ABCD Pilot Audit of Hyperglycaemia Management in ACS

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DM and ACS

- Observational relationship between hyperglycaemia and CVD

- DM without established CVD – at least 3-fold RR of CVD mortality of non-DM

- ? Similar risk to non-DM with prior AMI

- 2-fold greater mortality following AMI with DM than non-DM

- Uncertainty regarding benefit of intensive glycaemic control during ACS

- Intensive longer term glycaemic control (HbA1c target < 6%) in older Type 2 DM led to 1.22 RR of death (ACCORD)

Background -- Digami 1
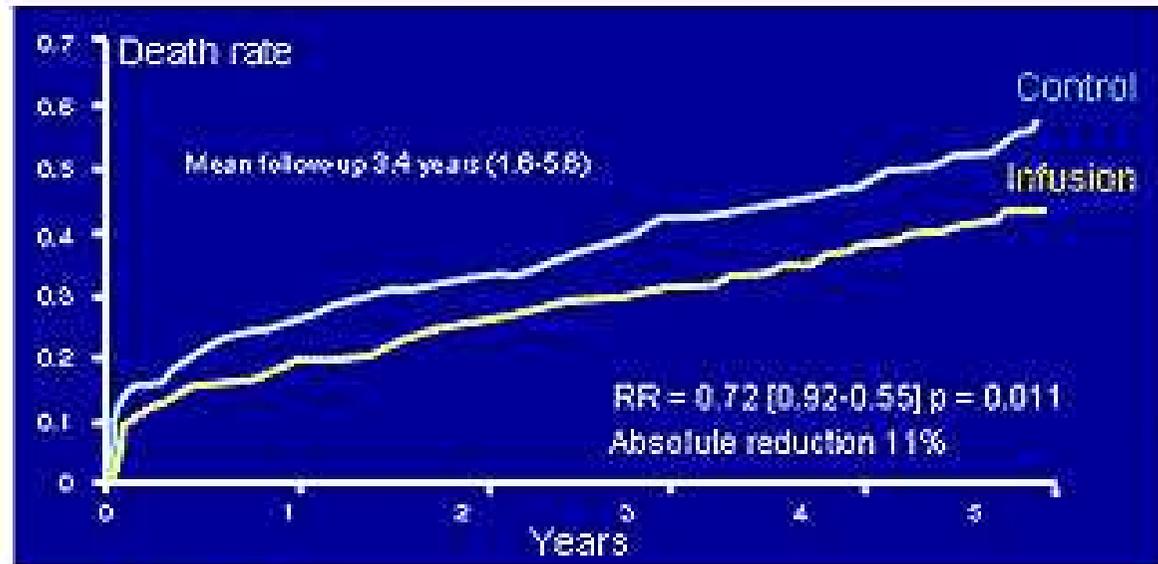
DIGAMI 2

Glucose control at admission

Parameter	Control group n=314	Infusion group n=306	Diff
HbA1c			
0 hours (%)	8.0±2.0	8.2±1.9	NS
Blood glucose			
0 hours (mmol/L)	15.7±4.2	15.4±4.1	NS
24 hours (mmol/L)	11.7±4.1	9.6±3.3	< 0.0001

1999

Background – Digami 1

DIGAMI 2

Long-term mortality All patients

Stratum 1

(Malmberg for DIGAMI study group Brit Med J 1997, 314:1512)
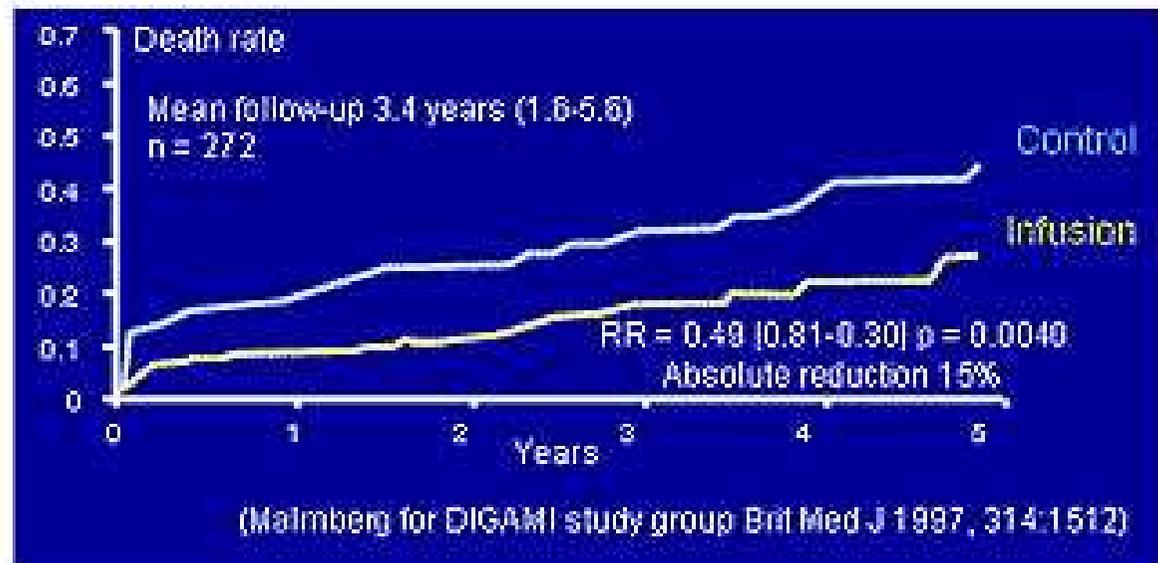
Study objectives

To conduct an international multicenter trial, the basic structure of which is similar to DIGAMI 1.

The study population, based on results from DIGAMI 1, will be larger, in the magnitude of 3.000 subjects.

The patients will be randomly allocated to one of three treatment strategies.
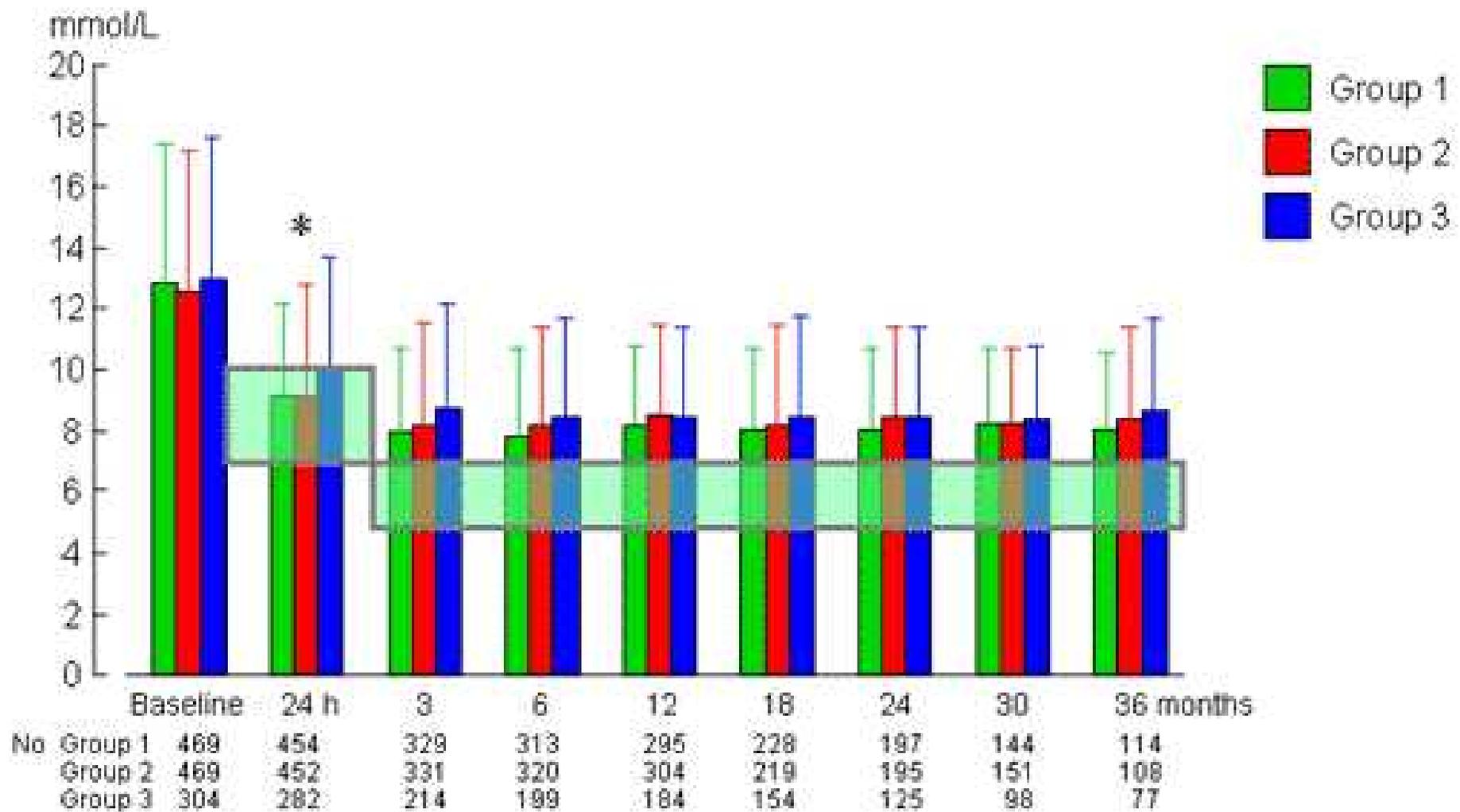
Group 1	acute administration of insulin-glucose followed by subcutaneous insulin;
Group 2	acute administration of insulin-glucose followed by conventional treatment;
Group 3	conventional treatment only.

The average time of follow up should be 2 years

Blood glucose levels by visit and treatment group

DIGAMI 2

Legend: Group 1 (green), Group 2 (red), Group 3 (blue)

mmol/L

No	Baseline	24 h	3	6	12	18	24	30	36 months
Group 1	469	454	329	313	295	228	197	144	114
Group 2	469	452	331	320	304	219	195	151	108
Group 3	304	282	214	199	184	154	125	98	77

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Primary and secondary endpoints ITT
Group 1 vs Group 2, ITT, unadjusted

DIGAMI 2

	HR (95% CI)	p
Death	1.03 (0.79-1.34)	0.832
Death/reinfarction/stroke	1.16 (0.94-1.44)	0.173
Stroke	1.42 (0.76-2.64)	0.268
Reinfarction	1.38 (0.97-1.96)	0.074

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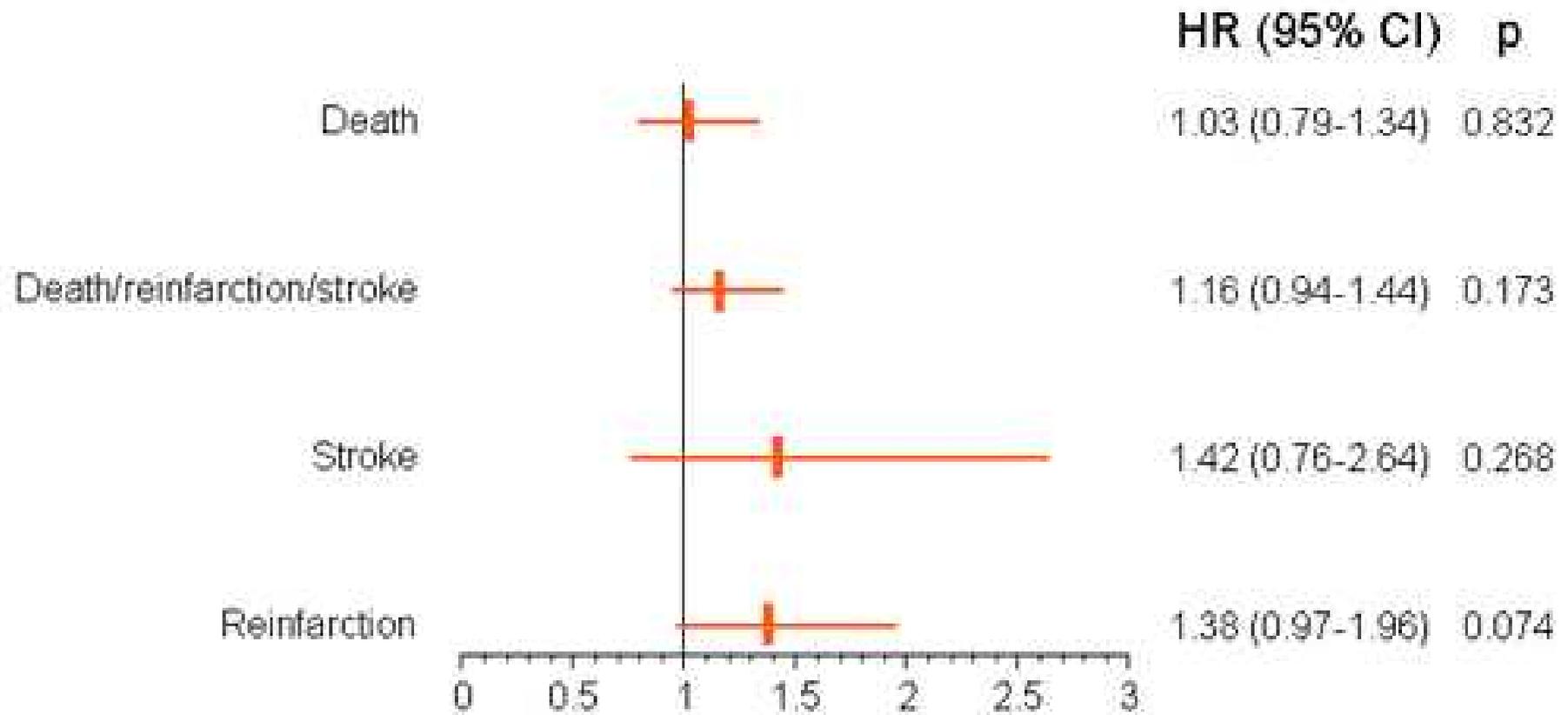
MINAP- 90 day mortality for all patients in database

Legend: Glucose Q1, Q2, Q3, Q4
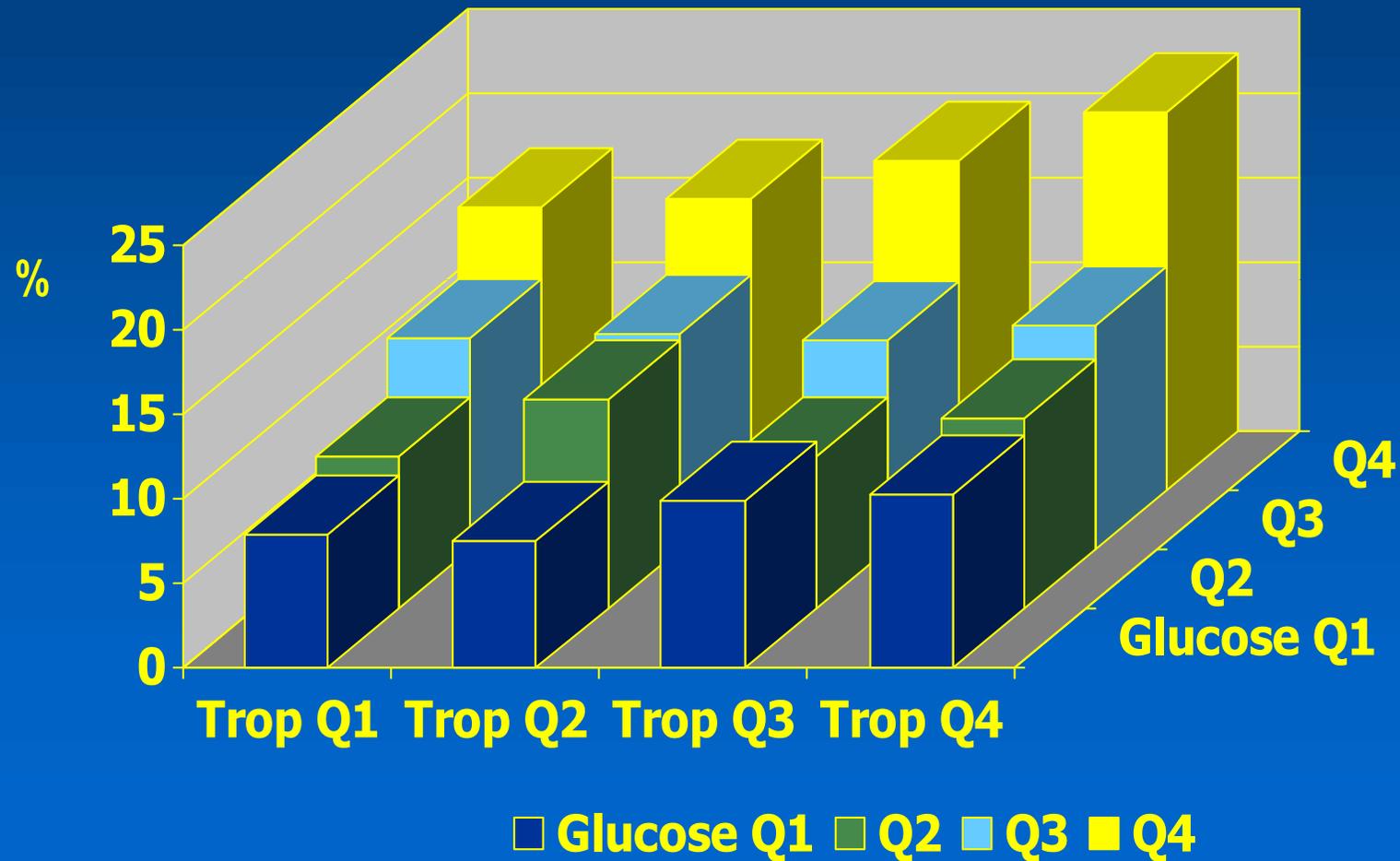
MINAP - 90 day mortality without previously recognised diabetes; all ACS
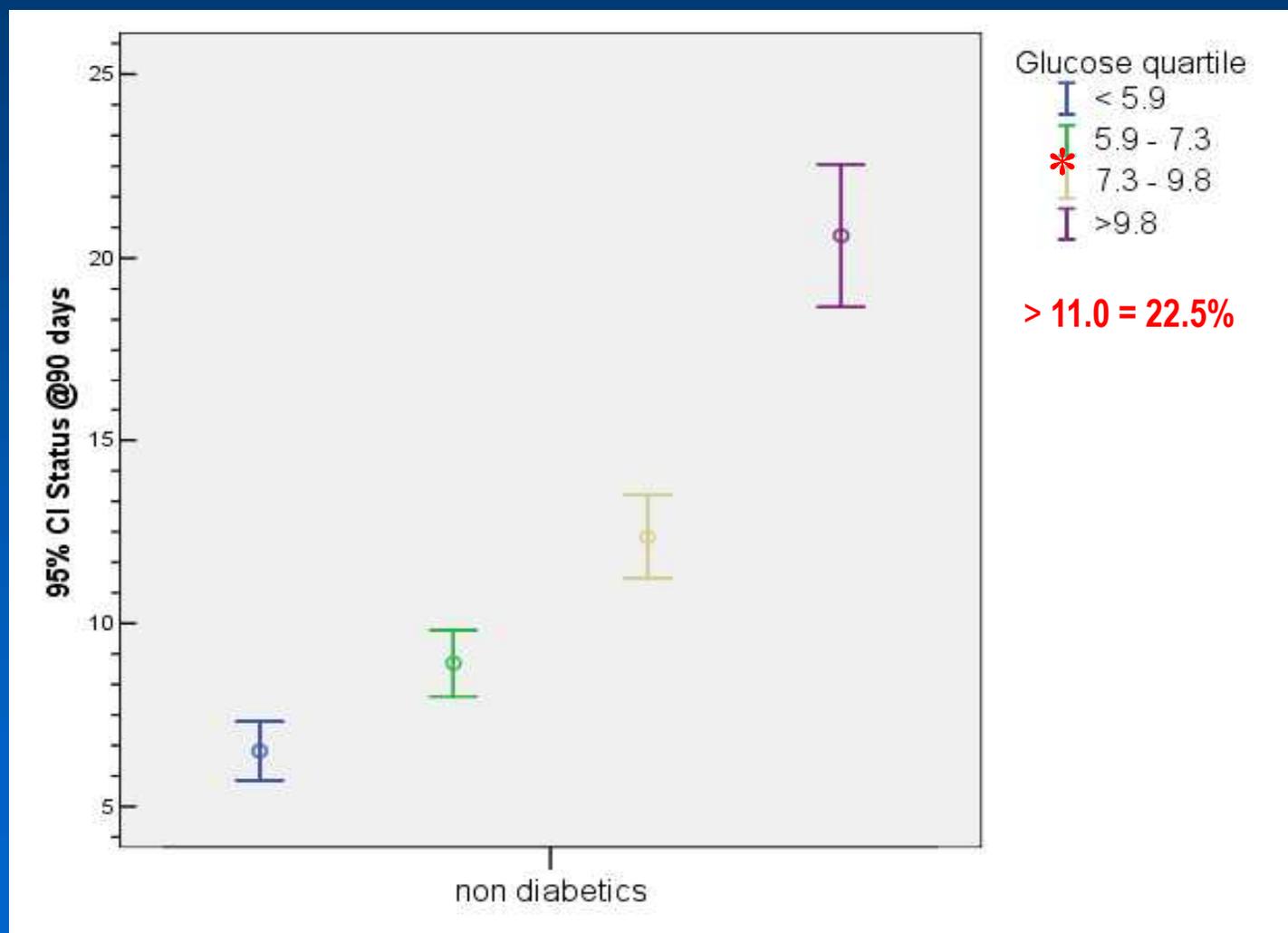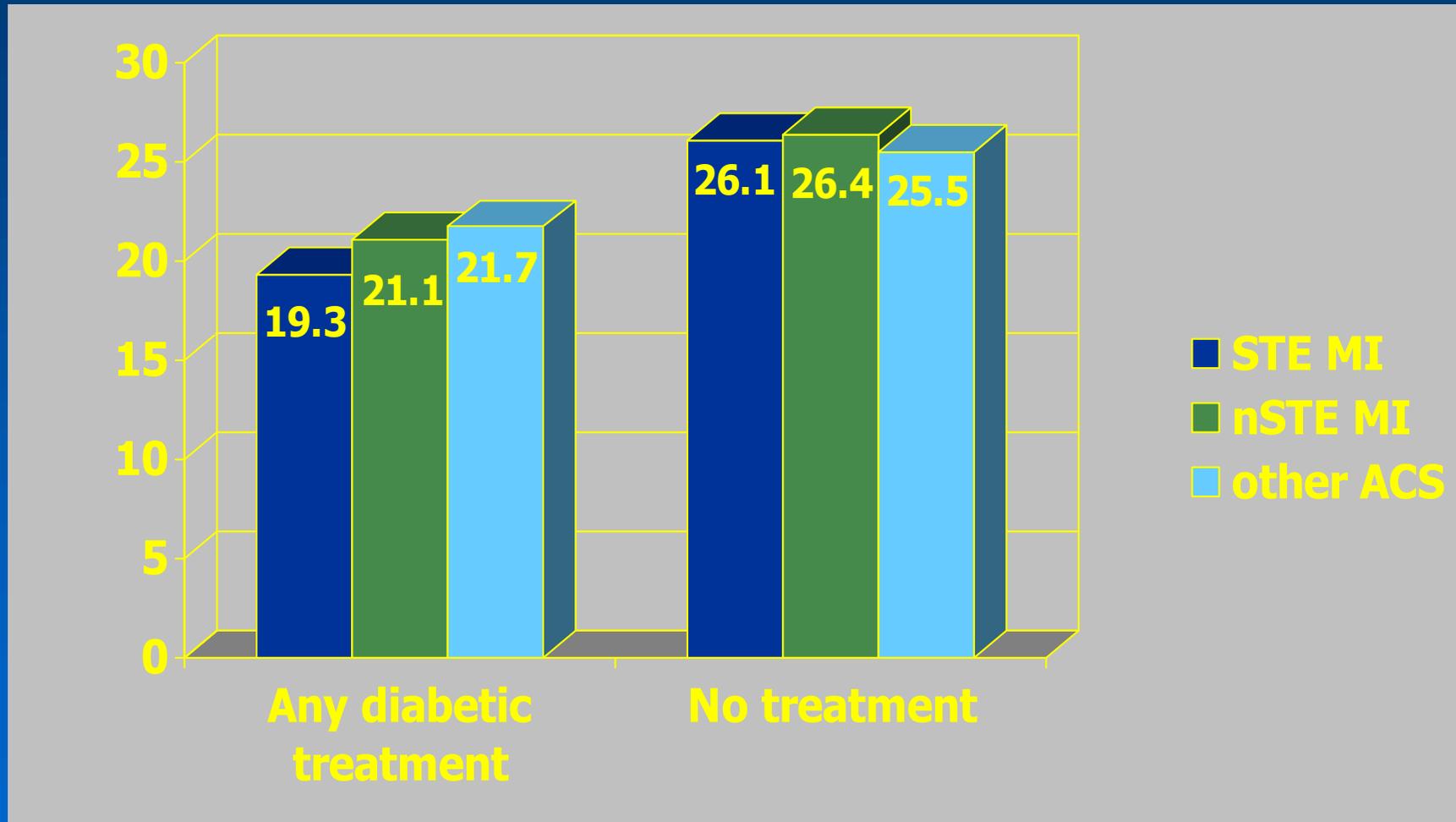
MINAP - Other findings in DM

- **DM – Impt dtmnt of pre-hospital delay in door-needle time**

- **Asian men and women with DM and ACS more often on insulin and oral therapy than Caucasian men and women**

- **Adjusted 1-year mortality no different between Asian and Caucasian men and women with DM**

MINAP – insulin treatment for hyperglycaemia in ACS

- 10% of MINAP troponin +ve ACS database (3.8K) without known DM had admission glucose >= 11 mmol/l

- 36% received 'some form of DM Rx' – insulin in majority (P)I-G > insulin infusion

- 30-day mortality with v without insulin 16% v 22%

- Adjusted RR CVD mortality if not on insulin 1.51

(Weston et al . Heart :2007)

Other recent observations – hyperglycaemia and ACS

- Admission hyperglycaemia in non-DM unreliable in diagnosis of DM*

- Fasting glucose less reliable than 2hr OGTT in diagnosis of DM post-ACS (26% missed diagnoses)+

- Poor prognosis (2-yr survival) in Trop -ve 'ACS' in DM (91.1%), comparable to non-DM ACS Trop +ve (90.7%)^

*Ishihara - Eur Heart J 2006
+Bartnik - Heart 2007
^Marso - Diabetes Care 2006

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National ABCD audit on in-patient diabetes services – MI care

- **Use of insulin after MI in 'DM patients'**

- **Use of 'DIGAMI protocol' in 177 (79%) /223 responding centres – not in 21%**

- **39% of centres stated that 'negative results' of DIGAMI2 had altered practice**

- **?? Interpreted as 60% had never used DIGAMI (? = insulin) or altered practice after DIGAMI 2**

Sampson et al , Diabetic Med , 2007

ABCD pilot audit of hyperglycaemia in ACS

- The 'MINAP black box' - What happens after hyperglycaemia in ACS detected?

- Who, where, how is glycaemic care provided in different centres?

- Adherence to local/pragmatic standards

- Prospective audit – 50 hyperglycaemic ACS cases expected over 6 months

- 6 centres in bid (Glasgow and Northampton unable to participate)

ABCD ACS Audit - Centre assessment

- **Initial management of ACS**

- **? ACS hyperglycaemia protocol**

- **? Glycaemic thresholds for insulin and targets for attainment**

- **? Utilisation of nurse led protocol for glycaemic control**

- **? Policy for insulin continuation post – ACS**

- **? Policy for post-ACS OGTT**

ABCD ACS Audit – Standards -1

- **Lab and meter glucose on admission in all cases**

- **Insulin therapy if admission glucose >= 11 mmol/l**

- **Target glycaemic average 5-8 mmol/l**

- **Avoidance of hypoglycaemia**

- **HbA1c measured during admission**

ABCD ACS Audit – 'Standards' - 2

- **Fasting glucose recorded after ACS if not known DM**

- **OGTT arranged after ACS if not known DM**

- **Retinopathy status documented in insulin treated cases**

- **Assessment by member of DM team during IP stay**

- **New Insulin therapy at discharge ? 50%**

- **Assessment for continuation of insulin 90 days post-ACS**

ABCD ACS Audit – Centre Protocols

All different!

- **<u>Norwich</u> - threshold FPG > 7 RBG > 11, No target**
  - Rx Insulin infusion / GIK

- **<u>Oxford</u> - threshold RBG > 8, target 4-8**
  - Rx Insulin infusion +/-dextrose -potassium

- **<u>Portsmouth</u> - threshold RBG >10, target 4-10**
  - Rx insulin infusion – varies with DM status

- **<u>E & North Herts</u> - threshold RBG >= 11, target 5-8**
  - Rx insulin infusion +/- dextrose-potassium–varies with prior insulin dose-obesity

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MANAGEMENT OF HYPERGLYCAEMIA IN
ACUTE CORONARY SYNDROME

PROVEN OR SUSPECTED M. I.

When on insulin:-

FLUID SCHEDULE

Urgent lab glucose/electrolytes & simultaneous bedside glucose meter measurement.

When glucose 8-9 mmol/L - commence 0.5 L 10% dextrose with 20 mmol/L KCl infusion 8-12 hourly ‡
Doctor prescribed, on fluid chart.

Bedside glucose with lab confirmation =11 mmol/L - whether known DM or not: Commence IV insulin infusion schedule. •
Doctor prescribes. Usual infusion rate 1 or 2 units/hr.
Target bedside glucose 5-8 mmol/L.

Hourly bedside glucose.

Blood sent for HbA1c.

Repeat electrolyte estimated after 6 hrs. Modify potassium content if levels are = 3.5 mmol/L.

Nurse-led protocol.

Glucose 5-8 mmol/L after 4 hrs - continue.	Glucose > 8 mmol/L after 4 hrs = doctor to modify schedule i.e. ↑ rate by 1 or 2 units/hr.

After 24-48 hrs - or when CVP stable - doctor to convert to S/C insulin - B.D. or Q.D.S. - contact diabetes team for advice.

- • IMPORTANT EXCEPTIONS:
- ① Obesity or known DM on > 60 units/day - start at 3-4 units/hr.
- ② If also in DKA - follow DKA protocol.
- ‡ Start potassium/dextrose earlier if hypokalaemic (< 3.5 mmol/L) on admission.
  Where overt CCF/fluid overload concern - 0.5 l over 12-24 hrs - consider 20% dextrose with 40-80 mmol/L KCl through central line.
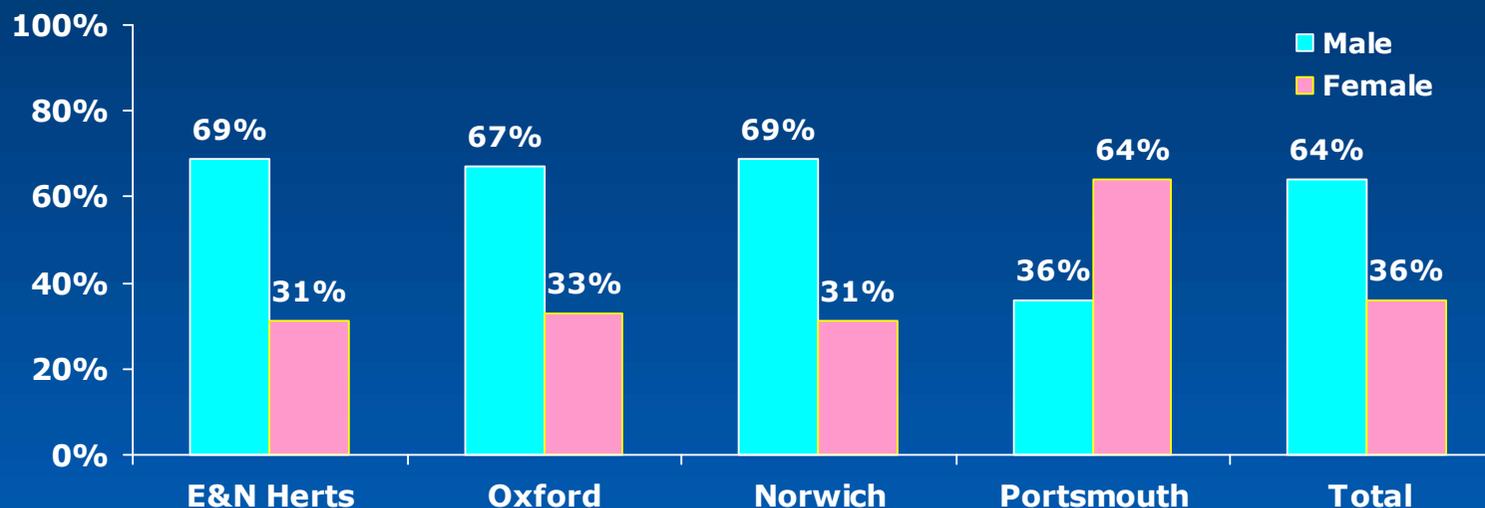
ABCD ACS Audit

- **Audit sample - 50 consecutive cases with BG >= 11 mmol/l on admission and/or known diabetes**

- **Data collection started June 2007**

- **Analysis October 2008**

- **Cases analysed:**

East & North Herts	67	(66 pts)
Norwich	59	(55 pts)
Oxford	49	
Portsmouth	28	(27 pts)
TOTAL	203	(197 pts)

Demographics

n = 203

Gender

Legend: ■ Male ■ Female

Bar chart values:
- E&N Herts: Male 69%, Female 31%
- Oxford: Male 67%, Female 33%
- Norwich: Male 69%, Female 31%
- Portsmouth: Male 36%, Female 64%
- Total: Male 64%, Female 36%

	E&N Herts	Oxford	Norwich	Portsmouth	Total
Age at presentation					
Median (Range)	72 (40 – 94)	74 (40 – 93)	74 (51 – 91)	77 (44 – 93)	74 (40 – 94)
Ethnicity					
White	90%	88%	100%	100%	93%

ACS, Diabetes and site of care

n = 203

Diabetes

Undiagnosed/not known diabetes   83 (41%)   Known diabetes   120 (59%)

Type 1 (12%)   Type 2 (88%)

ACS

Legend: Non STMI, STMI
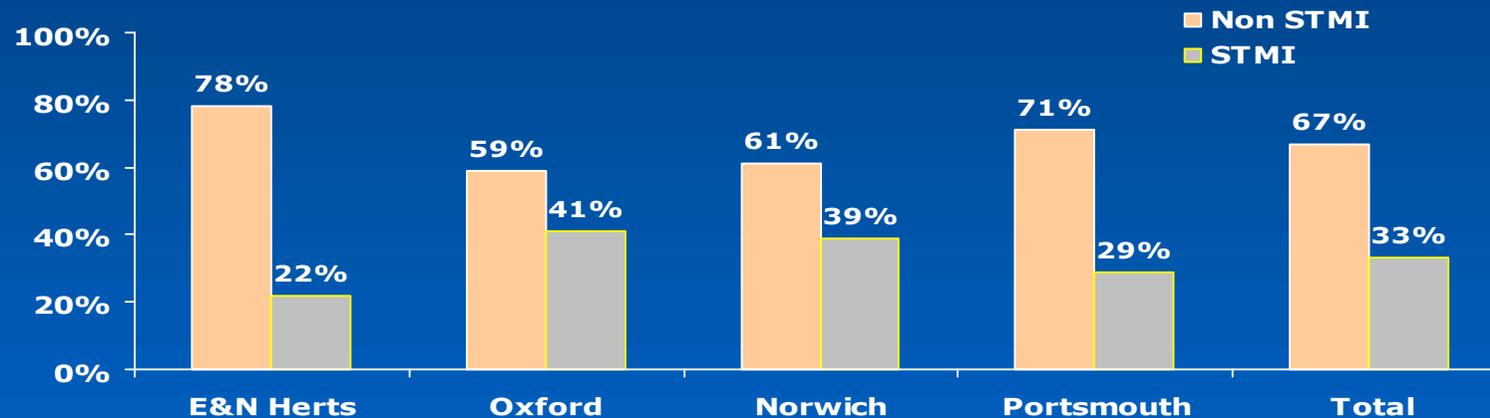
Main site of care	E&N Herts	Oxford	Norwich	Portsmouth	Total
Cardiac ward/CCU/ITU	72%	86%	100%	79%	84%
General wards	13%	8%		18%	9%
MAU	15%	6%		3%	7%

Glucose control – by site

n = 203

Standard: Lab and meter glucose on admission in all cases

	E&N Herts	Oxford	Norwich	Portsmouth
Lab & meter	75%	45%	48%	89%
Lab or meter	25%	47%	49%	11%
Neither		8%	3%	

Median (Range)	E&N Herts	Oxford	Norwich	Portsmouth
Initial Lab	12.2 (3.4 – 29.4)	10.5 (6.3 – 20.0)	10.6 (7.1 – 22.9)	13.9 (9.0 – 33.4)
Initial Meter	10.6 (5.1 – 24.3)	10.4 (7.5 – 26.8)	10 (5.8 – 23.4)	12.9 (4 – 26.9)

Initial bedside meter glucose

n = 182

All patients: Median 10.6 (4 – 26.9)

Non known/undiagnosed diabetes

	NDM	DM
Median (Range)	10.1 5.8 – 24.3	12.2 4 – 26.9

Gender

	Male	Female
Median (Range)	10.4 5.6 - 26.8	11.8 4 – 26.9

Immediate Management Plan

n = 203

	E&N Herts	Oxford	Norwich	Portsmouth
IV insulin/sliding scale	63%	96%	27%	43%
Subcut insulin	7%		2%	11%
Diet only/glucose monitoring	9%	4%	3%	
Oral hypoglycaemic therapy	9%			11%
No treatment			2%	11%
Nil recorded	12%		66%	25%

Glucose control – Site targets

Level of control:

*(Mean bedside meter glucose over 1st 24 hrs -
% of available data)*

E & N Herts	Target: 5 – 8	49%
Oxford	Target: 4 – 8	79%
Norwich	Target: ??	
Portsmouth	Target: 4 – 10	35%

Treatment 1

n = 110

Standard: Insulin therapy if admission lab and/or meter glucose ≥ 11 mmol/l

Compliance: Variable between sites
                      Variable use between IV and subcut insulin
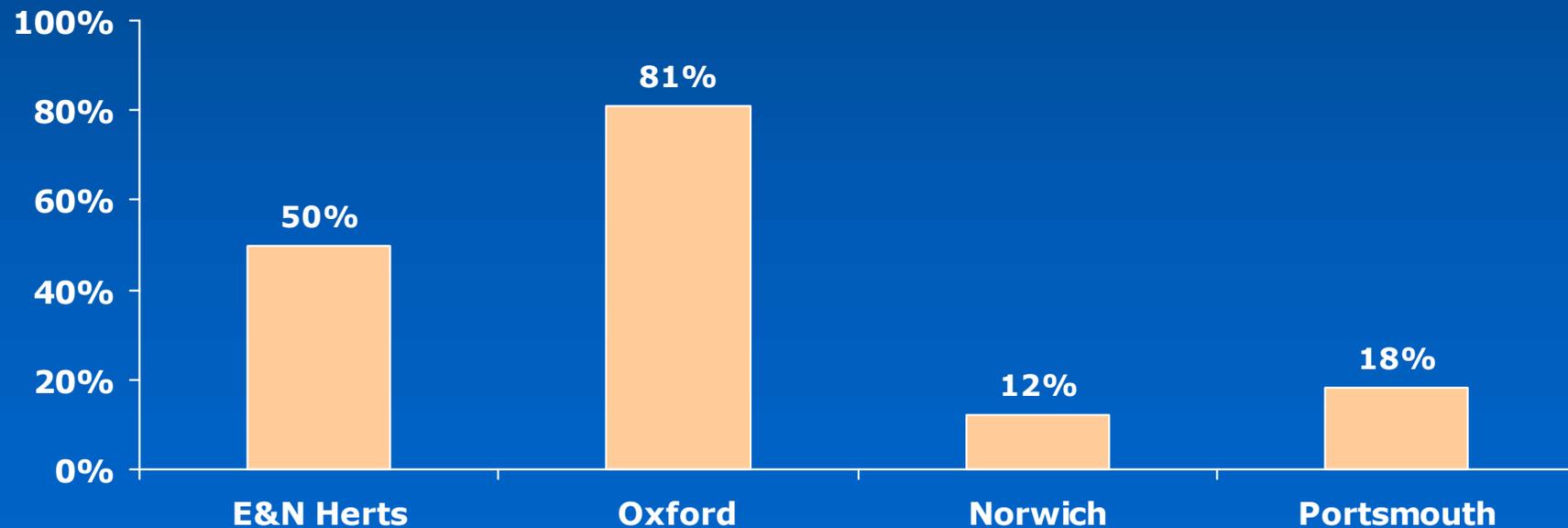   Lack of information

	E&N Herts	Oxford	Norwich	Portsmouth
IV Insulin infusion	72%	96%	38%	50%
Subcut insulin	8%		4%	12.5%
Oral therapy	5%			12.5%
Diet only	5%	4%	12%	12.5%
Not recorded	10%		46%	12.5%

Treatment 2

n = 83

Standard: Fasting glucose recorded after ACS if NOT known DM

Compliance: Very variable between sites

HbA1c

n = 69

Standard: HbA1c measured through admission

Compliance: Very variable between sites

	E&N Herts	Oxford	Norwich	Portsmouth
HbA1c measured	31%	92%	0%	11%
<7.5 %	8	36		1
≥7.5%	13	9		2
Range (%)	5 – 12.5	4.8 – 16.5		7.1 – 13.5

Centre-reported Hypoglycaemia
(<4 mmol/l in 1st 24 hrs)

Standard: **Avoidance of hypoglycaemia**

Compliance: **Centre-reported on at least 1 occasion**

                     Reported quite commonly in 2 centres

Pts with Hypoglycaemia incident reported

	E&N Herts	Oxford	Norwich	Portsmouth
	25%	22%	5%	
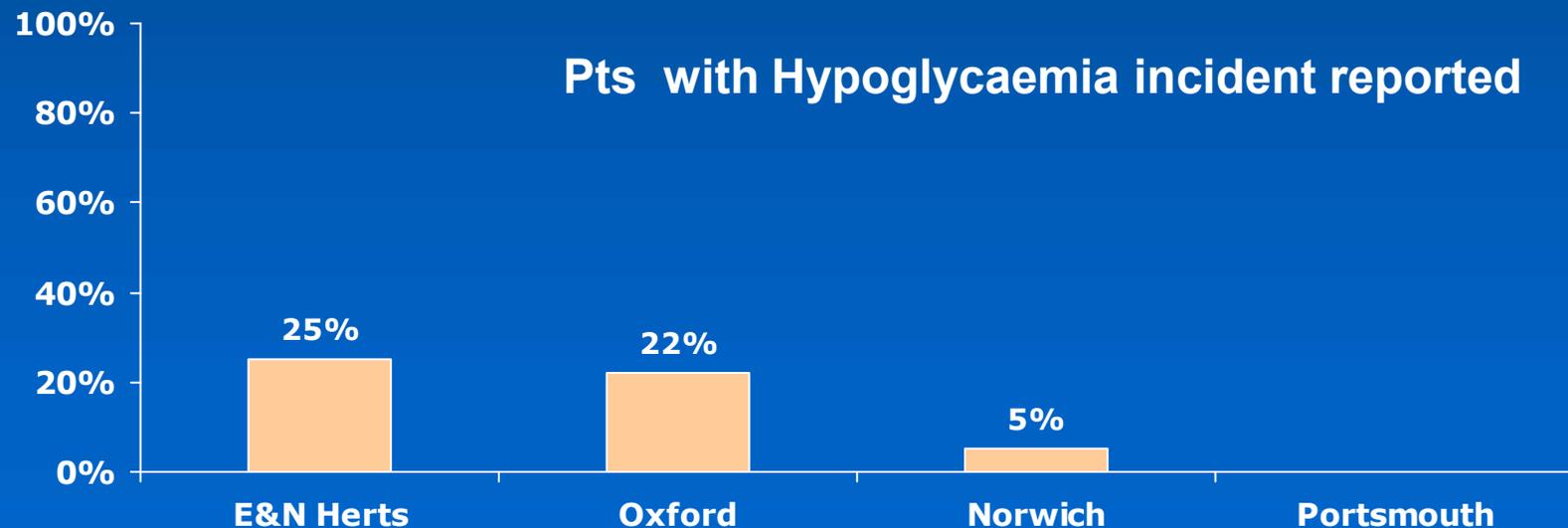
OGTT

Standard: OGTT arranged after ACS if NOT known DM

Result: Very poor uptake of 'standard'   n = 83

Undiagnosed/not known diabetes   2 (2%)

1 in Norwich

1 in East & North Herts

Retinopathy

Standard: Retinopathy status documented <u>in insulin treated cases</u>

Compliance: Poor compliance with standards

Immediate Management Plan – Insulin = 126
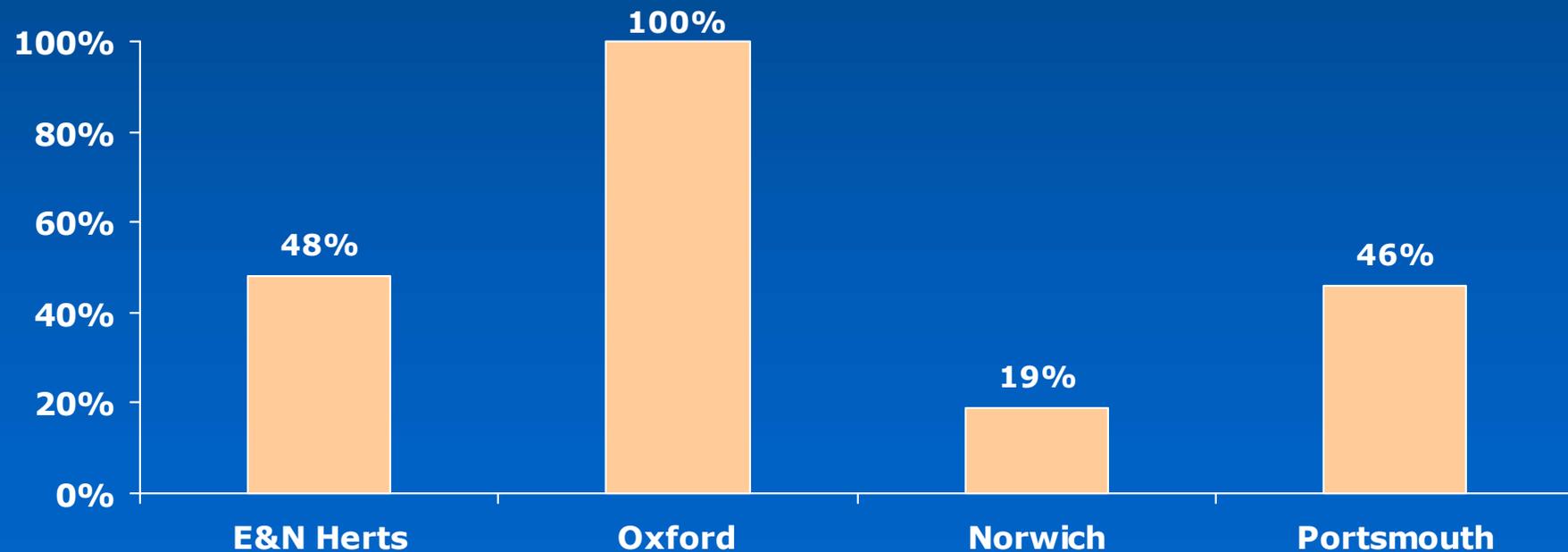
Retinopathy status documented:

        E&N Herts   **17%**

        Oxford   **11%**

        Norwich   **6%**

        Portsmouth   **20%**

Assessment by Diabetic Team

Standards: Assessment by member of DM team during IP stay

Compliance: Wide range from 19% - 100%

n = 105

Discharge Therapy for undiagnosed – not-known diabetes pts

n = 83

- Wide variation in discharge therapy between sites

- Information not recorded in 4-21%

	E&N Herts	Oxford	Norwich	Portsmouth
Diet only/no therapy	43%	78%	85%	82%
Oral therapy	21%	9.5%	4%	18%
Insulin therapy	14%	3%	7%	
Not recorded	21%	9.5%	4%	

Diabetes Therapy – Admission/Discharge for prior known Diabetes pts

n = 120

- **13% overall increase in insulin therapy**

- **30% increase East & North Herts**

- **14% increase Portsmouth**

- **No increase in Oxford**

- **Decrease at Norwich**

In Hospital Mortality

By Site*

n = 166

	E&N Herts	Oxford	Norwich	Portsmouth
Death	9%	19%	7%	11%

Complete dataset for Norwich and Portsmouth only

By Diabetes

	Not known-Undiagnosed diabetes	Diabetes
Death	10%	9%

By Type of ACS

%	Non STMI	STMI
Death	11%	7%

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Sub cut insulin newly commenced continued at 3 mths

n = 66

By Site

	E&N Herts	Oxford	Norwich	Portsmouth
Yes	46%	8%	50%	100%

By Diabetes

	Non diabetes	Diabetes
Yes	12%	41%

By Type of ACS

	Non STMI	STMI
Yes	26%	25%

Clinical Audit Team

Main Findings and Discussion - 1

- The 4 centres have subtly different protocols for insulin initiation and glycaemic targets

- Males:Females 2:1 except Portsmouth!

- Effectively an all white study

- 1/6 cared for out of 'intensive setting'

- 2:1 Non STMI:STMI - as expected

- 60% known DM – of these 1/10 Type 1

- Variable centre adherence to standard re lab and meter glucose on admission

Main Findings and Discussion - 2

- **Apparent good matching of admission lab vs admission meter glucose**

- **Variable use of insulin by centre for 110 with admission glucose > = 11 mmol/l**

- **Patchy measurement of fasting glucose if not known to have DM**

- **Variable adherence to process measures by site**

- **Very variable HbA1c measurement**

Main Findings and Discussion - 3

- **Hypos happen!! ++ apart from Portsmouth?- Case for basal-bolus rather than IV infusion of insulin if eating**

- **OGTT - a rare event**

- **Retinopathy documentation infrequent - ? important – for insulin initiation and thrombolysis**

- **DM team review – a process best in Oxford – a case for IP DM medical team**

- **Insulin Rx post MI increase in established DM – modest increase at discharge**

- **Insulin continuation at 3 months – ? less frequent reflecting DIGAMI 2**

Conclusions

- **ACS glycaemic care within and between centres remains variable**

- **DIGAMI2 may have adversely affected approach to care although more recent MINAP data highlights importance of good glycaemic control**

- **Process of care ? requires proactive IP DM specialist medical and nursing team**

- **Need for detailed national review and standards for ACS glycaemic care**