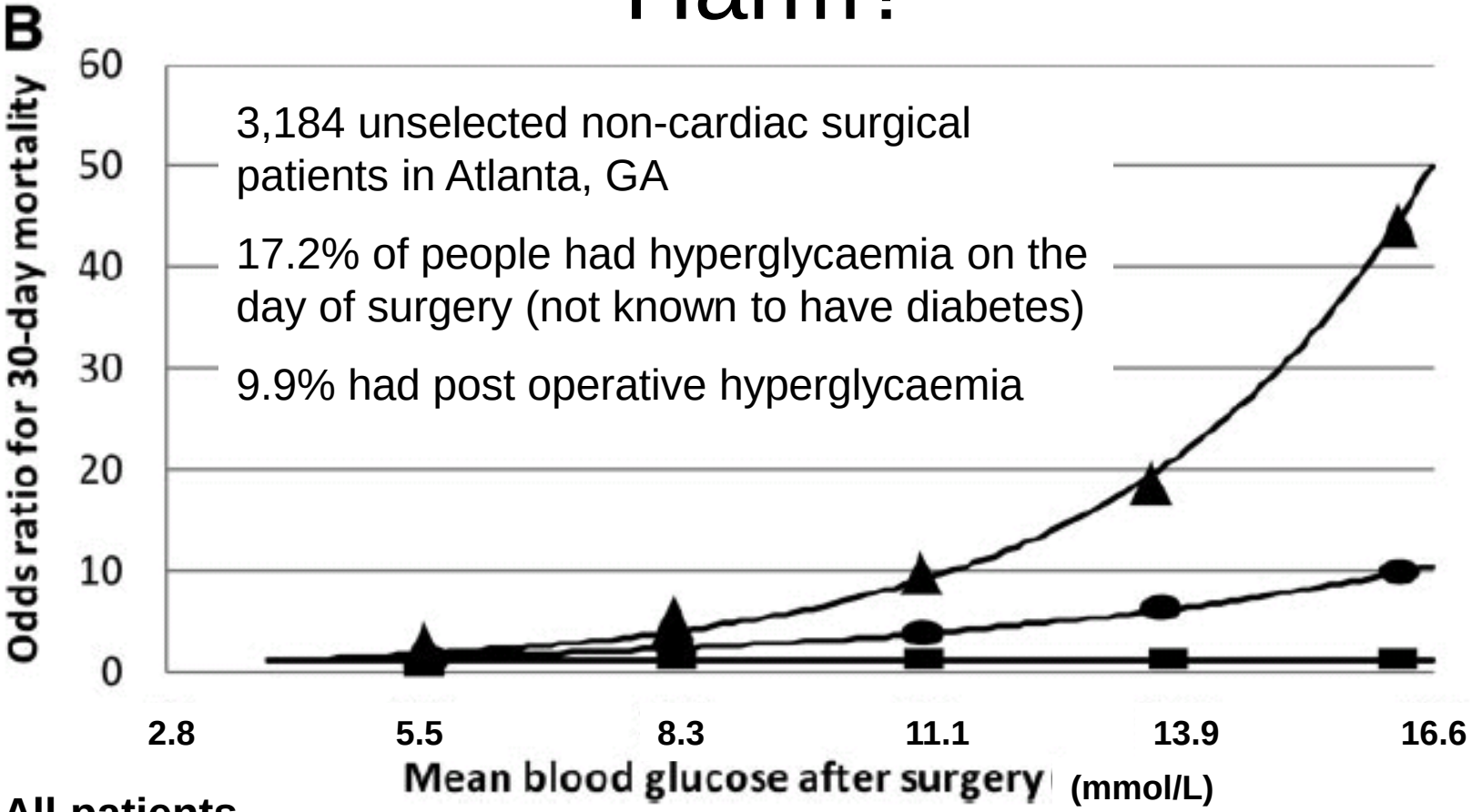
Sampson MJ et al Diabetes Research & Clinical Practice 2007;77(1):92-98

Do High Glucose Levels Cause Harm?



Frisch A et al Diabetes Care 2010;33(8):1783-1788

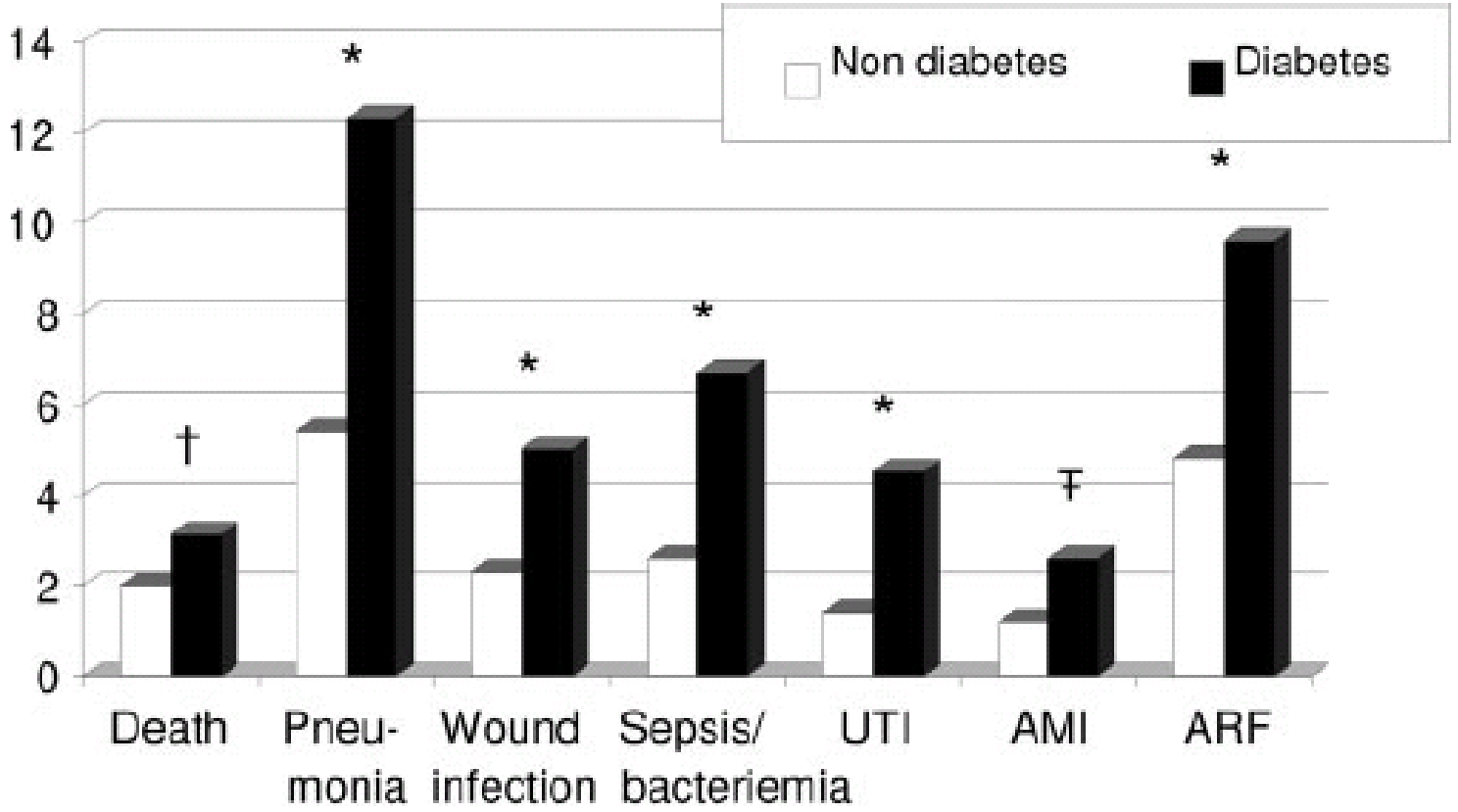
Do High Glucose Levels Cause Harm?



- All patients
- Patients with diabetes
- Patients without diabetes

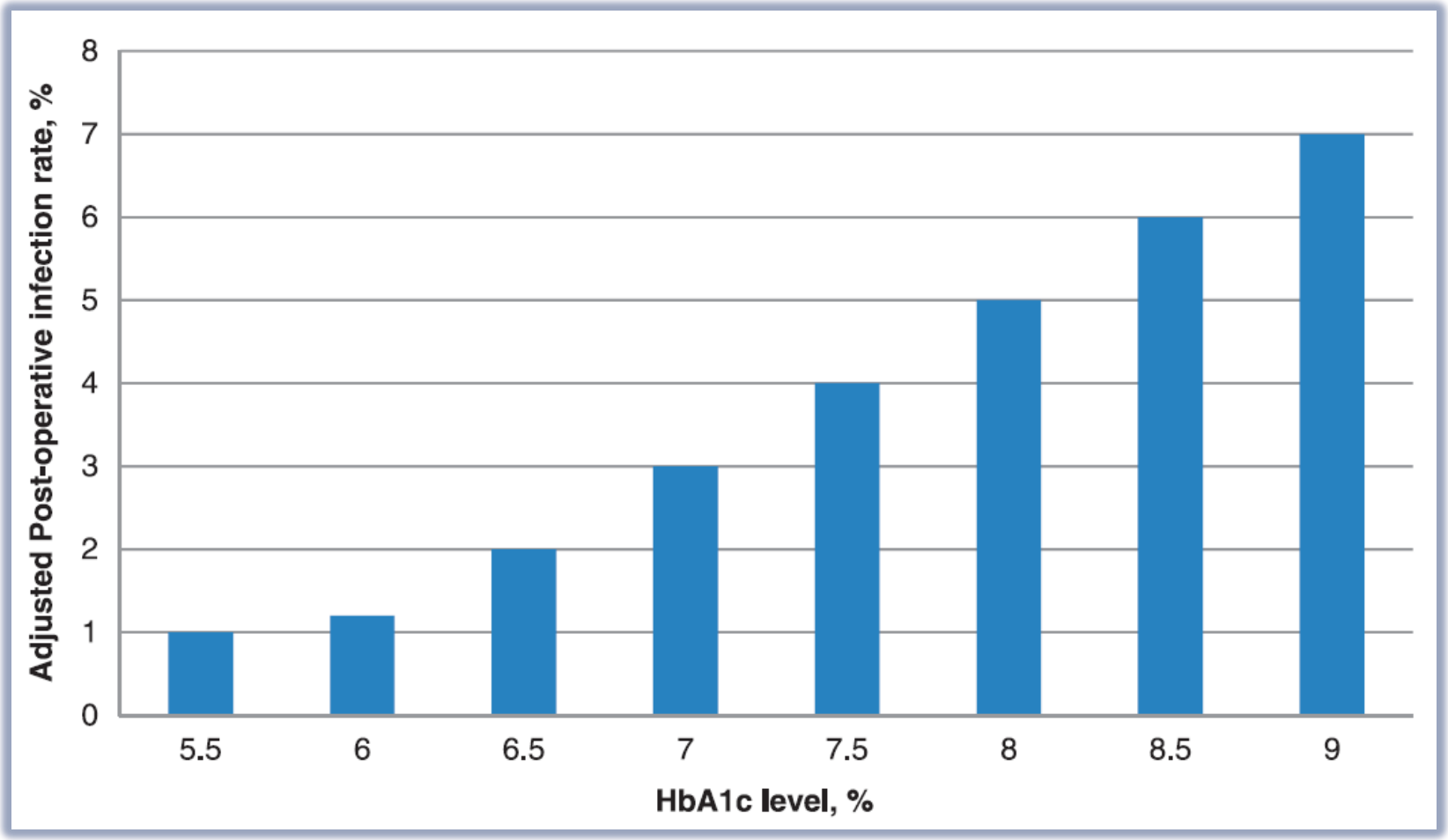
Frisch A et al Diabetes Care 2010;33(8):1783-1788

Do High Glucose Levels Cause Harm?



Frisch A et al Diabetes Care 2010;33(8):1783-1788

402 Emergency Surgical Patients



Jehan F et al J Trauma Acute Care Surg 2018;84(1):112-117

More Observational Data

- Observational data from 55 US hospitals over 5 years looked at the 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
- 55.4 ± 15.3 years
- 65.7% women

Kwon S et al Ann Surgery 2013;257(1):8-14

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)

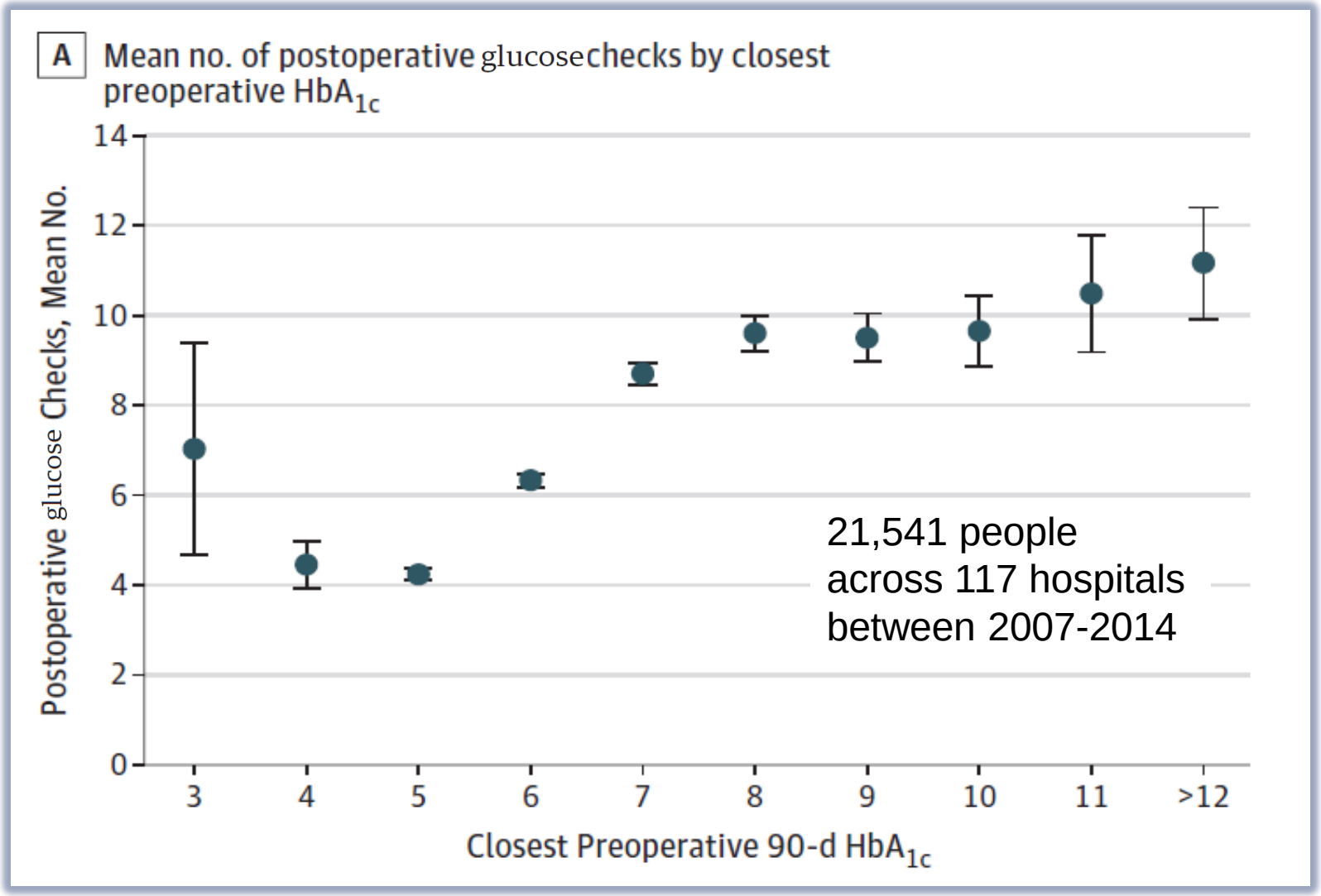
	Composite Infections (n = 491)	Deaths (n = 48)	Reoperative Interventions (n = 257)	Anastomotic Failures (n = 43)	Myocardial Infarctions (n = 13)
Hyperglycemia	2.0 (1.63–2.44)	2.71 (1.72–4.28)	1.8 (1.41–2.3)	2.43 (1.38–4.28)	1.15 (0.43–3.1)
Diabetes[§]					
Noninsulin-dependent	0.51 (0.37–0.69)	0.48 (0.25–0.93)	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)

High glucose levels were associated with poor outcomes

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

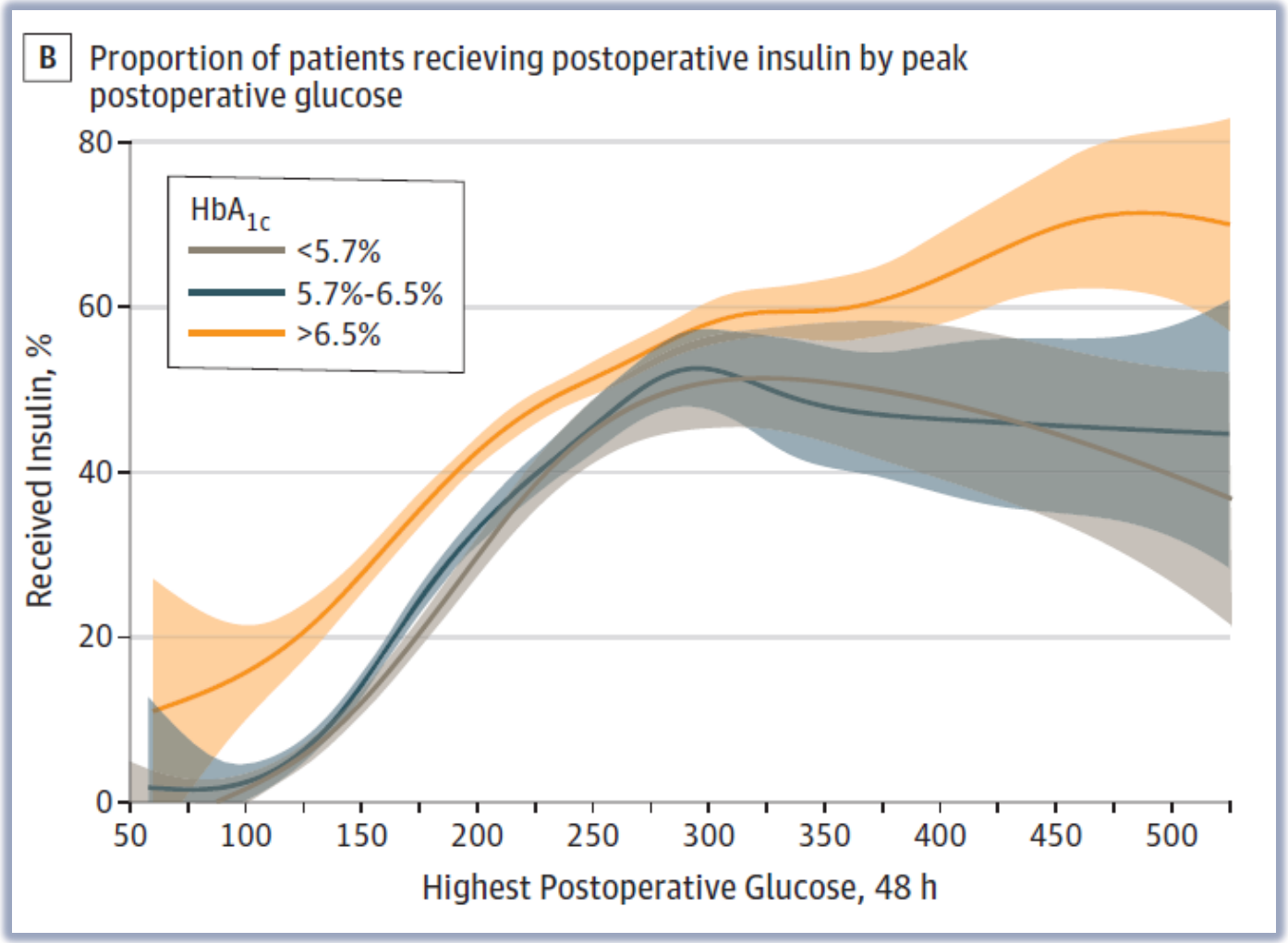
Kwon S et al Ann Surgery 2013;257(1):8-14

Probably



Jones CE et al JAMA Surg 2017;152(11):1031-1038

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

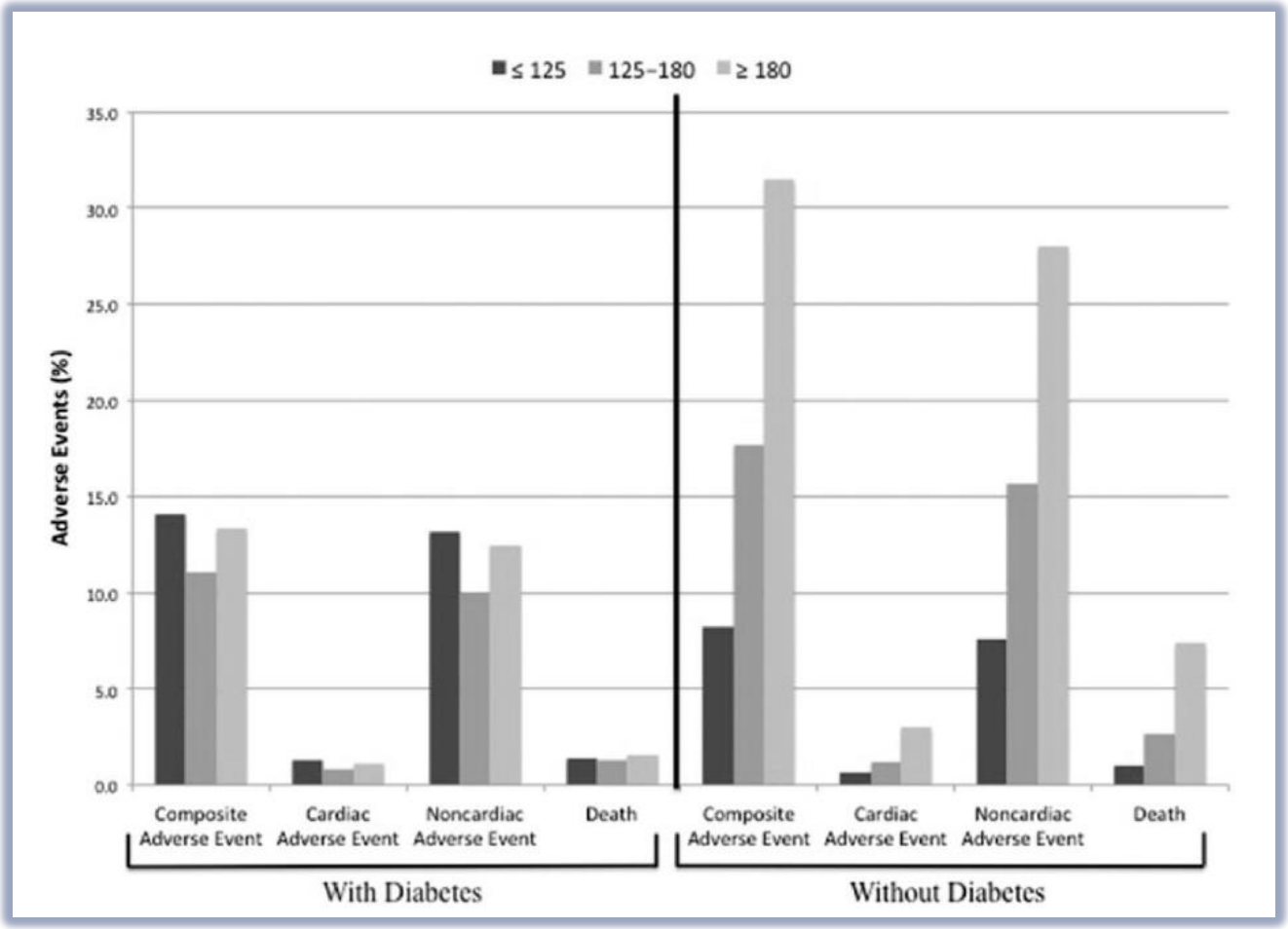


Jones CE et al JAMA Surg 2017;152(11):1031-1038

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

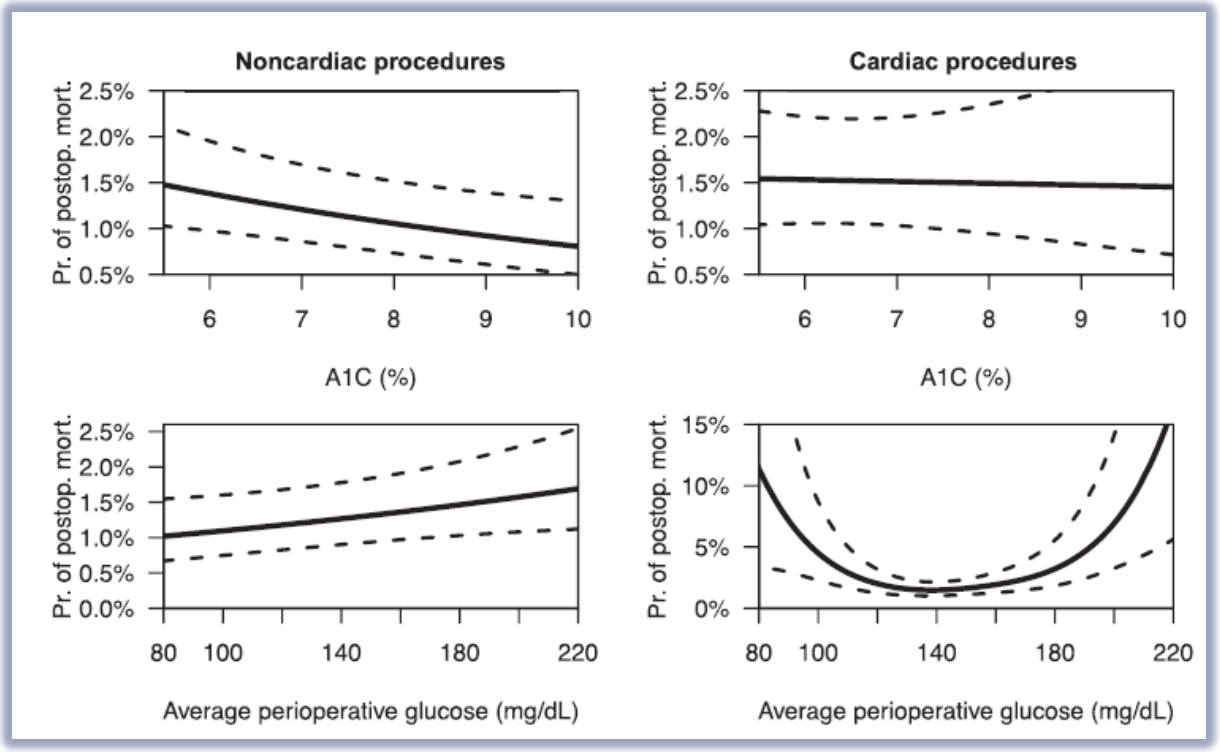
Hyperglycaemia in Previously Normoglycaemic People is Bad



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

Kotagal M et al Annals of Surgery 2015;261(1):97-103

But it is Complicated!

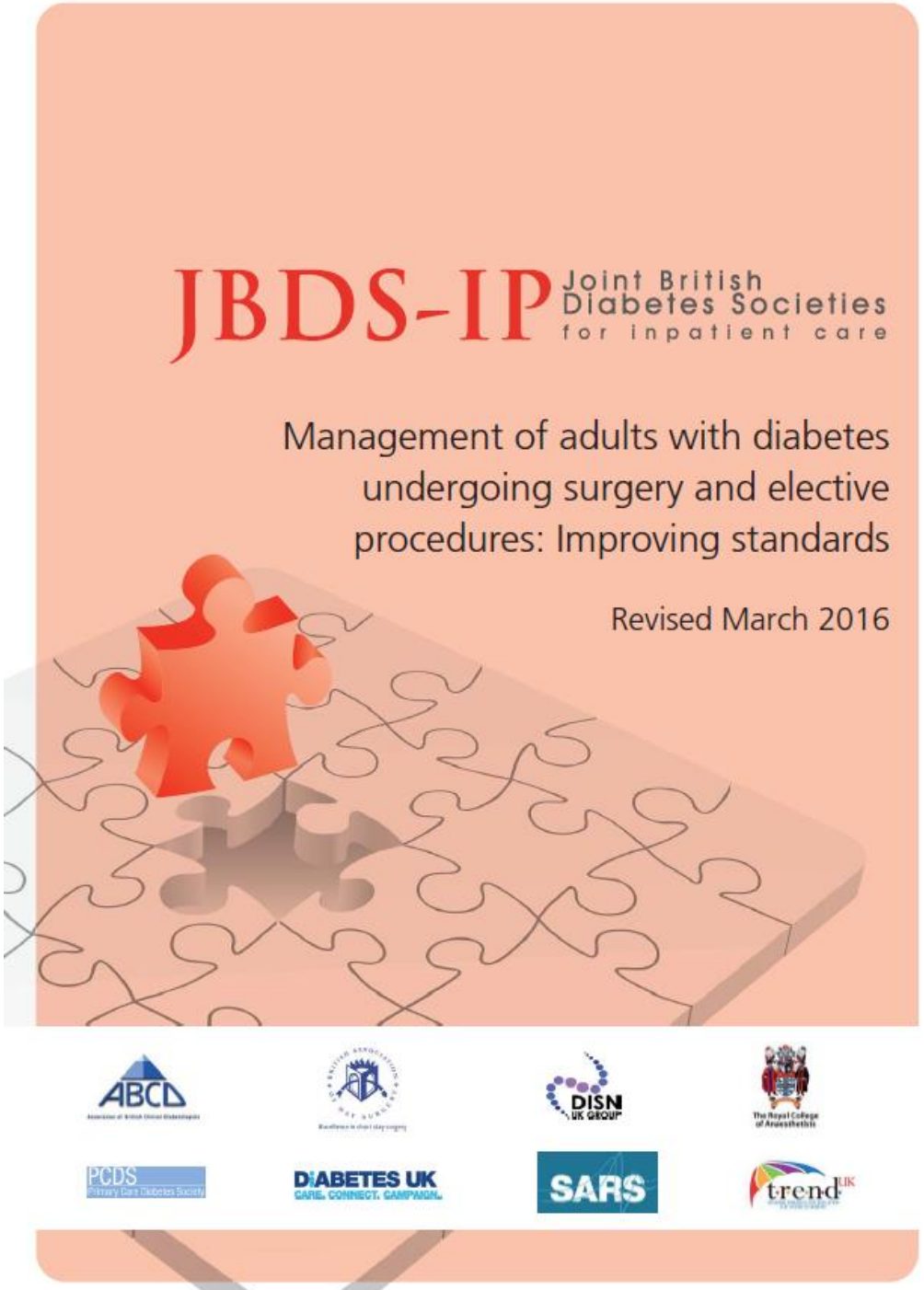


- 6684 non-cardiac and 6393 cardiac surgeries – mean and 95%CI
- Is it glucose or HbA1c that matters most?

Van den Boom W et al Diabetes Care https://doi.org/10.2337/dc17-2232 on line 21st Feb 2018

In 2011 Along Came This…..

Revised in 2016…..



And These…..

Diabetes UK Position Statements and Care Recommendations

NHS Diabetes guideline for the perioperative management of the adult patient with diabetes*

K. Dhatariya[1], N. Levy[2], A. Kilvert[3], B. Watson[4], D. Cousins[5], D. Flanagan[6], L. Hilton[7], C. Jairam[8], K. Leyden[3], A. Lipp[1], D. Lobo[9], M. Sinclair-Hammersley[10] and G. Rayman[11] for the Joint British Diabetes Societies

Diabet. Med. 29, 420–433 (2012)

Guidelines

Peri-operative management of the surgical patient with diabetes 2015

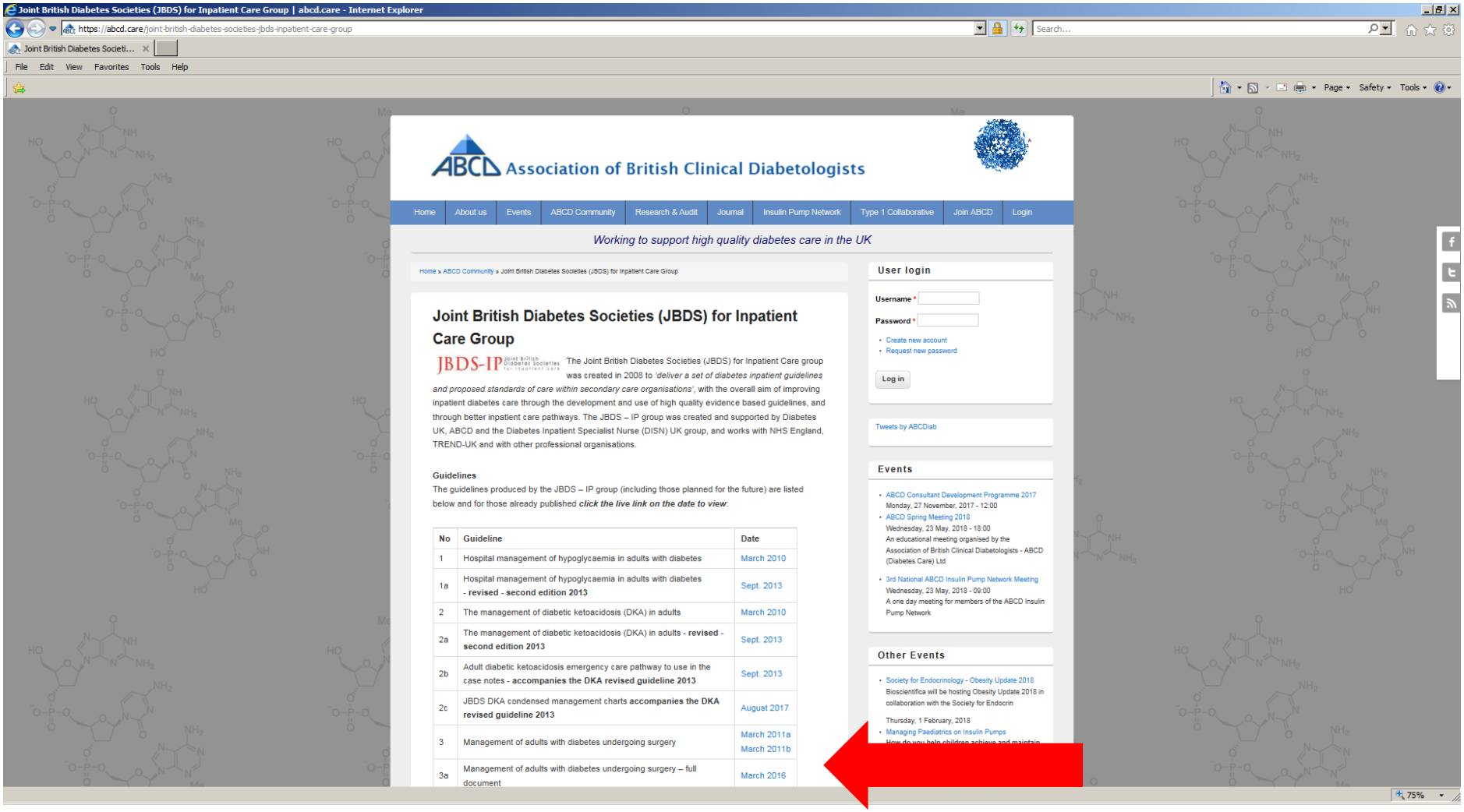
Association of Anaesthetists of Great Britain and Ireland

Membership of the Working Party: P. Barker, P. E. Creasey, K. Dhatariya,[1] N. Levy, A. Lipp,[2] M. H. Nathanson (Chair), N. Penfold,[3] B. Watson and T. Woodcock

Anaesthesia 2015, 70, 1427–1440

How to Access the Guideline(s)

- Open your search engine of choice
- Type in ‘ABCD’ and ‘JBDS’
- Click on the first link



https://abcd.care/joint-british-diabetes-societies-jbds-inpatient-care-group Last accessed 1st March 2018

National Guidelines

- Document divided into sections:
  - Primary care
  - Surgical outpatients
  - Pre-operative assessment clinic
  - Hospital admission
  - Theatre and recovery
  - Post-operative care
  - Discharge

What Does the Surgical Outpatients Section Say?

- Aims
  - Arrange pre-operative assessment as soon as possible after the decision is taken to proceed with surgery to allow optimisation of care
  - Day of surgery admission should be the ‘default’ position. Diabetes specific pre-admission should be avoided

Recommendations - 1

- Systems should be in place to allow early preoperative assessment to identify people with suboptimal diabetes control
- Clear institutional plans should be in place to facilitate day of surgery admission and prevent unnecessary overnight pre-operative admission
- Hospital patient administration systems should be able to identify all patients with diabetes so they can be prioritised on the operating list

Recommendations - 2

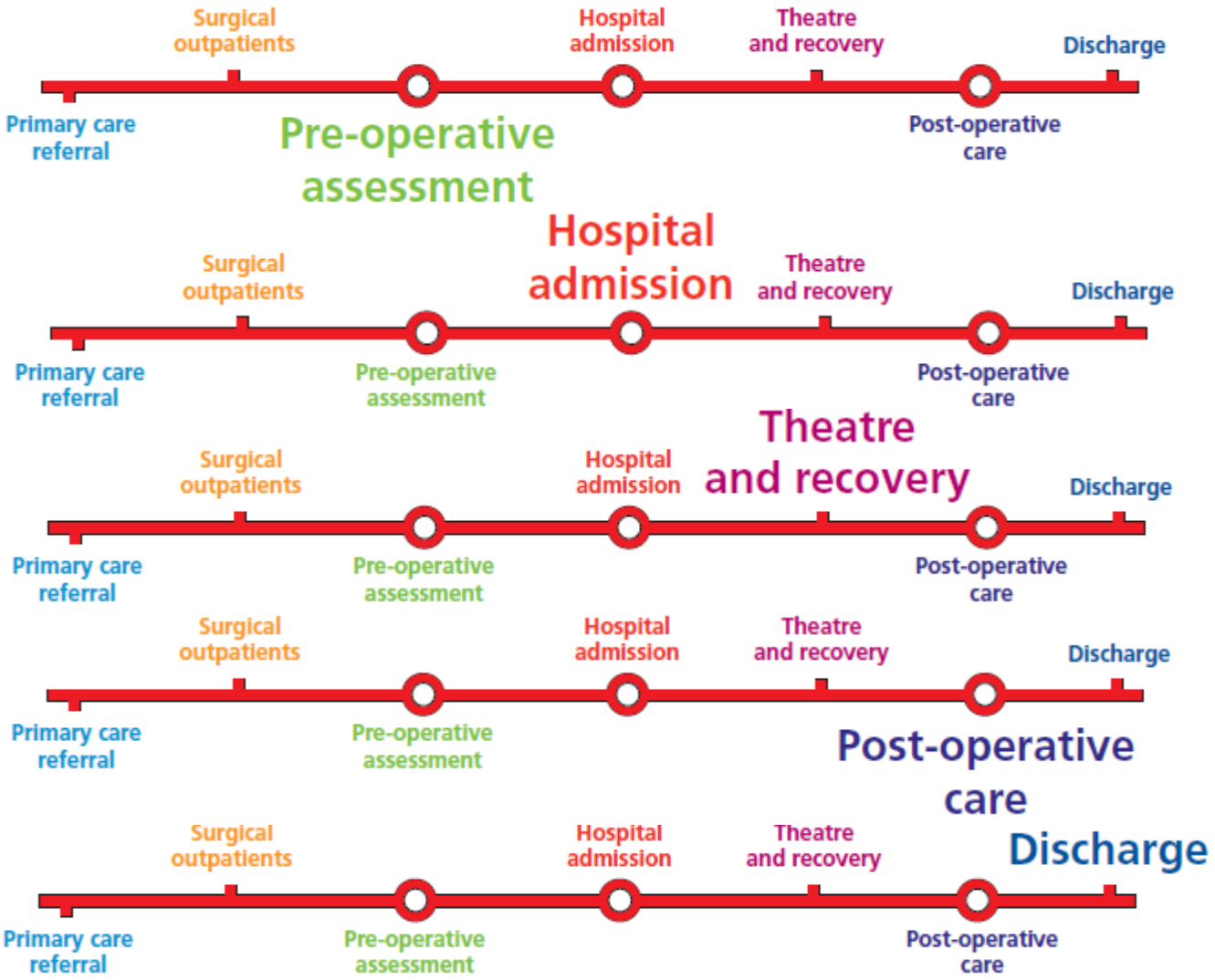
- Patients undergoing investigative procedures requiring a period of starvation should be identified and provided with written information about diabetes management
- The surgeon in the outpatient clinic should ensure that patients with diabetes are not scheduled for an evening list. This avoids prolonged starvation times, the use of a VRIII and an unnecessary overnight stay
- Only operate on weekends if there is adequate diabetes support available

http://www.diabetologists-abcd.org.uk/JBDS/Surgical_guidelines_2015_full_FINAL_amended_Mar_2016.pdf

Insulins	Day prior to admission	Day of Surgery / whilst on a VRIII		
		Patient for AM surgery	Patient for PM surgery	If a VRIII is being used*
Once daily (evening) (e.g. Lantus® or Levemir® Tresiba®,Insulatard®, Humulin I®, Insuman®)	Reduce dose by 20%	Check blood glucose on admission	Check blood glucose on admission	Continue at 80% of the usual dose
Once daily (morning) (Lantus® or Levemir® Tresiba® Insulatard® Humulin I®, Insuman®)	Reduce dose by 20%	Reduce dose by 20% Check blood glucose on admission	Reduce dose by 20% Check blood glucose on admission	Continue at 80% of the usual dose
Twice daily (e.g. Novomix 30®, Humulin M3® Humalog Mix 25®, Humalog Mix 50®, Insuman® Comb 25, Insuman® Comb 50 twice daily Levemir® or Lantus®)	No dose change	Halve the usual morning dose. Check blood glucose on admission Leave the evening meal dose unchanged	Halve the usual morning dose. Check blood glucose on admission Leave the evening meal dose unchanged	Stop until eating and drinking normally
Twice daily - separate injections of short acting (e.g. animal neutral, Novorapid® Humulin S®) Apidra® **and intermediate acting** (e.g. animal isophane Insulatard® Humulin I® Insuman®)	No dose change	Calculate the total dose of both morning insulins and give half as intermediate acting only in the morning. Check blood glucose on admission Leave the evening meal dose unchanged	Calculate the total dose of both morning insulins and give half as intermediate acting only in the morning. Check blood glucose on admission Leave the evening meal dose unchanged	Stop until eating and drinking normally
3, 4 or 5 injections Daily (e.g. an injection of mixed insulin 3 times a day or 3 meal time injections of short acting insulin and once or twice daily background)	No dose change	**Basal bolus regimens:** omit the morning and lunchtime short acting insulins. Keep the basal unchanged.* **Premixed a.m. insulin:** halve the morning dose and omit lunchtime dose Check blood glucose on admission	Take usual morning insulin dose(s). Omit lunchtime dose. Check blood glucose on admission	Stop until eating and drinking normally

Tablets	Day prior to admission	Day of Surgery / whilst on a VRIII		
		Patient for AM surgery	Patient for PM surgery	If a VRIII is being used*
Acarbose	Take as normal	Omit morning dose if NBM	Give morning dose if eating	Stop once VRIII commenced, do not recommence until eating and drinking normally
Meglitinide (e.g repaglinide or nateglinide)	Take as normal	Omit morning dose if NBM	Give morning dose if eating	Stop once VRIII commenced, do not recommence until eating and drinking normally
Metformin (eGFR is greater than 60ml/min/1.73m^2 and procedure not requiring use of contrast media**)	Take as normal	If taken once or twice a day – take as normal If taken three times per day, omit lunchtime dose	If taken once or twice a day – take as normal If taken three times per day, omit lunchtime dose	Stop once VRIII commenced, do not recommence until eating and drinking normally
Sulphonylurea (e.g glibenclamide, gliclazide, glipizide, etc.)	Take as normal	Once daily am omit Twice daily omit am	Once daily am omit Twice daily omit am and pm	Stop once VRIII commenced, do not recommence until eating and drinking normally
Pioglitazone	Take as normal	Take as normal	Take as normal	Stop once VRIII commenced, do not recommence until eating and drinking normally
DPP IV inhibitor (e.g. sitagliptin, vildagliptin, saxagliptin, alogliptin, linagliptin)	Take as normal	Take as normal	Take as normal	Stop once VRIII commenced, do not recommence until eating and drinking normally
GLP-1 analogue (e.g. exenatide, liraglutide, lixisenatide, dulaglutide)	Take as normal	Take as normal	Take as normal	Take as normal
SGLT-2 inhibitors (e.g. dapagliflozin, canagliflozin)	Omit if there is reduced intake	Omit on day of surgery	Omit on day of surgery	Omit until eating and drinking normally

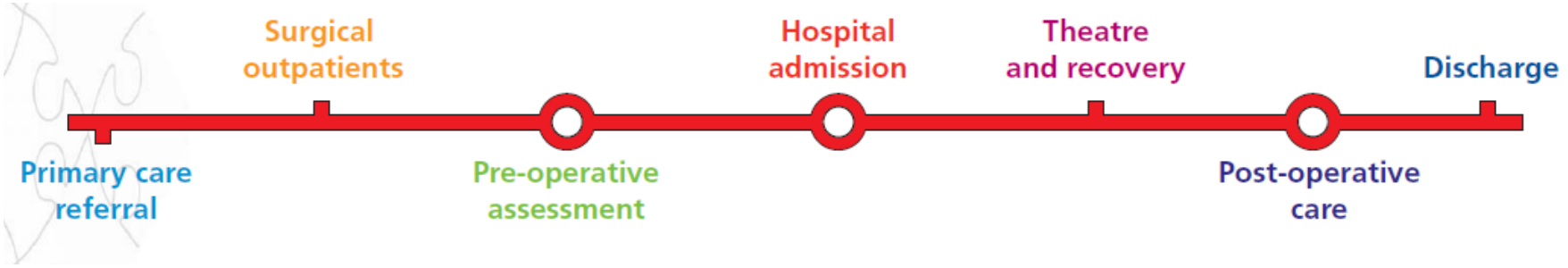
Aims and Recommendations for Each



http://www.diabetologists-abcd.org.uk/JBDS/Surgical_guidelines_2015_full_FINAL_amended_Mar_2016.pdf

Conclusions

- Perioperative glycaemic control matters
- Communication along the patient journey is key
- Good peri-operative glycaemic control is everyone's responsibility



Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Peri-operative Management of the Diabetic Foot

Yes - peri-operative glucose control is important!

www.norfolkdiabetes.com

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