Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Peri-operative Glycaemic Control

- Is it Important?

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Recent Data

- 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

http://www.yhpho.org.uk/resource/view.aspx?RID=105866

Do Peri-Operative High Glucose Levels Cause Harm?

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

Walid MS et al 2010 J Hosp Med 5:E10-E14
O'Sullivan CJ et al 2006 Europ Jl of Vasc Endovasc Surg 32:188-197
Gustafsson UO et al 2009 Brit J Surg 96:1358-1364
Halkos ME et al 2008 Ann of Thorac Surg 86:1431-1437
Kreutziger J et al 2009 J Trauma 67(4):704-8
Vilar-Compte et al 2008 Am J Infect Control 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

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

Day Case Avoidance

	Admissions for males with diabetes	Admissions per 1000 males with diabetes	Admissions per 1000 males without diabetes	Diabetes admissions/non-diabetes admissions	Excess admissions in diabetes
0-15	956	99	50	1.99	475
16-24	1,633	51	43	1.20	274
25-34	3,289	70	57	1.24	627
35-44	10,014	93	79	1.18	1,511
45-54	27,487	122	118	1.04	994
55-64	60,788	210	203	1.04	2,148
65-74	87,207	241	355	0.68	-41,187
75+	77,832	328	413	0.79	-20,344
All male	269,206	205	123	0.82 (age adjusted)	-55,501

	Admissions for females with diabetes	Admissions per 1000 females with diabetes	Admissions per 1000 females without diabetes	Diabetes admissions/non-diabetes admissions	Excess admissions in diabetes
0-15	975	106	40	2.63	604
16-24	1,986	58	62	0.94	-136
25-34	3,708	79	91	0.87	-567
35-44	10,390	190	118	1.61	3,942
45-54	23,708	172	160	1.08	1,736
55-64	42,589	202	207	0.97	-1,184
65-74	61,743	233	288	0.81	-14,657
75+	62,924	213	279	0.76	-19,748
All female	208,023	197	137	0.87 (age adjusted)	-30,011
Total (male and female)	477,229	202	130	0.85 (age-adjusted)	-85,512

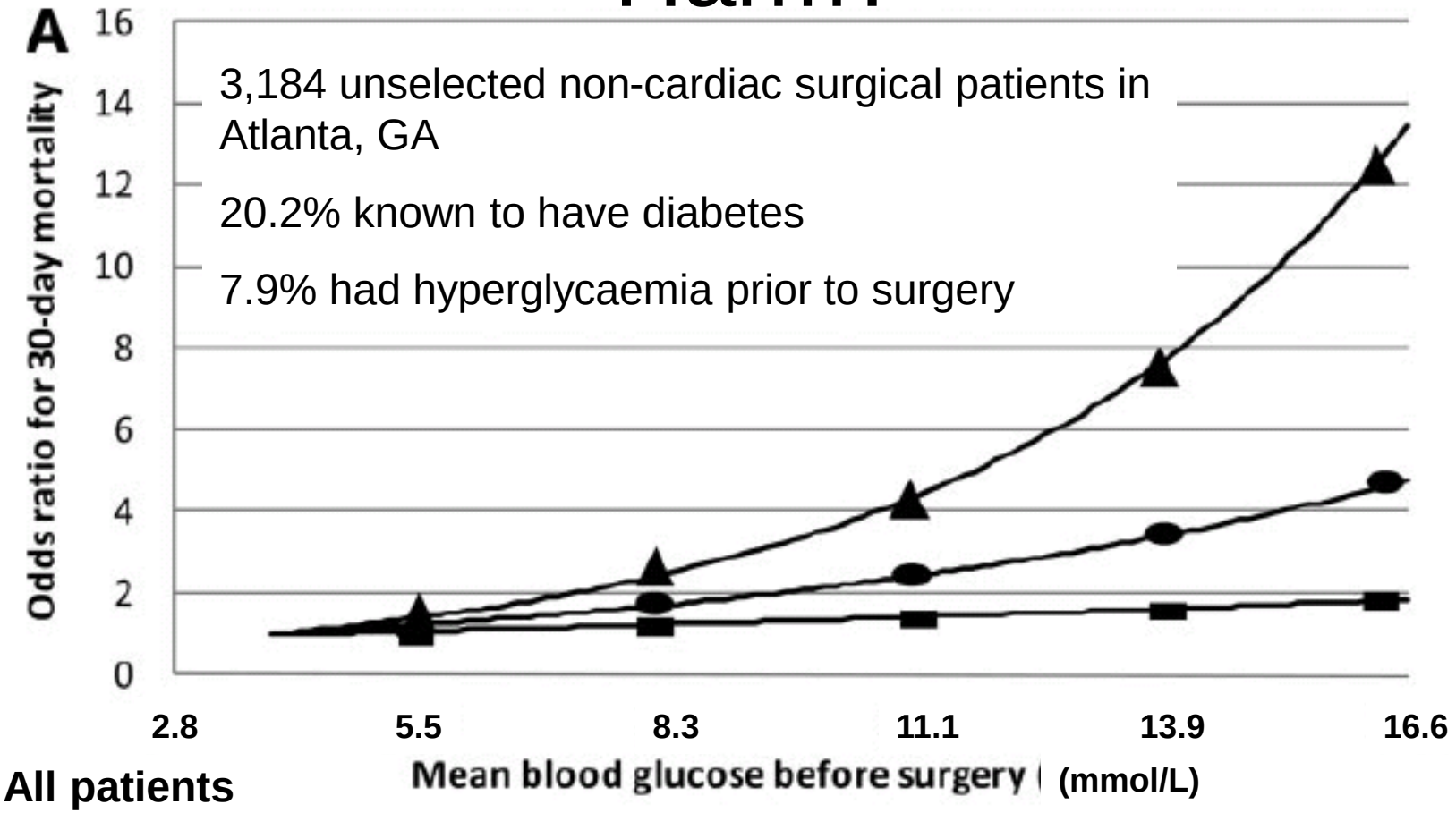
Men

In 2009-10, 85,512 people with diabetes were denied day case surgery. If 1 bed day costs £300, then this equates to £25.6m

Women

Kerr M, *'Inpatient Care for People with Diabetes: the Economic Case for Change'*. NHS Diabetes 2012

Do High Glucose Levels Cause Harm?



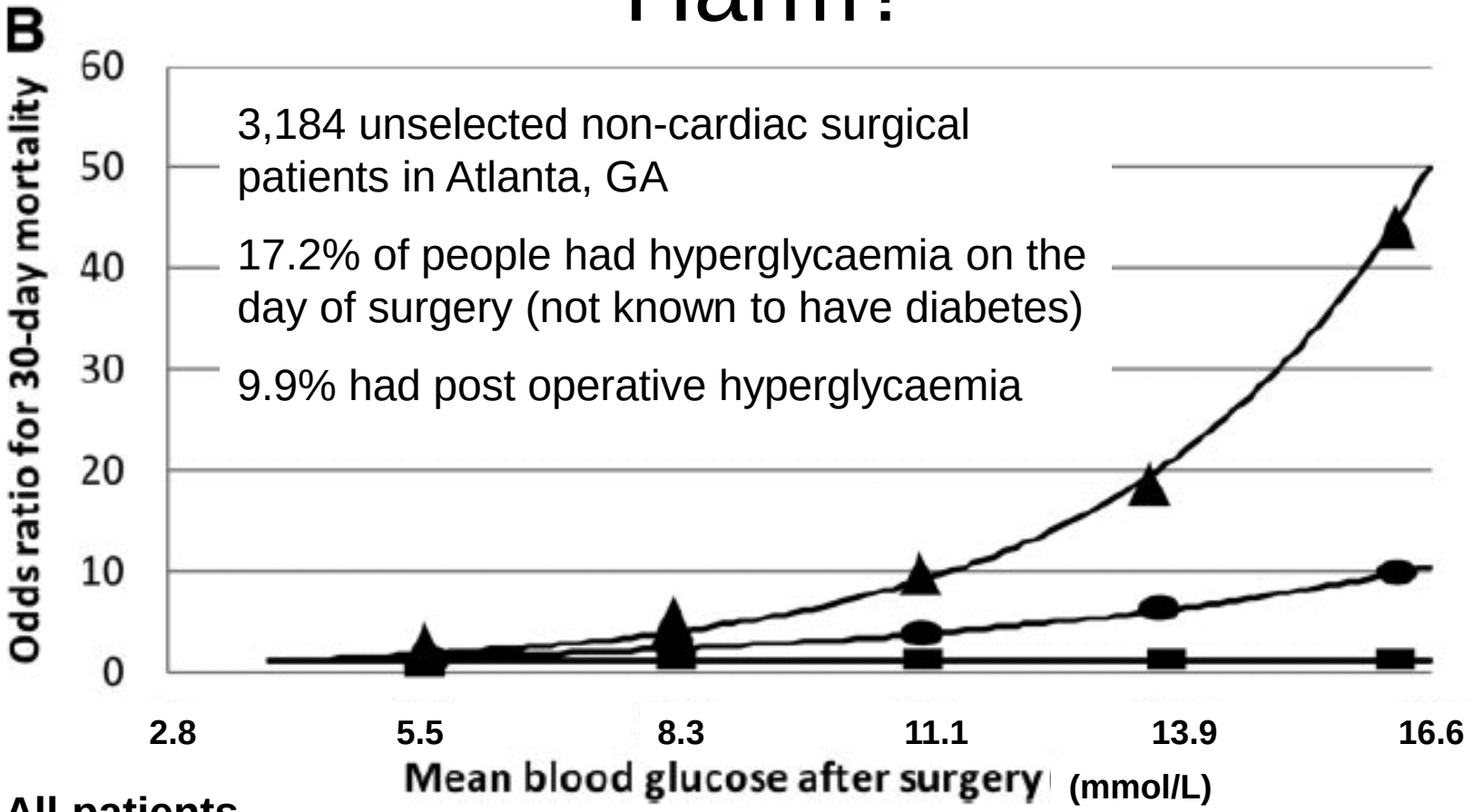
All patients

Patients with diabetes

Patients without diabetes

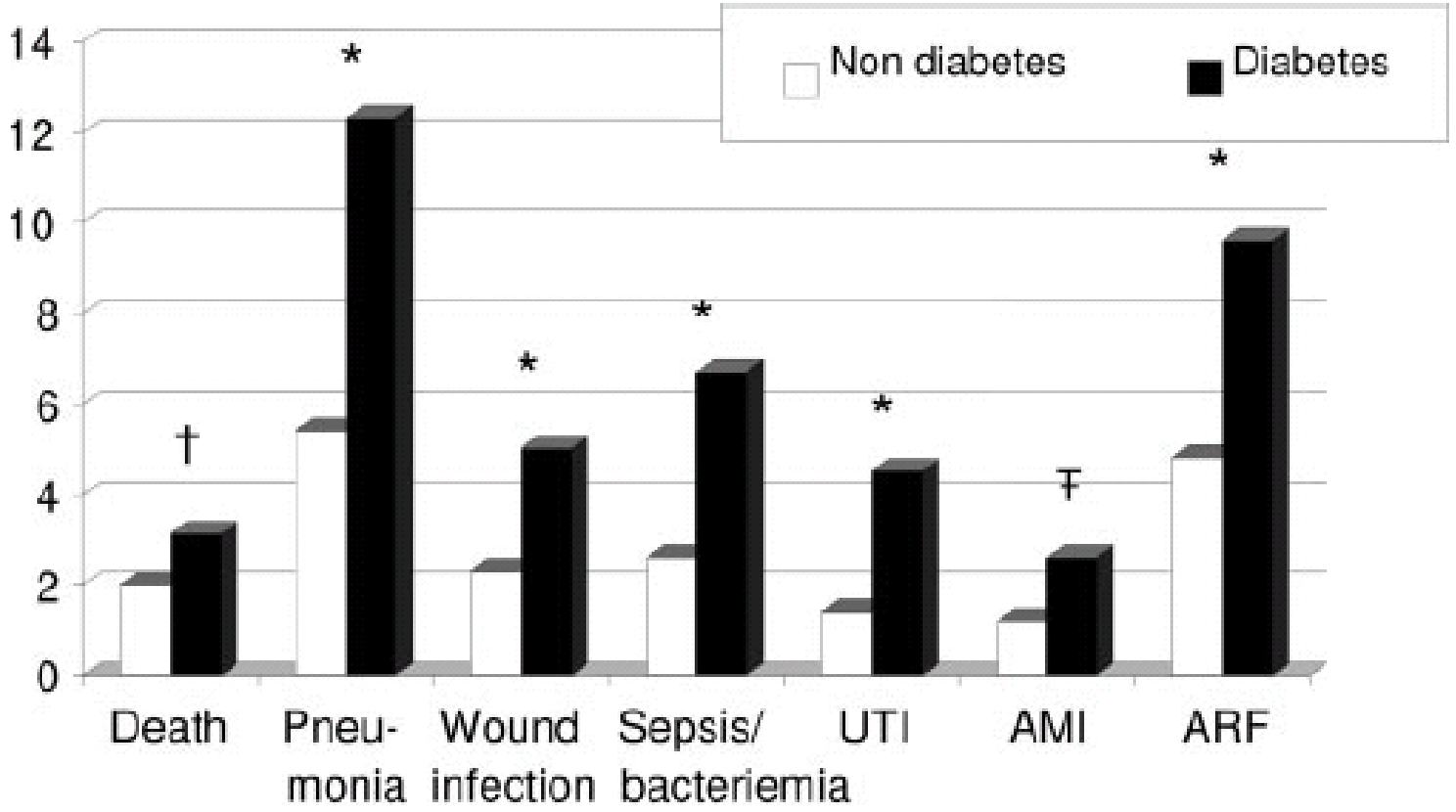
Frisch A et al Diabetes Care 2010;33(8):1783-1788

Do High Glucose Levels Cause Harm?



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

Do High Glucose Levels Cause Harm?



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

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

Hyperglycaemic Individuals

- Were more likely to be
  - Older
  - Heavier
  - More comorbidities
  - Have longer operations
  - Have diabetes (but not always)

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)

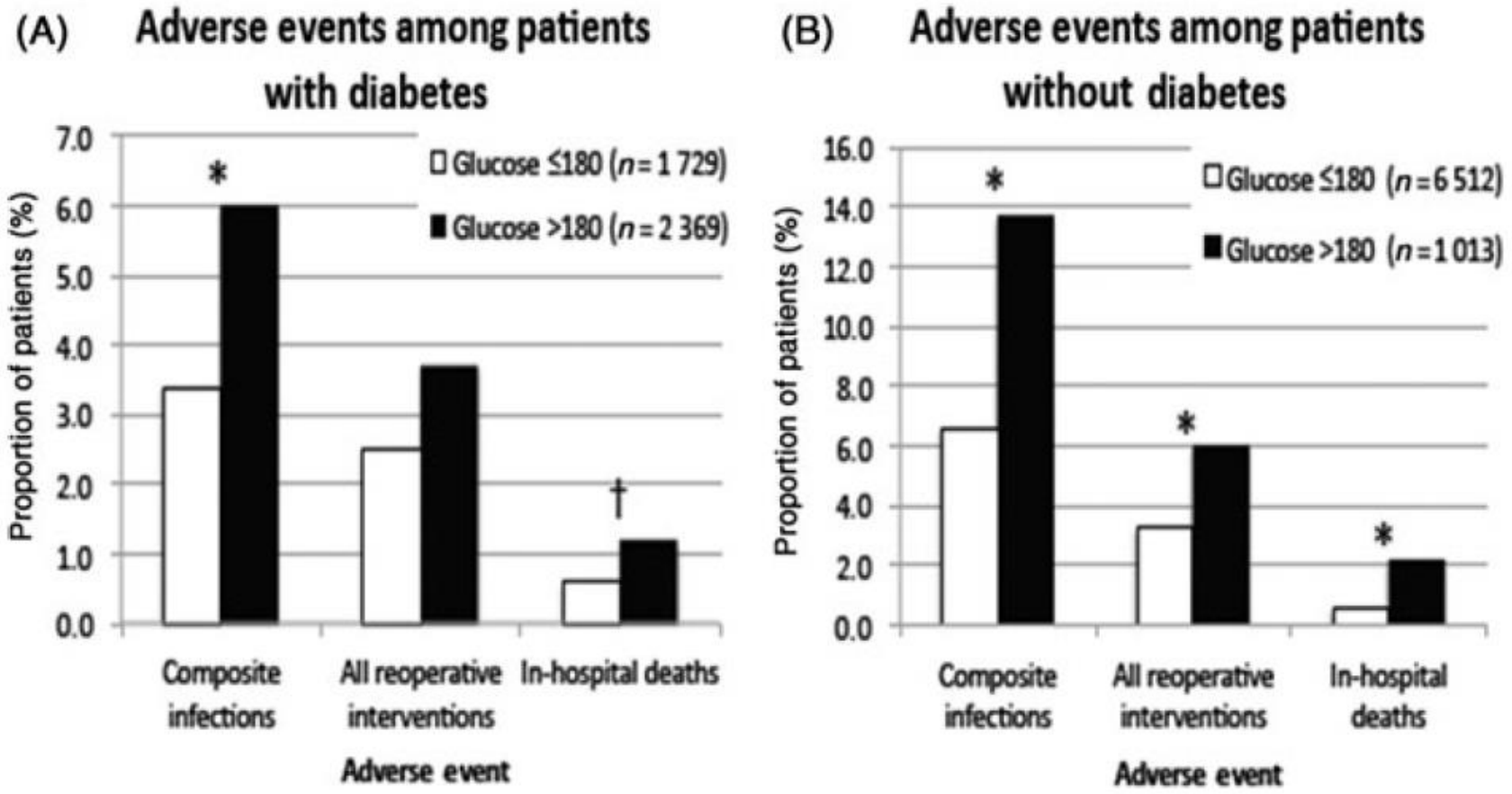
	Composite Infections (n = 491)	Deaths (n = 48)	Reoperative Interventions (n = 257)	Anastomotic Failures (n = 43)	Myocardial Infarctions (n = 13)
Hyperglycemia	2.0 (1.63–2.44)	2.71 (1.72–4.28)	1.8 (1.41–2.3)	2.43 (1.38–4.28)	1.15 (0.43–3.1)
Diabetes[§]					
Noninsulin-dependent	0.51 (0.37–0.69)	0.48 (0.25–0.93)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

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

Outcomes



180 mg/dl = 9.72 mmol/L $^{*}P < 0.01$; $^{\dagger}P < 0.05$.

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

Colorectal Surgery

- Single centre, 2 year retrospective analysis of outcomes in 2447 patients without diabetes undergoing elective colorectal surgery and 181 with diabetes

Non diabetic (n=2447 (93.1%))	Diabetic (n=181 (6.9%))
Normoglycaemic (<6.7 mmol/L) 816 (33.3%)	Normoglycaemic (<6.7 mmol/L) 63 (34.8%)
'Mild' hyperglycaemia (6.8-10.7 mmol/L) 1289 (52.7%)	'Mild' hyperglycaemia (6.8-10.7 mmol/L) 98 (54.1%)
'Severe' hyperglycaemia (>10.8 mmol/L) 342 (14%)	'Severe' hyperglycaemia (>10.8 mmol/L) 20 (11%)

66.7% of the 'non-diabetics' developed hyperglycaemia

Kiran RP et al Annals of Surgery 2013;258(4):599-605

Outcomes

- In patients with or without a previous diagnosis of diabetes, a high blood glucose was found to be associated with
  - Estimated blood loss
  - Length of surgery
  - Transfusion
  - Diverting ostomy
  - AKI
  - Anastomotic leak
  - Arrythmia
  - Reintubation
  - Sepsis
  - SSI
    - Deep
    - Superficial
    - Organ / space
  - UTI
  - LOS
  - Reoperation
  - Mortality

Kiran RP et al Annals of Surgery 2013;258(4):599-605

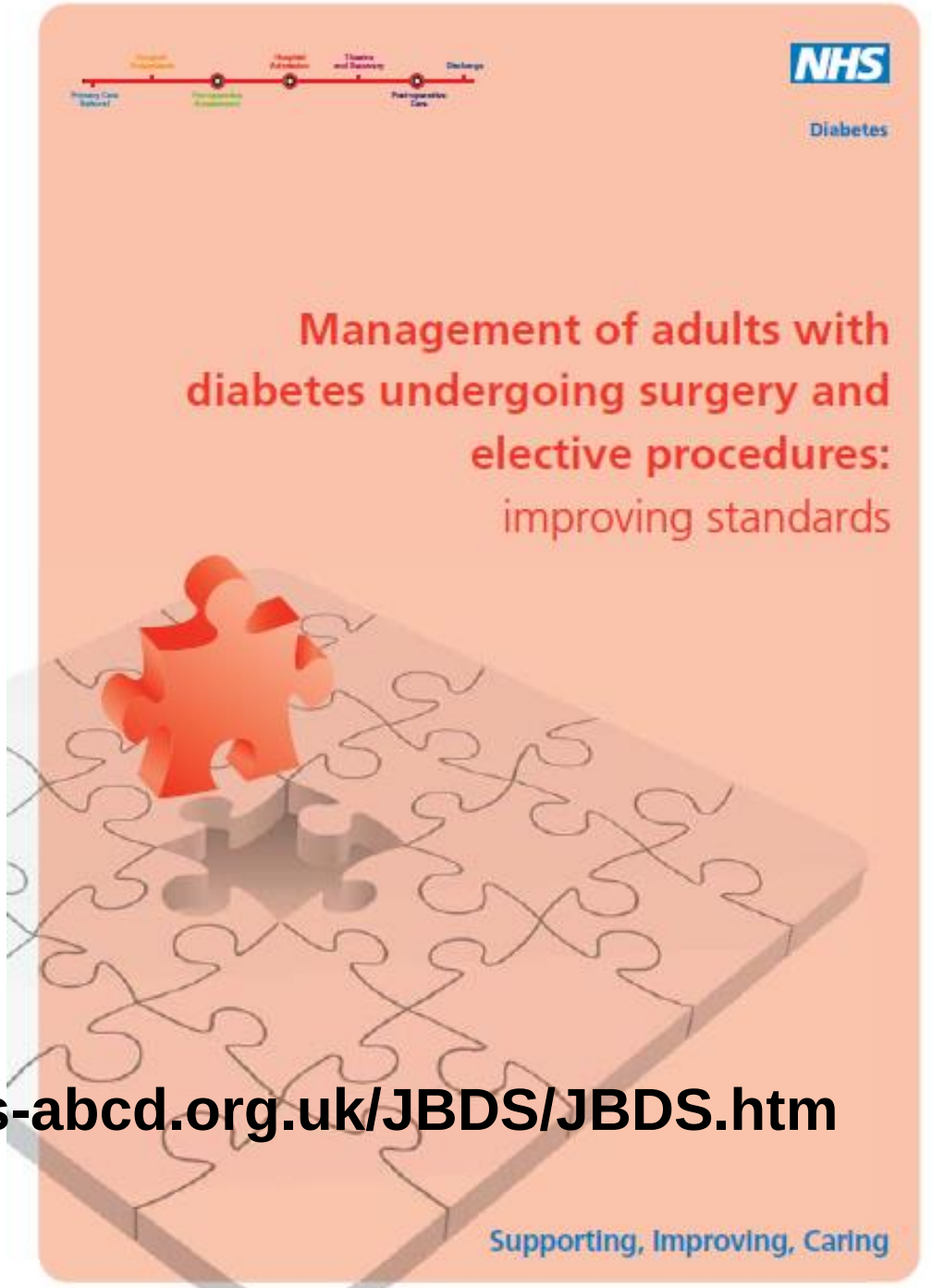
Thus….

- Whilst there is data to show that poor glycaemic control is associated with poor outcomes
- There is no consistent data to show that improving control also improves outcomes

(A bit like diabetes care in general until the mid 1990's)

Dhatariya K BMJ 2013;346:f134

Along Came This…..



http://www.diabetologists-abcd.org.uk/JBDS/JBDS.htm

And This…..

Diabetes UK Position Statements and Care Recommendations

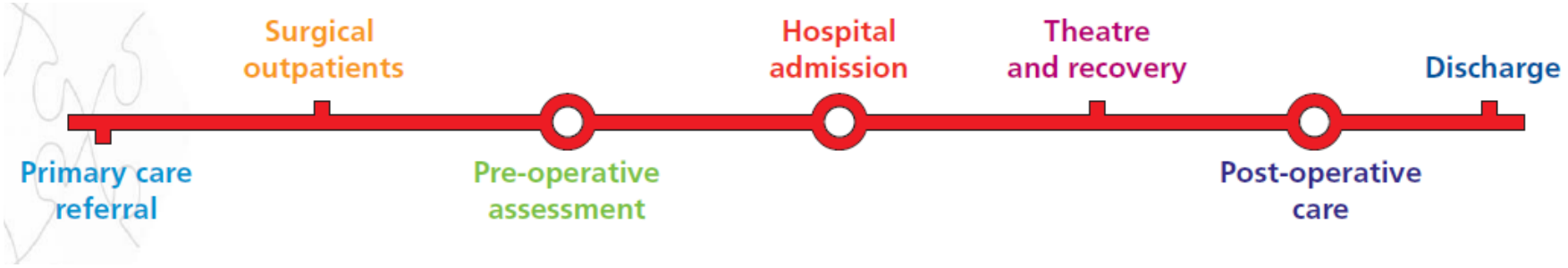
NHS Diabetes guideline for the perioperative management of the adult patient with diabetes*

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

Diabetic Medicine 2012;29(4):420-433

National Guidelines

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



In Summary

- Patients undergoing surgery should ideally
  - Have their diabetes optimised prior to referral (where possible)
  - Have their diabetes optimised whilst in hospital
  - If they are not known to have diabetes then be screened at pre-assessment
  - Have the diabetes specialist team available

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www.norfolkdiabetes.com