

# Severe hypoglycaemia in England – frequent and fatal. Are local diabetes specialist teams aware?

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# NICE Quality Standards in Adults with Diabetes – no.14

Evidence of local arrangements to ensure that people with diabetes who have experienced hypoglycaemia requiring medical attention are referred to a specialist diabetes team.

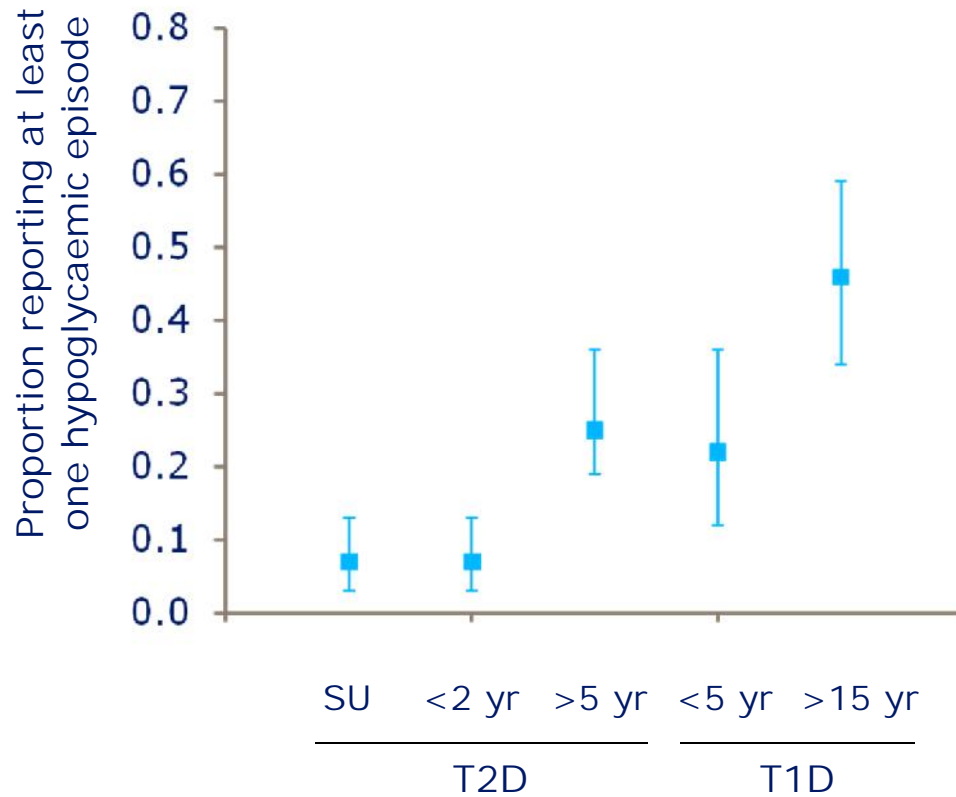
Proportion of people with diabetes who have experienced hypoglycaemia requiring medical attention who are referred to a specialist diabetes team.

## Outcome:

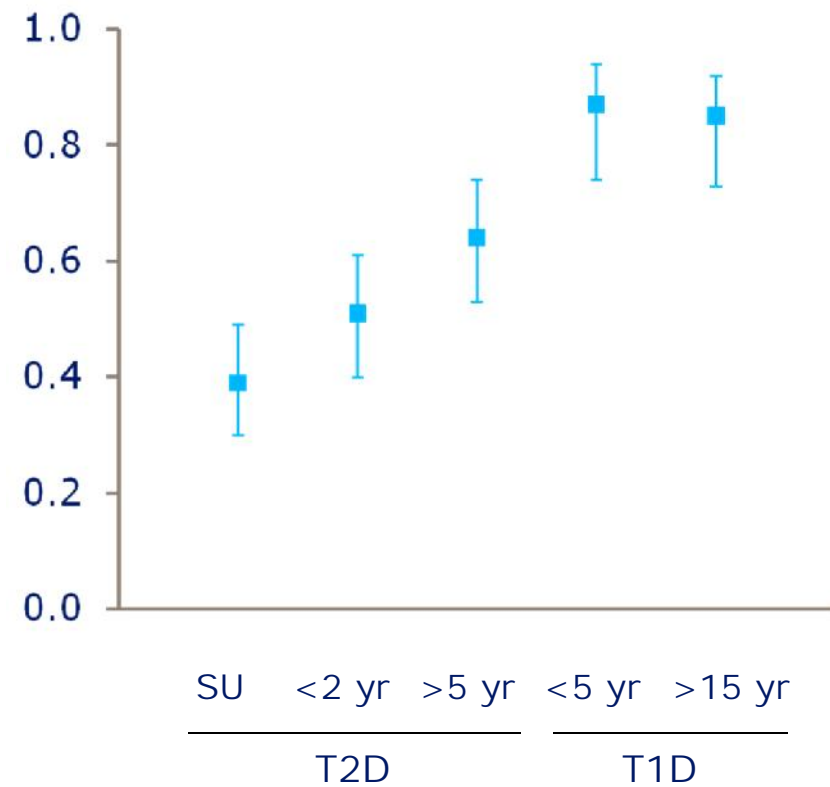
- Reduction in number of people with diabetes requiring medical attention as a result of a hypoglycaemic episode.
- Reduction in rate of recurrence of an episode of hypoglycaemia requiring medical attention over 12 months.

# UK Hypoglycaemia Study – observational study of 383 people with diabetes

## Major hypoglycaemia



## Mild hypoglycaemia



SU, sulphonylurea

1. UK Hypoglycaemia Study Group. Diabetologia 2007; 50: 1140–7

# Socio-economic consequences of major hypoglycaemia in T1D and T2D

## Major hypoglycaemic events (UK, Germany and Spain)

### Frequency



- T1D: 1.1–3.2 major hypoglycaemic events/year<sup>1</sup>
- T2D: 0.1–0.7 major hypoglycaemic events/year (treatment dependent)<sup>1</sup>

### Increased treatment cost



- Annual cost of hospitalisation and ambulances for major hypoglycaemia in the UK estimated at £16.9 million<sup>2</sup>
- Total cost of a major hypoglycaemic event across the survey: £364.56 in T2D and £160.22 in T1D<sup>3</sup>
- Annual cost of admissions with hypoglycaemia in Scotland: £0.9 million T1D, £2.5 million T2D<sup>4</sup>

# Socio-economic consequences of minor hypoglycaemia in T2D

Minor hypoglycaemic events (France, Germany, UK, USA)

## Reduced productivity



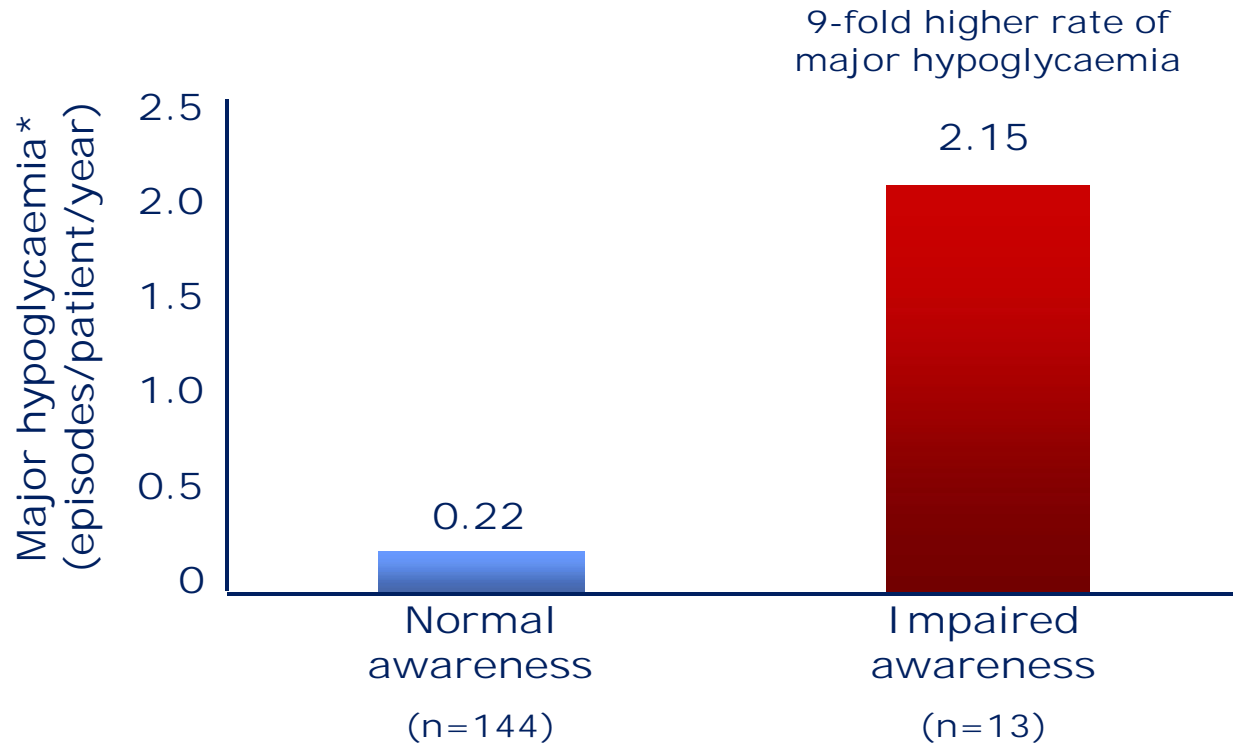
- Following a daytime event:
  - 18.3% lose an average of 9.9 hours of work time
  - 23.8% miss a meeting/deadline
- Following a nocturnal hypoglycaemic event:
  - 22.7% arrive late/miss work
  - 31.8% miss a meeting/deadline
  - 14.7 hours of work are lost

## Increased treatment cost



- 5.6 extra blood glucose tests within 7 days after event
- 25% contact a healthcare provider after an episode
- Out-of-pocket costs due to extra/special groceries, extra testing supplies and transport: £16.42/month

# Hypoglycaemia unawareness is associated with a higher rate of major hypoglycaemia



Major hypoglycaemia was defined as an episode requiring external assistance for recovery. Subjective changes in hypoglycaemia symptom intensity were recorded by the participants based on a hypoglycaemia awareness scale of 1 to 7, where 1 = always aware and 7 = never aware, and a score of 4 or more correlates with impaired awareness

\*Based on data from a retrospective survey of 215 patients with T2DM treated with 2 injections of insulin daily for 1 year

# Major hypoglycaemia significantly increases the risk for adverse outcomes in patients with T2DM

Hazard ratios for incident vascular outcomes and death among patients who had major hypoglycaemia as compared with those who did not

| Clinical outcome and interval after hypoglycaemia | No. of events | Hazard ratio adjusted for treatment assignment (95% CI) | p-value | Hazard ratio adjusted for multiple covariates (95% CI) | p-value |
|---|---------------|---|---------|--|---------|
| Macrovascular events                              | 1147          | 4.05 (2.86–5.74)  | <0.001  | 3.45 (2.34–5.08)                                       | <0.001  |
| Death from any cause                              | 1031          | 4.86 (3.60–6.57)  | <0.001  | 3.30 (2.31–4.72)                                       | <0.001  |
| Death from cardiovascular cause                   | 542           | 4.87 (3.17–7.49)  | <0.001  | 3.78 (2.34–6.11)                                       | <0.001  |
| Death from non-cardiovascular cause               | 489           | 4.82 (3.16–7.35)  | <0.001  | 2.86 (1.67–4.90)                                       | <0.001  |

Zoungas et al. ADVANCE Collaborative Group. Severe hypoglycemia and risks of vascular events and death  
N Engl J Med 2010; 363(15): 1410–18

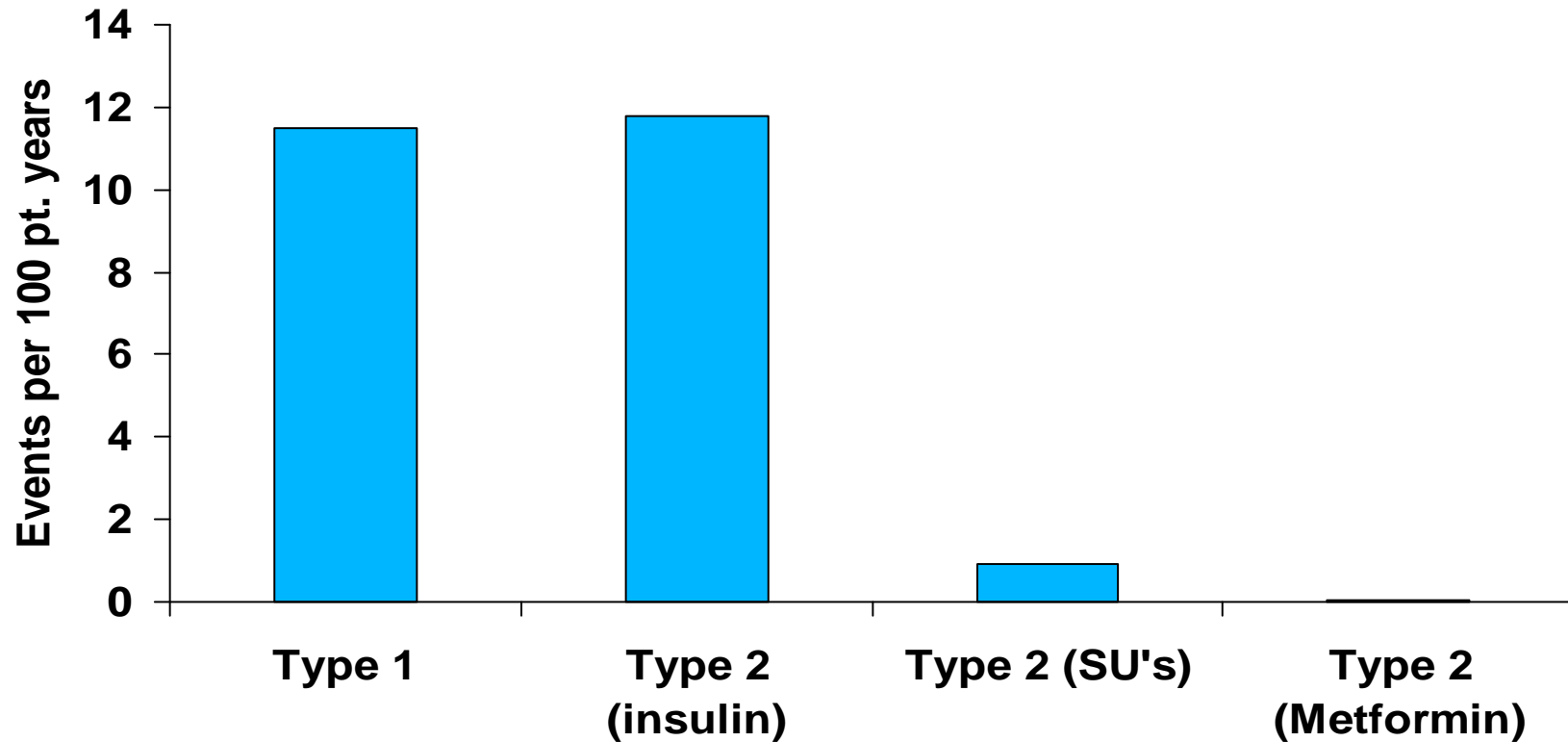
How common is severe hypoglycaemia?



## Frequency of Severe Hypoglycaemia Requiring Emergency Treatment in Type 1 and Type 2 Diabetes

- Tayside study looked at routinely collected datasets in a population of 367,051 people, including 8,655 people with diabetes
- All episodes of hypoglycemia between June 1997 and May 1998 requiring emergency treatment from primary care, ambulance, and accident and emergency or hospital services were identified

# Frequency of Severe Hypoglycaemia Requiring Emergency Treatment



Graham P Leese for the DARTS/MEMO collaboration, *Diabetes Care* 2003; 26:1176–80

# Outcome of severe hypos

- Of 260 episodes, 89 (34%) involved contact with ambulance service only
- 52 cases (28%) resulted in direct or indirect hospital admission

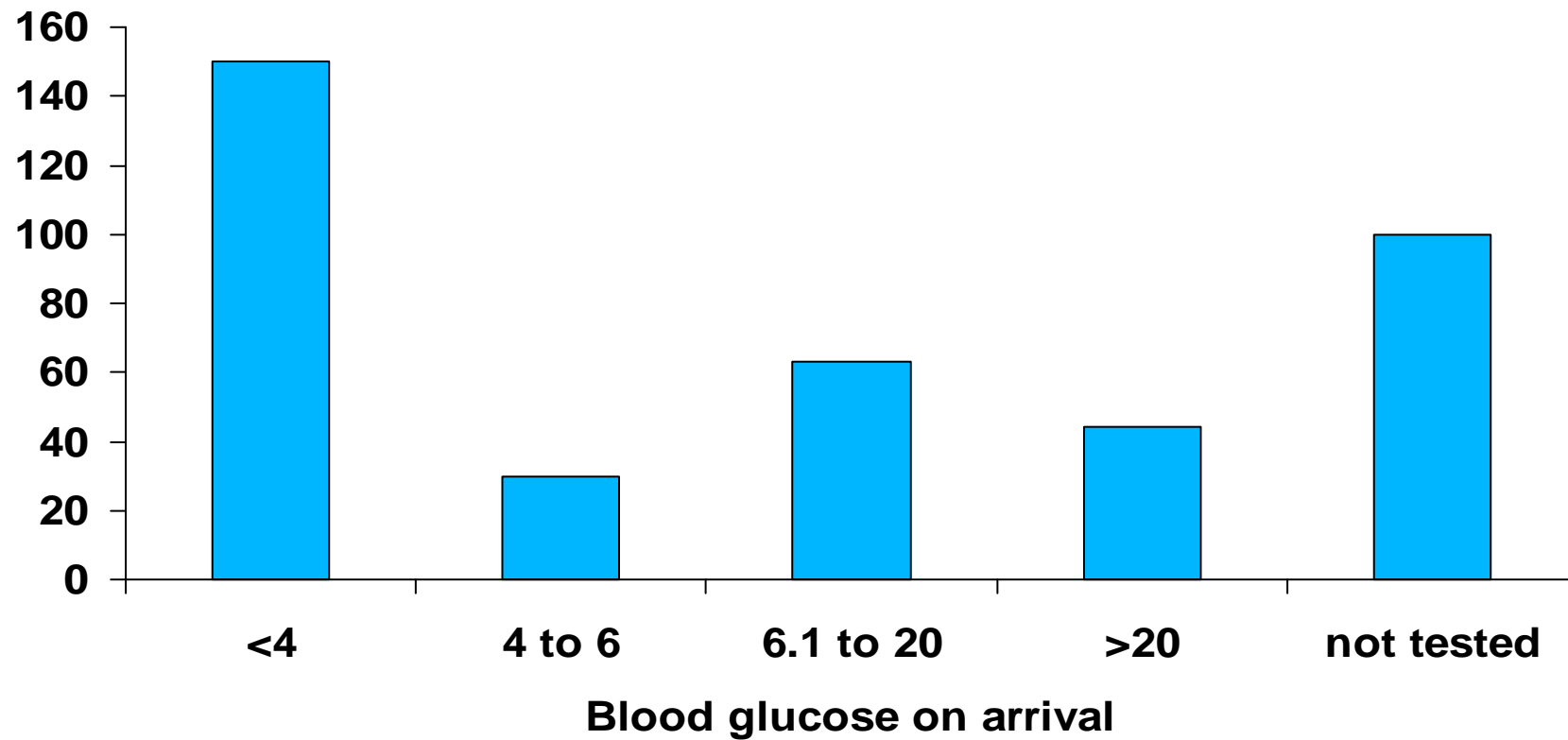
## Sheffield Audit of A&E adult attenders with hypoglycaemia (Mackie 2003)

- 125 cases in 12 months in people with diabetes
- 102 (87%) via ambulance
  - 50 (40%) admitted
  - 90 (72%) insulin treated
  - 56 no cause identified

## South Yorkshire Ambulance Services (SYAS) code 13 audit 2006

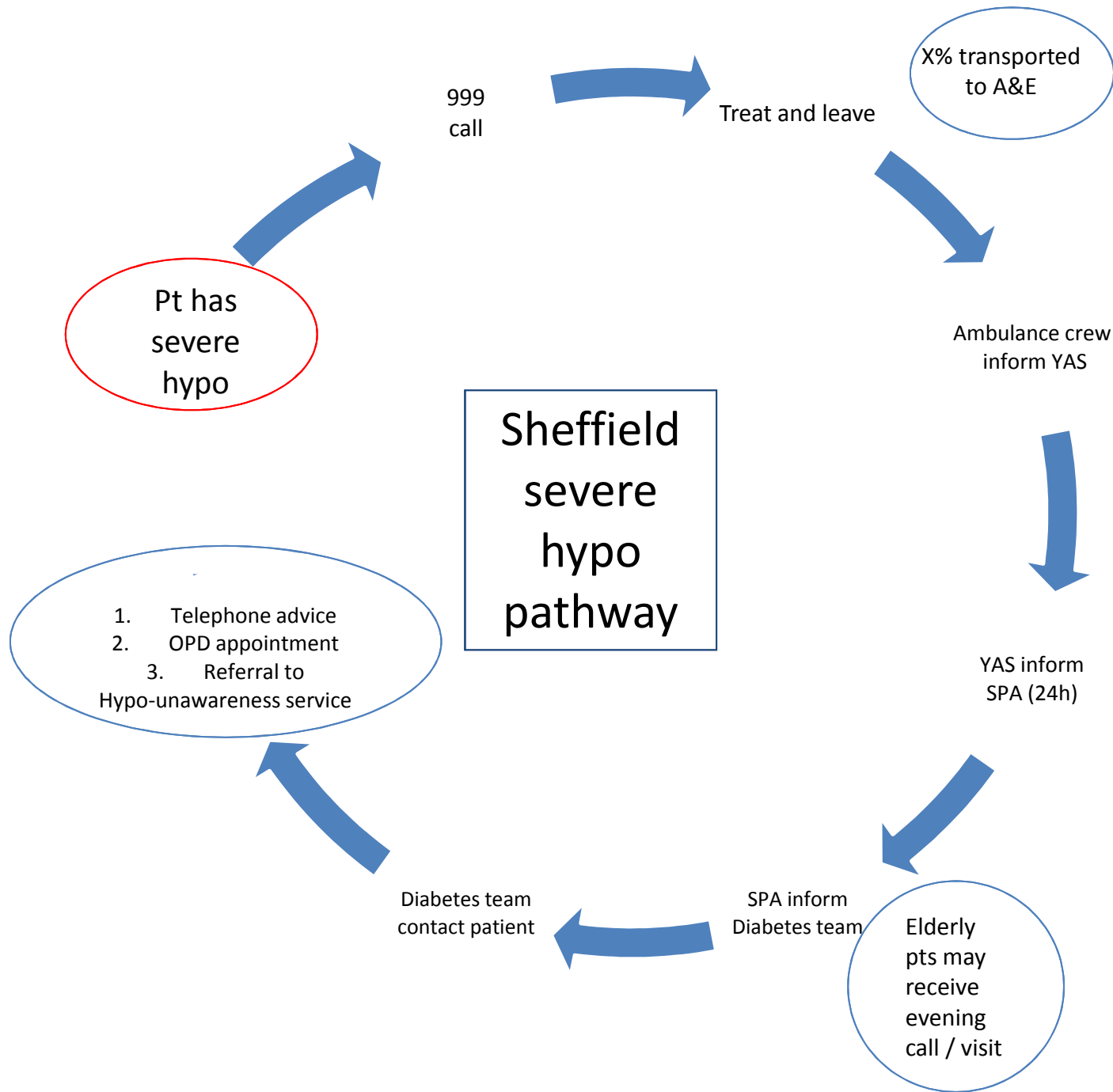
- Over a 6 month period in 2006 there were 385 call outs to people with diabetes (code 13).
- Of these 285 (74%) had a blood sugar measured on arrival.
- The mean age was 58+19years

# Blood glucose values on arrival of ambulance (N=385)



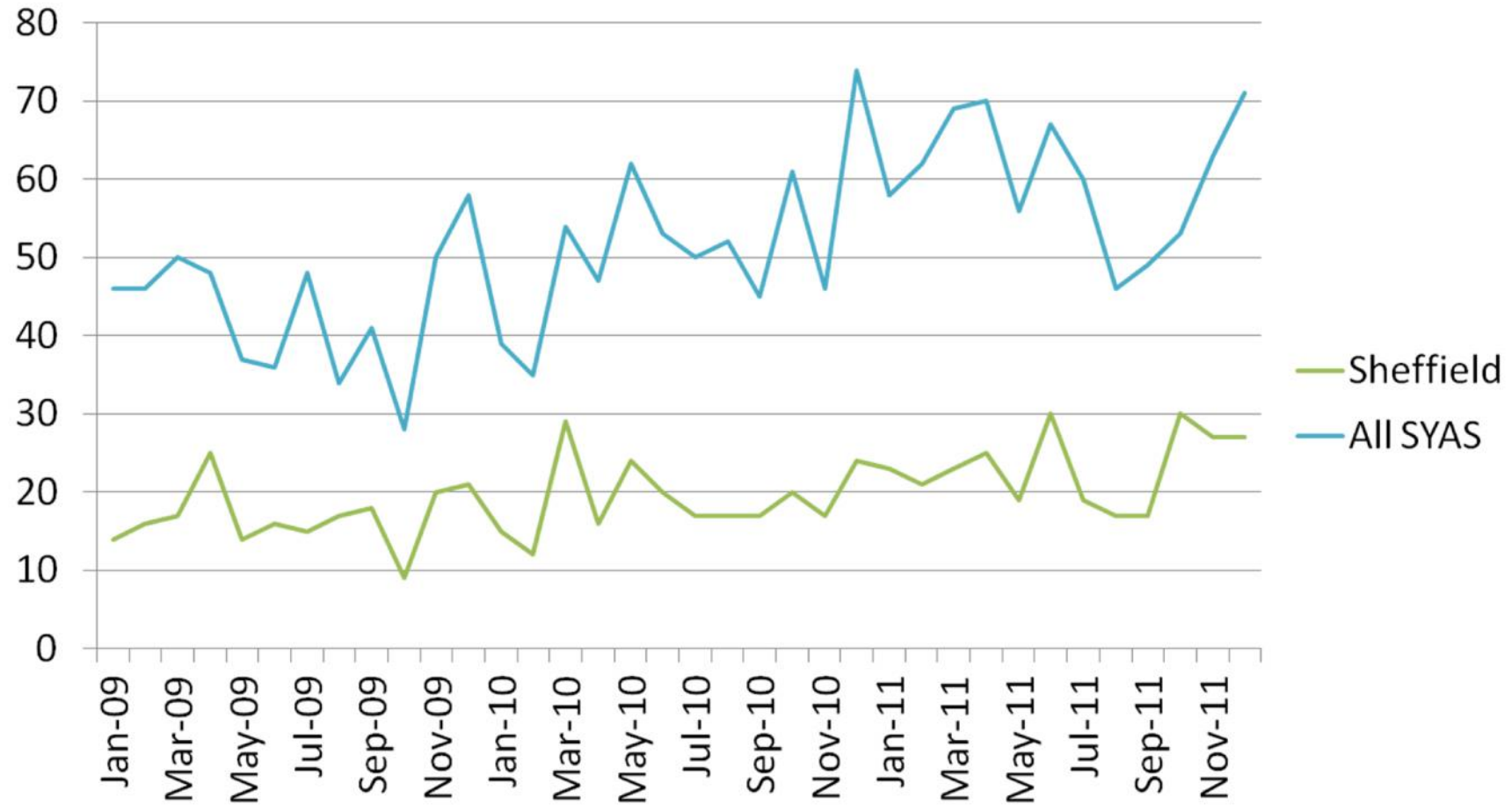
# SYAS 2006 audit

- 148 people had a blood glucose <4 mmol/l (296 per year)
- 55 females, 81 males
- Mean age  $59 \pm 19$ yr.
  - 72 >60yr, 13 <30yr
- 36 (24%) were taken to hospital
- 58 (39%) made the emergency call between the hours of 2200 and 0800h

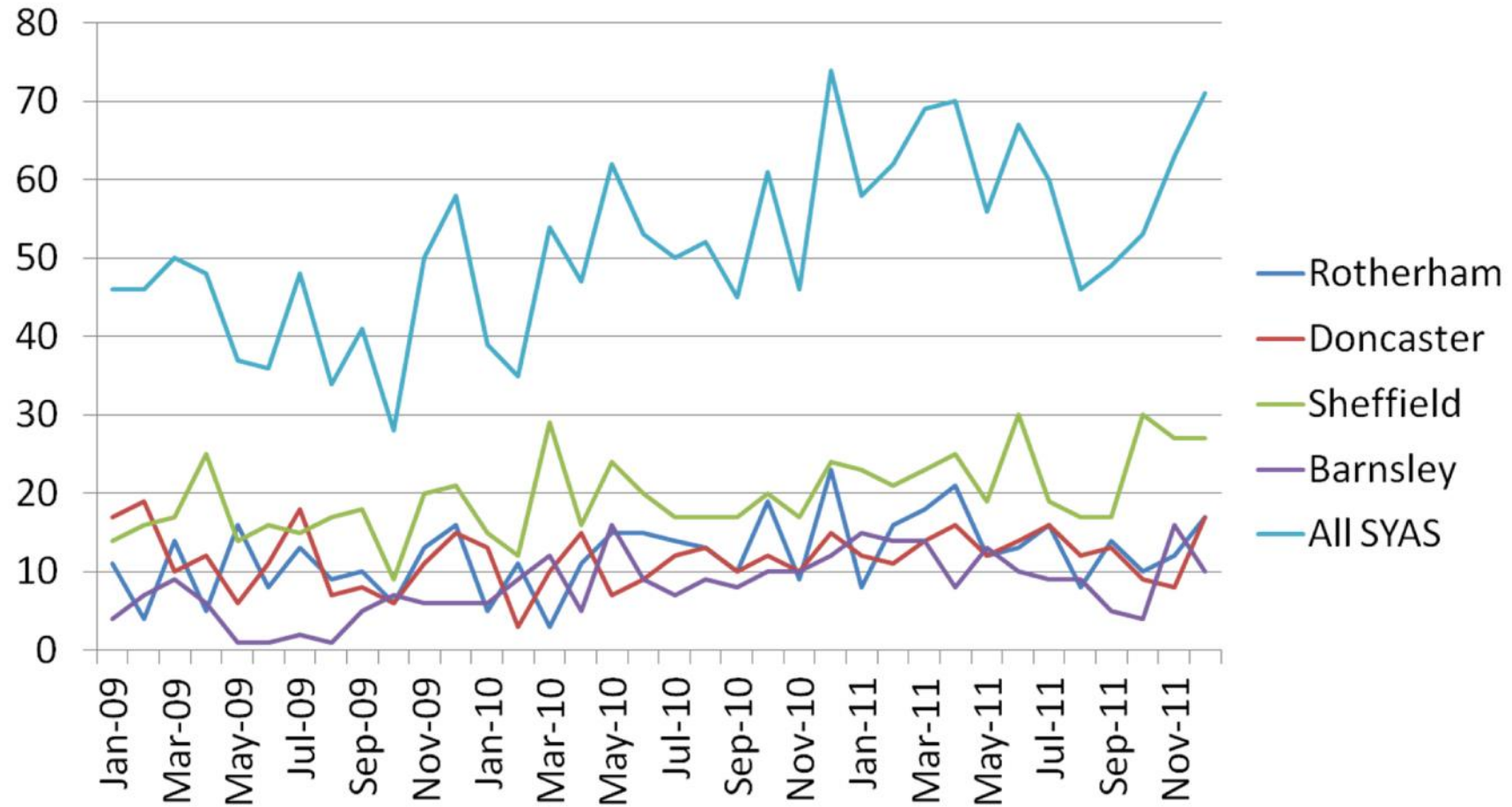




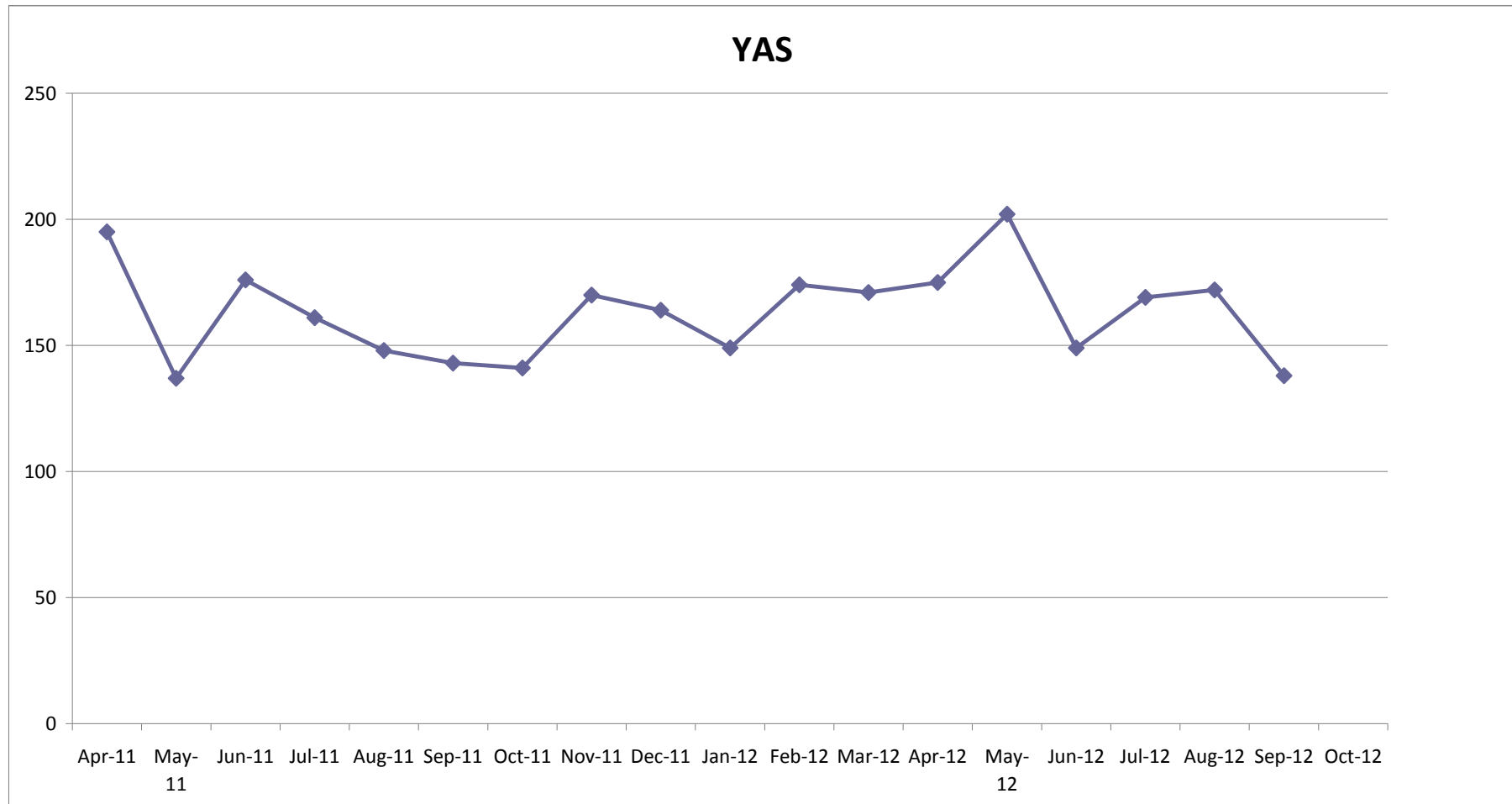
# Ambulance call-outs for severe Hypoglycaemia in South Yorkshire Jan 2009 to Dec 2011



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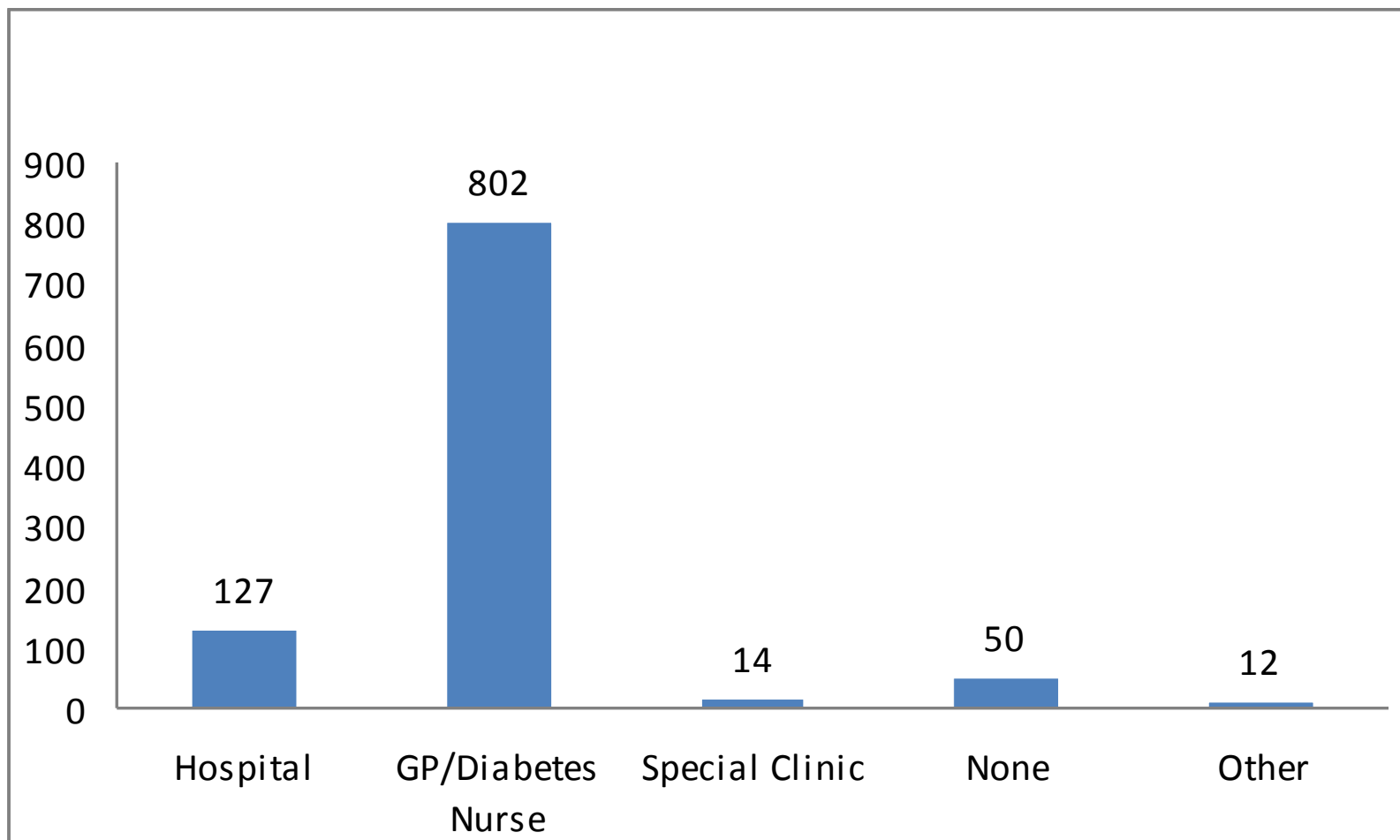
# Ambulance call outs for severe hypoglycaemia Yorkshire Ambulance Service (YAS) April 2011 - Sept 2012



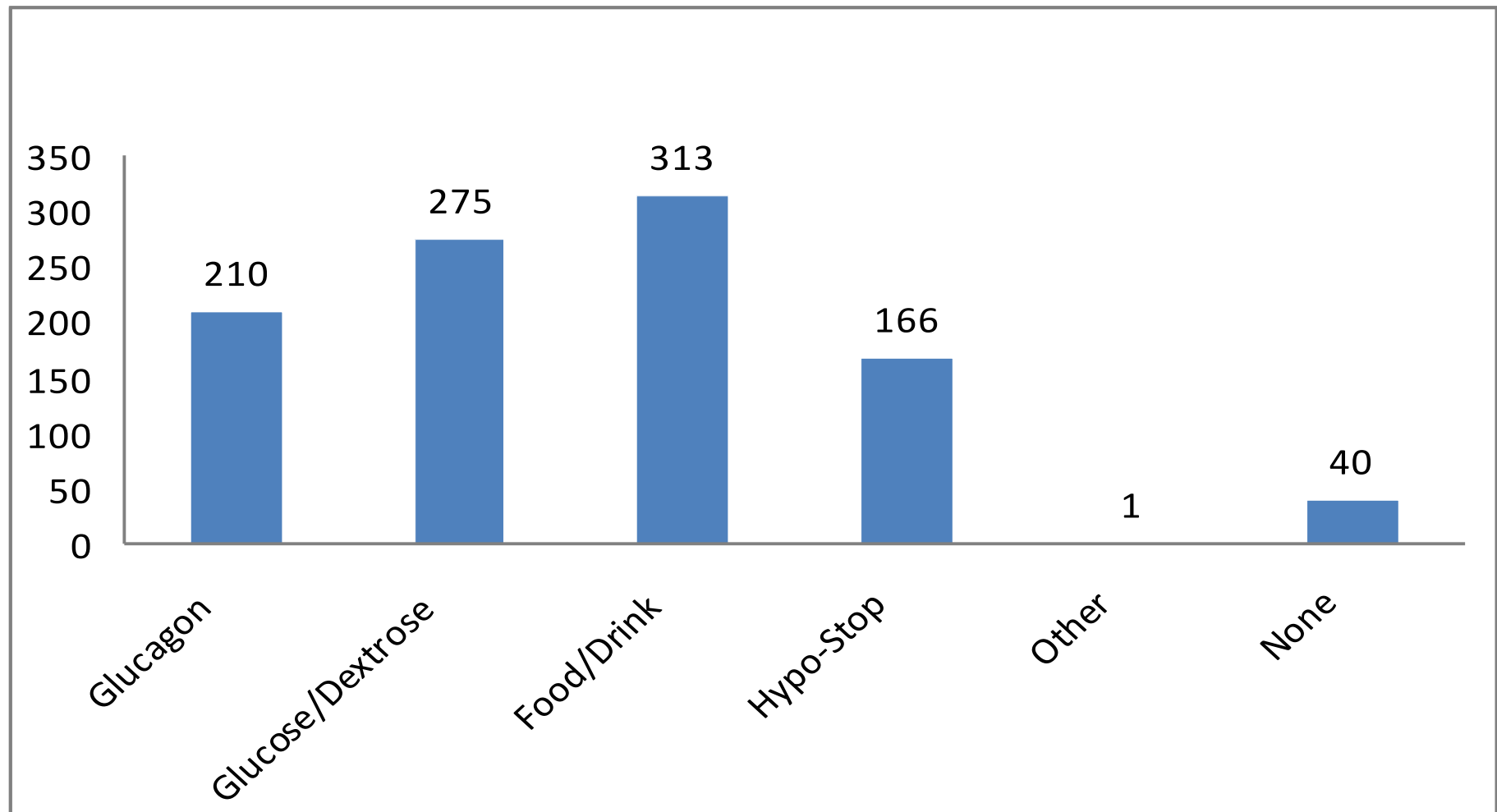
## Characteristics of adults treated in the community (all YAS April to Sept 2012)

- 128 of 1005 (12.8%) transported to hospital
- 291 live alone
- 895 on insulin (with or without tablets)

# Who provides your usual diabetes care?

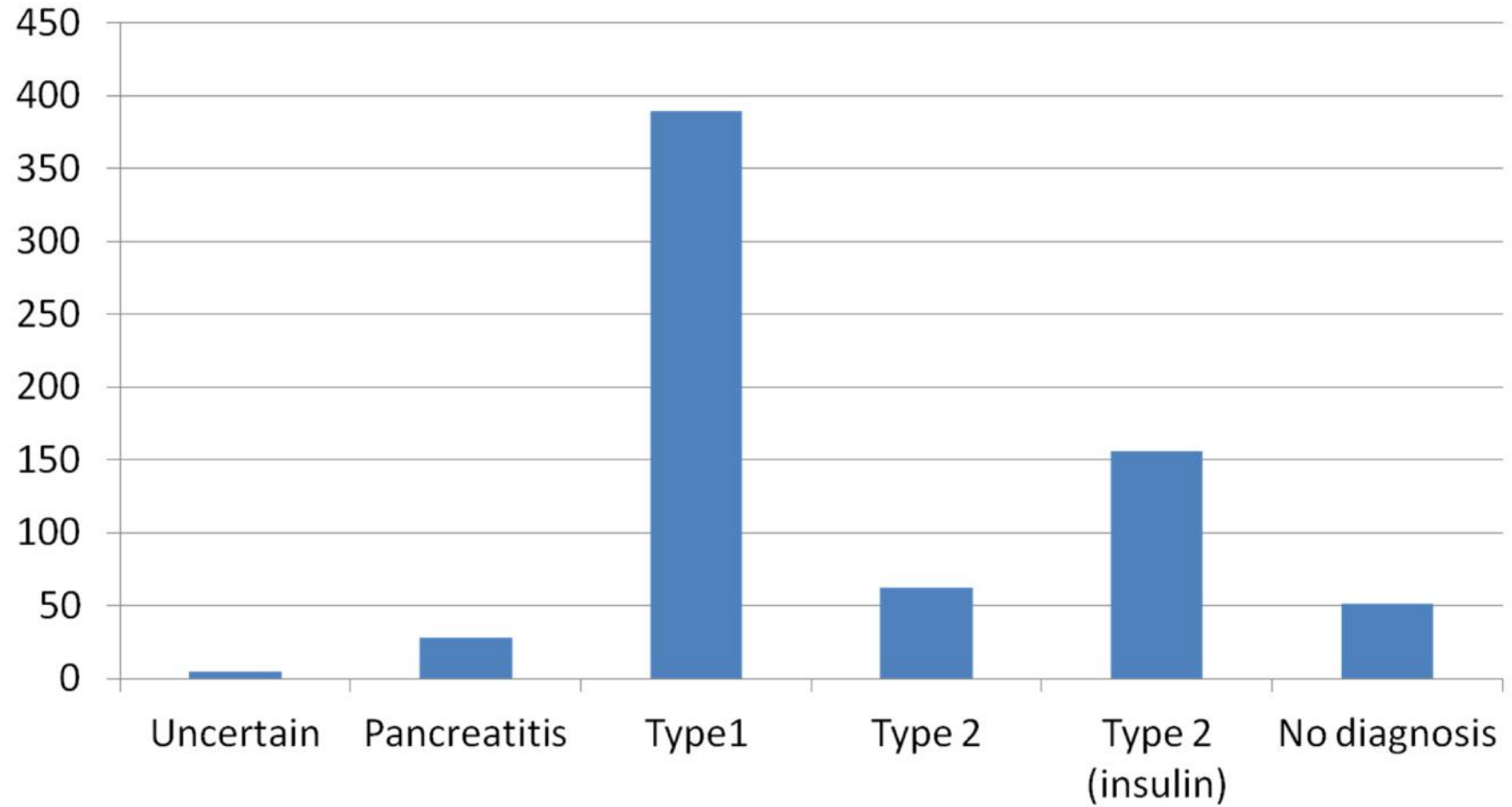


# Method of treatment of adults with severe hypos (all YAS April to Sept 2012)



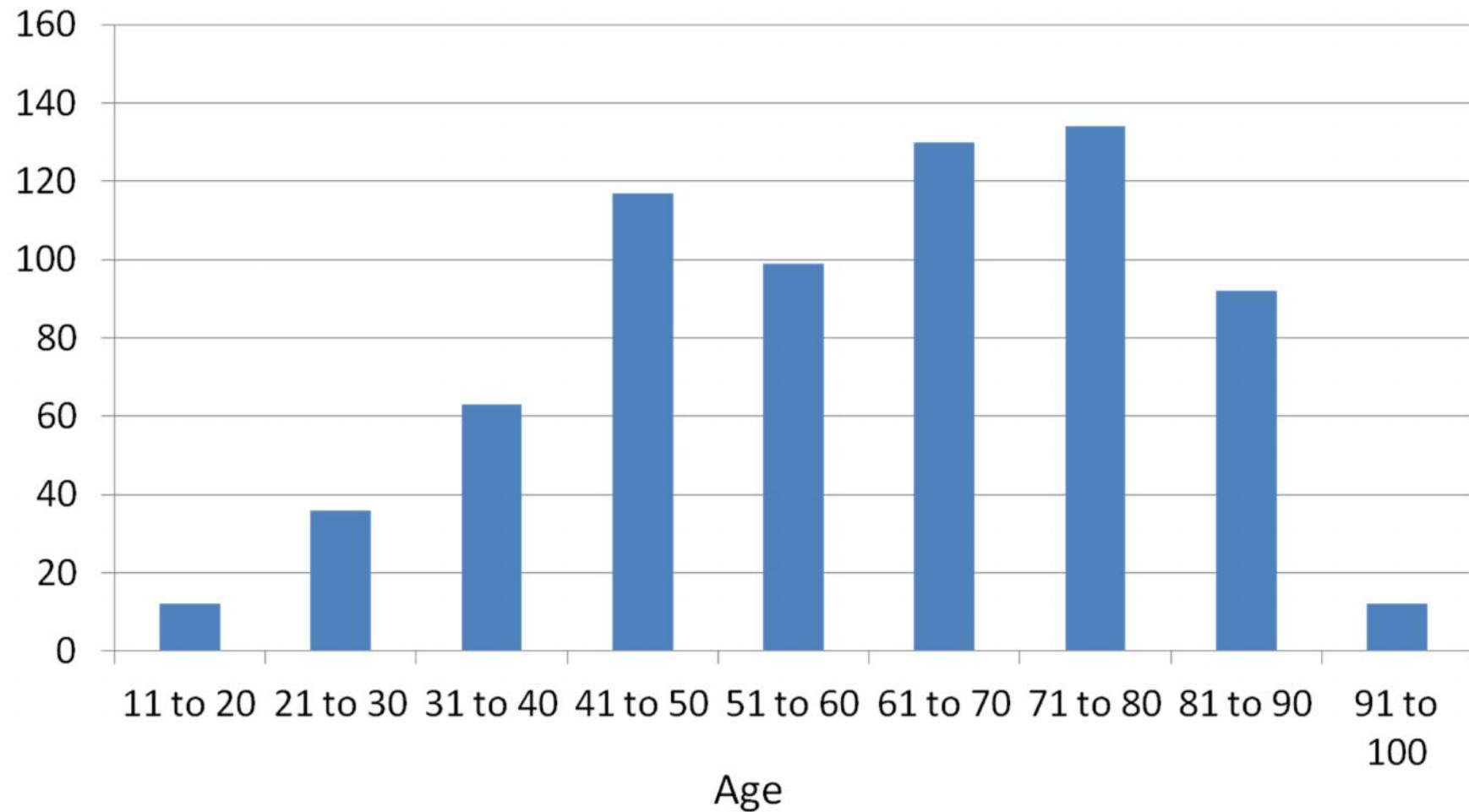
Characteristics of adults with severe  
hypoglycaemia treated in the  
community in Sheffield  
(1/7/2008 – 30/6/2012 )  
N= 692

# Type of diabetes (n=692)

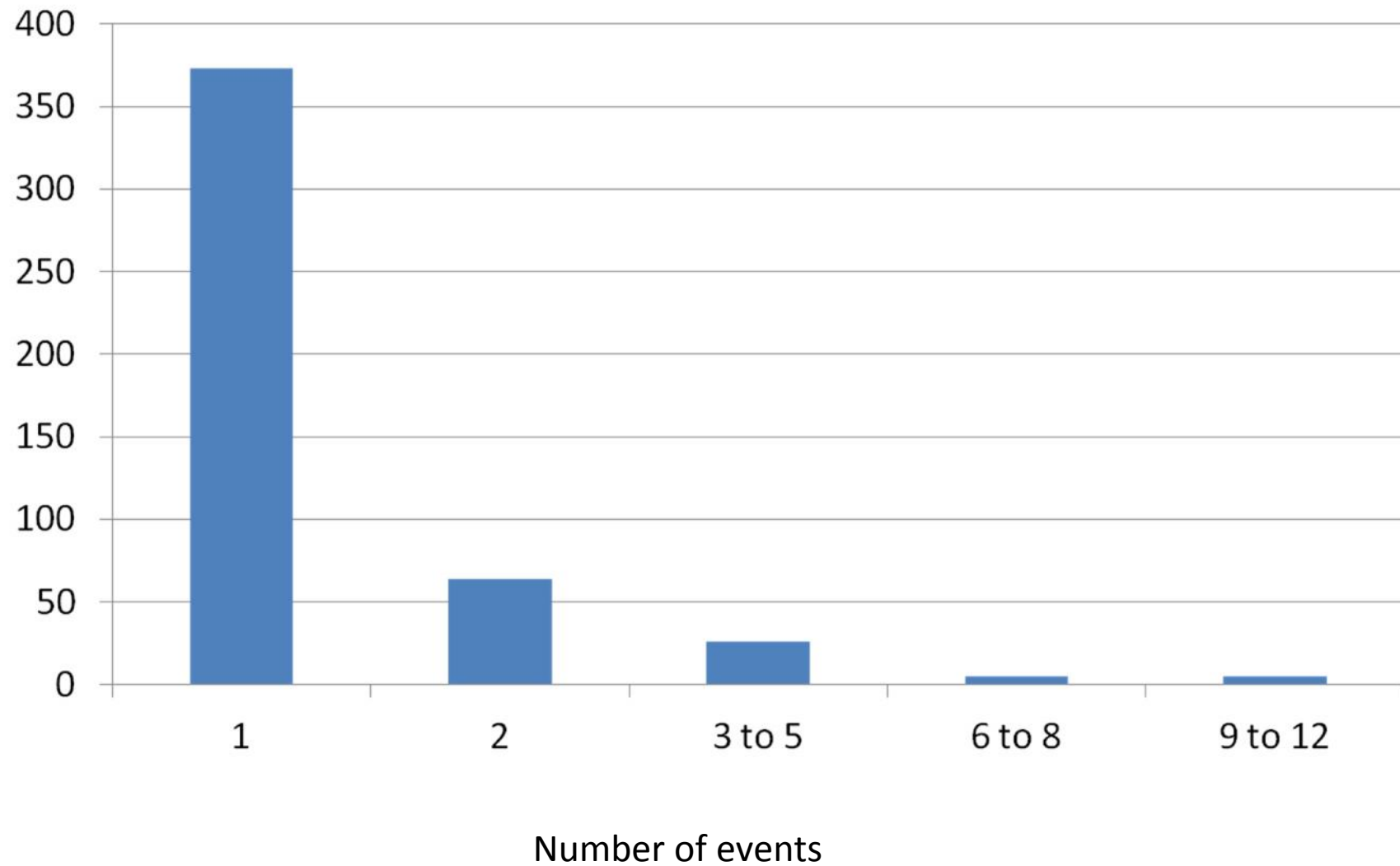




# Age of people with hypoglycemia (n=692)



# No. of hypo events per person (over 4 years)

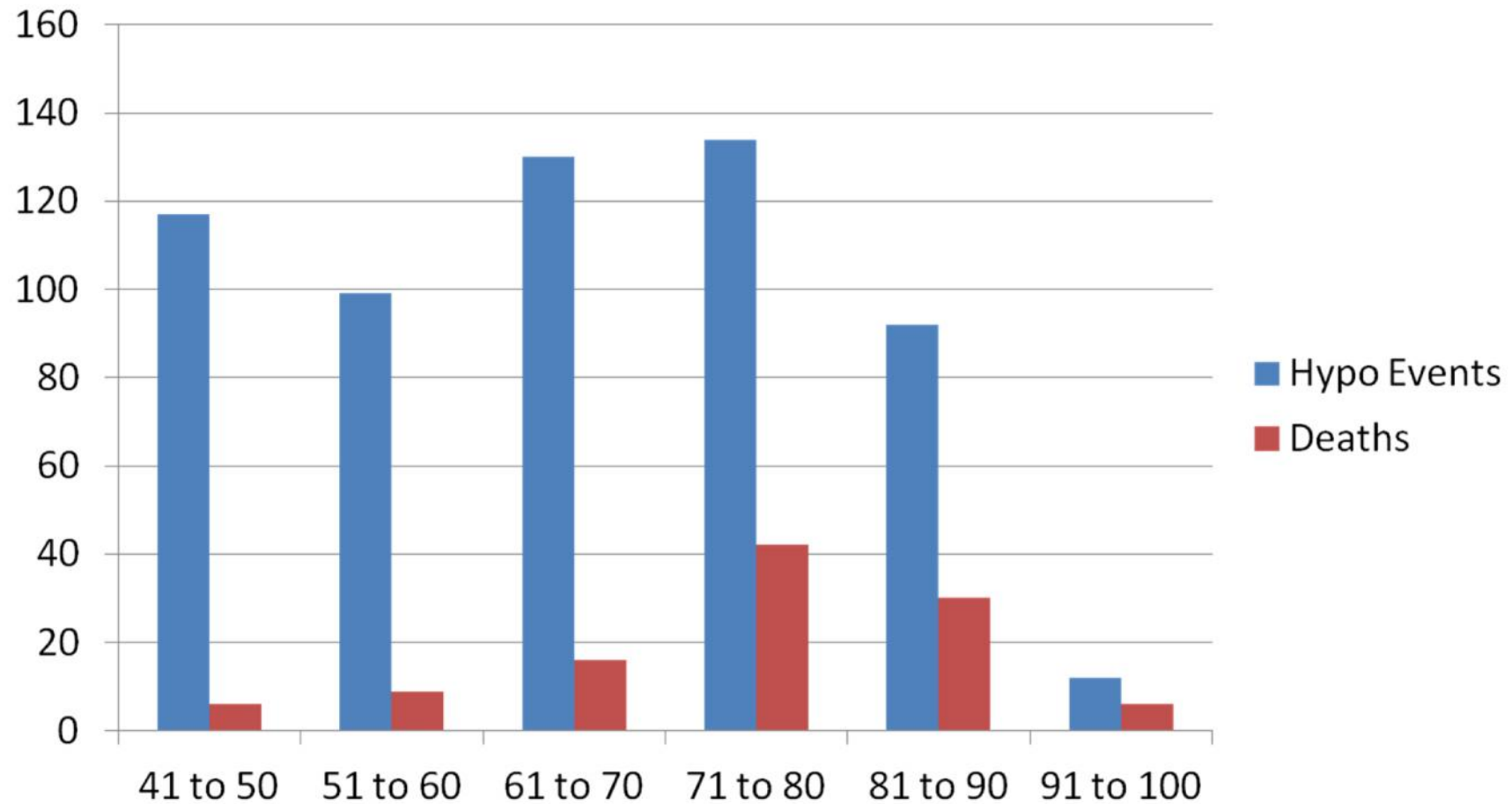


## How did patient access the specialist diabetes service?

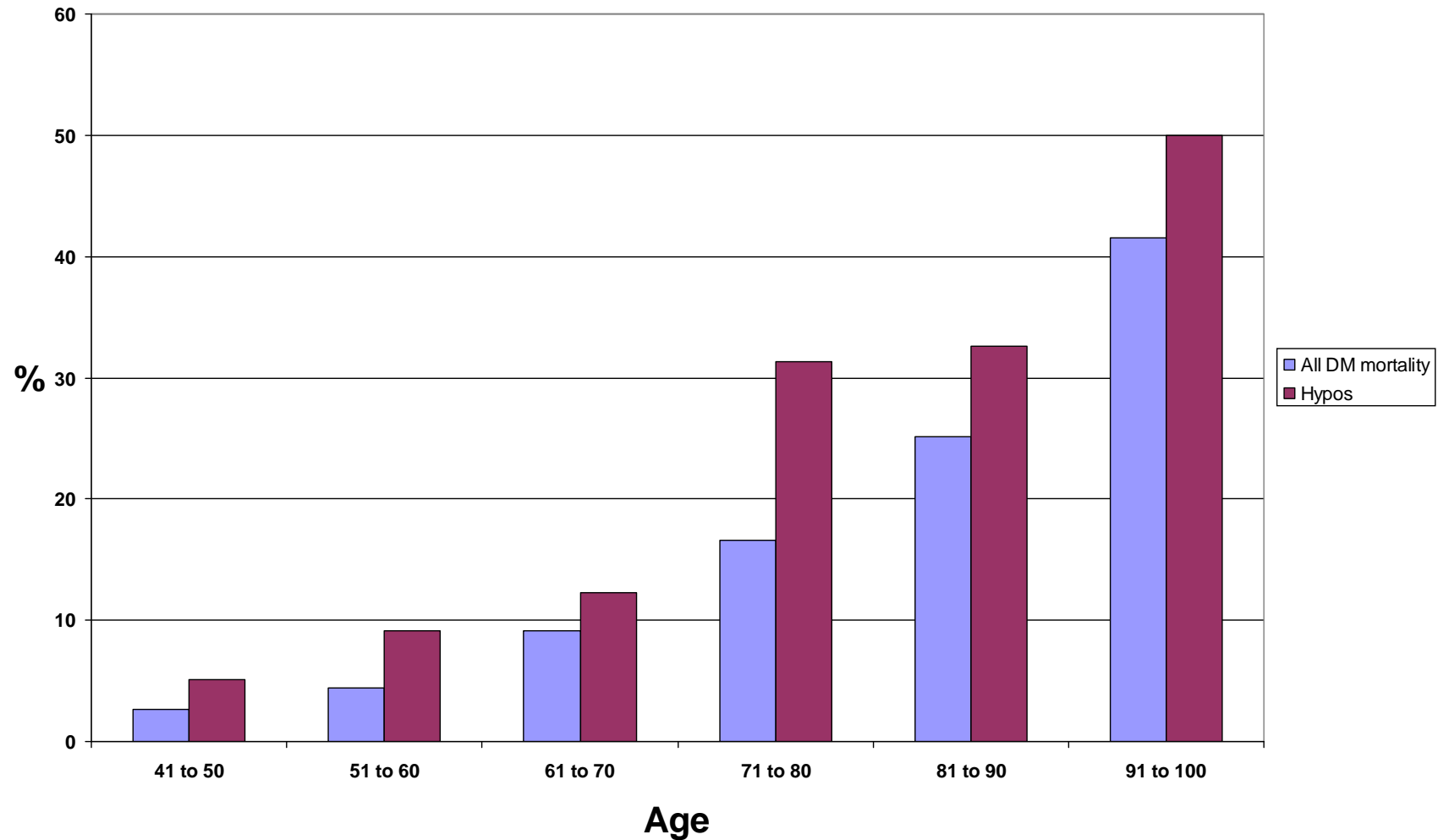
- Direct referral 47.6%
- Self referred 7.8%
- Via A&E 10.6%
- Other (e.g. GP) 2.9%
- Not recorded 31.1%

39% reported a reduced (no symptoms until BG <3mmol/L) or absent warning for hypoglycaemia

# Age distribution and subsequent deaths following hypoglycaemia



# 4y Mortality (%) in people experiencing a severe hypo compared to total clinic population



# East Anglian Ambulance Trust

## Hypoglycaemia Audit 2005

EAAT covers 17 PCTs and a population of 2,173,009 (2003/4) : ~  
86,920 people with diabetes if prevalence 4.0%

Analysis of CODE 13 call data from the EAAT VisiCAD database for 12  
months between 1.4. 2004 and 31.3.05.

Survey of patients with a hypoglycaemia ambulance call out, a  
structured questionnaire on diabetes management and  
hypoglycaemia was given to patients by Ambulance Crew  
between May and July 2005.

# Results

|                  | Total   | Hypo (%)    | Hyper (%)  |
|------------------|---------|-------------|------------|
| EAAT '999' calls | 164,718 | 1920 (1.16) | 336 (0.20) |
| GP Urgent calls  | 40,756  | 158 (0.38)  | 395 (0.96) |
| Total            | 205,474 | 2078 (1.01) | 731 (0.35) |

Equivalent to 57,360 call outs per annum if extended to a demographically identical population of 60 million

# Results

31.8 % of patients were taken to A/E, but overall only 8 % of patients calling an ambulance were admitted with hypoglycaemia.

Most patients (63.5%) were managed at home by EAAT staff.

92.5 % were using insulin either alone or in combination with oral hypoglycaemics.

20.9% of hypoglycaemia ambulance call outs were to patients described as category A (Unconscious)

38.2 % of respondents said that that they had used emergency ambulance services in the previous 12 months for a diabetic emergency.

4 fold variations between PCTs in call - out rates



What is known nationally ?  
All England ambulance audit 2010

# NHS national ambulance audit 2010

All NHS ambulance services participate in a regular benchmarking audit, one topic of which is hypoglycaemia. This requires a detailed submission of all cases occurring during the sample month OR a maximum of 300 cases. In 2010, if number exceeded 300, authorities were requested to estimate the total.

| Trust:                          | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12 | Total        |
|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|--------------|
| Cases submitted <sup>1</sup>    | 132 | 300 | 300 | 300 | 268 | 300 | 178 | 300 | 300 | 200 | 300 | 26 | <b>2904</b>  |
| Extra cases                     | 0   | 50* | 50* | 336 | 0   | 72  | 0   | 50* | 50* | 0   | 317 | 0  | <b>925*</b>  |
| Estimated total number of cases | 132 | 350 | 350 | 636 | 268 | 372 | 178 | 350 | 350 | 200 | 617 | 26 | <b>3829*</b> |

# Summary of all England ambulance audit 2010

- If corrected estimate of hypos is correct (3800 per month)
- Extrapolating these figures for a year amount to 45,948 cases of hypoglycaemia using the 999 system.
- Direct referral was made to an 'appropriate health professional' in 0 to 68.2% of 999 calls for hypoglycaemia.

# Code 13 calls

| Ambulance Trust | Code 13 responses | Patients transported | Percentage transported |
|-----------------|-------------------|----------------------|------------------------|
| 1               | 1495              | 396                  | 26.5                   |
| 2               | 3087              |                      |                        |
| 3               | 2181              | 916                  | 42.0                   |
| 4               | 6289              | 2560                 | 41.2                   |
| 5               | 2707              | 879                  | 32.5                   |
| 6               | 2182              | 793                  | 36.3                   |
| 7               | 4188              | 2160                 | 51.6                   |
| 8               | 12994             | 7523                 | 57.9                   |
| 9               | 3423              | 1311                 | 38.3                   |
| 10              | 2797              | 1207                 | 43.2                   |
| Total           | 41,343            | 17,745               | 35.4%                  |

## Results of ambulance audit of call-outs for hypoglycaemia – referral to ‘appropriate health professional’

| Criterion H4 Direct referral made to an appropriate health professional |                         |                    |                 |                 |   |                       |
|---|-------------------------|--------------------|-----------------|-----------------|---|-----------------------|
| Cycle 9   |                         |                    |                 |                 |   | Comparison<br>Cycle 8 |
| Ambulance<br>service<br>identifier                                      | Total<br>sample<br>size | Performance<br>(%) | Upper<br>95% CI | Lower<br>95% CI | Total<br>Exceptions<br>(included in<br>performance<br>figure) | Performance<br>(%)    |
| 1   | 129                     | 66.7               | 74.8            | 58.5            | 53  | 76.7                  |
| 2   | 300                     | 68.7               | 73.9            | 63.4            | 171   | 76.3                  |
| 3   | 300                     | 32.3               | 37.6            | 27.0            | 87  | 34.7                  |
| 4   | 300                     | 88.7               | 92.3            | 85.1            | 255   | 64.7                  |
| 5   | 283                     | 81.3               | 85.8            | 76.7            | 150   | 80.9                  |
| 6   | 200                     | 67.0               | 73.5            | 60.5            | 115   | 53.7                  |
| 7   | 210                     | 73.3               | 79.3            | 67.4            | 108   | 71.6                  |
| 8   | 300                     | 57.0               | 62.6            | 51.4            | 151   | 51.3                  |
| 9   | 283                     | 43.8               | 49.6            | 38.0            | 82  | 52.6                  |
| 10  | 238                     | 65.1               | 71.2            | 59.1            | 136   | 91.5                  |
| 11  | 300                     | 43.3               | 48.9            | 37.7            | 106   | 43.8                  |
| 12  | 11                      | 54.5               | 84.0            | 25.1            | 3   | 100.0                 |

# Results of ambulance audit of call-outs for hypoglycaemia – patient refused referral to ‘appropriate health professional’

| <b>Criterion H4 Direct referral made to an appropriate health professional</b> |                          |                                |                                 |
|--|--------------------------|--------------------------------|---------------------------------|
| <b>Ambulance service identifier</b>  | <b>Total sample size</b> | <b>Transported to hospital</b> | <b>Patient refused referral</b> |
| 1  | 129                      | 36                             | 17                              |
| 2  | 300                      | 113                            | 58                              |
| 3  | 300                      | 87                             | 0                               |
| 4  | 300                      | 136                            | 119                             |
| 5  | 283                      | 140                            | 10                              |
| 6  | 200                      | 93                             | 22                              |
| 7  | 210                      | 105                            | 3                               |
| 8  | 300                      | 86                             | 65                              |
| 9  | 283                      | 78                             | 4                               |
| 10   | 238                      | 105                            | 31                              |
| 11   | 300                      | 102                            | 4                               |
| 12   | 11                       | 3                              | 0                               |

# NHS Diabetes hypo service audit 2012




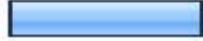
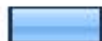
- Survey monkey poll sent to consultant diabetes specialists, PCT diabetes leads and ambulance Trusts
- PCT/acute trust survey: 61 responses
- Ambulance trust survey: 6 responses

### 3. Following an ambulance call-out to a person with diabetes who has experienced a severe hypo what proportion are taken to the local A&E?

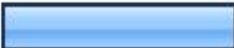


|                    |  | Response Percent         | Response Count |
|--------------------|--|--------------------------|----------------|
| 76 to 100%         |  | 3.7%                     | 2              |
| between 51 and 75% |  | 9.3%                     | 5              |
| between 25 and 50% |  | 5.6%                     | 3              |
| less than 25%      |  | 7.4%                     | 4              |
| <b>don't know</b>  |  | <b>74.1%</b>             | <b>40</b>      |
|                    |  | <b>answered question</b> | <b>54</b>      |
|                    |  | <b>skipped question</b>  | <b>1</b>       |



**8. Following 999 ambulance call-out to a person with a severe episode of hypoglycaemia, are patients referred by the Ambulance Trust to their local diabetes specialist team?**

|                             |   | Response Percent | Response Count |
|-----------------------------|---|------------------|----------------|
| Yes                         |    | 13.0%            | 7              |
| No                          |   | 40.7%            | 22             |
| Only if the person consents |    | 11.1%            | 6              |
| Don't know                  |   | 24.1%            | 13             |
| Other (please specify)      |  | 11.1%            | 6              |
| <b>answered question</b>    |   |                  | <b>54</b>      |
| <b>skipped question</b>     |   |                  | <b>1</b>       |

#### 4. Is there a care pathway for the management of severe hypoglycaemia in the community?

|                   |  | Response Percent | Response Count |
|-------------------|--|------------------|----------------|
| Yes               |    | 27.8%            | 15             |
| No                |    | 31.5%            | 17             |
| Don't know        |  | 40.7%            | 22             |
| answered question |  |                  | 54             |
| skipped question  |  |                  | 1              |

# Conclusions

- Severe hypoglycaemia requiring 3<sup>rd</sup> party treatment is common
- Most people experiencing a severe hypo are treated and left. Less than 25% are transported to hospital and < 10% are admitted
- There is a significant mortality during the 4 years following an episode of hypoglycaemia
- Referral to a diabetes specialist team following a severe hypo is variable
- Drivers are often reluctant to be referred

# Acknowledgements

- Catherine James YAS
- Mike Sampson Norfolk & Norwich
- Steve Mortley EAAS
- Marcus Bailey EAAS
- Ursula Anderson NHS Diabetes