An integrated severe hypoglycaemia service for Ambulance attended patients in the East of England.

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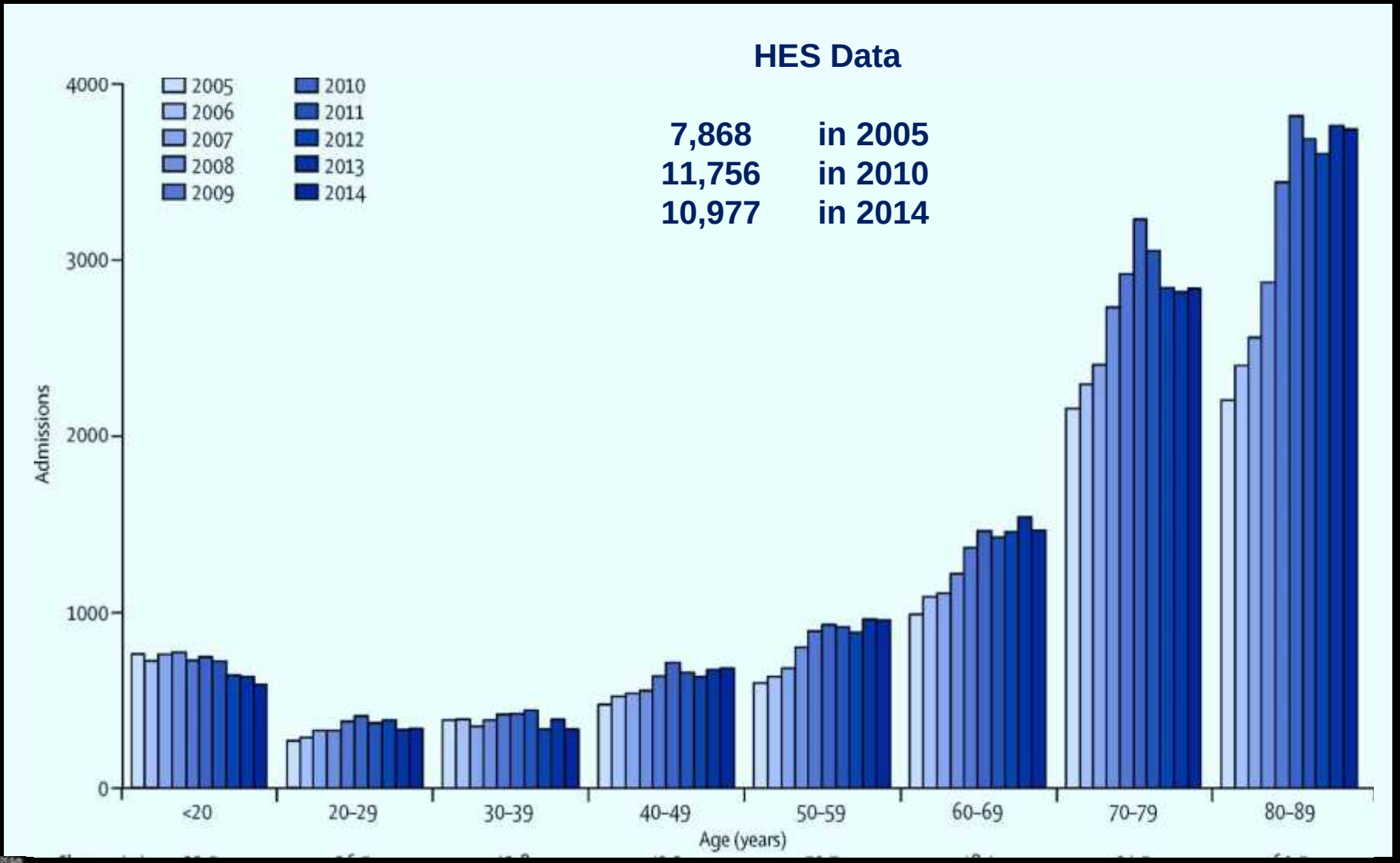
- Translatable model for the further care of Ambulance attended severe hypoglycaemia (SH) (Diabetes Res Clinical Practice. 2017 Sep 1;133:50-59)
- National data for SH (admissions and Ambulance activity)
- Outcome data from new model
- Cost benefit & translatability

Trends in admissions for hypoglycaemia in England (2005 – 2014)

Zaccardi F et al 2016 Lancet Diabetes 4 677 – 85)



The Lancet Diabetes & Endocrinology 2016 4, 677-685DOI: (10.1016/S2213-8587(16)30091-2)

Tayside severe hypoglycaemia episodes (per patient per year) seen by emergency medical services (2011 – 2012 and 1997 - 1998) *Wang et al 2017 Clinical Diab & Endo*

T1 DM (n)	977	2,029		
T1DM (events pp/per yr)	0.115	0.082	**- 38 %**	0.0001
T2 DM (n)	7,678	21,734		
Insulin treated T2DM (events pp/per yr)	0.118	0.037	**- 69 %**	0.008
Absolute number of episodes	244	351	**+ 41 %**	

UK Ambulance Trusts are the main provider of emergency SH care

- 48,400 – 98,756 severe hypoglycaemic episodes (999 calls) per annum based on UK Ambulance Trust data (0.51 – 1.02% all UK calls).

- 2 – 7% have repeat ambulance call in next 3 days

- 11% have repeat SH episode in next 14 days *(Khunti K 2013 Prim Care Diabetes; Fitzpatrick D PhD Thesis 2015 Univ. Stirling)*

- 39 % make no further contact with any HCP *(Fitzpatrick D, Duncan E 2015 EMJ)*
  - Inconsistent delivery of advice by paramedics
  - Loss of awareness
  - Not sure of benefits of HCP contact
  - Fear of driving licence issues.

- 57 % describe antecedent loss of hypoglycaemia awareness *(Duncan E, Fitzpatrick D BMJ Open 2017 7 A12)*

UK Ambulance ‘see and treat’ policies for SH: transport rates to A/E

(*Siriwardena et al 2009 Emergency Med. J*).

		n	Onward to A/E
Farmer AJ et al	2012	3962	35.3%
Khunti K et al	2013	523	32.0 %
Elwen FR et al	2015	1156	7.0 %
Wang H et al *	2016	702	25.0 %
Sampson MJ et al	2017	2000	11.2 %

* *Tayside data based on whole system A/E attended SH patients*

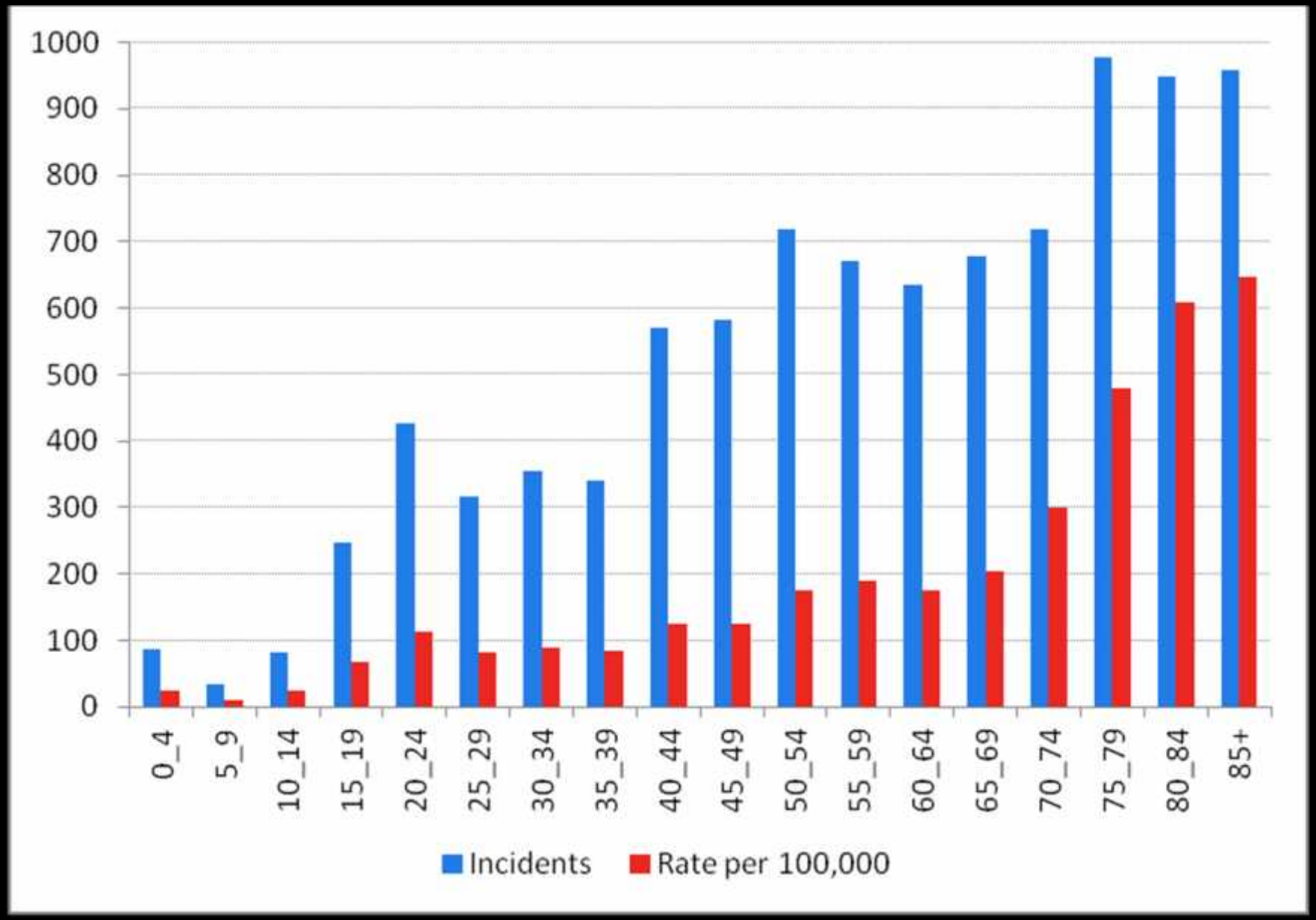
UK Ambulance ‘see and treat’ SH policies

- Systemic failure in communication between patient, diabetes teams (primary or secondary) and Ambulance crew.
- Some individuals generate multiple 999 calls .
- Lack of education in SH avoidance, or reported lack of education
- Risk can be mitigated by education on SH
- Well rehearsed discussions about onward referral , confidentiality, and DVLA.

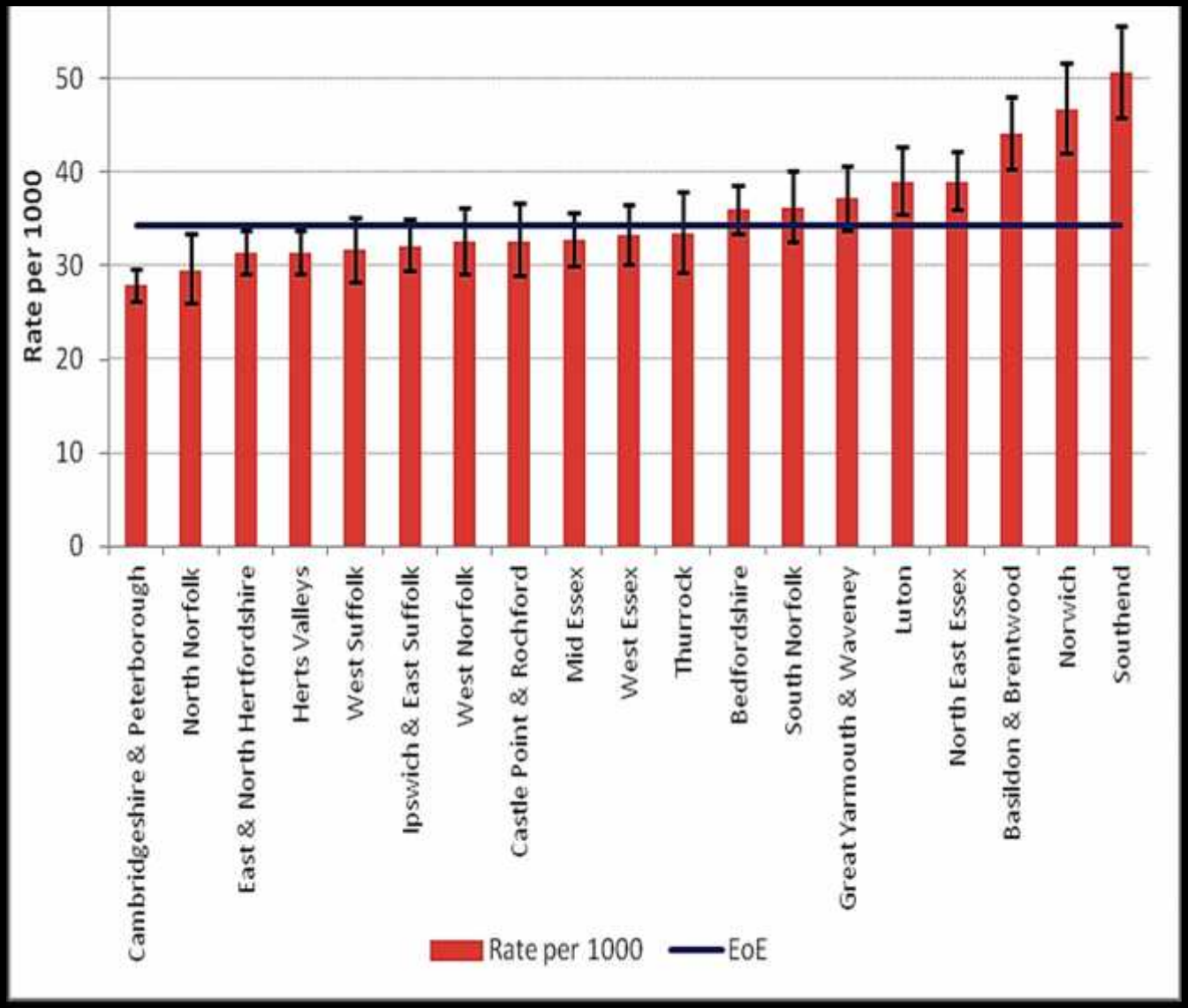
Recent collaborations between diabetes teams and Ambulance Trusts for SH

- NIHR CLARCH East Midlands (*Khunti K, Siriwardena S 2016)* 'Ambulance Hypo' project and East Midland Ambulance Trust (EMAT) approach
- London Integrated Hypoglycaemia Pathway *(Healthinnovationnetwork.com)*
- Yorkshire Ambulance Trust model *(Walker A et al EMJ 2006)*
- KSS AHSN Ambulance Trust model *(2016 www.kssahsn.net)*
- Hypo hot line Portsmouth *(Buchanan J et al Diabetes and primary Care 2014)*
- West Hampshire model (*Perry et al 2015 DM A63 – 68*)

Age of 9387 severe hypoglycaemia subjects attended by East of England Ambulance Trust in 2013 by age band.



Variance in SH frequency by CCG in East of England

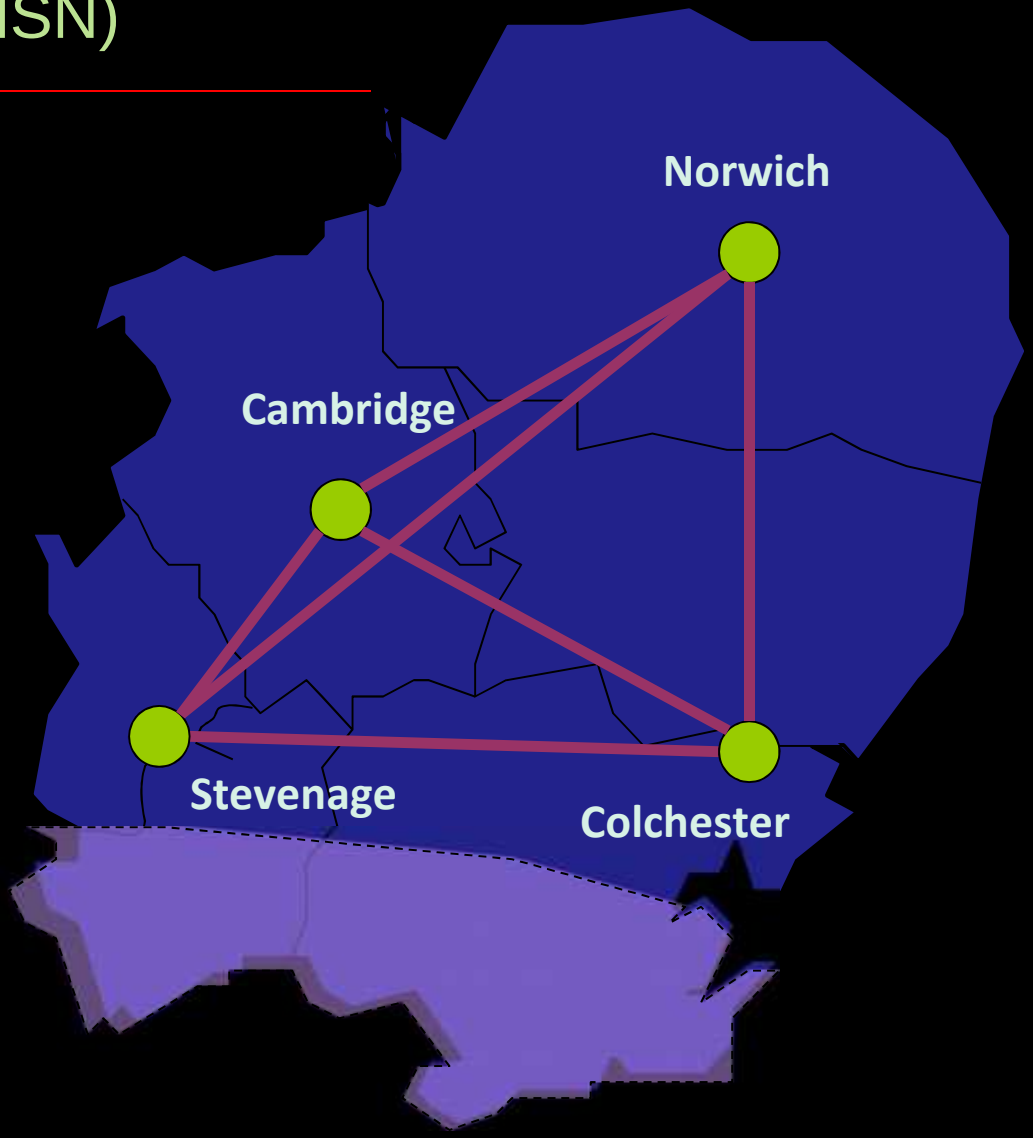


2 – 3 fold variance between CCGs in Ambulance SH rates per 1000 with diabetes

2 – 3 fold variance in transfer rates to Acute Trusts

Eastern Academic Health Science Network (EAHSN)

- One of 15 AHSN in England
- £112M 5 years EAHSN
- Based on 4 University ‘nodes’
- Deliver transformational change in a population 4,5 M
- Reduce variance in outcomes
- Improving LTC outcomes
- Build workforce capacity



EAHSN Diabetes Clinical Study Group (CSG)

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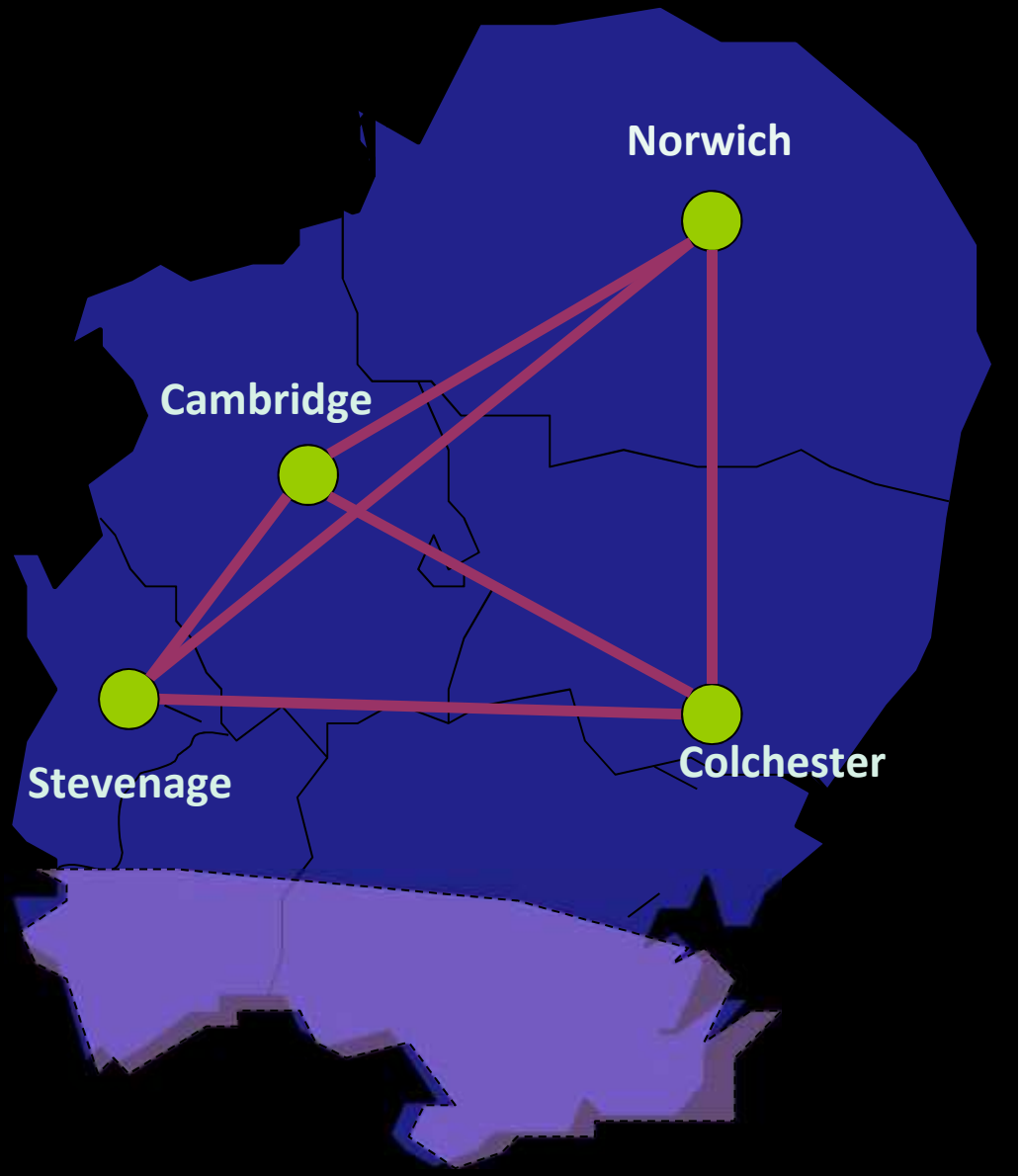


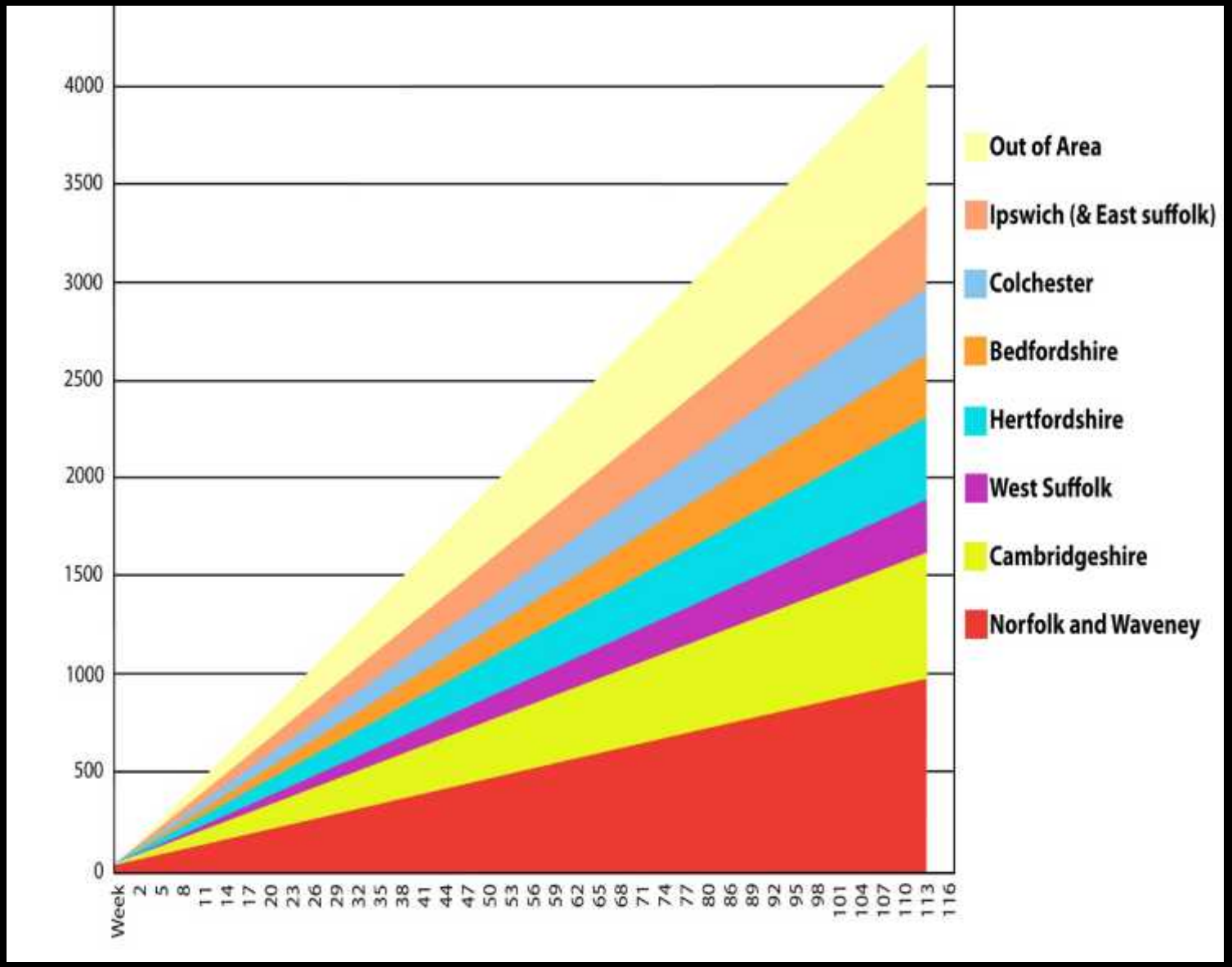
Diabetes CSG staff and projects

- **£722k over 2.5 years (2014 -)**
- **Cohort of diabetes educators and project managers to improve diabetes care across EAHSN area over 5 years.**
- **Band 7 Programme Manager**
- **10 x Band 6 Clinical Educators and project managers**
- **Severe acute hypoglycaemia and East of England Ambulance Trust**
- **Improving preconception advice in primary care in East of England**
  412 practices and **4316 women with diabetes via GP registers**

A new pathway for the management of severe acute hypoglycaemia (SH) attended by Ambulance crew (2014 – 2017)

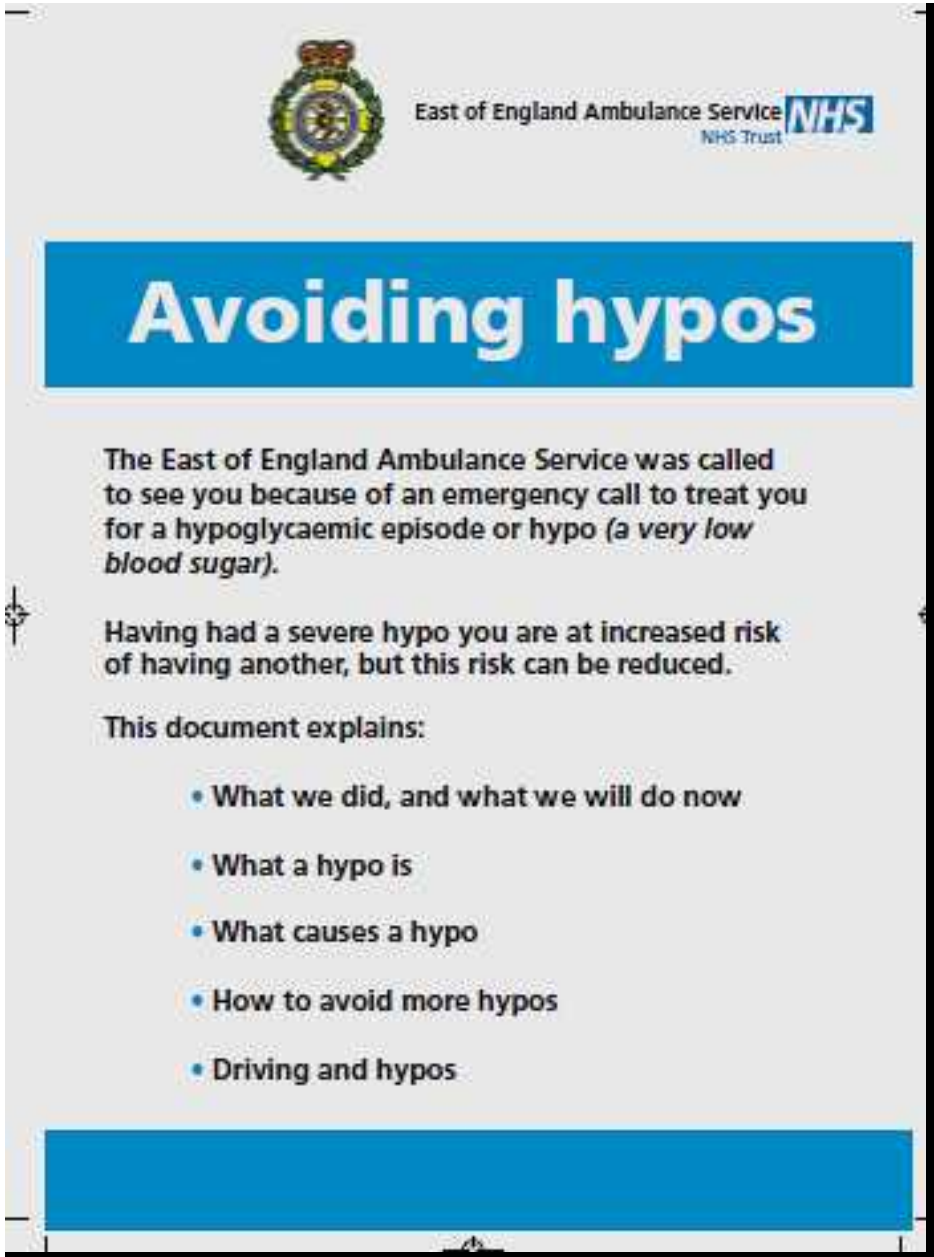
- A new Single Point of Contact (SPOC) model for Ambulance crew in East of England
- SH patient details called in to SPOC office , with cascade to local Hypo Prevention project managers and educators.
- Managed centrally by programme manager
- Local hypo prevention staff contact patient and normal team
- Adapted to local models for further education
- GP contact for all patients
- Single information document for all recovered ‘see and treat’ SH patients, delivered by AMBULANCE CREW
- Contact is an ‘opt out’ model – team is informed after 3 working days unless SPOC contacted by patient

Cumulative accrual of SH patients by area attended by Ambulance crew and taken through new pathway from Dec 2015



4,244 SH patient taken through pathway by March 2017.

Maximum 62 per week peak across East of England



East of England Ambulance Service NHS Trust

Avoiding hypos

The East of England Ambulance Service was called to see you because of an emergency call to treat you for a hypoglycaemic episode or hypo *(a very low blood sugar)*.

Having had a severe hypo you are at increased risk of having another, but this risk can be reduced.

This document explains:

- What we did, and what we will do now
- What a hypo is
- What causes a hypo
- How to avoid more hypos
- Driving and hypos

For all Ambulance attended patient

- Opt out model
- Causes of SH
- Risks for SH
- Preventing recurrence
- Risks for recurrence
- Alcohol
- Driving
- Educational links

HCP education on severe hypoglycaemia (2015 - 2017)

- **35 ambulance stations visited for crew events on SH and new pathway**
- **1,600 crew and paramedics (of 2,600) at educational meetings on SH**
- **58 % of crews referring within first year**
- **Regional community pharmacy (75,000 leaflets per annum to 742 community pharmacies).**
  - information on SH avoidance with all insulin and OHG prescriptions
  - LPC and Regional pharmacy leads
  - Advice on hypoglycaemia and diabetes medication.
  - Medicine Use Reviews and New Medicine Service consultations
- **230 teams accessed free CDEP programme on SH**

with thanks to Professor David Simmons and Sister Candice Ward

Clinical and treatment details for the first 2,000 episodes with severe acute hypoglycaemia attended by Ambulance crew and managed through the integrated single point of contact (SPOC) pathway.

n	2,000
m : f	1126 :
Age (yrs)	66 (3
> 70 years	*853 (4*
> 80 years	*449 (2*
Insulin treated	1696 (84
Oral hypoglycaemic treated	252 (12
Unconscious on attendance	662 (33
Similar episode in previous month	680 (34
Lives alone	569 (28
Under primary care management	1310 (65
Transferred to Acute Hospital	251 (12

Data as n (%) or as median (IQR)

Age band and treatment categories for 2,000 episodes of severe acute hypoglycaemia attended by Ambulance crew and managed through the integrated single point of contact (SPOC) pathway

	< 70 yrs	70 – 80 yrs	> 80 yrs
n	1116	435	449
Insulin	1018 (91.2%)	342 (78.6%)	336 (74.8%)
Oral hypoglycaemics	70 (6.3%)	85 (19.5%)	97 (21.6%)
Diet	27 (2.4%)	8 (1.8%)	13 (2.9%)
'No diabetes'	1(0.1%)	0 (0%)	3 (0.7%)

Severity and immediate treatment outcomes of severe hypoglycaemia for 2,000 episodes attended by Ambulance crew and (SPOC) pathway.

Glucose level on attendance (mmol/l)	2.4 (1.0)
Glucose level < 2.5mmol/l on attendance	1105 (55.3%)
Treated with i.m glucagon or i.v glucose	849 (42.5 %)
Treated with oral carbohydrate	956 (47.8 %)
Other treatment	195 (9.8 %)
Glucose level after treatment (mmol/l)	6.4 (2.7)
Glucose level > 4 mmol/l after treatment	1935 (96.8%)

Data as n (%) or as median (IQR)

Clinical characteristics by treatment category for 2,000 severe acute hypoglycaemia episodes attended by Ambulance crew and managed through (SPOC) pathway.

	OHG	Insulin
n	304	1696
Age (yrs)	76 (19.5)	63 (31) **
Unconscious on attendance	56 (18.4)	606 (35.7%) **
Similar SH in previous month	65 (21.4 %)	615 (36.3%)
Glucose level on attendance (mmol/l)	2.7 (1.0)	2.3 (1.0) **
Glucose level < 2.5mmol/l	115 (37.8 %)	990 (58.4) **
Treated with glucagon or iv glucose	84 (27.6%)	765 (45.1%) **
Transferred to Acute Hospital	54 (17.8 %)	197 (11.6%)

Data as n (%), or median (interquartile range) * p < 0.01 ** p < 0.0001

Clinical characteristics of those managed by Ambulance Crew alone at scene, or transferred to Acute Hospital, for 2,000 severe acute hypoglycaemia episodes.

	Not transferred	Trans
n	1749	251
Age (yrs)	65 (31)	69 (26) **
Unconscious on attendance	542 (31.0 %)	120 (47.8%)
Similar SH episode in previous month	593 (33.9)	87 (34.7%)
Lives alone	481 (27.5)	88 (35.1%)
Glucose level on attendance (mmol/l)	2.4 (1.1)	2.3 (1.0
Glucose level < 2.5mmol/l on attendance	966 (55.2)	139 (55.4 %
Treated with im glucagon or iv glucose	722 (41.3)	127 (50.1%)
Glucose level after treatment (mmol/l)	6.4 (2.7)	5.9 (3.2) ***
Glucose level > 4.0 mmol/l after treatment	1712 (97.9 %)	223 (8

Model is an opt out - patients have to actively decline further contact from staff within 3 days.

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48 /2000 (2.4%) opted out

No complaints from patients

Pathway is acceptable to patients

EDUCATIONAL CONTACT WITH FIRST 2000 EMERGENCY 999 CALLS

- 1,442 (72.1%) THEN HAD DIRECT FACE TO FACE OR TELEPHONE CONTACT EDUCATION ON SH MANAGEMENT AND AVOIDANCE, LARGELY DELIVERED BY THE DEDICATED TEAM OF EDUCATORS WORKING IN PRIMARY CARE.

  - MEDIAN TIME BETWEEN SPOC CONTACT IN THE AMBULANCE TRUST
    - AND THE EDUCATION TEAM BEING MADE AWARE WAS 1 (0 – 4) DAYS
    - TEAM BEING INFORMED AND FIRST CONTACT WAS 3 (0 – 6) DAYS

- 558 (27.9%) CALLERS HAD NO IMMEDIATE DIRECT CONTACT BY THE EDUCATION TEAM,
  - MISSED AN INITIAL EDUCATION APPOINTMENT : (111; 5.6%)
  - DID NOT RESPOND TO CONTACT : 238 (11.9%)
  - THE USUAL TEAM WERE MADE AWARE OF THE SH EPISODE AND AMBULANCE CONTACT, AND THE NEED FOR FURTHER CLINICAL INPUT.

STRUCTURED SURVEY OF SEVERE HYPOGLYCAEMIA PARTICIPANTS AT EDUCATION SESSIONS – WHY DO YOU THINK YOU HAD THIS SEVERE EPISODE ?

IN TOTAL, 1051 PATIENTS, GAVE ONE OR MORE REASONS (N = 1,771 TOTAL) FOR THE EMERGENCY AMBULANCE SH CONTACT, THE COMMONEST BEING :

- INSULIN DOSE ERROR IN CURRENT INSULIN USAGE (556; 31.4%)
- MISSED OR DELAYED MEALS (297 ; 16.8%)
- INTERCURRENT ILLNESS (199; 11.2%)
- HYPOGLYCAEMIA UNAWARENESS (189 ; 10.7%)
- TOO FEW CARBOHYDRATES (169 ; 9.5%).
- EXERCISE, EXCESS ALCOHOL, OR PROBLEMS WITH INJECTION TECHNIQUES

EACH WERE EACH REPORTED BY < 5% OF ALL PATIENTS AS CAUSES OF SH.

Repeat SH calls to Ambulance Trust during programme

Based in 1,806 'in area' calls from 1,418 individuals

- **1180 calls (65%) were from patients who made a single call**
- **626 calls (35%) were from patients who made one or more calls (max.10)**
- **388 calls (21.4%) were 'true' repeat calls**
- **78 /1,418 patients (5.1%) made three or more calls generating 298 (16.3%) of the 1806 calls**
- **92% repeat callers were insulin treated**

National Ambulance Service Medical Directors position statement on severe hypoglycaemia (July 2016) and patient consent

- All patients, of all ages, who have had an ambulance response to a hypoglycaemic episode or a seizure should automatically be referred for follow up……..

- The issue was discussed at the UK Council of Caldicott Guardians on 4th May 2016.

- They recommended that, due to issues relating to wider public interest, patients should always be referred with or without consent

Costs benefit and outcomes

- Analysis of potential impact on SH rates over time confounded by :
  - moving baseline in diabetes numbers, therapeutics, glycaemic targets
  - lack of comparator or control group at patient, practice or CCG level
  - variable transfer rates
  - decline in SH admission rates nationally

- Analysis of Ambulance Trust activity at a ‘case note’ level for 714 subjects who entered this programme

- All Ambulance call out data from the 6 months before and 6 months after our intervention.

- Before our contact (n = 365; 51.1%) had made one or more 999 additional hypoglycaemia calls, a total of 524 hypoglycaemia 999 calls.

- After contact this fell to 226 calls (57% ; $p < 0.0001$) in following 6 months.

Tariff costs, invest to save and business modelling

- Upper tariff cost (2013/4) is
  £ 159 for an SH patient (see and treat)
  £ 314 for an SH patient taken to A/E and not admitted
  £ 60 per episode in indirect costs
  Khunti, K et al (2013). Primary Care Diabetes, 7, 159 - 65

- Total tariff and indirect cost incurred by this activity (n = 4,000)
  £ 719,444 total
  £ 251,804 patients who made repeat calls.

- Reduction *just* in repeat calls by 20% (excluding admissions) would be £ 50,360 per 4000 SH attended patients

- Strong invest to save arguments

Sustainability planning 2017 -

- Strong invest to save argument for recurring costs of programme (21 CCGs & Acute Trusts)

- Important areas from commissioning perspective (admissions avoidance / frail elderly / ED pressures/ medicine management)

- Important caseload – 50,000 999 calls every 5 years for SH in East England

- Major commissioning campaign for sustainability costs (2016/2017)

- All CCG and Acute Trust CEO and Chairs
- SCN reinforcement
- NHS England East
- Clinical senate
- Direct contact with local CCG commissioning leadership
- Ambulance Trust

Current model in EAHSN area /East of England Ambulance Trust (March 2017 -

Summary of outcomes for EAHSN SH project

- Acceptable to patients and nearly all accessed dedicated SH education after episode.
- Patients are elderly, insulin treated , under primary care alone
- About one - third lived alone, were unconscious when attended, required glucagon or iv glucose, or had had an SH episode recently .
- SH events more likely to be clinically ‘severe’ in subjects on insulin.
- No confidentiality issues about further referral (Caldicott 2016)
- Opt out model may offer lowest risk of patient dissatisfaction with onward referral
- Commissioning issues and costs – STP and CCG engagement
- Model is simple and easily translatable with strong cost benefit arguments at any level of resource.
- Many areas in UK do not operate this model and could (should) with local Ambulance Trust at minimal cost.

Thanks to EAHSN Diabetes Clinical Study Group (CSG) and hypoglycaemia prevention team

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