



Inpatient Hyperglycaemia and it's Consequences

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Who is this Man?

- I am a consultant in diabetes and endocrinology in Norwich, UK

Where is Norwich?



Who is this Man?

- I am a consultant in diabetes and endocrinology in Norwich, UK
- I am an executive officer of the Association of British Clinical Diabetologists
- I am the medical secretary for the SCE in diabetes and endocrinology
- I am on the steering committee of the Joint British Diabetes Societies Inpatient Care group and am an author on several national guidelines

Topics to Cover

- Surgical patients – UK and US data
- Medical patients – UK data

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	

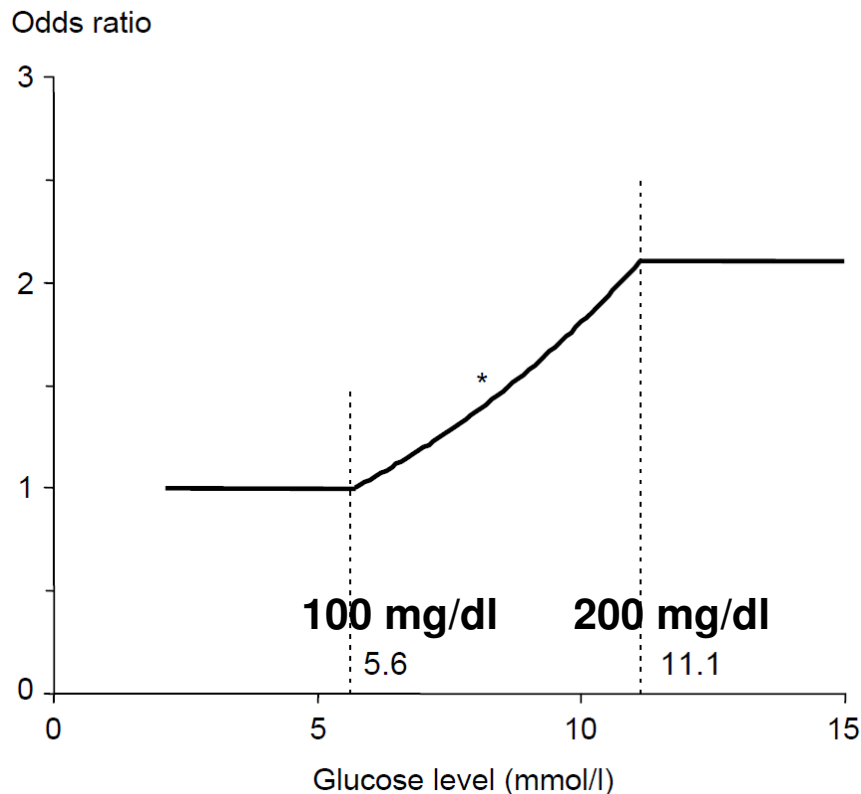
E10 = Type 1 diabetes E11 = Type 2 diabetes c = controls

English Hospitals, 4 consecutive years of discharges 2000-2004

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

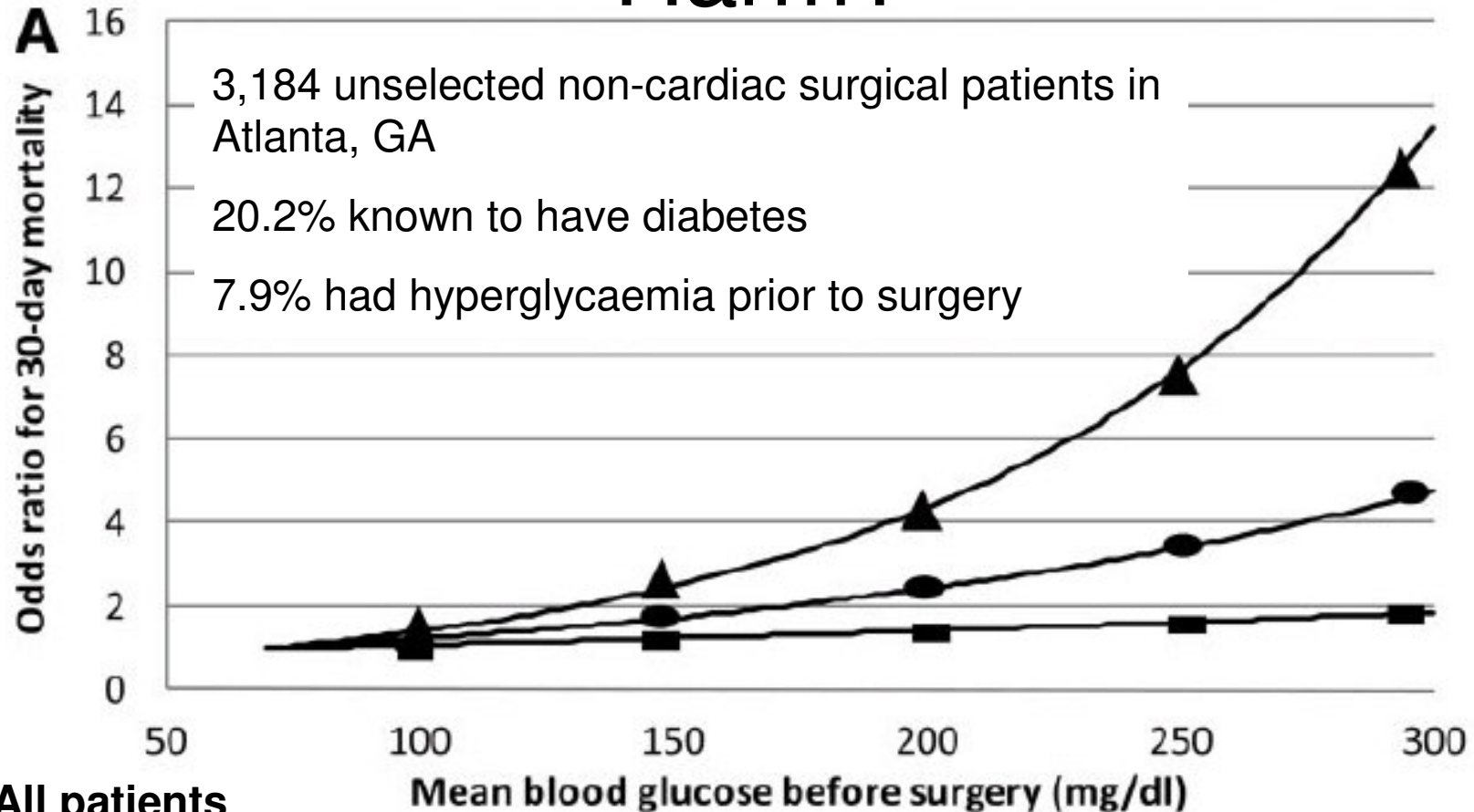
However.....

- Other data has confirmed the harm of high pre-operative glucose levels in non-cardiac, non vascular surgery



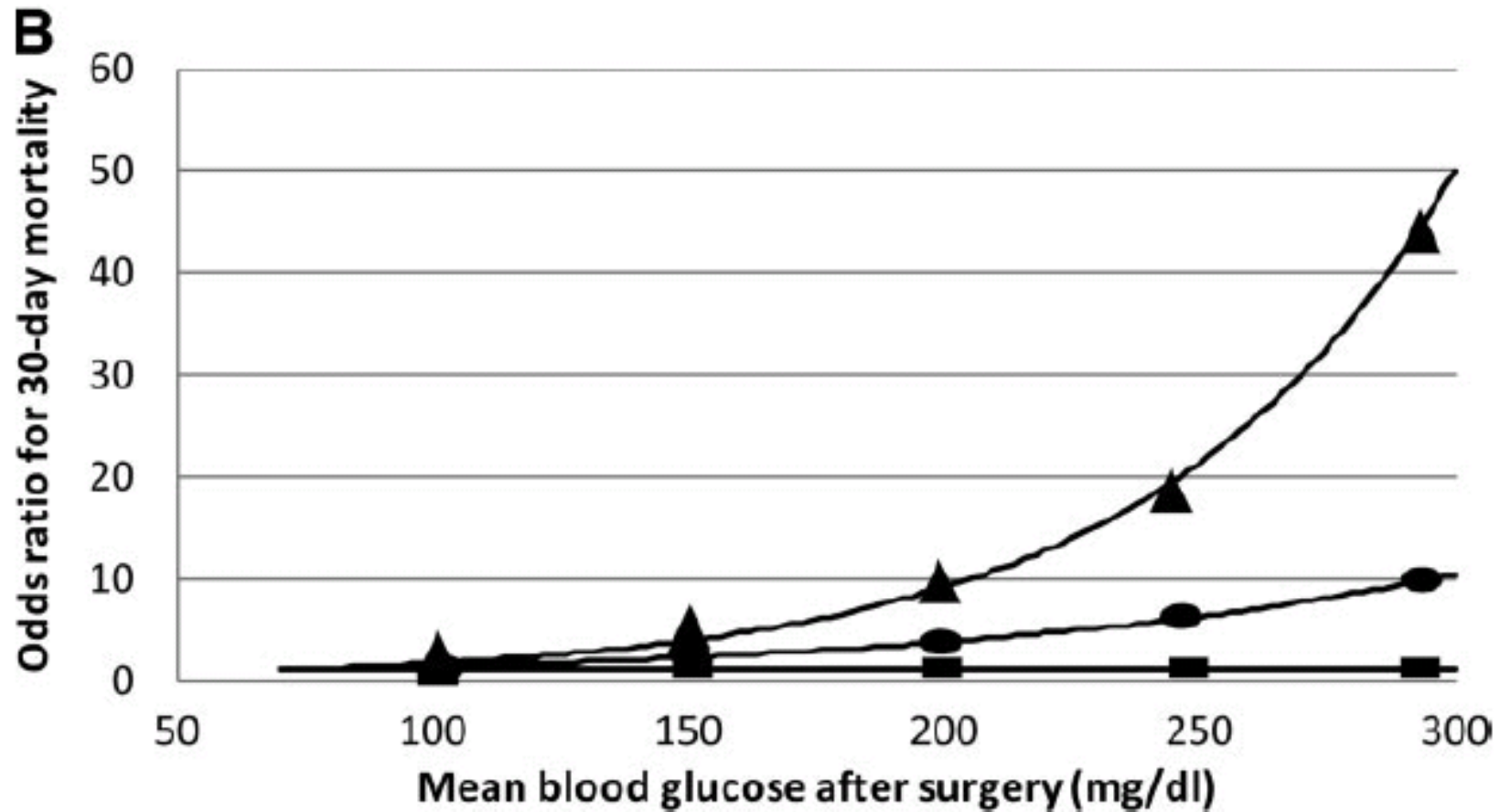
30 day mortality rates for 989 patients with diabetes – for each mmol/L increase in blood glucose, OR for mortality rose by 1.19 (CI 1.1 - 1.3)

Do High Glucose Levels Cause Harm?



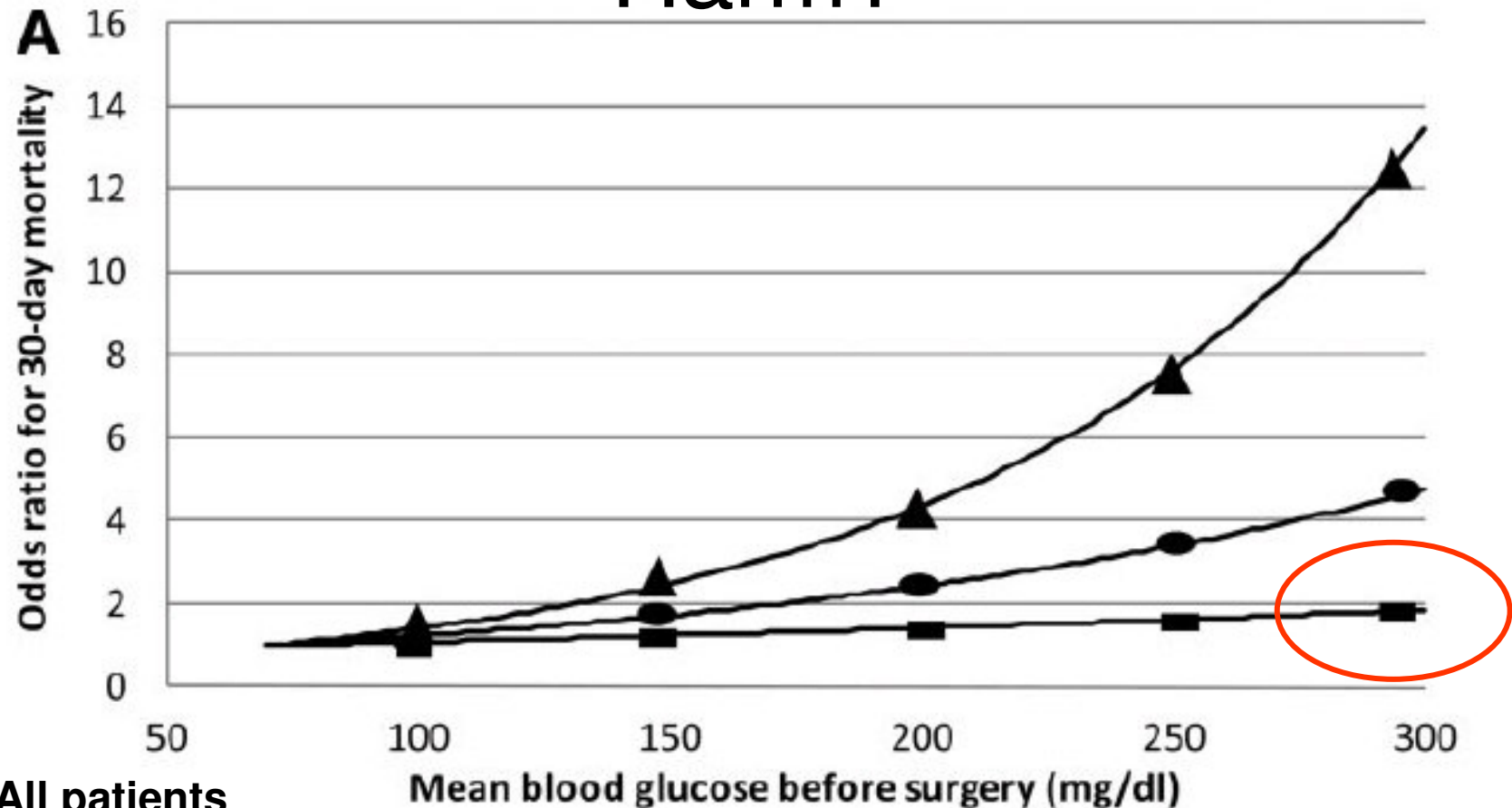
- All patients
- Patients with diabetes
- ▲ Patients without diabetes

Do High Glucose Levels Cause Harm?



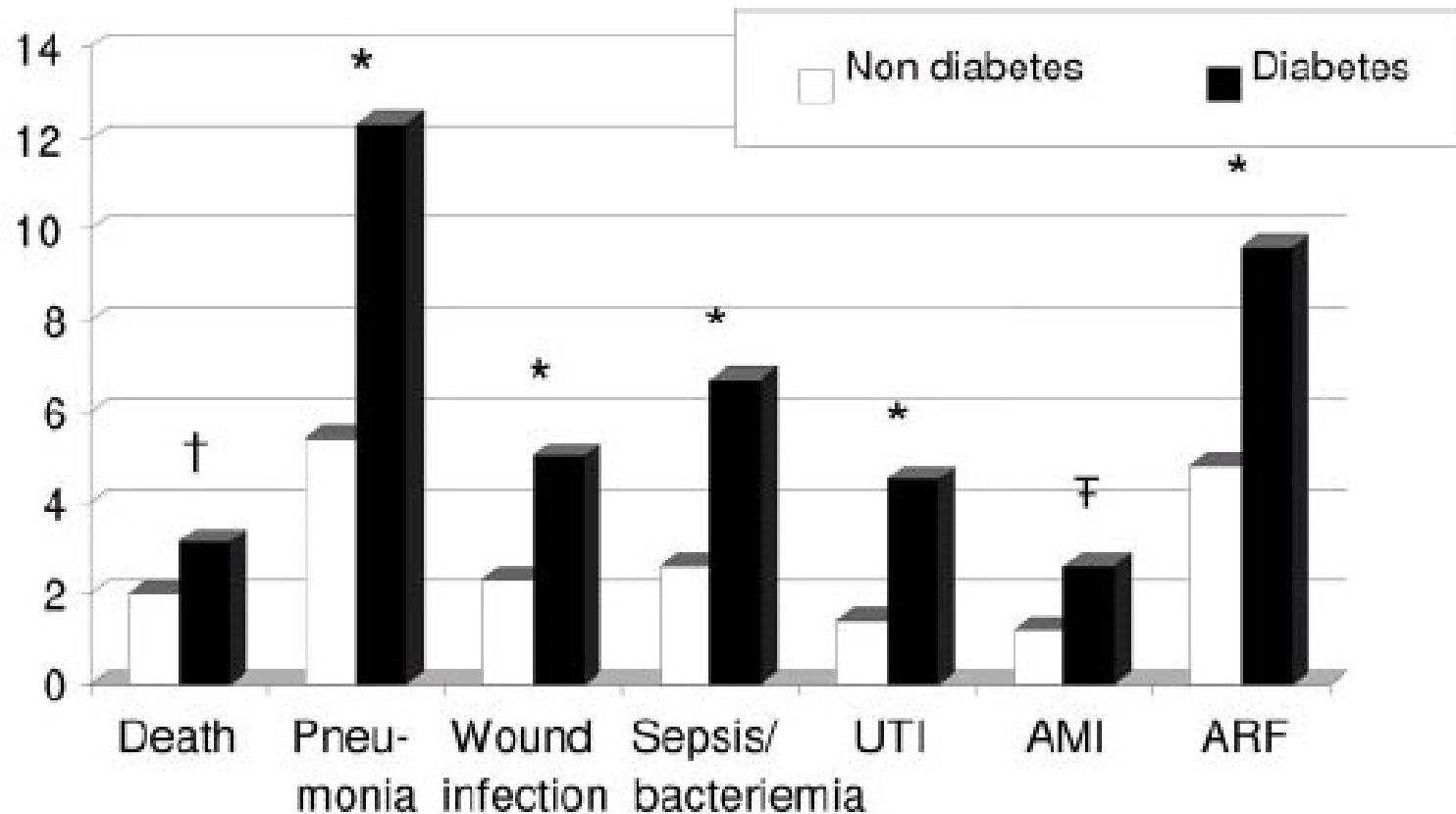
-
- Patients with diabetes
- ▲ Patients without diabetes

Do High Glucose Levels Cause Harm?



- All patients
- Patients with diabetes
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Do High Glucose Levels Cause Harm?



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

TABLE 1. Patient Demographics of Those Tested for Glucose and Stratified by Perioperative Hyperglycemia (Defined as >180 mg/dL at Any Point on the Day of Surgery, Postoperative Day 1, or Postoperative Day 2)

	Normal Glucose	Hyperglycemia	P
Number	8247	3383	
Clinical characteristics			
Age, yr	54.3 ± 15.8	58.1 ± 13.6	<0.001
Sex (% female)	5377 (65.2%)	2268 (67.0%)	0.06
Insurance			
Private	5509 (67.1%)	2170 (64.4%)	0.005
Medicare	2354 (28.7%)	1299 (38.6%)	<0.001
Medicaid	515 (6.3%)	249 (7.4%)	0.03
Uninsured	109 (1.3%)	31 (0.9%)	0.07
Charlson comorbidity index			
0	5,289 (64.1%)	771 (22.8%)	<0.001
1	2,242 (27.2%)	1,776 (52.5%)	
2	603 (7.3%)	714 (21.1%)	
3+	115 (1.4%)	123 (3.6%)	
Diabetes	1729 (21.0%)	2369 (70.1%)	<0.001
Diabetes treatment			
No meds	420 (24.1%)	231 (9.8%)	<0.001
Single noninsulin	776 (44.6%)	740 (31.2%)	
Multiple noninsulin	229 (13.2%)	437 (18.5%)	
Insulin	132 (7.6%)	370 (15.6%)	
Insulin plus other	185 (10.6%)	591 (25.0%)	
BMI for colorectal procedures	27.8 ± 7.5	29.3 ± 7.6	<0.001
BMI for bariatric procedures	45.8 ± 13.7	46.8 ± 12.6	0.009
Tobacco use	1287 (15.6%)	370 (11.0%)	<0.001
Creatinine >2 mg/dL	97 (1.5%)	71 (2.7%)	<0.001
Home oxygen	90 (1.1%)	68 (2.0%)	<0.001
Immunosuppression*	373 (4.5%)	181 (5.4%)	0.06
Coronary artery disease	646 (7.8%)	464 (13.7%)	<0.001
Hypertension	4212 (51.1%)	2453 (72.5%)	<0.001
Procedural characteristics			
Procedure types			
Bariatric	3513 (42.6%)	1847 (54.6%)	<0.001
Colorectal	4736 (57.4%)	1537 (45.4%)	
Surgical approach			
Laparoscopic	3,795 (46.1%)	1,760 (52.1%)	<0.001
Lap converted to open	362 (4.4%)	152 (4.5%)	
Lap, hand assisted	869 (10.6%)	216 (6.4%)	
Open	3163 (38.4%)	1243 (36.8%)	
Indication for surgery			
% Cancer	1696 (20.6%)	699 (20.7%)	0.9
Surgery time	145.7 ± 91.9	168.5 ± 101.4	<0.001
Prophylactic antibiotics†	7462 (97.4%)	3094 (97.4%)	0.9
Normothermia	7,473 (95.1%)	2,980 (95.1%)	0.9

Hyperglycaemic individuals were more likely to.....

Be older

Have more co-morbidities

Have diabetes - but not always

Be heavier

Have longer operations

*Patients on immunosuppressants preoperatively.

†Preoperative antibiotics given within 60 minutes of incision.

BMI indicates body mass index.

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)

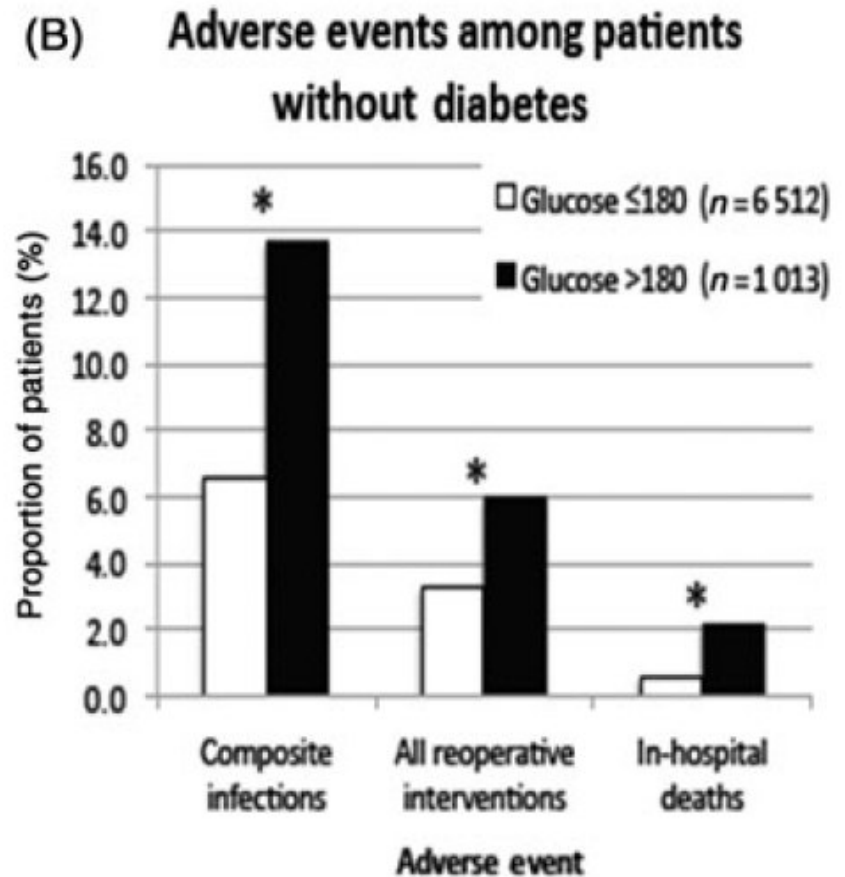
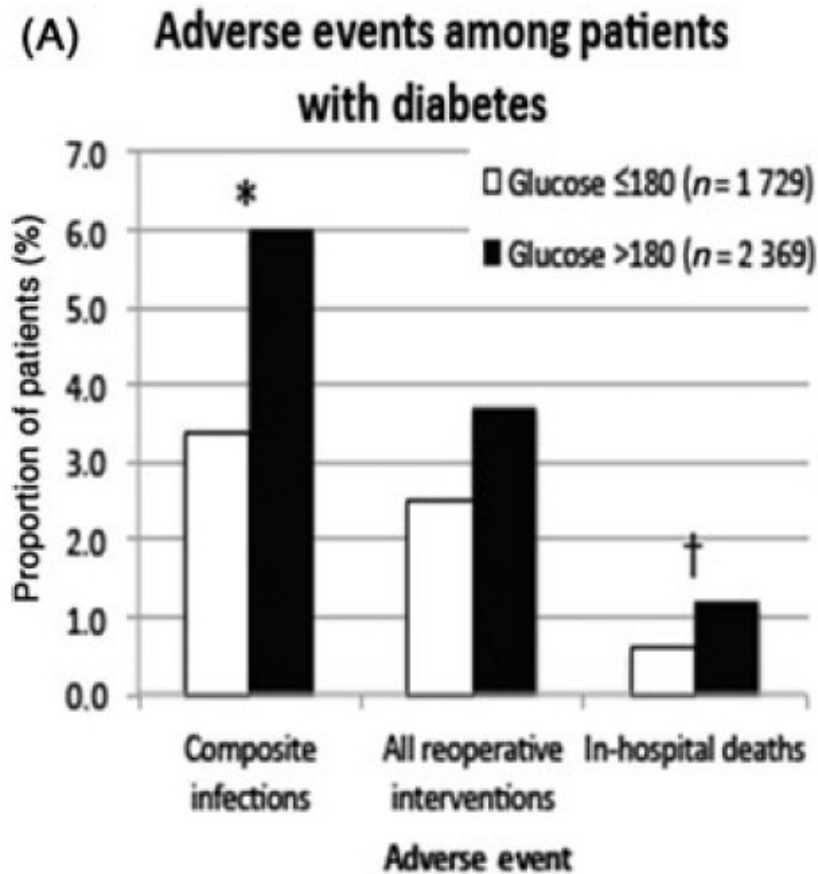
High glucose levels were associated with poor outcomes

Diabetes[§]

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 – having diabetes was protective (?increased vigilance)

Outcomes



180 mg/dl = 9.72 mmol/L * $P < 0.01$; † $P < 0.05$.

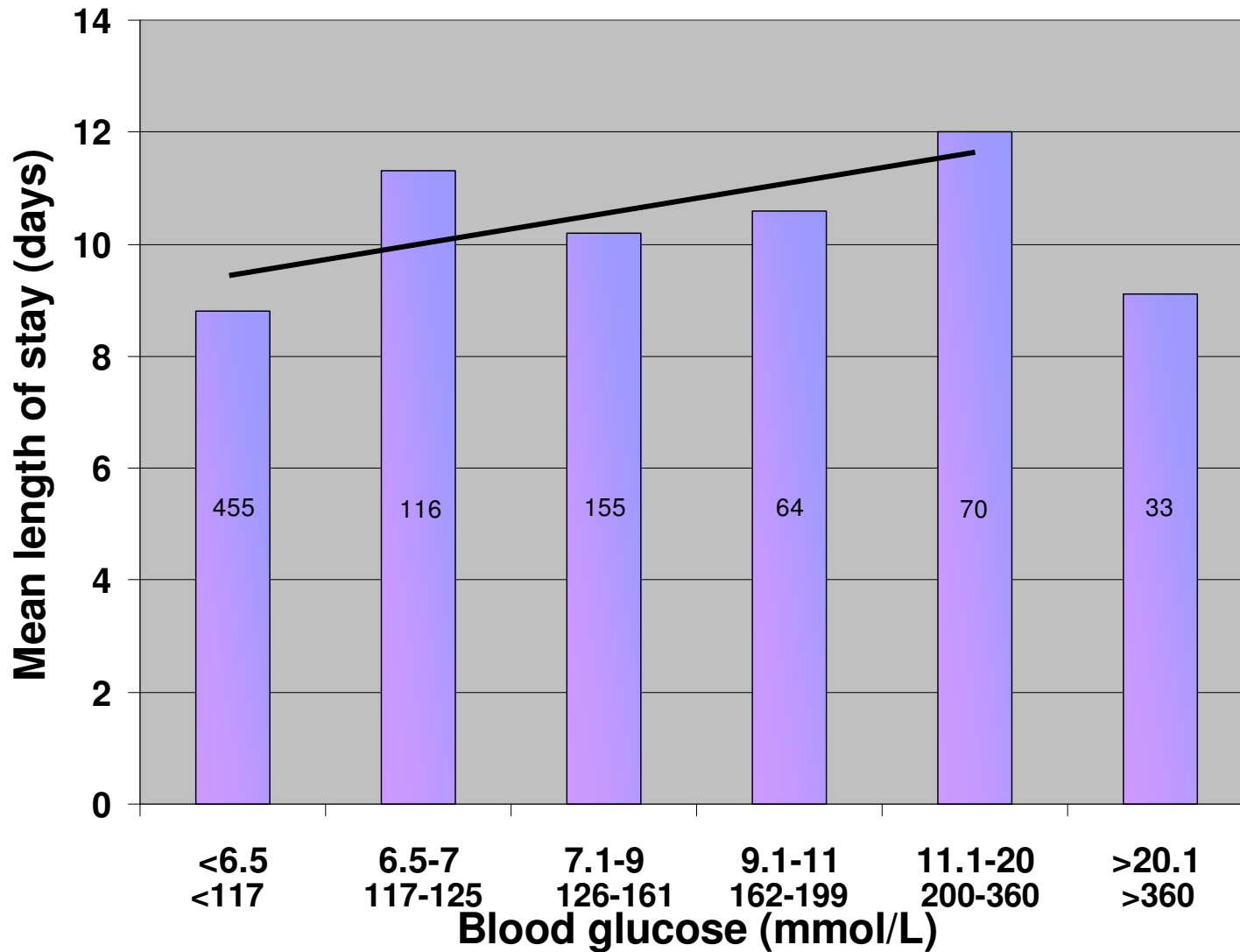
UK Data

- We analysed the data for all 1,502 patients admitted through our AMU in February 2010
- We assessed
 - admission blood glucose,
 - LOS
 - 28-days readmission and mortality
 - whether admission blood glucose ≥ 11.1 mmol/l in non-diabetic individuals was followed-up

Who Admitted Them?

Specialty	Number of patients	Number with diabetes
Medicine for the elderly	577	94 (16.3%)
Cardiology	221	25 (11.3%)
Respiratory	200	28 (14%)
Nephrology	30	9 (30%)
Gastroenterology	132	18 (13.6%)
Endocrinology	30	22 (73%)
Neurology	77	12 (16.9%)
Dermatology	1	0 (0%)
Haematology	16	0 (0%)
Oncology	56	4 (7.4%)
General medicine	162	27 (16.7%)

LOS vs Admission Glucose

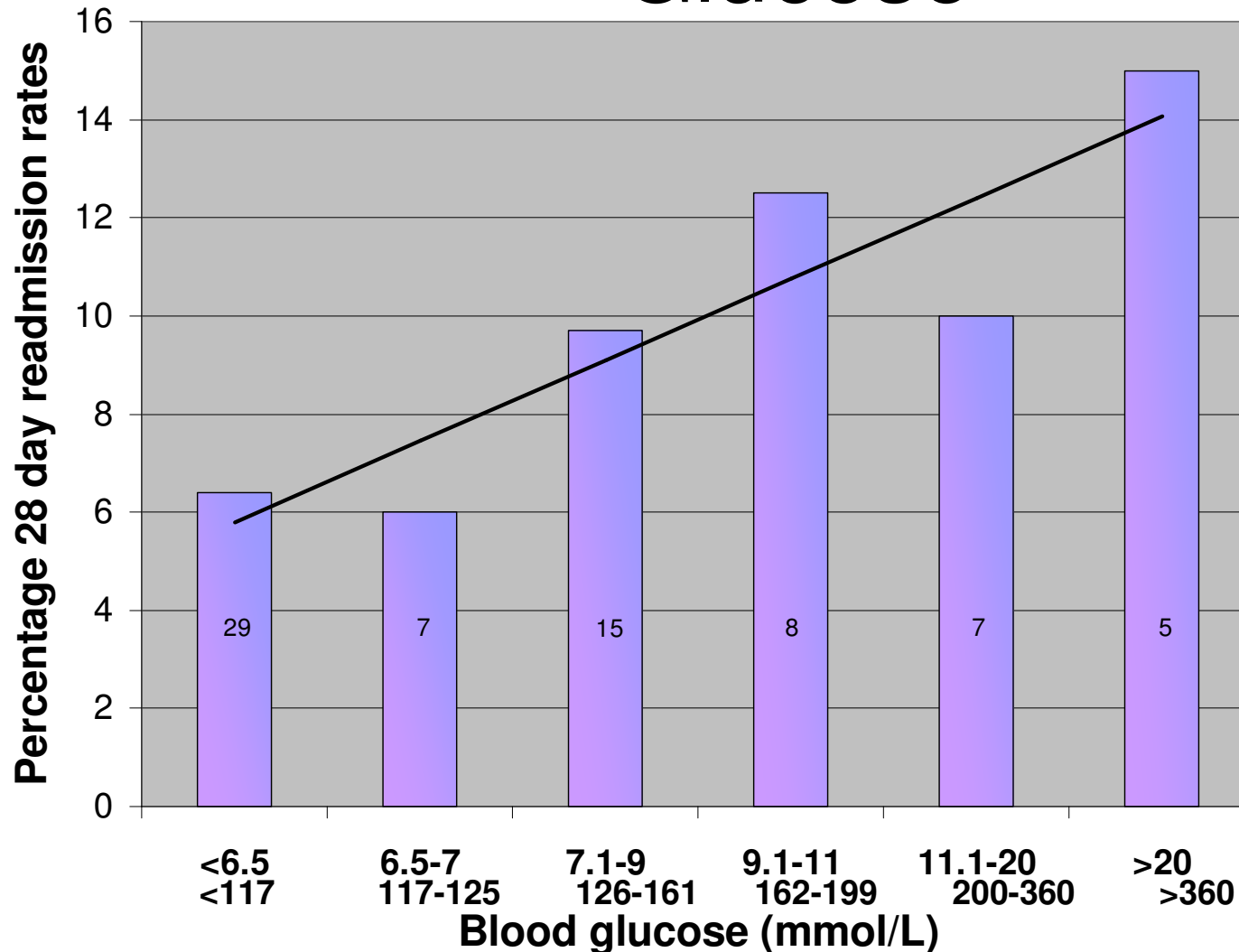


Trend $R^2 = 0.5556$

$P=0.002$

Those above 20mmol/L excluded (most under the diabetes team)

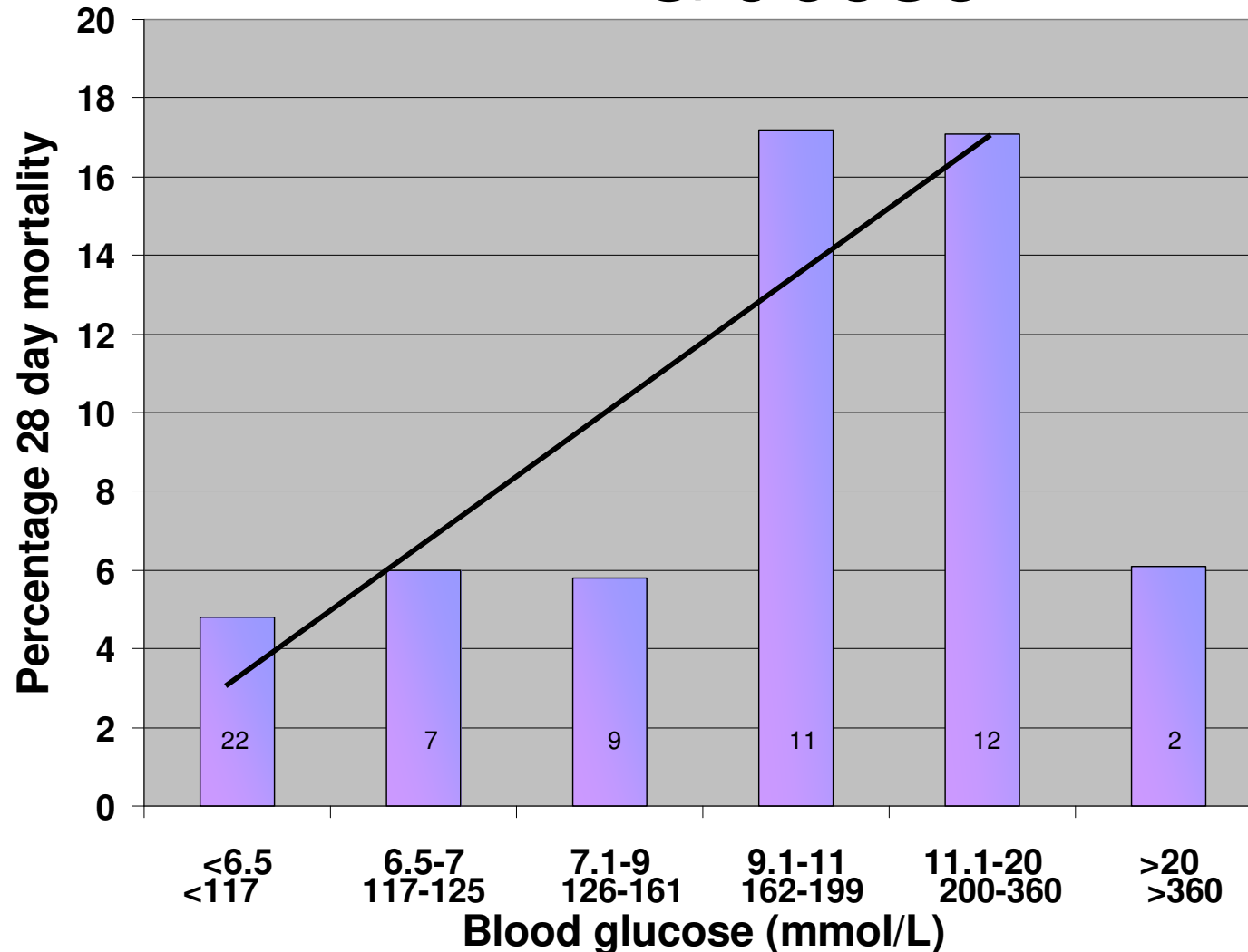
28 Day Readmission vs Admission Glucose



Trend $R^2 = 0.7918$

Of the 1,502 admissions in February 2010, 71 (4.73%) were readmitted within 28 days

28 Day Mortality vs Admission Glucose



Trend $R^2 = 0.7874$

$P < 0.0001$

Of the 1,502 admissions in February 2010, 63 (4.19%) died within 28 days

National UK Data

Excess mortality during hospital stays among patients with recorded diabetes compared to those without diabetes

N Holman¹, R Hillson² and R J Young³

- In the UK, having diabetes is associated with a 6.3% increased risk of death compared with those without diabetes admitted for the same conditions
- This equates to 2300 excess deaths per year

What is the US Doing About This?

P E R S P E C T I V E S I N C A R E

Pathways to Quality Inpatient Management of Hyperglycemia and Diabetes: A Call to Action

BORIS DRAZNIN, MD, PHD¹
JANICE GILDEN, MS, MD²
SHERITA H. GOLDEN, MD, MHS³

SILVIO E. INZUCCHI, MD⁴
FOR THE PRIDE INVESTIGATORS*

be true, especially in the context of such short hospital stays. This skepticism led to confirmatory trials, most conducted using a multicenter design. These could not confirm the initial positive findings from

Documents to Help

Joint British Diabetes Societies
Inpatient Care Group

The Hospital Management of
Hypoglycaemia in Adults
with Diabetes Mellitus

Management of adults with
diabetes undergoing surgery and
elective procedures:
improving standards

Self-management of
diabetes in hospital

Joint British Diabetes Societies
for Inpatient Care Group

SPECIAL FEATURE

Clinical Practice Guideline

**Management of Hyperglycemia in Hospitalized
Patients in Non-Critical Care Setting: An Endocrine
Society Clinical Practice Guideline**

(J Clin Endocrinol Metab 97: 16–38, 2012)

Documents to Help

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

What is Lacking?

- Interventional studies to show that lowering glucose makes a difference to outcomes

BMJ

BMJ 2013;346:f134 doi: 10.1136/bmj.f134 (Published 17 January 2013)

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PRACTICE

UNCERTAINTIES

Should inpatient hyperglycaemia be treated?

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Finally

- Something to ask your anaesthetic colleagues...

BJA

Editorial II

British Journal of Anaesthesia 110 (5): 674–5 (2013)
doi:10.1093/bja/aet010

EDITORIAL II

Does dexamethasone-induced hyperglycaemia contribute to postoperative morbidity and mortality?

K. Dhatariya*



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