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Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust


# Management of Hyperglycaemia in People Without Known Diabetes

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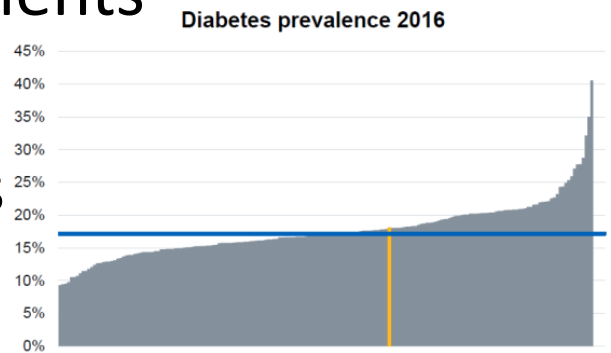
# What is the Difference Between Hyperglycaemia and Diabetes?

- Hyperglycaemia
  - A random (plasma or capillary) glucose concentration of >7.8mmol/l
- Diabetes
  - A complex metabolic disorder characterised by chronic hyperglycaemia resulting from defects in insulin secretion or insulin action, or both

# Prevalence of Inpatients With Diabetes

- Approximately 18% of all hospital inpatients have diabetes
- Most are in hospital *with* their diabetes rather than *because* of it
- The most common reason for a diabetes specific hospital admission is the 'diabetic foot' with £1Bn spent on this complication every year




National Diabetes Audit – 2015-2016 NHS Digital http://www.content.digital.nhs.uk/catalogue/PUB23241 Accessed 7/10/17
Kerr M Diabetic foot care in England: An economic study. Insight Health Economics 2017

# Prevalence of Admission Hyperglycaemia

- Varies – but in the region of ~40% for general admissions and 80% for cardiac surgery

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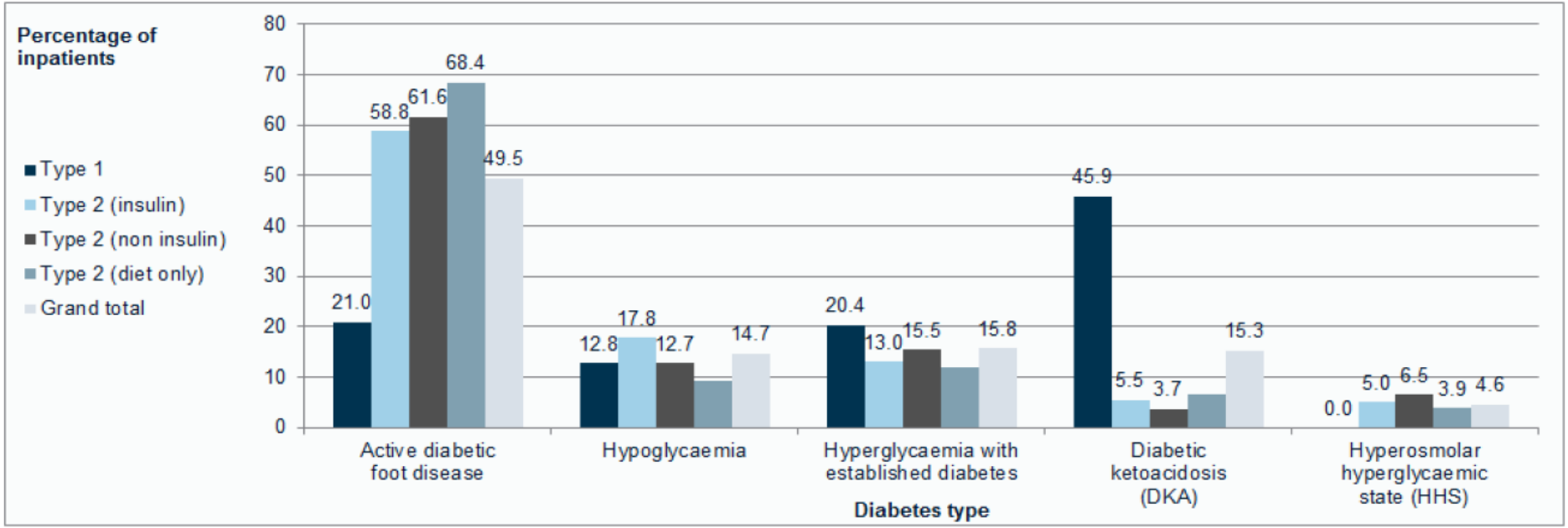
# Reasons for Acute Admission

**Chart 8: Percentage of inpatients admitted for management of diabetes or a diabetes complication by diabetes type, England and Wales, 2015**




National Diabetes Inpatient Audit 2015 - http://digital.nhs.uk/catalogue/PUB20206 Last accessed 7th October 2017

# Why Diagnose People Early?

- Prevention of long terms complications
- Identification of people at risk of developing diabetes
- Prevention of progression to diabetes

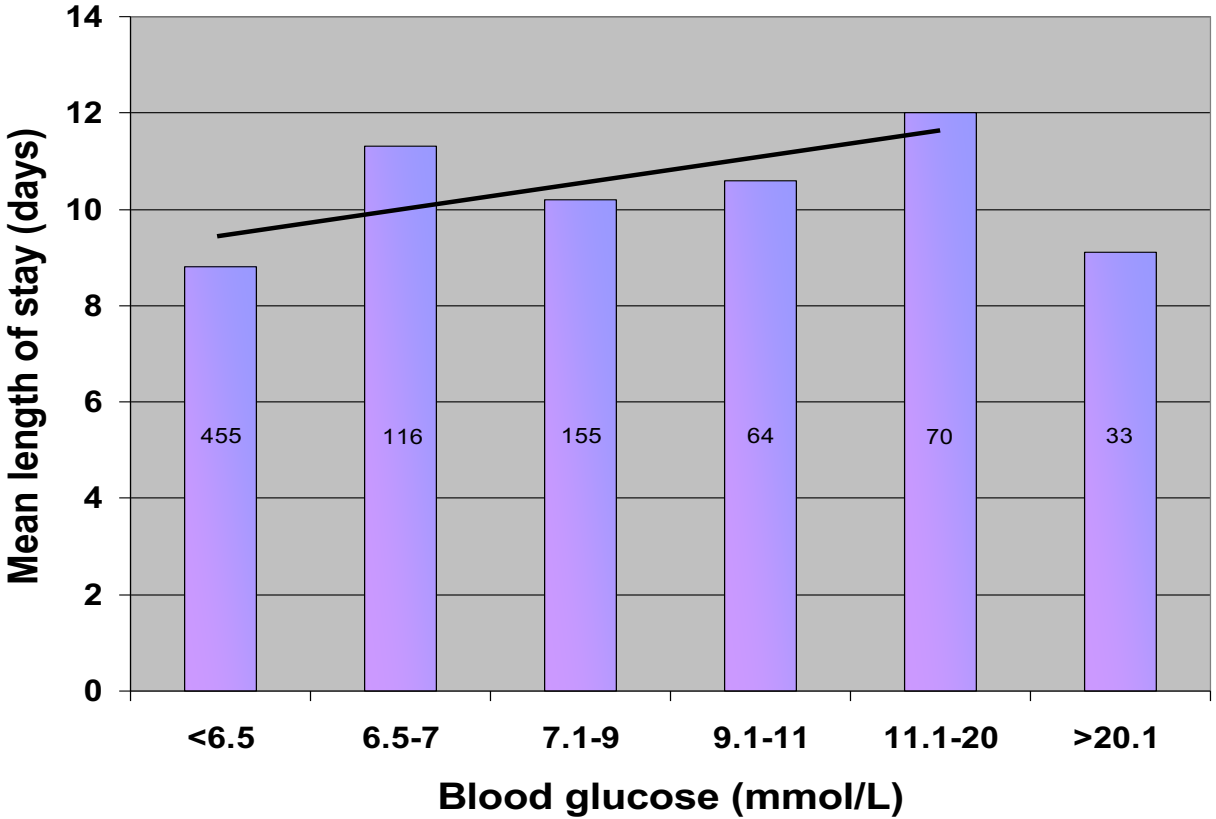
# Outcomes of Inpatient Hyperglycaemia

# Acute Admissions – UK Data

- We analysed data from all 1502 patients admitted through the Acute Medical Unit at NNUH in February 2010
  - 893 had a glucose concentration measured
- Was there a relationship between a single glucose concentration at the time of acute hospital admission and outcomes?

Evan NR, Dhatariya KK Clinical Medicine 2012;12(2):137-139

# LOS vs Admission Glucose



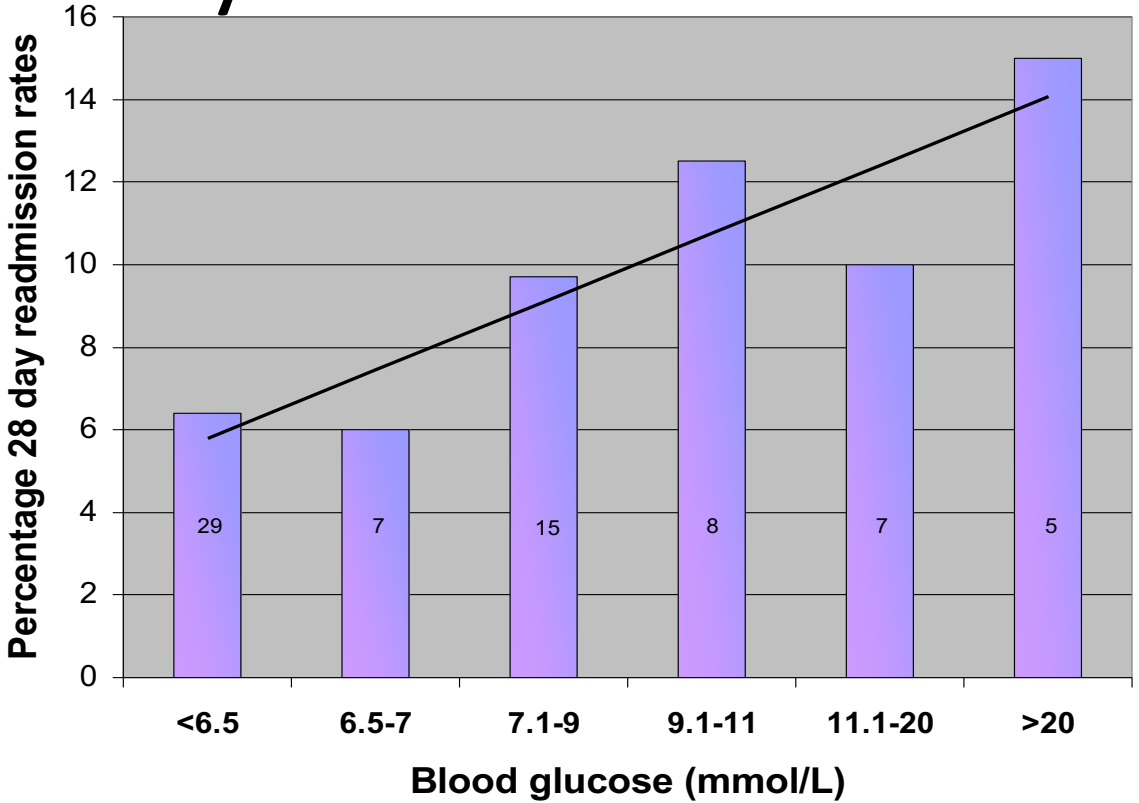

Trend $R^2 = 0.5556$

P=0.002

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

Evan NR, Dhatariya KK Clinical Medicine 2012;12(2):137-139

# 28 Day Readmission vs Admission Glucose

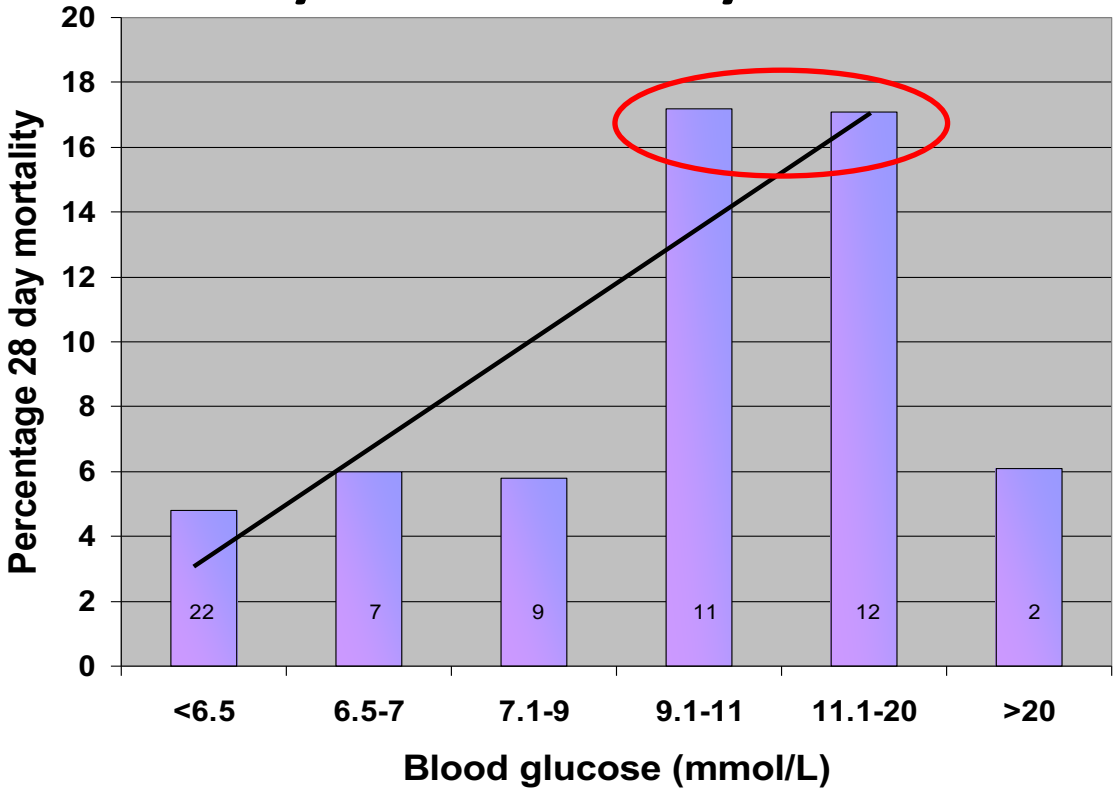



Trend $R^2 = 0.7918$

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

Evan NR, Dhatariya KK 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

Evan NR, Dhatariya KK Clinical Medicine 2012;12(2):137-139

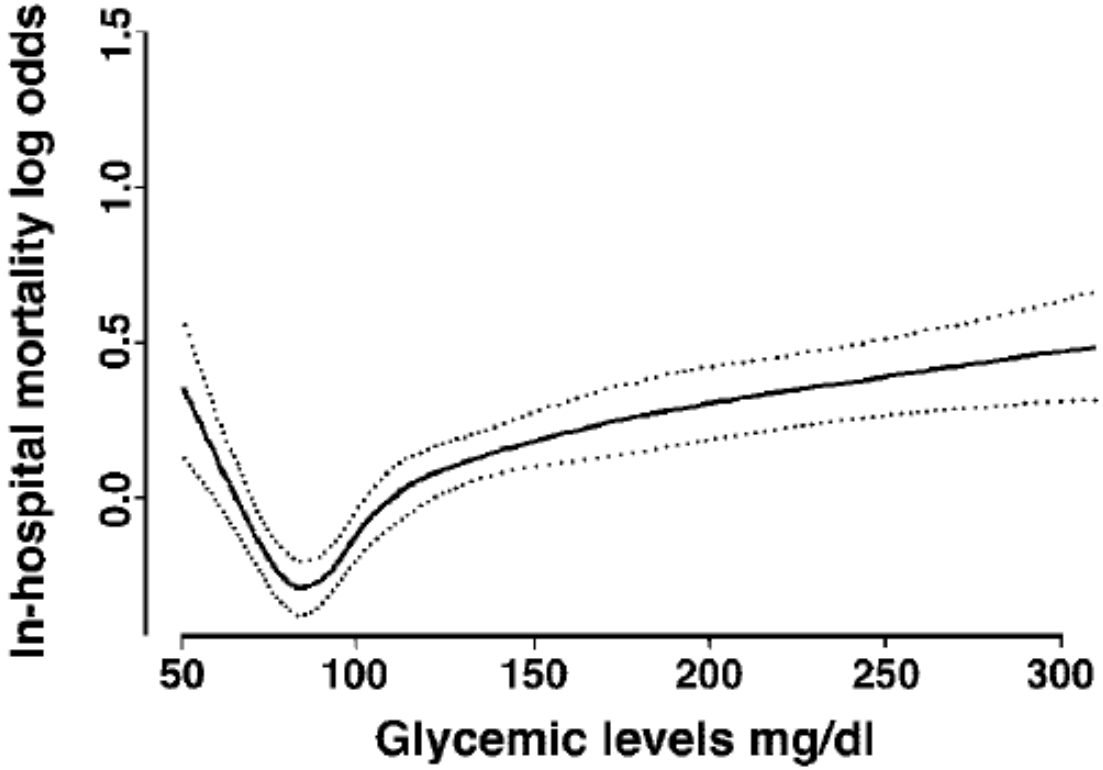
# But What About Longer Term Outcomes?

- We looked at 1 and 2 year outcomes in this same cohort to see if that index glucose concentration could predict mortality

| | For death within 28 days | | | | For death within 1 year | | | | For death within 2 years | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blood glucose (mmol/l) | Crude odds ratio (95% CI) | p-value | Adjusted odds ratio (95% CI) | p-value | Crude odds ratio (95% CI) | p-value | Adjusted odds Ratio (95% CI) | p-value | Crude odds ratio (95% CI) | p-value | Adjusted odds ratio (95% CI) | p-value |
| < 6.5 | 1.52 (0.78–2.99) | 0.22 | 1.61 (0.81–3.19) | 0.174 | 1.43 (0.9–2.28) | 0.129 | 1.63 (0.99–2.66) | 0.053 | 1.06 (0.69–1.61) | 0.797 | 1.18 (0.75–1.85) | 0.482 |
| 6.5–7 | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
| 7.1–9 | 1.71 (0.79–3.68) | 0.171 | 1.53 (0.7–3.33) | 0.281 | 1.5 (0.87–2.59) | 0.143 | 1.3 (0.74–2.31) | 0.366 | 1.23 (0.75–2.03) | 0.418 | 1.04 (0.61–1.77) | 0.875 |
| 9.1–11 | 2.83 (1.2–6.66) | **0.018** | 2.75 (1.15–6.59) | **0.023** | 2.01 (1.04–3.89) | **0.037** | 2.04 (1.01–4.11) | **0.047** | 1.5 (0.8–2.79) | 0.206 | 1.48 (0.76–2.88) | 0.254 |
| 11.1–20 | 2.91 (1.28–6.61) | **0.011** | 3.23 (1.4–7.45) | **0.006** | 2.07 (1.11–3.87) | **0.023** | 2.57 (1.31–5.02) | **0.006** | 1.49 (0.82–2.69) | 0.186 | 1.8 (0.95–3.41) | 0.071 |
| > 20 | 1.09 (0.33–3.63) | 0.887 | 1.41 (0.41–4.82) | 0.585 | 1.39 (0.63–3.07) | 0.417 | 2.24 (0.94–5.37) | 0.07 | 1.06 (0.5–2.25) | 0.873 | 1.69 (0.74–3.88) | 0.214 |

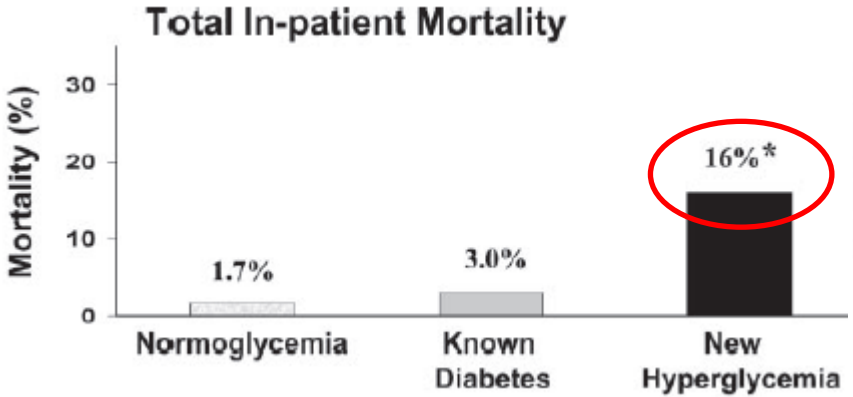
Haddadin F et al Int J Clin Pract 2014;69(6):643-648

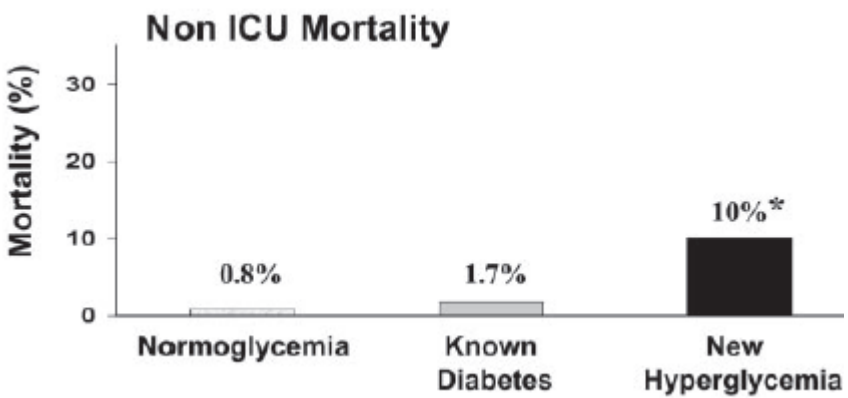
# Data from the USA - 1

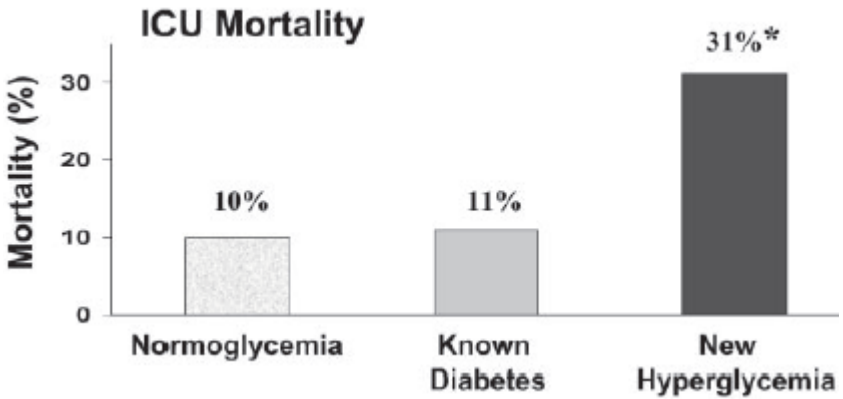



Bruno A et al Diabetes Care 2008;31(11):2209-2210

# Data from the USA - 2



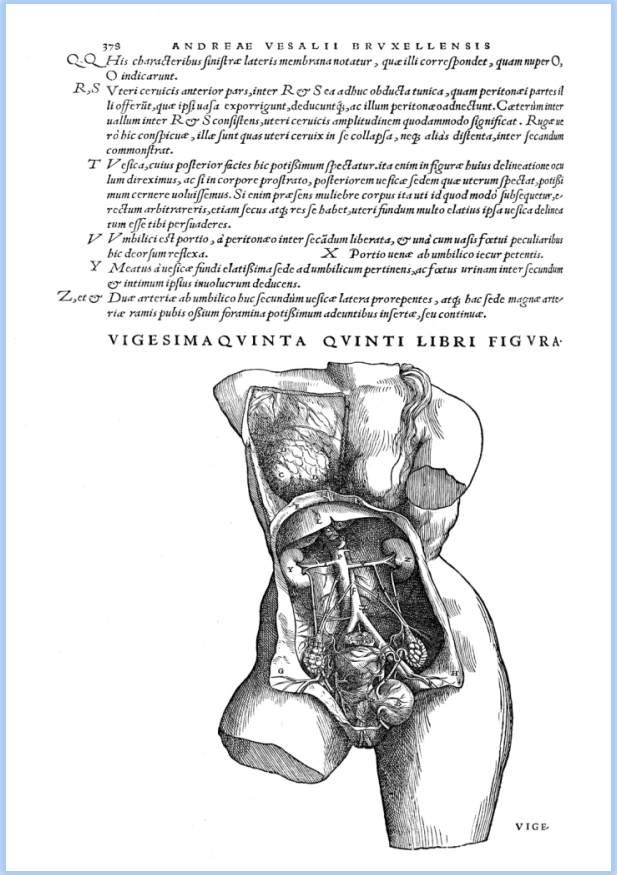




2030 consecutive admissions to 1 institution

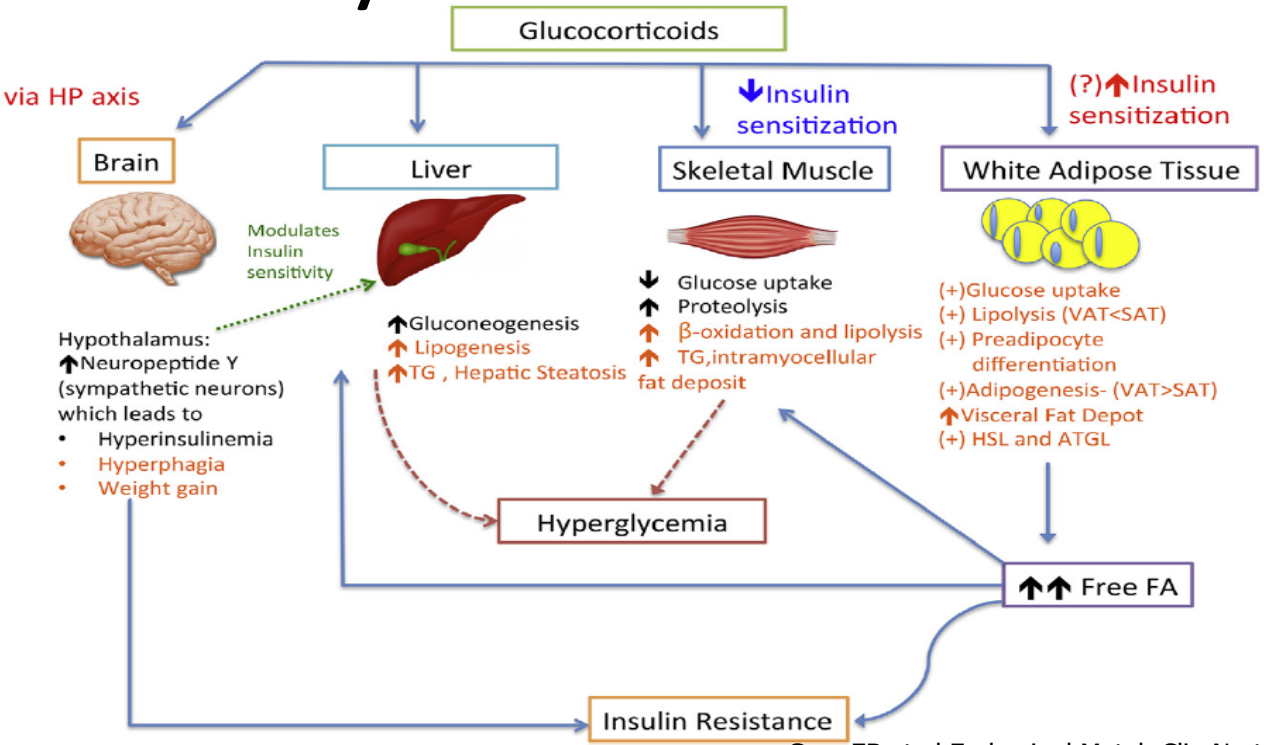
Umpierrez GE et al JCEM 2002;87(3):978-982

# Glucocorticoids and Diabetes

- Is it a problem?
- How to control hyperglycaemia associated with glucocorticoid use?



# How do Glucocorticoids Affect Carbohydrate Metabolism?




Geer EB et al Endocrinol Metab Clin North Am 2014;43(1):75-102

# A Bit Of Background

- At any one time, ~0.75% of the UK population is on oral glucocorticoids (0.2% in 20-29 year olds, 2.5% in 70-79 year olds)
- 40% of glucocorticoid use is for respiratory disease, with most of the rest being musculoskeletal and cutaneous diseases and conditions requiring immunosuppression
- Most use is for <5 days, but 22% is for > 6 months and 4.3% for > 5 years

Royal College of Physicians 2002 Glucocorticoid guidelines https://cdn.shopify.com/s/files/1/0924/4392/files/glucocorticoid-induced-osteoporosis-guideline.pdf?2801907981964551469 Last accessed 6/10/17
Fardet L et al Rheumatology 2011;50(11):1982-1990

# In Hospital Prevalence Data

- All adult wards (excluding A+E, CCU, ITU/HDU)
- 120 out of 940 (12.8%) patients were receiving glucocorticoids – of whom 16 had pre-existing diabetes
- Only 25 (13 with diabetes) had their BG checked regularly
- 3 people with diabetes on glucocorticoids had no BG checked
- 95 patients had no evidence of BG checking

Swafe L et al Clinical Medicine 2014;14(3):327-328

# Surgical Considerations

*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*

STATISTICAL GRAND ROUNDS

## Limitations of Significance Testing in Clinical Research: A Review of Multiple Comparison Corrections and Effect Size Calculations with Correlated Measures

Terrie Vasilopoulos, PhD,* Timothy E. Morey, MD,* Ketan Dhatariya, MD, FRCP,† and Mark J. Rice, MD‡

Anesthesia & Analgesia 2016;122(3):825-830

# Peri-operative Glucose Testing

- We looked at every patient undergoing an operation in 1 week in August 2013
- Assessed how many had a general anaesthetic
- Of those how many had dexamethasone
- Of those how many had post-operative glucose concentrations measured

# Results

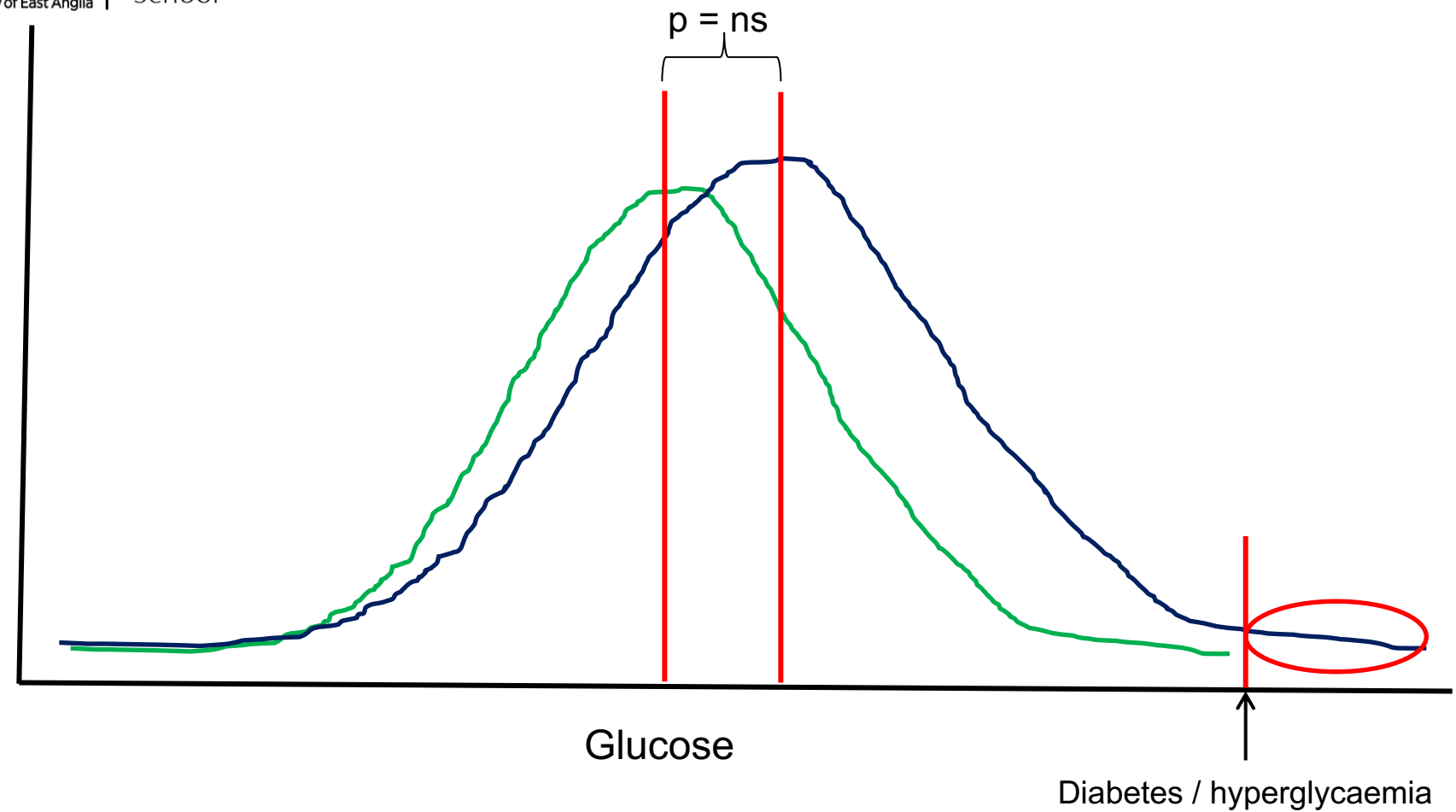
| Surgical specialty | Total no. of cases | No. (%) given dexamethasone | Mean dose (mg) of dexamethasone given (±SD) |
|---|---|---|---|
| General | 91 | 66 (73) | 7.1 (1.5) |
| Gynaecology | 54 | 27 (50) | 7.4 (1.0) |
| ENT | 11 | 8 (73) | 8.0 (0) |
| Vascular | 20 | 9 (45) | 7.1 (1.3) |
| Orthopaedic | 95 | 60 (63) | 7.3 (1.4) |
| Dental | 7 | 7 (100) | 6.2 (2.3) |
| Urology | 36 | 24 (67) | 6.8 (1.8) |
| Thoracic | 6 | 5 (83) | 7.2 (0.8) |
| Paediatric | 20 | 18 (90) | 3.0 (1.5) |
| Plastics | 11 | 10 (91) | 6.9 (1.7) |
| Cardio | 4 | 0 (0) | 0 (0) |
| **Totals** | **355** | **234 (66)** | |

Sudlow A et al Pract Diabet 2017;34(4):117-121

# Results

- 848 people had some form of operation that week
  - Mean age 49.1 years (range 3 months – 97 years)
- 355 had a GA
  - Of whom none had T1DM and 24 had T2DM
- 234 were given dexamethasone as part of their anaesthetic regimen
  - Only 16 people had their glucose levels checked in the first 24 hours post-op (all of whom had diabetes)

Sudlow A et al Pract Diabet 2017;34(4):117-121


p = ns
Glucose
Diabetes / hyperglycaemia

# Joint British Diabetes Societies

# What is a Guideline?

- *'A principle put forward to set standards or determine a course of action'*

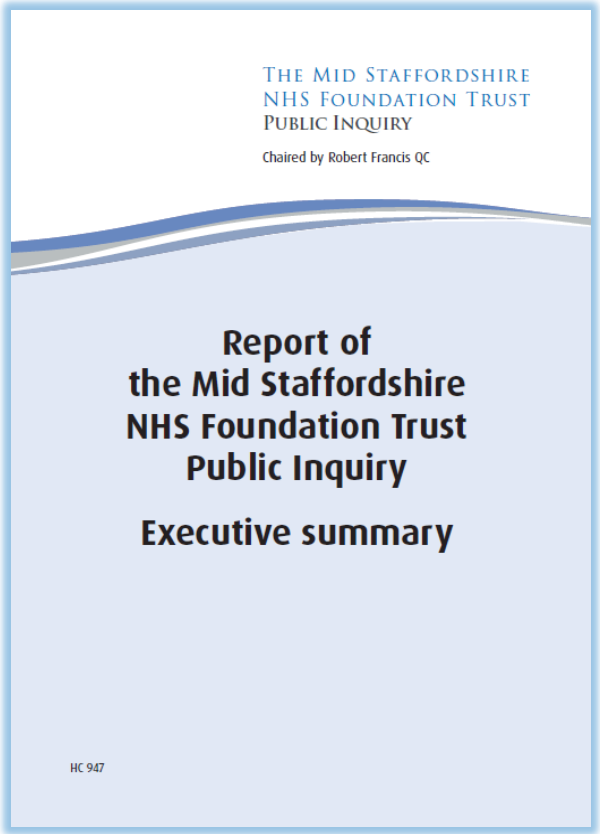
Collins English Dictionary – Complete and Unabridged, 12th Edition, Glasgow, Collins. 2014

# Why Are They Needed?

- To standardise and improve the quality of care people receive and outcomes

Woolf SH et al BMJ 1999;318(7182):527-530

# February 2013




"Commissioners…….must insist on quality and challenge the inefficiencies of providers, particularly unevidenced variations in clinical practice"

Mid Staffordshire NHS Foundation Trust Public Inquiry. Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry. February 2013. Available from: https://www.gov.uk/government/publications/report-of-the-mid-staffordshire-nhs-foundation-trust-public-inquiry. Accessed 21 March 2017.

# What is the Proposed Solution?

- A JBDS guideline!

# What Does the Guideline Recommend - 1?

- All patients should be assessed for a clinical history of diabetes on admission. If present, this should be clearly documented on the electronic patient record and/or medical notes

# What Does the Guideline Recommend - 2?

- All adult inpatients (over the age of 40) should have a laboratory or capillary blood glucose test (point of care test, POCT) following admission
  - Age on testing dependent on local demographics, obesity rates and prevalence of ethnic minorities

- Those known to have diabetes should have an $HbA_{1c}$ if it has not been done in the previous 3 months

# What Does the Guideline Recommend - 3?

- This not known to have diabetes, but with a *plasma* glucose of >7.8mmol/L should have a $HbA_{1c}$ test
  - Ensuring that there is nothing to preclude $HbA_{1c}$ use

- Those with a *POC* test >7.8mmol/L should have a subsequent laboratory test to confirm hyperglycaemia before $HbA_{1c}$ testing

# Stress Hyperglycaemia

- Those with admission hyperglycaemia (>7.8mmol/l) but an $HbA_{1c}$ of <42mmol/mol should be suspected as having
  - stress hyperglycaemia
  - impaired glucose regulation
  - new onset T1DM

- It should be clearly documents in the notes and discharge letter

# After Discharge

- Fasting plasma glucose and $HbA_{1c}$ should be rechecked once the intercurrent illness has resolved but no later than 3-6 months after discharge
  - Unless T1DM is suspected – urgent referral to diabetes team necessary

# Impaired Glucose Regulation

- Those with admission hyperglycaemia (>7.8mmol/l) but an $HbA_{1c}$ of 42 - 47mmol/mol should be suspected as having pre-diabetes

- It should be clearly documents in the notes and discharge letter because they are at high risk of developing T2DM and thus need annual assessment

# What are the Dangers of this Approach ?

- This becomes a vast screening programme
  - Cost – immediate and long term for ‘case finding’
  - But does it save money if treating hyperglycaemia improves outcomes?

# But - Where is the Evidence?

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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