Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

The Challenges of Inpatient Hyperglycaemia

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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

- Peri-operative care
  - Surgical patients – US data
- Effects of hyperglycaemia on the AMU
  - Medical patients – NNUH data
- Guidelines

Peri-operative Care

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

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

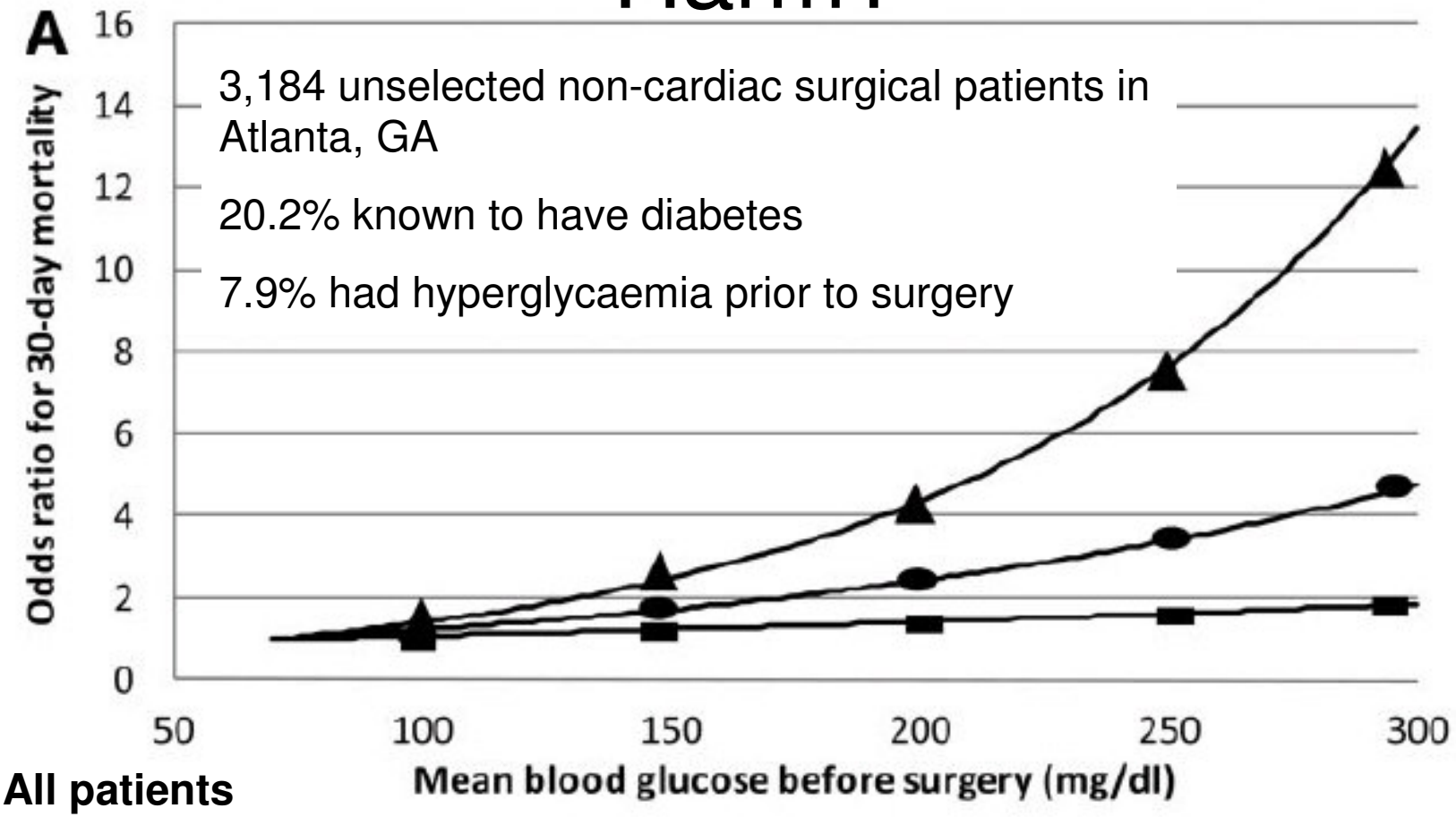
	Mean LOS (days)			Excess LOS (days)		n		
	E10	E11	C	E10	E11	E10	E11	C
Surg.	5.4 (0.1)	5.1 (0.1)	4.2 (0.2)	1.2	0.9	18,032	32,135	1,501,453
T &O	4.8 (0.1)	5.3 (0.2)	4.6 (0.1)	0.2	0.7	8,178	12,203	885,606
GM	4.8 (0.2)	5.4 (0.2)	4.4 (0.1)	0.4	1.0	70,988	82,446	1,709,553
Card.	4.2 (0.1)	4.2 (0.1)	3.8 (0.1)	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?



- **All patients**
- **Patients with diabetes**
- **Patients without diabetes**

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

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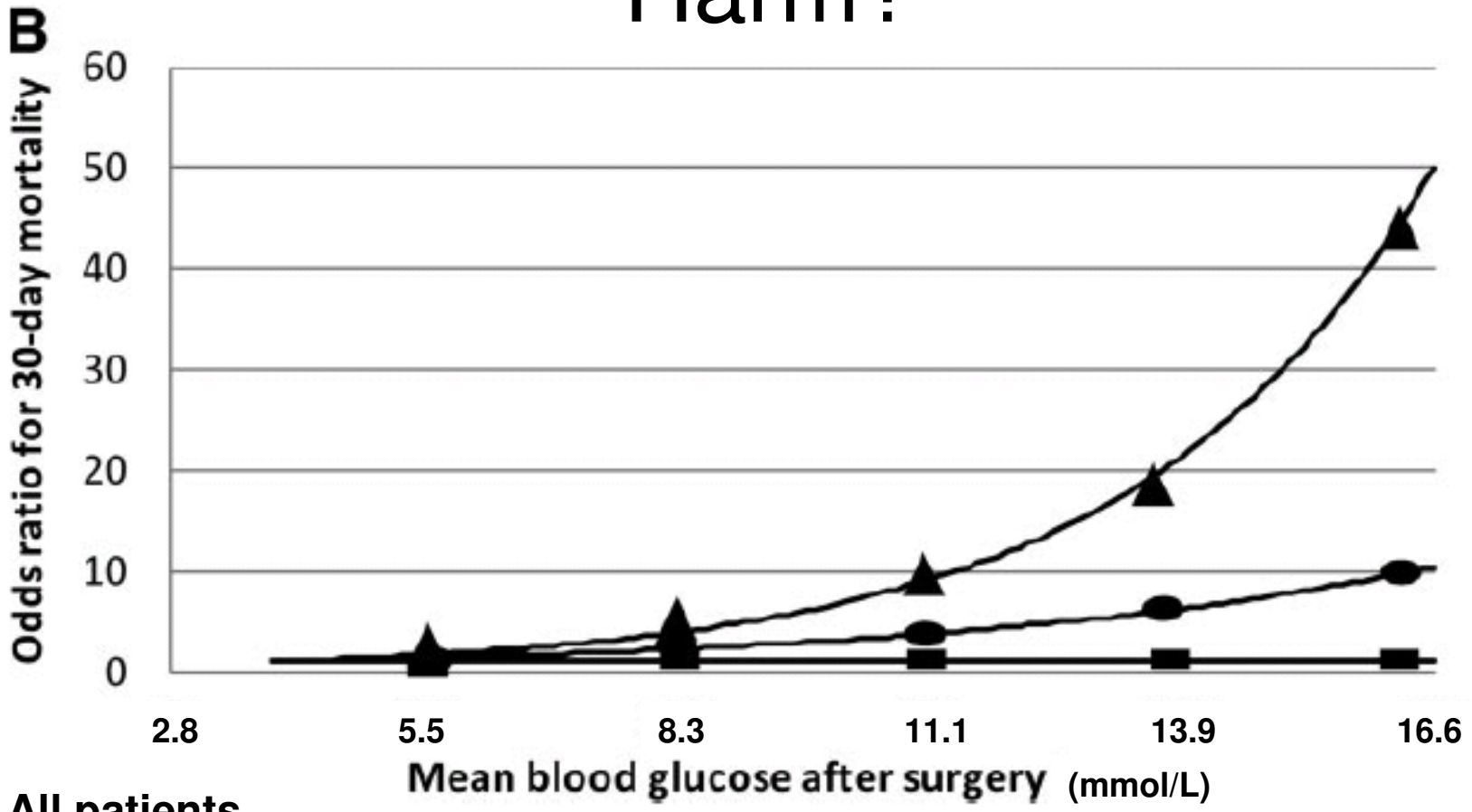

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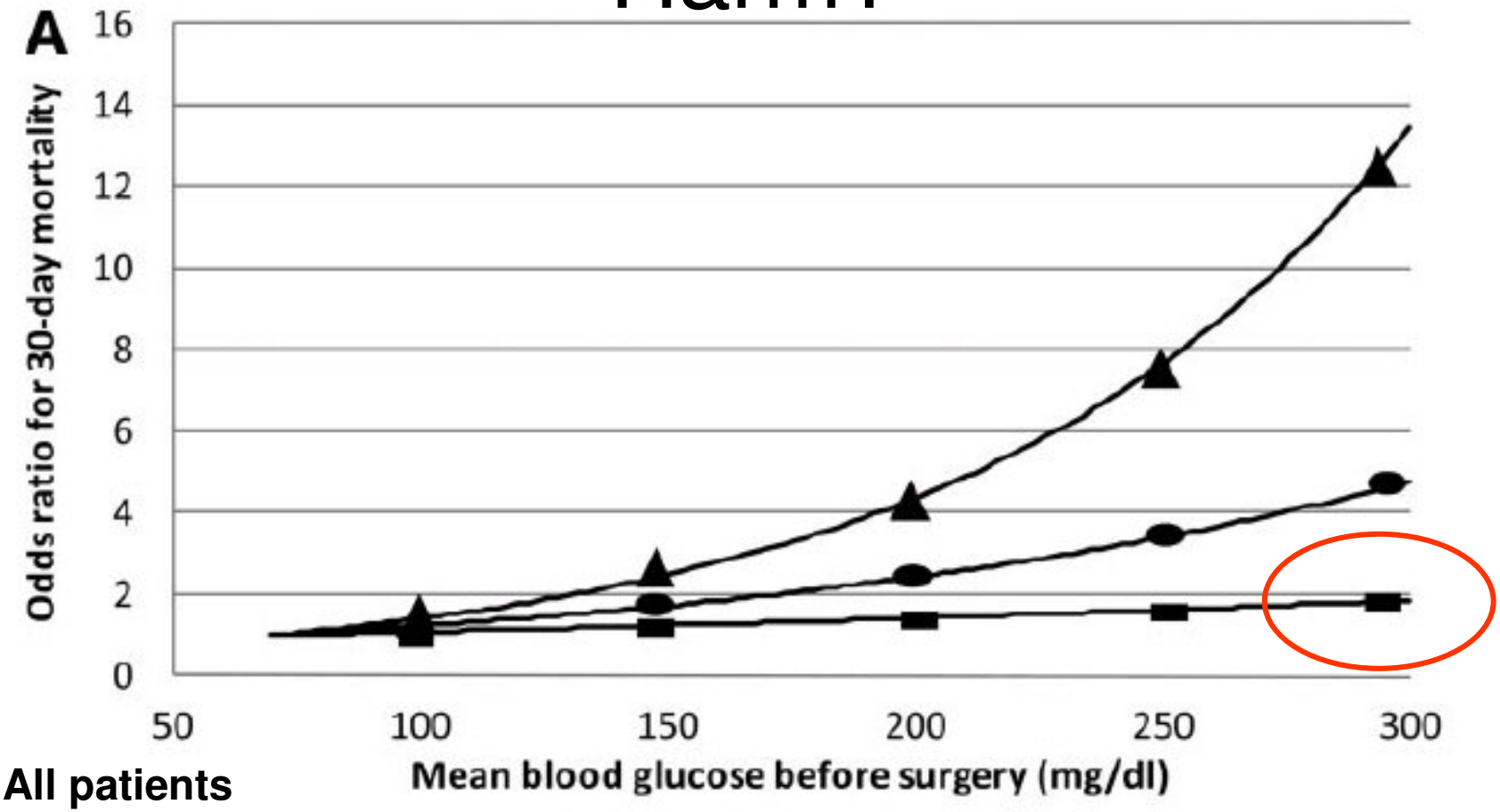

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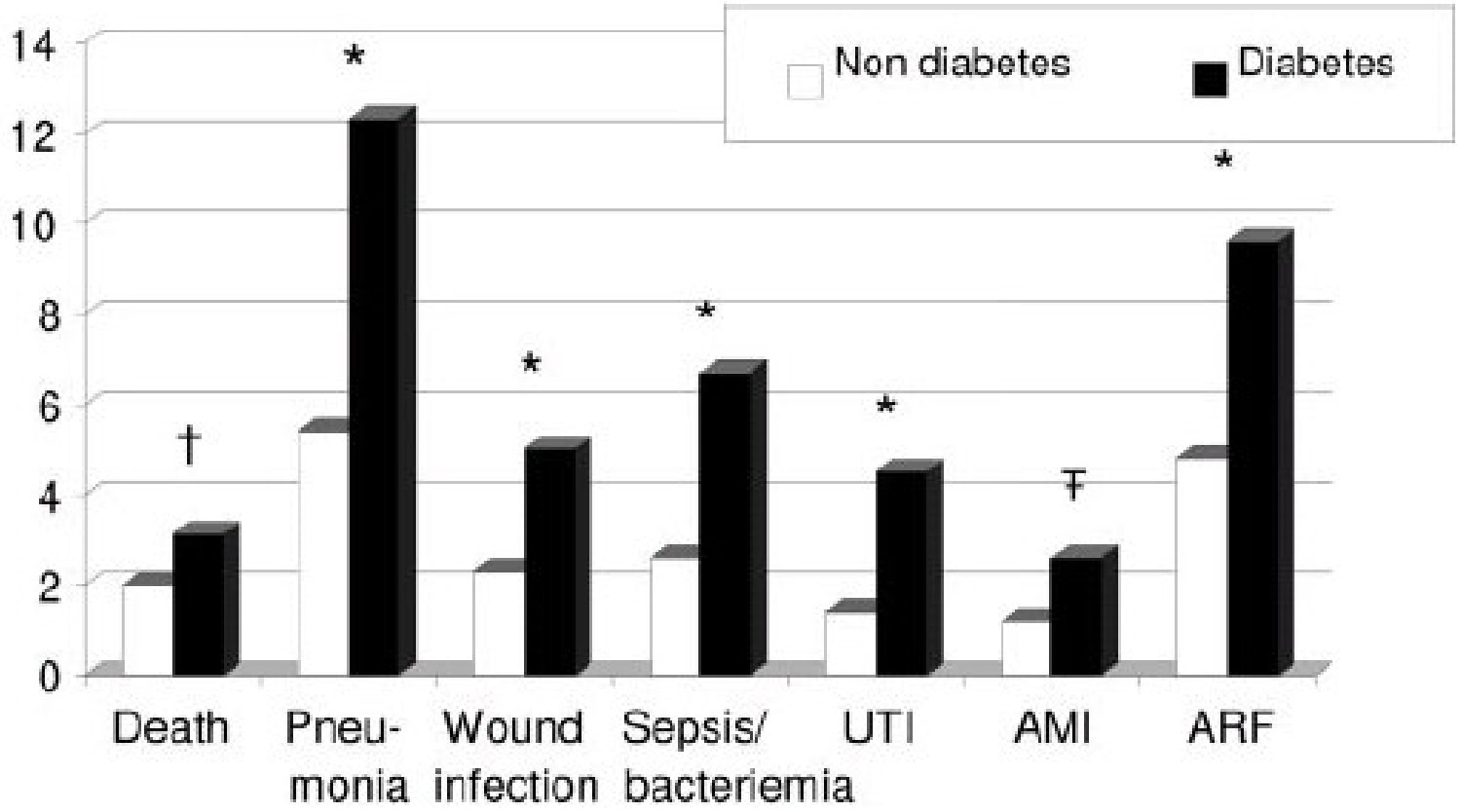
Do High Admission Glucose Levels Cause Harm?



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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

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			<0.001
0	5,289 (64.1%)	771 (22.8%)	
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			<0.001
No meds	420 (24.1%)	231 (9.8%)	
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			<0.001
Bariatric	3513 (42.6%)	1847 (54.6%)	
Colorectal	4736 (57.4%)	1537 (45.4%)	
Surgical approach			<0.001
Laparoscopic	3,795 (46.1%)	1,760 (52.1%)	
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			0.9
% Cancer	1696 (20.6%)	699 (20.7%)	
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

*Patients on immunosuppressants preoperatively.
†Preoperative antibiotics given within 60 minutes of incision.
BMI indicates body mass index.

Hyperglycaemic individuals were more likely to……..

- Be older
- Have more co-morbidities
- Have diabetes - but not always
- Be heavier
- Have longer operations

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)

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)

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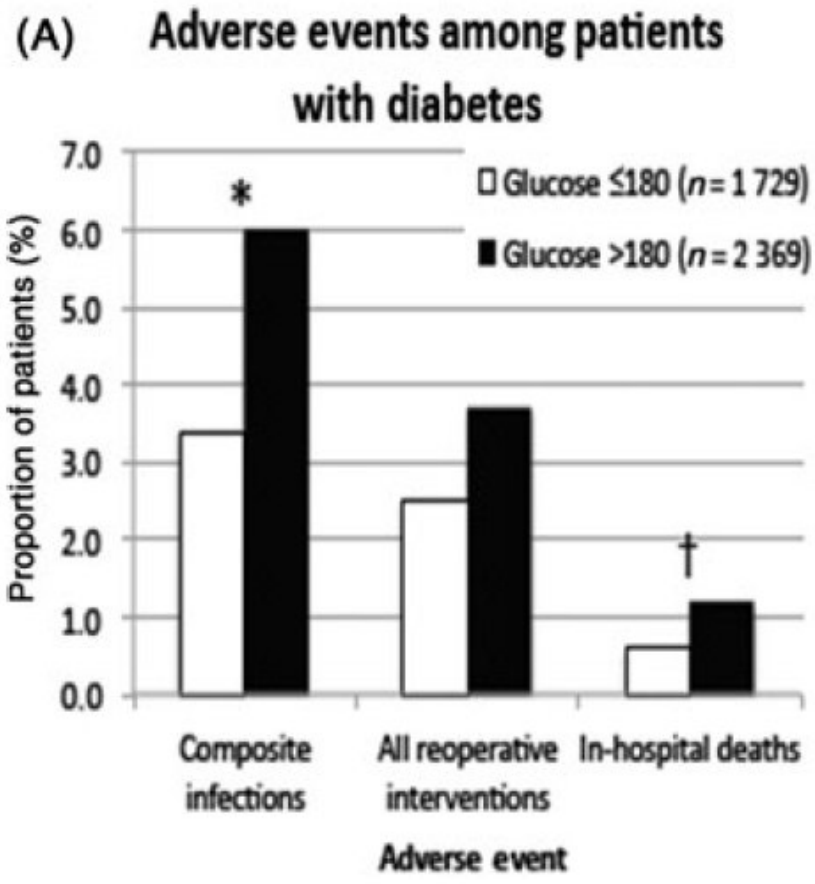
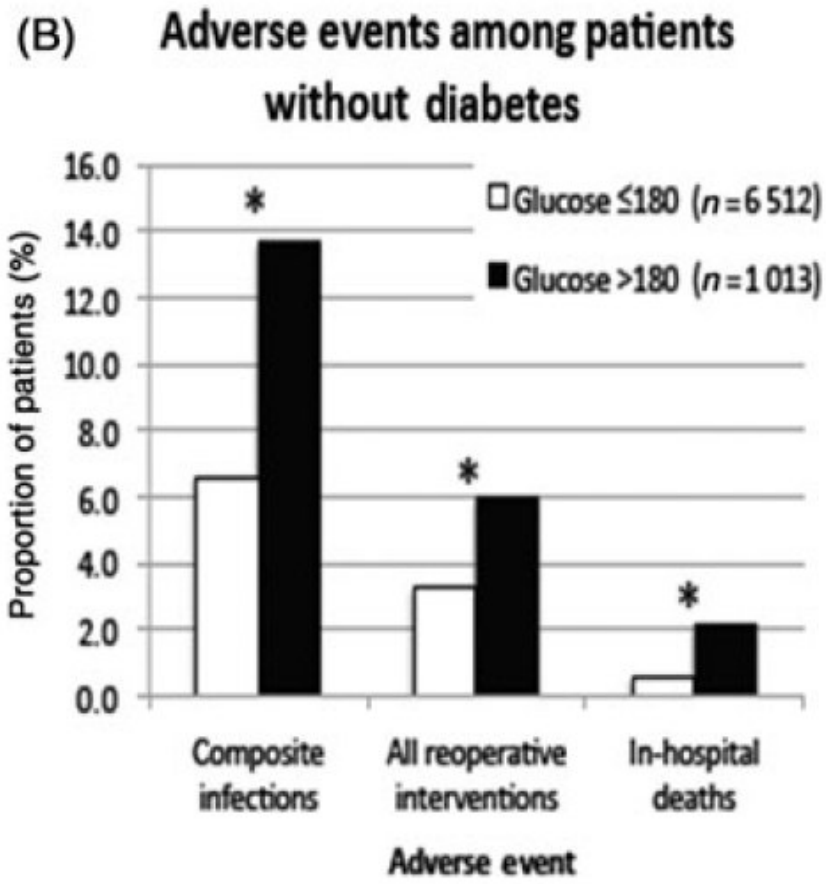
Outcomes

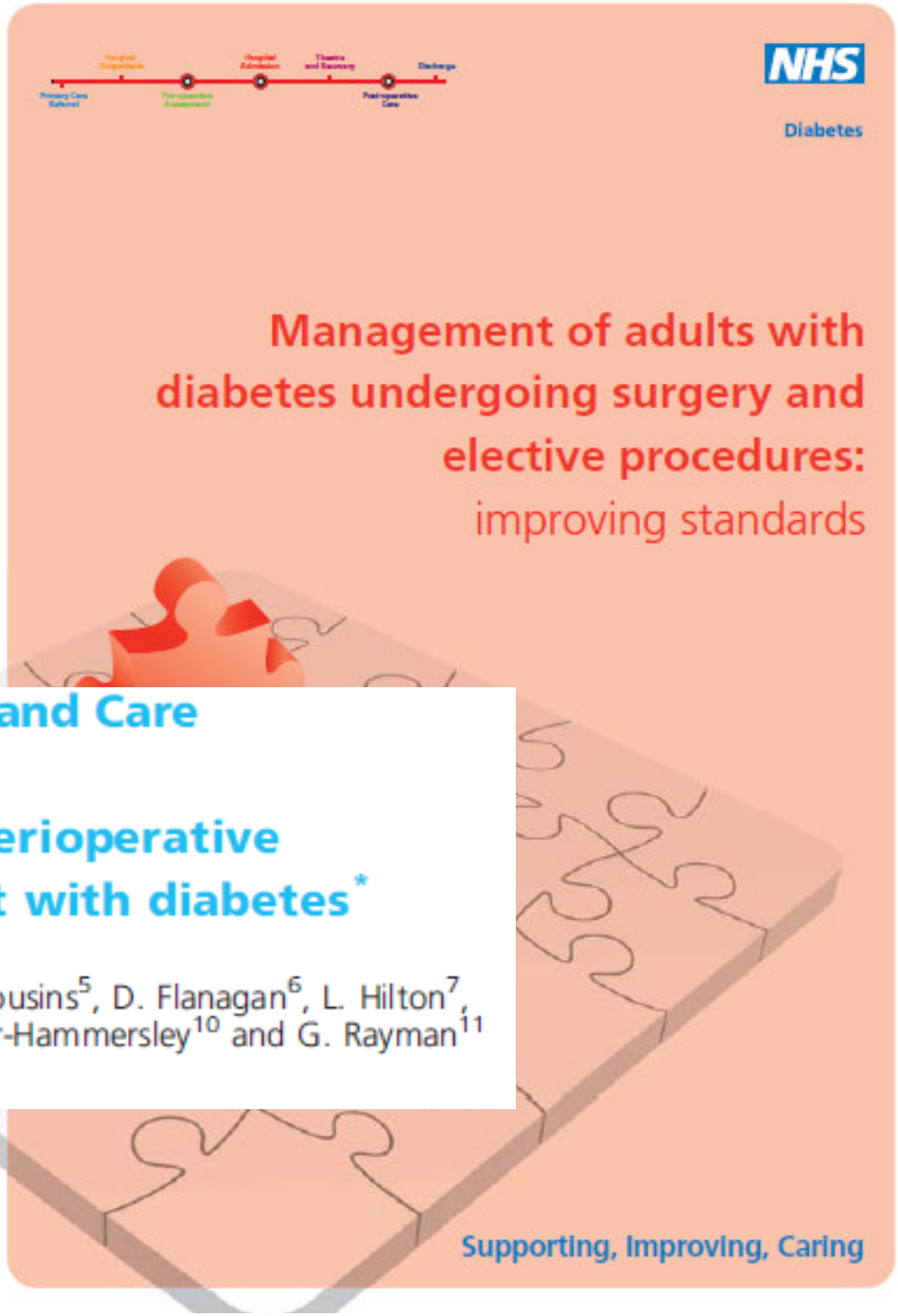




180 mg/dl = 9.72 mmol/L $^{*}P < 0.01$; $^{\dagger}P < 0.05$

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

Fortunately There is 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

Diabet. Med. 29, 420–433 (2012)

National Guidelines

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

Documents to Help

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

Data from Our Acute Medical Unit

NNUH Data

- We analysed the data for all 1,502 patients admitted through our AMU in February 2010
- Our average MAU intake is 60 patients every 24 hours
- We assessed
  - admission blood glucose
  - LOS
  - 28-days readmission and mortality
  - whether admission blood glucose ≥11.1mmol/l in non-diabetic individuals was followed-up

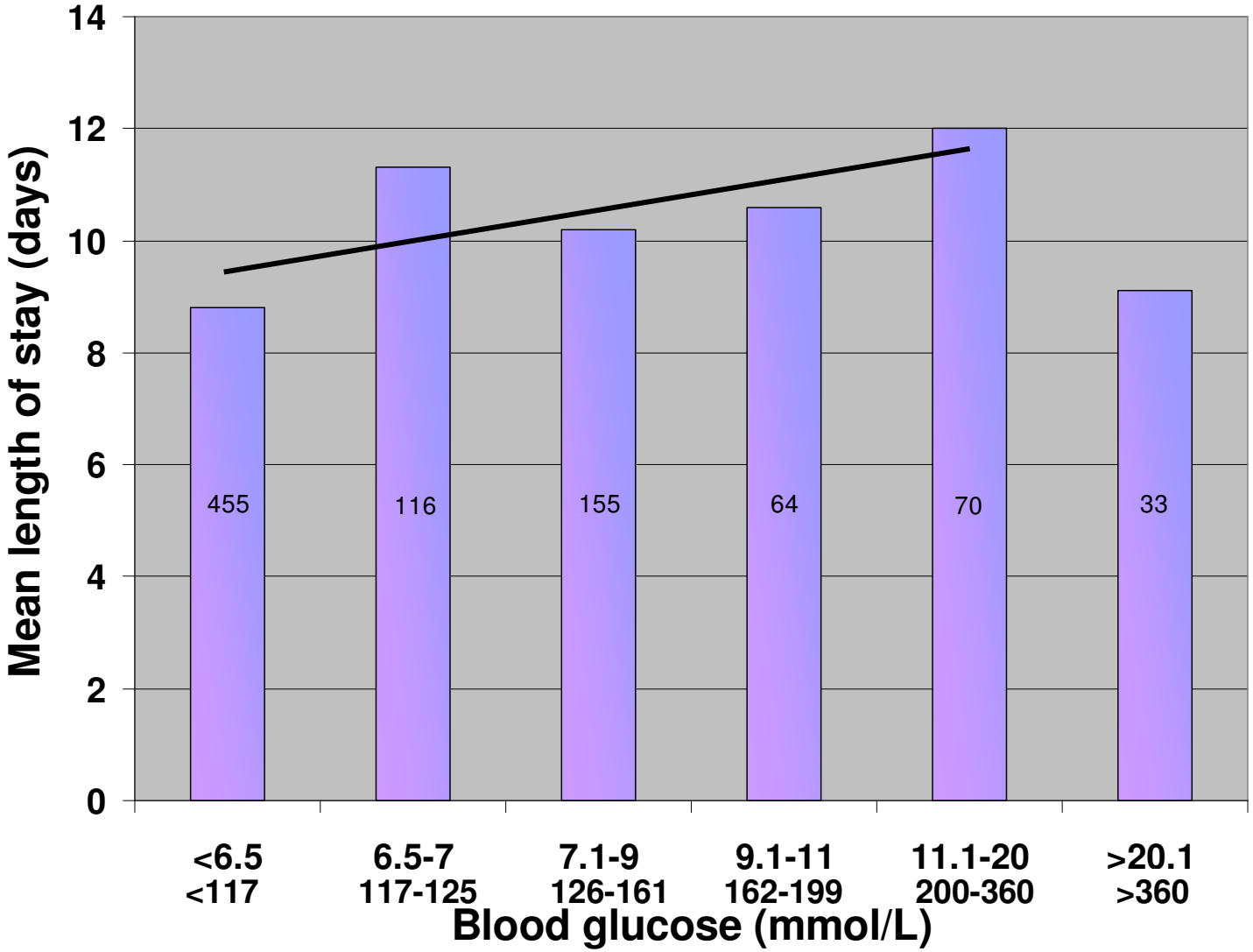
Evans N, Dhatariya K Clinical Medicine 2012;12(2):137-139

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)

Evans N, Dhatariya K Clinical Medicine 2012;12(2):137-139

LOS vs Admission Glucose



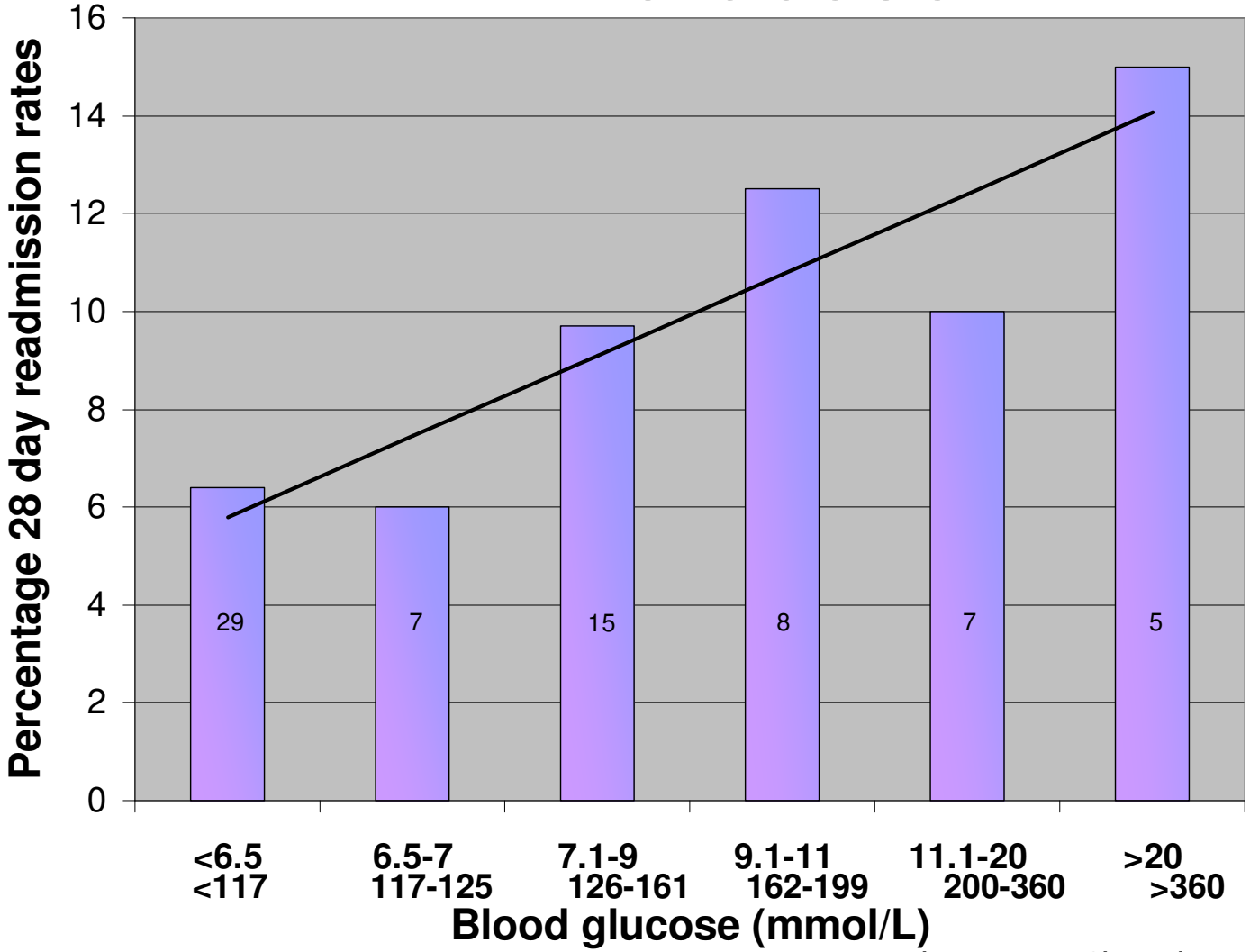
Trend R^2 = 0.5556

P=0.002

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

Evans N, Dhatariya K Clinical Medicine 2012;12(2):137-139

28 Day Readmission vs Admission Glucose

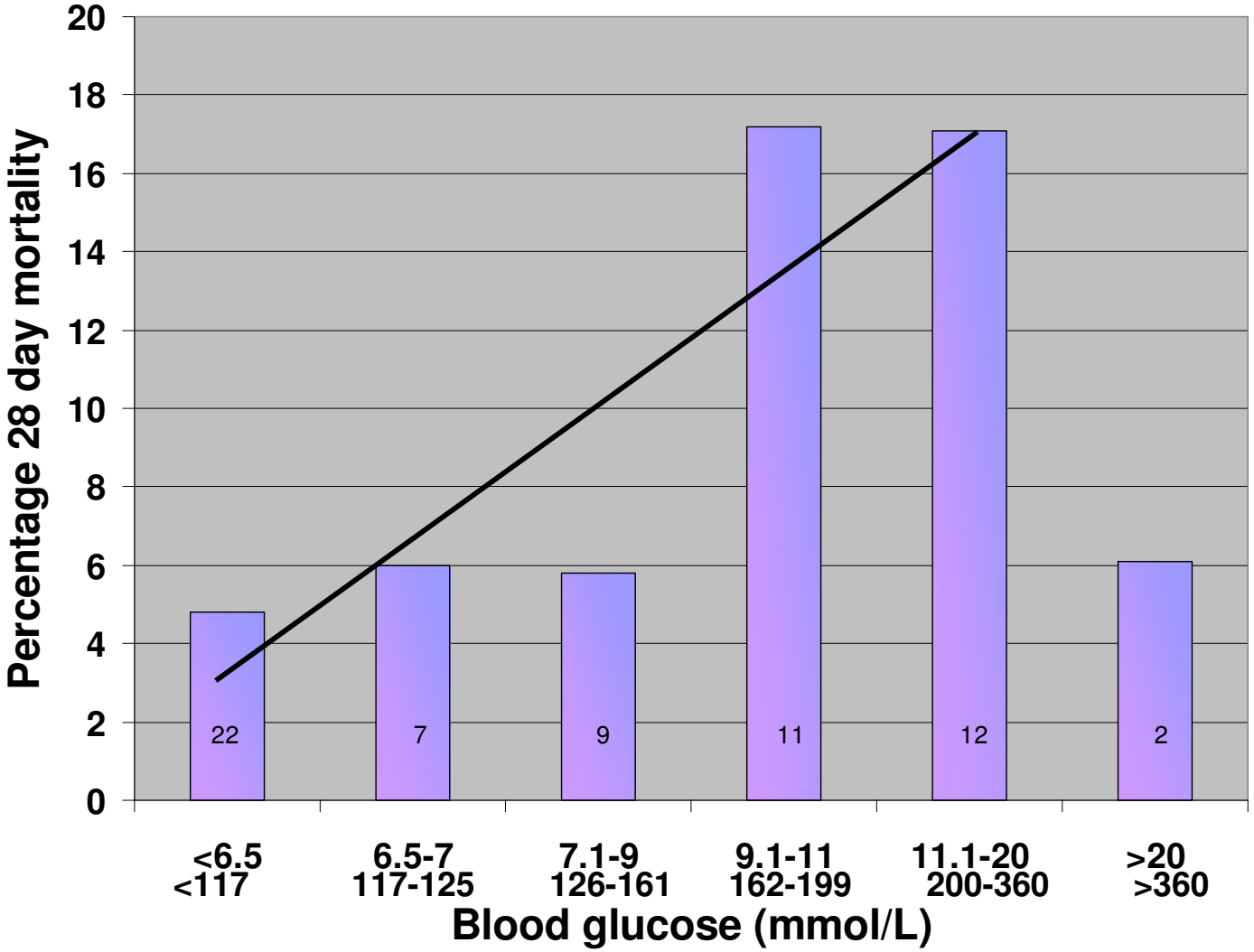


Trend R^2 = 0.7918

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

Evans N, Dhatariya K Clinical Medicine 2012;12(2):137-139

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

Evans N, Dhatariya K Clinical Medicine 2012;12(2):137-139

The Future

- First – a glimpse into the murky past of diabetes related eye disease

- In 1978 Kelly M West wrote “The extent to which the level of hyperglycaemia determines the risk of retinopathy is not at all clear. This is the most important issue at hand and deserves high priority in epidemiologic research”

West KM. 1978. *Epidemiology of Diabetes and Its Vascular Lesions* . Elsevier, NY

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)

PRACTICE

UNCERTAINTIES

Should inpatient hyperglycaemia be treated?

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Elsie Bertram Diabetes Centre, Norfolk and Norwich University Hospitals NHS Foundation Trust, Norwich NR4 7UY, UK

Guidelines

Documents to Help

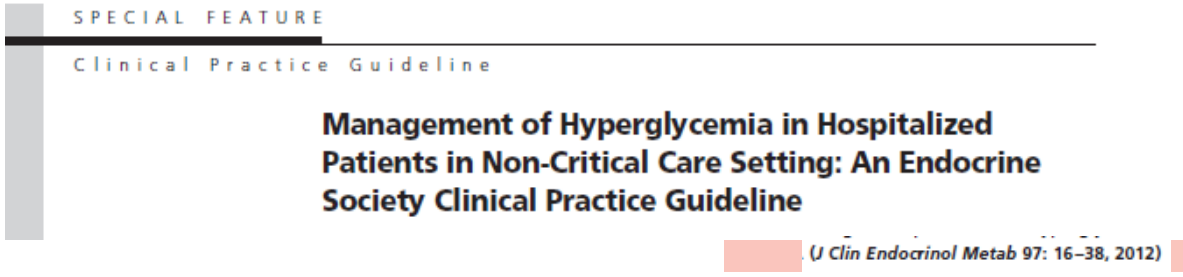
Joint British Diabetes Societies
Inpatient Care Group

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 Can *You* Do?

- Try and get data from your own units – and publish it!
- Try and disseminate the knowledge contained in the guidelines – especially the peri-op one
- Be an advocate for diabetes

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Thank you for your attention

www.norfolkdiabetes.com