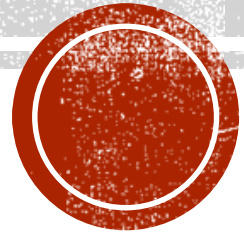
YOUNG ADULT DIABETES

Siobhan Pender
Dulmini Kariyawasam



DIAGNOSIS AND MANAGEMENT

- Case 1 & 2

- How would you assess this patient
- What investigations would you do
- What is the Diagnosis
- How would you manage and communicate

- Seen in A&E on the 24/10 /24

- 16 year old Male of African origin
- PC – polyuria and polydipsia since September
- Weakness and weight loss
- Mother has type 1 DM

- Height 1.65
- Weight 60Kg(Baseline weight had been 65Kg)

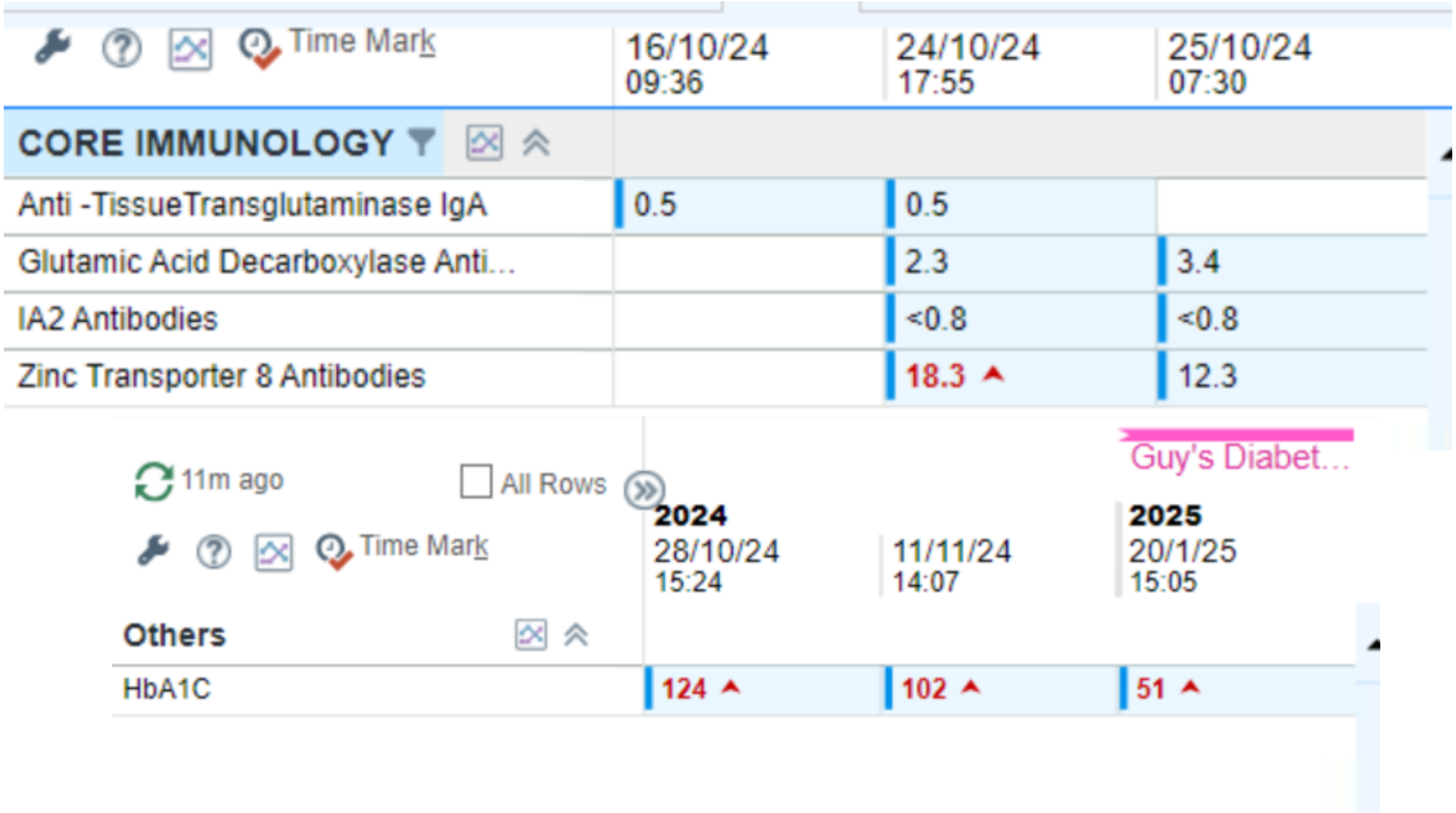
- Student studying Law -1st year 6th form

ADMISSION BLOODS

POCT BLOOD GAS ...			
pH Temp Corrected, Venous	7.36	7.35	7.42
PCO2 Temp. Corrected, Venous	5.4	5.4	4.2
pO2 Temp. Corrected, Venous	6.9	7.2	9.4
HCO3 act, Venous	23.2	22.6	20.1 ↓
HCO3 std, Venous	22.6		
BE(B), Venous	-2.2 ↓	-2.9 ↓	-3.3 ↓
Na+, Venous	129 ↓	131 ↓	135 ↓
K+, Venous	3.3 ↓	3.2 ↓	3.9
Cl-, Venous	95 ↓	96 ↓	102
Ca++, Venous	1.26	1.26	1.32
Glucose, Venous	28.4 ↑	17.3 ↑	11.4 ↑
Lactate, Venous	1.3	1.0	1.2
tHb, Venous	154.0	152.0	148.0
HCT(C), Venous	46	46	44
Hct, Venous	47	47	43

Blood Ketone 3.6

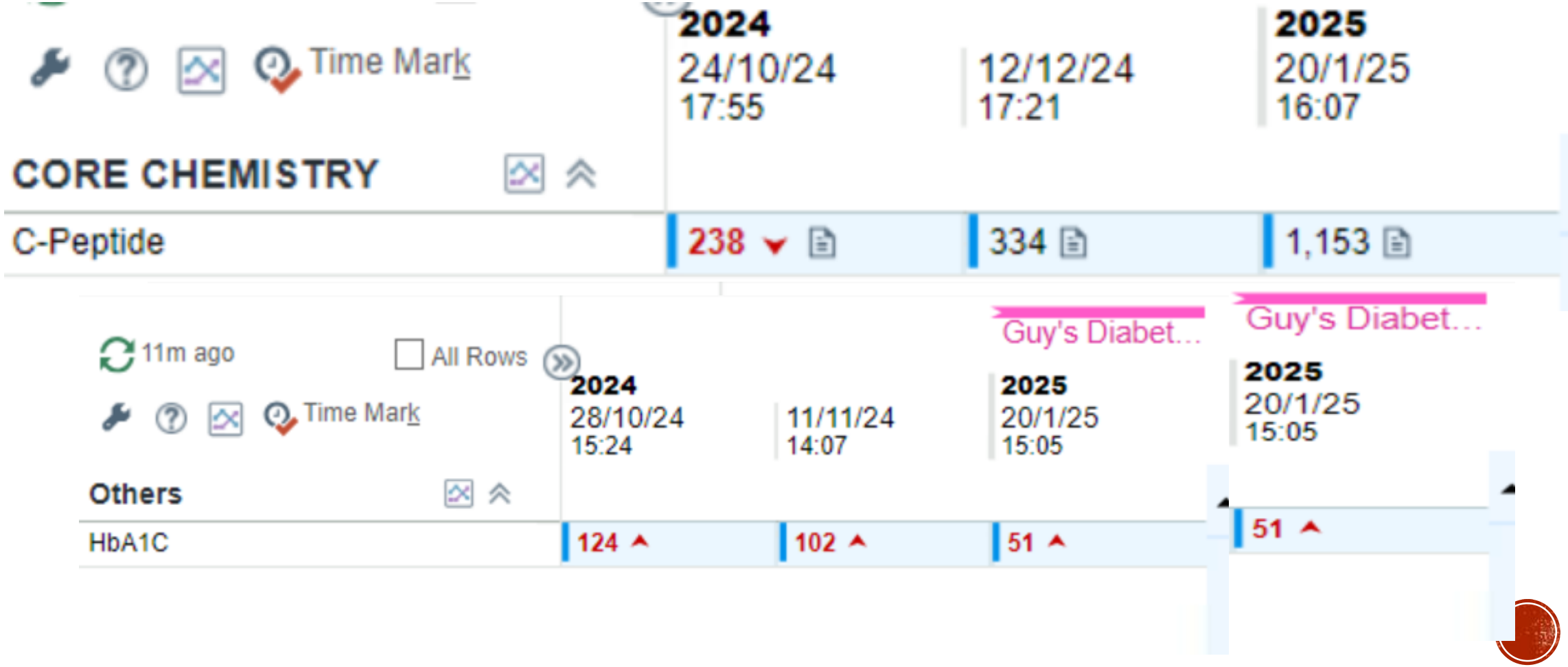
IMMUNOLOGY



Time Mark	16/10/24 09:36	24/10/24 17:55	25/10/24 07:30
CORE IMMUNOLOGY			
Anti -TissueTransglutaminase IgA	0.5	0.5	
Glutamic Acid Decarboxylase Anti...		2.3	3.4
IA2 Antibodies		<0.8	<0.8
Zinc Transporter 8 Antibodies		18.3 ▲	12.3

11m ago All Rows Guy's Diabet...

Time Mark	2024 28/10/24 15:24	11/11/24 14:07	2025 20/1/25 15:05
Others			
HbA1C	124 ▲	102 ▲	51 ▲


Time Mark
2024
24/10/24
17:55
12/12/24
17:21
2025
20/1/25
16:07
CORE CHEMISTRY
C-Peptide
238
334
1,153
11m ago
All Rows
Time Mark
Guy's Diabet...
Guy's Diabet...
2024
28/10/24
15:24
11/11/24
14:07
2025
20/1/25
15:05
2025
20/1/25
15:05
Others
HbA1C
124
102
51
51

CASE STUDY 2

- 23 year Afro-Caribean Man -University Student and also works at a warehouse
- 2 weeks history of polyuria and polydipsea
- Few weeks history of D&V
- Mother has Diabetes – on insulin (not sure when she was diagnosed
- Maternal uncles have diabetes

POCT BLOOD GAS (V...						
pH Temp Corrected, Venous	7.31					7.39
PCO2 Temp. Corrected, Venous	4.7					3.3
pO2 Temp. Corrected, Venous	6.6					11.4
HCO3 act, Venous	17.6 ↓					15.1 ↓
HCO3 std, Venous	18.1 ↓					
BE(B), Venous	-7.7 ↓					-8.0 ↓
Na+, Venous	128 ↓					142
K+, Venous	5.3 ↑					5.0
Cl-, Venous	93 ↓					109 ↑
Ca++, Venous	1.29					1.52 ↑
Glucose, Venous	29.4 ↑					14.4 ↑
Lactate, Venous	2.4 ↑					1.2
tHb, Venous	177.0 ↑					138.0
HCT(C), Venous	53					41
Hct, Venous	60 ↑					42

INTERFACED POINT ...									
POCT Glucose Meter				19.6				18.7	
POCT Ketone Meter		4.6			4.2		2.8 ↑		3.2

- Patient's weight 113 kg
- Height 1.8

- Initially managed as DKA
- Needing 10Units of insulin/Hour
- Osmolality – 280

C-PEPTIDE – NOT DONE

CORE IMMUNOLOGY	
Anti -TissueTransglutaminase IgA	19/12/24 0.4
Glutamic Acid Decarboxylase Anti...	19/12/24 1.0
IA2 Antibodies	19/12/24 <0.8
Zinc Transporter 8 Antibodies	19/12/24 <1.0

Patient –DNA the clinic appointments

MANAGEMENT

How do you communicate the Diagnosis to patient?

How do you manage this patient ?

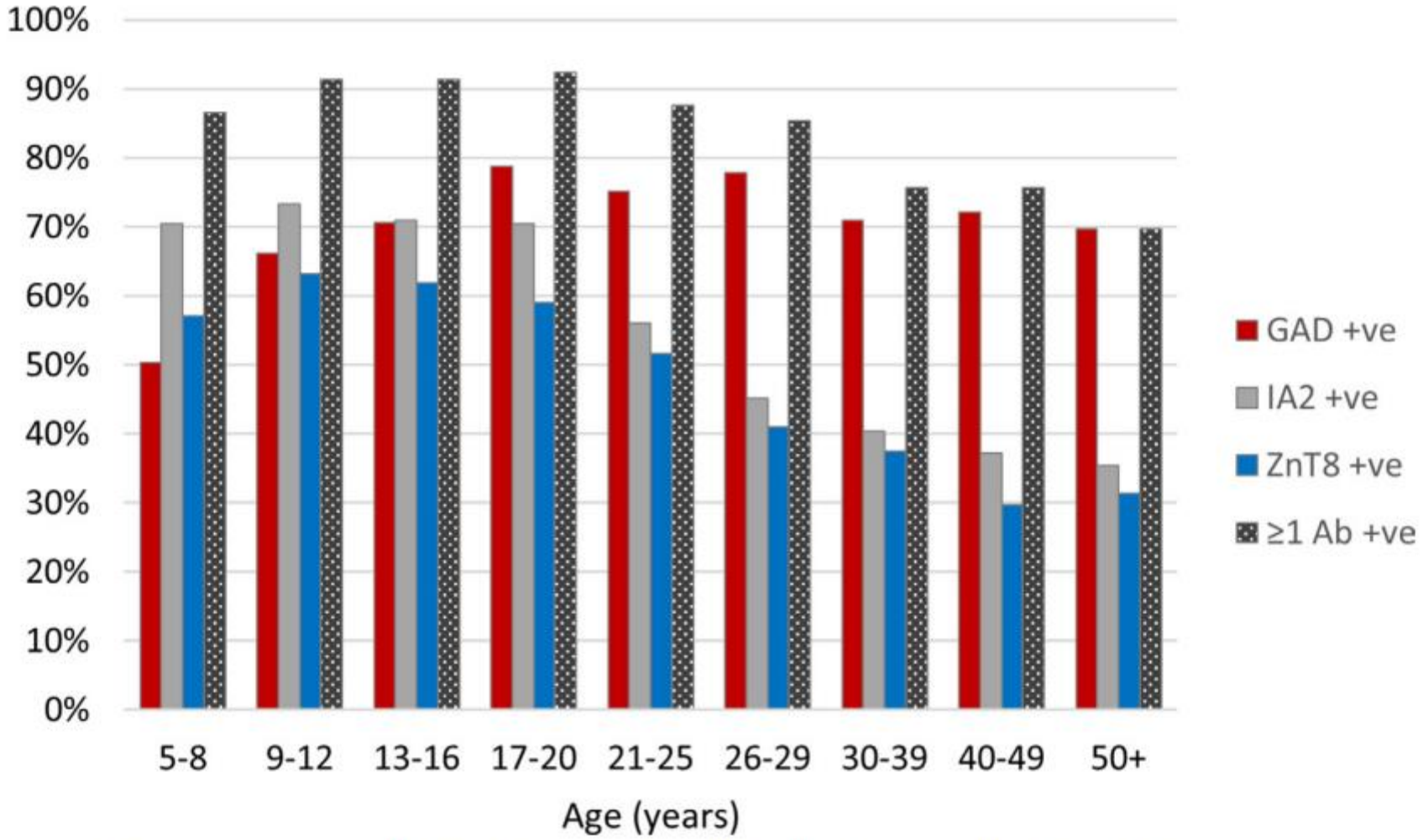


Figure 2 The percentage of participants exhibiting islet autoantibodies (any and individual) in relation to age at diagnosis. GAD, glutamate decarboxylase; IA2, islet antigen-2; ZnT8, zinc transporter 8.

CHARACTERISTICS OF ANTIBODY POSITIVE AND NEGATIVE PATIENTS

Table 2 Characteristics of pancreatic autoantibody (Ab) positive and negative participants (n=1778 with known antibody status)

	Ab positive (n=1510)	Ab negative (n=268)	P values
Individual characteristics			
Age	20.1 (13.1–31.1)	31.4 (17.7–41.0)	0.0001
Male	56 (851)	72 (192)	<0.0001
Children	41 (614)	25 (66)	<0.0001
Body mass index			
Children (z score, n=545, 56)*	0.41 (–0.35 to 1.19)	0.47 (–0.48 to 0.97)	0.4
Adult (kg/m^2, n=825, 184)	23.9 (21.4–26.7)	25.5 (23.1–29.2)	0.0001
Overweight (n=1370, 240)	36 (490)	48 (114)	0.0005
White European ethnicity	86 (1413)	14 (232)	<0.0001
Other autoimmune disease (n=1495, 265)	8 (117)	4 (10)	0.01
Parent(s) with any diabetes (n=1493, 261)	16 (233)	28 (74)	<0.0001
Siblings with any diabetes (n=1374, 238)	9 (117)	8 (20)	0.9
Diabetes presentation			
Clinical presentation			
Ketoacidosis (n=1483, 260)	43 (639)	40 (104)	0.3
Osmotic symptoms (n=1495, 267)	97 (1444)	94 (250)	0.02
Weight loss (n=1480, 267)	87 (1285)	88 (235)	0.5
Fatigue (n=1490, 265)	86 (1282)	80 (213)	0.01
Symptom duration (weeks, n=1424, 246)**	6.8 (10.5)	10.4 (32.2)	0.004

Relationship between islet autoantibody status and the clinical characteristics of children and adults with incident type 1 diabetes in a UK cohort Vassiliki Bravis, Akaal Kaur,1 Helen C Walkey,1 Ian F Godsland,1 Shivani Misra,1 Polly J Bingley,2 Alistair J K Williams,2 David B Dunger,3 Colin M Dayan,4 Mark Peakman,5 Nick S Oliver,1 Desmond G Johnston,1 on behalf of the ADDRESS-2

RATES OF OBESITY

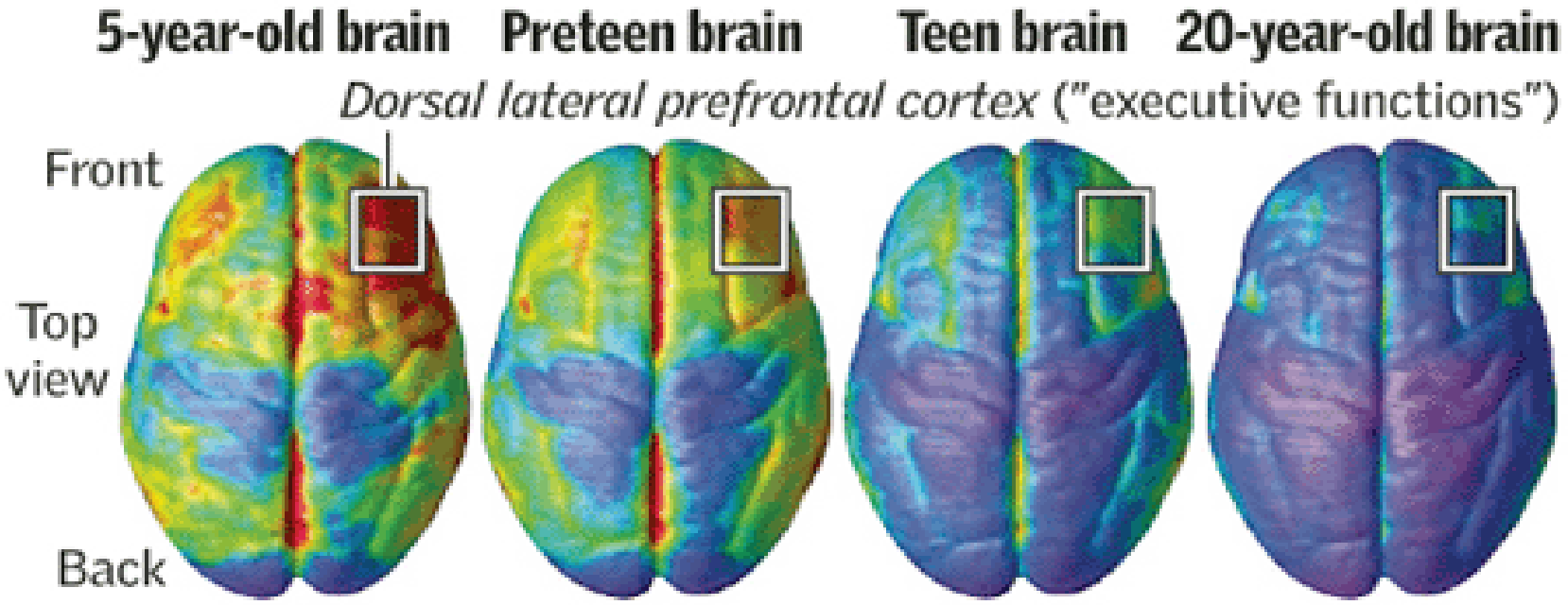
- 25.9 % adults aged 18years were living with Obesity
- 2022 Health survey 14% of 16-25 year olds were classified as obese

WHY IS THIS TOPIC IMPORTANT FOR HCP LOOKING AFTER CHILDREN

- Adolescent age group is different to adults and children.
  - Physiology – hormonal & Brain development
  - Psychological
  - Social
  - Educational

Judgment last to develop

The area of the brain that controls "executive functions" — including weighing long-term consequences and controlling impulses — is among the last to fully mature. Brain development from childhood to adulthood:



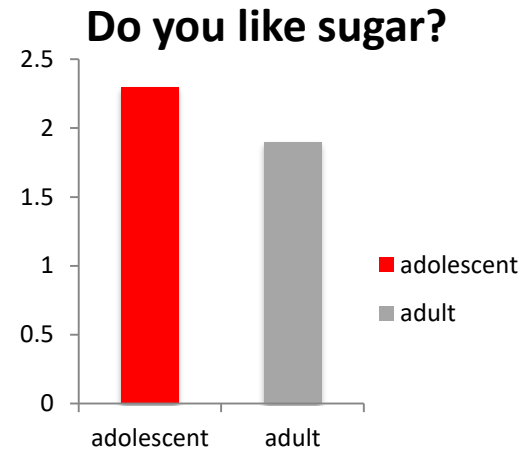
Red/yellow: Parts of brain less fully mature

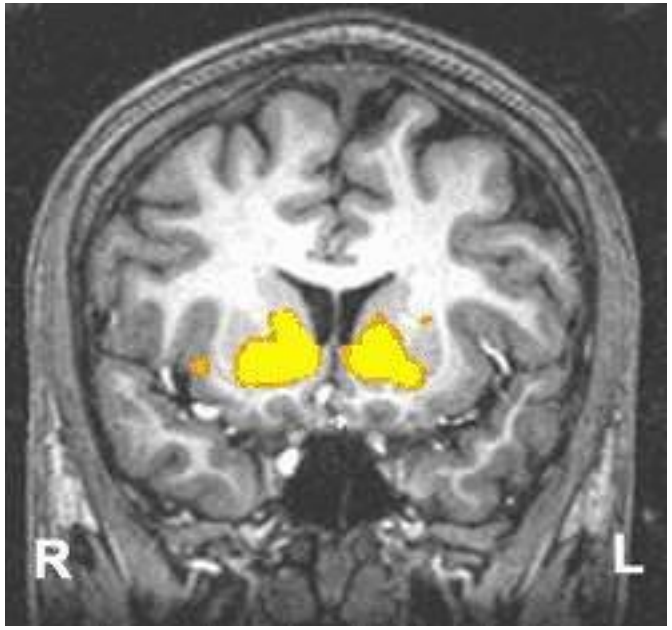
Blue/purple: Parts of brain more fully matured

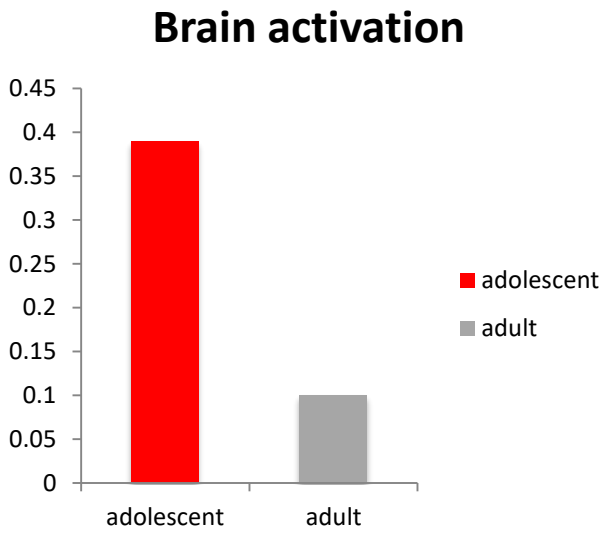
Sources: National Institute of Mental Health; Paul Thompson, Ph.D., UCLA Laboratory of Neuro Imaging

Thomas McKay | The Denver Post

REWARD PROCESSING

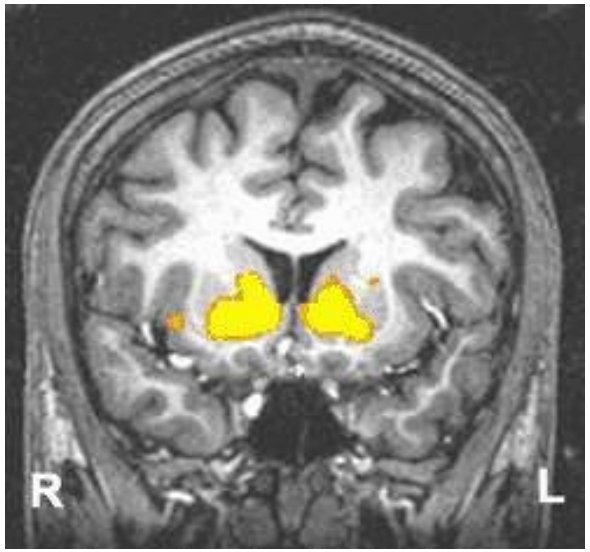




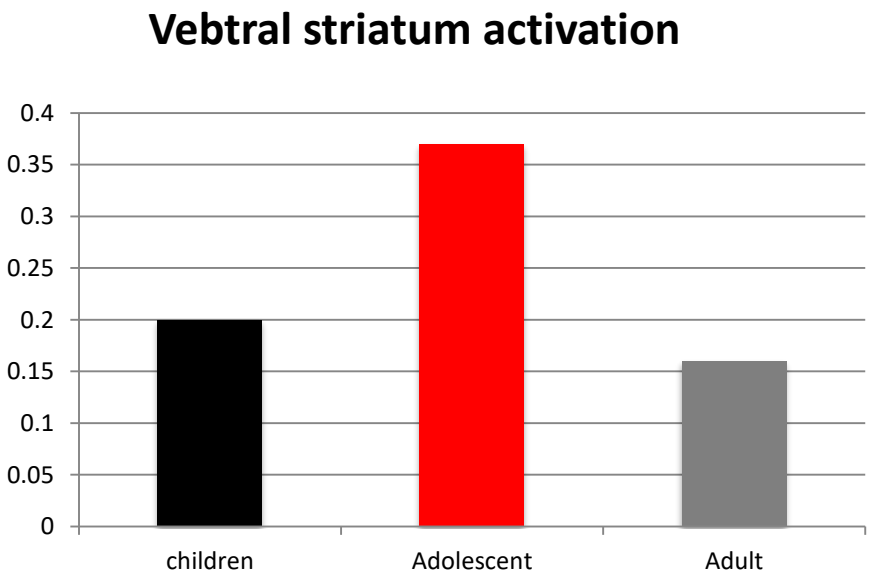


Galvin et al :2016

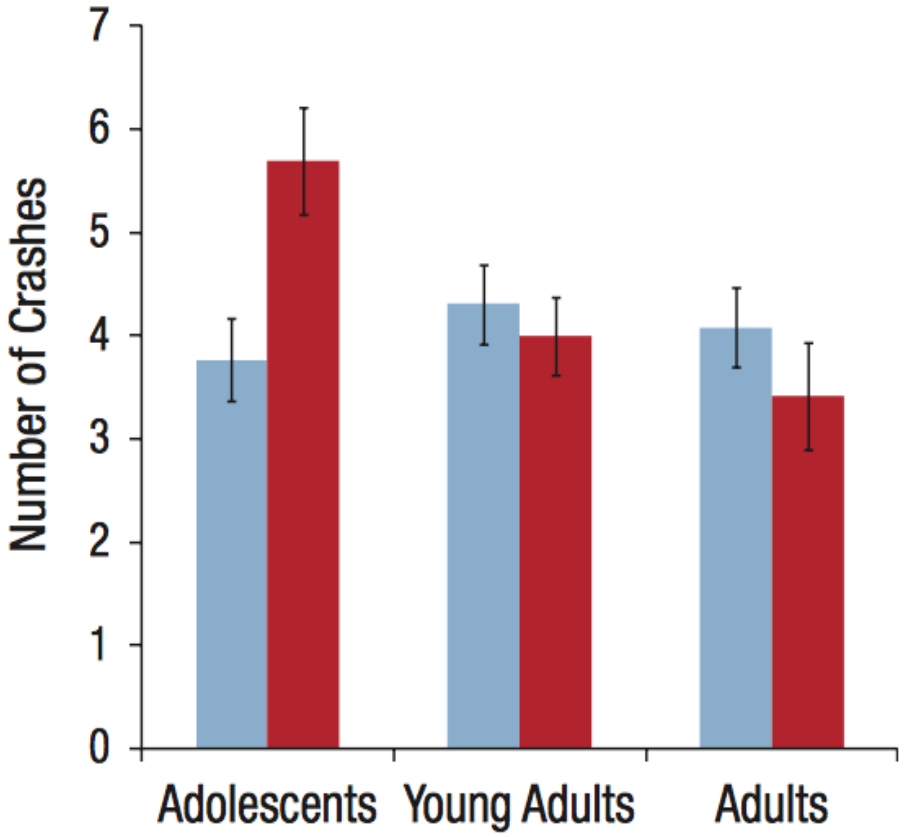
Reward Processing

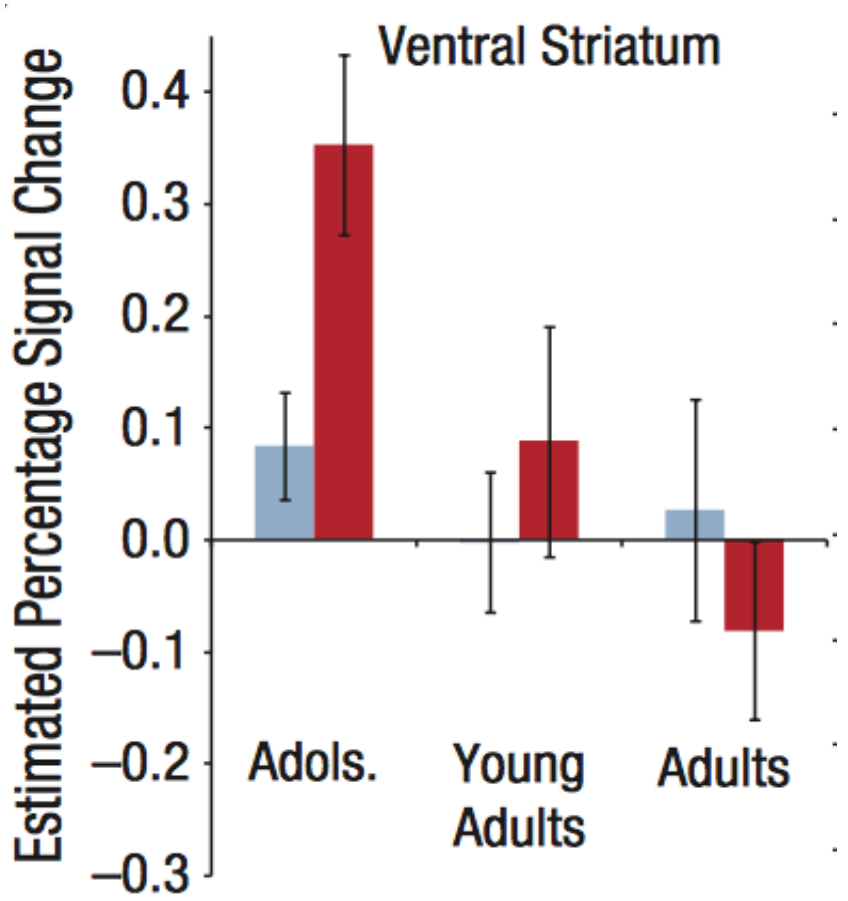


Galvin et atl 2016



PEER INFLUENCE



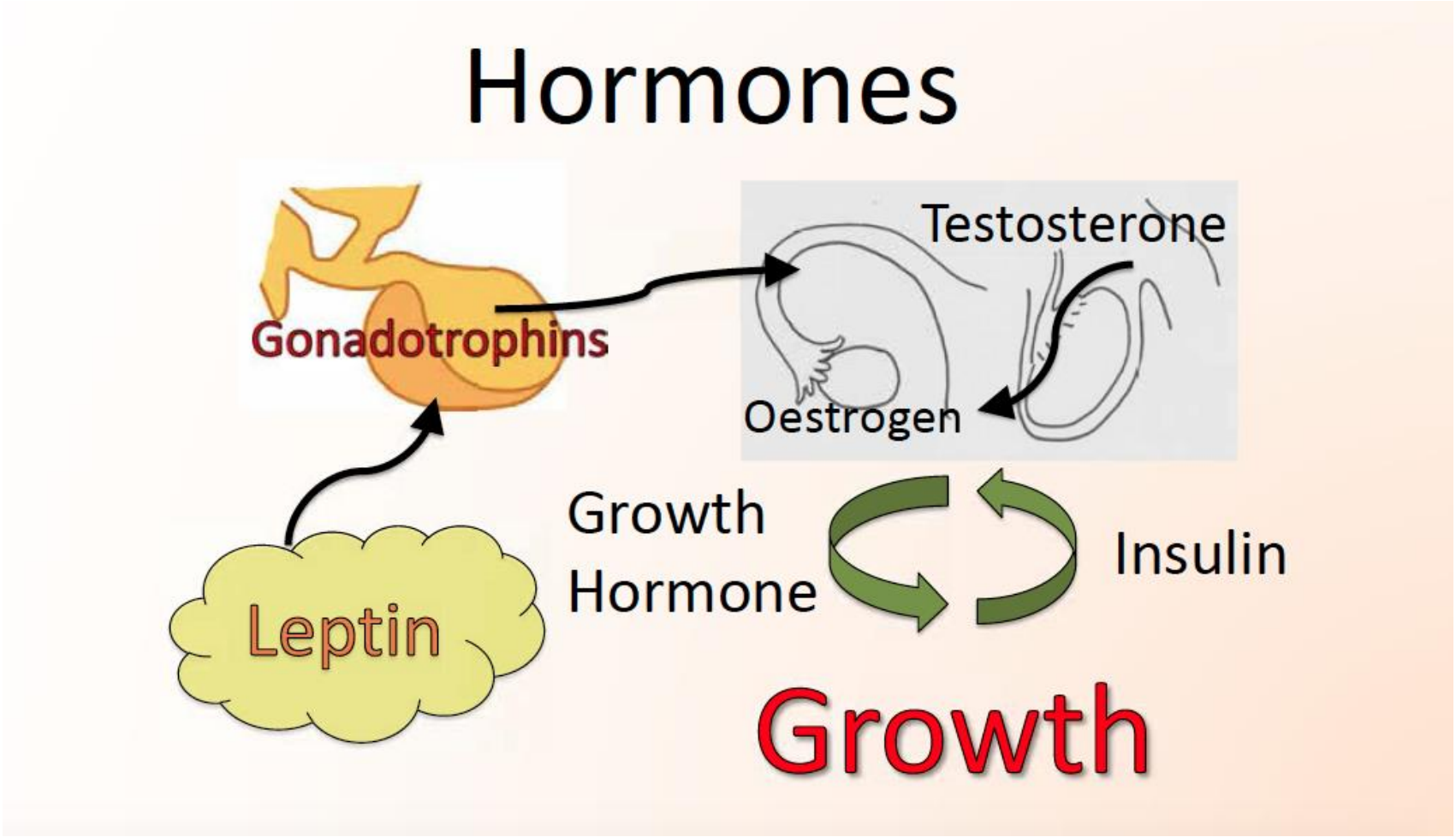


Steinburg et al 2012

NEURODEVELOPMENTAL SEQUAELAE:

- Adolescents may be more susceptible to peer pressure than other age groups
- Limbic system development associated with ‘hot cognitions’- taking risks and experimentation
- Young people’s decision-making is different than that of adults-in the present , peer & context influence more important
- This is an adaptive behavior – to develop independence from primary care giver

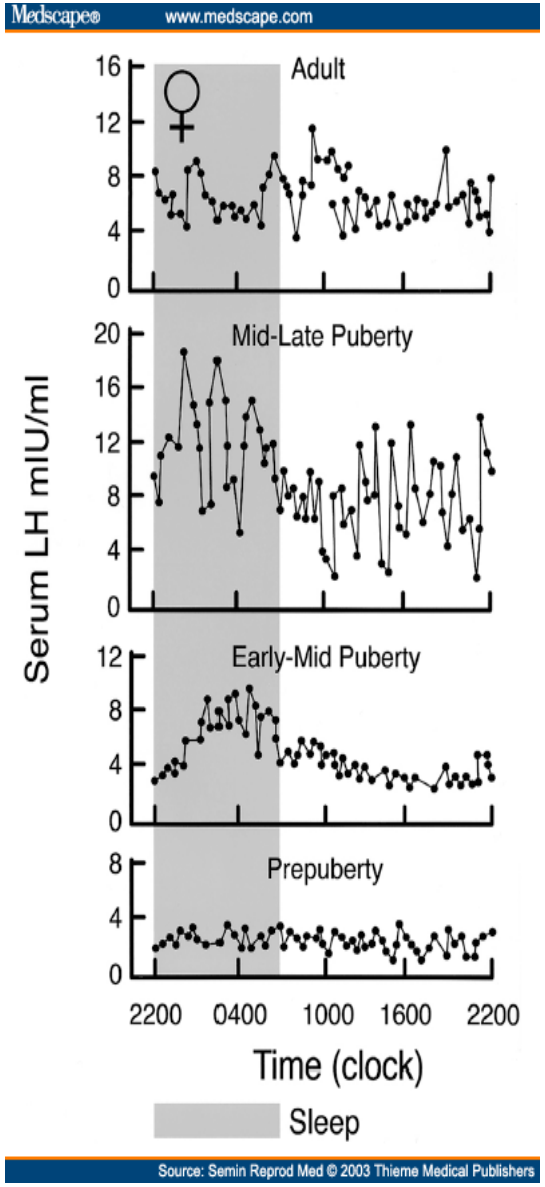
Hormones


Gonadotrophins
Testosterone
Oestrogen
Leptin
Growth
Hormone
Insulin
Growth

EFFECT OF PUBERTY ON DIABETES.

- Peripheral insulin resistance increases markedly during puberty.(Amiel JCEM 1991)
- Fasting insulin concentration in a non-diabetic subject double or treble during puberty.
- Attributed to
  - Increased fat oxidation.
  - Rising serum IGF-1 levels.
  - Increased GH secretion. –Prone to Ketosis.

- Hormonal pulses occur at night.
- GH-Baseline, amplitude,
  frequency all increase at night time.
- Insulin resistance peak at night.
  (8-9am)
- High blood sugar levels in the morning.



RISK OF COMPLICATIONS

- Changes in GH/IGF-1 axis – complications.
- High IGF-1 levels directly related to development of
  - Retinopathy.
  - Nephropathy.
- Children developing diabetes before the age of 15 yrs have worse retinopathy, nephropathy and neuropathy.

EFFECT OF DIABETES ON GROWTH.

- Diabetes affect timing and duration of growth spurt
- Poor glycaemic control associated with low IGF-1 levels

- There is a clear link to shorter final height to high HbA1c(Donahue 2003)

Youth Empowerment Skills

EFFECT OF DIABETES ON PUBERTY

- Poor metabolic control can lead to hypo-gonadotrophic hypogonadism.
- Always ask for pubertal development-some may need pubertal induction

Youth Empowerment Skills

- Puberty does not cause hepatic insulin resistance
- Large doses of insulin is needed to overcome the peripheral insulin resistance.
- Hyperinsulineamia switches off hepatic glucose production
- Increase risk of postprandial hypoglycaemia- overnight

HIGH DOSES OF INSULIN IN ADOLESCENT IS –NOT ALWAYS BECAUSE THEY ARE NON COMPLIANT!

- Child with Type 1 diabetes will need 0.25- 0.5Units/Kg/Day insulin
- Pre-pubertal children - 0.75Units/Kg/day
- Adolescents **- 1.0 -1.5Units/Kg/day.**
- Peak insulin requirement during Tanner stage 3-4

- *The time it is most difficult to have diabetes is the time diabetes is most difficult to control.*

MEETING THE YOUNG PERSON AND THEIR FAMILY FOR THE FIRST TIME

Building a rapport from the outset of the consultation.

The way in which you approach the young person may set the tone for the rest of the consultation

SMILE

Ask the young person to introduce the rest of the family

Begin by seeing the young person on their own and then bring in the family.

Seeing young people on their own is that increases the chance that we can understand their perspective, concerns and agenda.

In some circumstances it may be appropriate to see the young person with their parents/carers first and then to see the young person alone (for example when the young person has had a seizure or collapse and third party witness account is required.

REMEMBER THE ROLE OF THE CARE-GIVER

- Managing the transition from child to adult is a challenge and having Diabetes makes the challenge more interesting.
- Changing role and relationship from parent child to adult – this is a challenge.
- What parents/care givers do in this situation can help or hinder this metamorphosis.
- The best solution is for parents and professionals to work together to provide a backdrop of support.

DOLFIN

DIABETES ORIENTED LEARNING FAMILY INTERVENTION (2010)

This innovation is a training programme for carers of individuals with diabetes. It is aimed primarily at carers of children and adolescents with diabetes.

There is a substantial body of evidence of the stress that a long-term condition places upon carers and families and of the vital importance of family dynamics and the role of the carer in the outcomes of those with diabetes.

1). Educate carers in the basics of diabetes care

2). to provide training in strategies to minimise conflict and distress in those with type 1 diabetes and those caring for them.

Based on techniques developed in the management of families with an individual with an eating disorder.

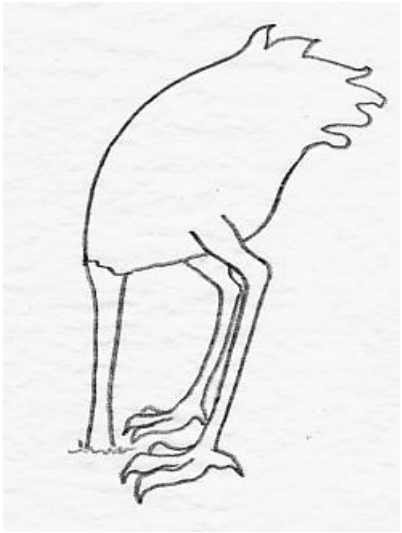
Professor Khalida Ismail Psychiatry King's College London Professor Janet Treasure Eating Disorders King's College London

THE USE OF METAPHORS TO UNDERSTAND HOW THE MAIN CARERS MANAGE THE EMOTIONS OF LIVING WITH THEIR YOUNG PERSONS DIABETES

PARENTAL RESPONSE METAPHORS USED IN DOLFIN

Jelly Fish

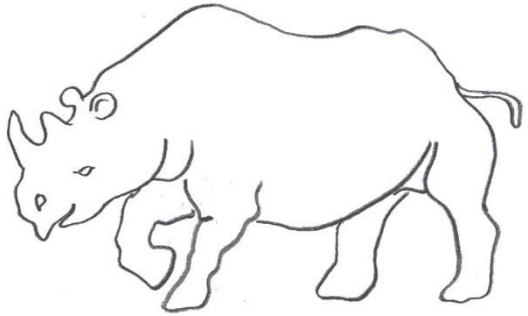
Emotional Response transparent
Overtly distressed, depressed, anxious, irritable & angry



Ostrich

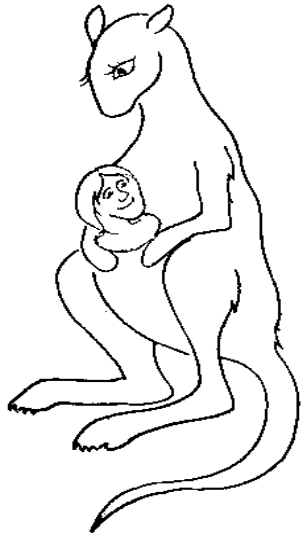
Avoiding seeing, thinking & dealing With problem

PARENTAL RESPONSE METAPHORS



Rhinoceros

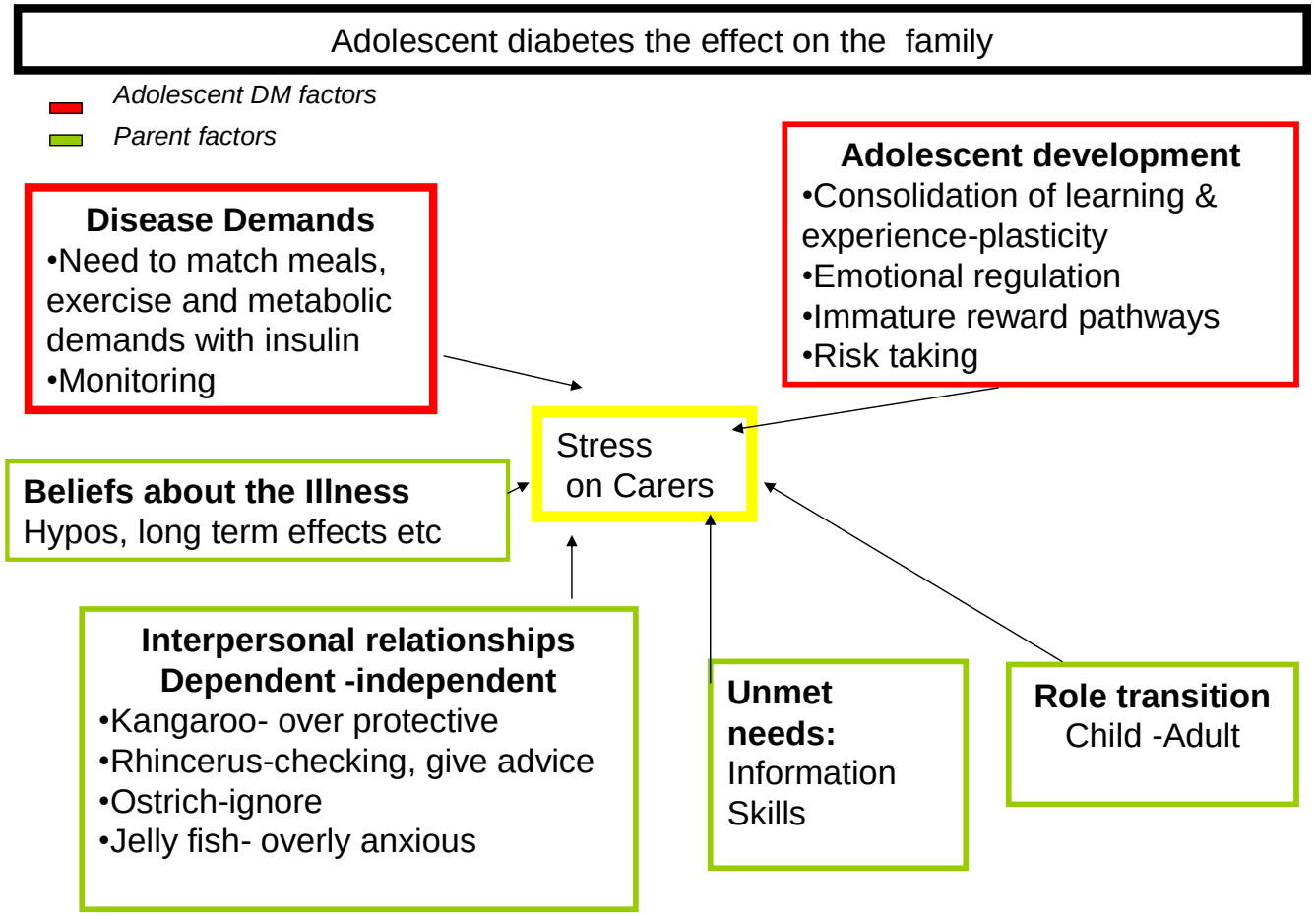
Too responsible for taking control of Change. Persuading with logic, argument & protracted debate.



Kangaroo

Over protective, overtly sympathetic, Infantilising offspring by taking on all responsibility

ADOLESCENTS DIABETES AND THE EFFECT ON THE FAMILY – THE DOLFIN APPROACH



THE VICIOUS CIRCLE OF BEING "IN" SAD & MAD

It is all so worrying
What is going to happen unless
the Diabetes comes under better control
He will go blind

Unhelpful behaviours
Burst into tears
Unable to sleep
Cut self off from people
Shout angry

Create or worsen Problems
Person with diabetes feels bad & irritated
Avoids contact & letting parents know what is really happening

Worsen how they feel

THE VICIOUS CIRCLE OF TRYING TOO HARD TO SUPPORT

Nags about what should eat & makes special effort to adjust to Diabetes
Takes over control of insulin

Unhelpful behaviours
Become "overly"/unhelpfully supportive
Don't allow any space/ personal responsibility

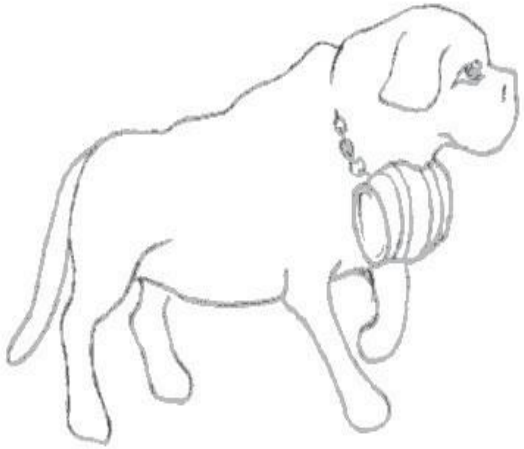
Create or worsen Problems
Does not allow individual to tackle challenges
Gives message that they are incompetent
Suffocating& exhausting
Over-involvement squeezes other things/life out
Focuses unhelpfully on Diabetes only.

Worsen how they feel

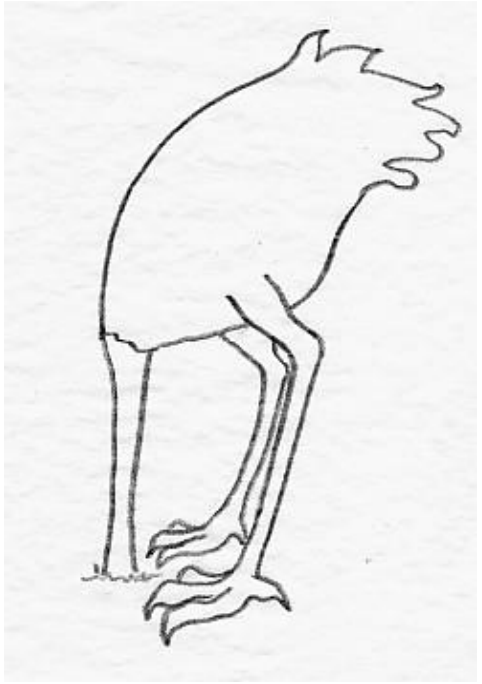
The Correct Balance of Emotion

Too much emotion

Warmth and Calmness



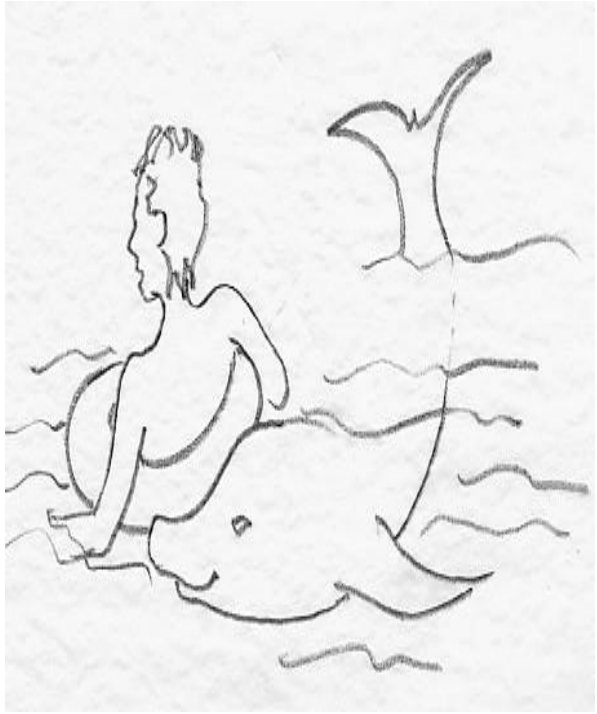
Too little emotion



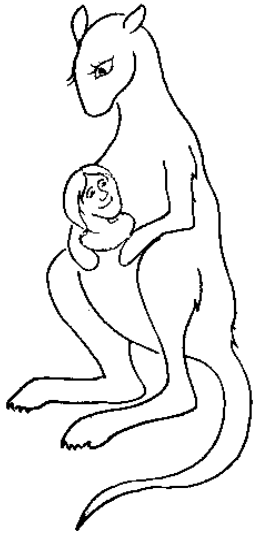
BALANCE OF WARMTH & DIRECTION

Too much Control & direction

Just enough Subtle direction



Too much sympathy & micro-management



COMMUNICATION SKILLS TO EXHIBIT TO THE YOUNG PERSON AND THEIR PARENT

- Genuine support, kindness and respect can make a difference
- Be patient it is difficult to change
- Listen without judgment
- Find out what help is wanted
- Use emotional intelligence: calm warmth
- Don't be a rhinoceros- it is up to the person to change
- Don't be a kangaroo- it is up to the person with Diabetes to take control
- If you find yourself getting frequent negative feelings towards person with Diabetes- get support

FOUR LISTENING SKILLS: OARS

- Ask OPEN questions - not short-answer, yes/no, or rhetorical questions
- AFFIRM the person - comment positively on strengths, effort,intention
- REFLECT what the person says - "active listening“
- SUMMARIZE - draw together the persons own perspectives on change

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BE A BEE: LOOK FOR THE POSITIVE

DO NOT BE A FLY: DO NOT FOCUS ON THE NEGATIVE- CRITICISM AND HOSTILITY

ASSESSMENT OF A PATIENT TRANSITIONING TO THE YOUNG ADULT SERVICE

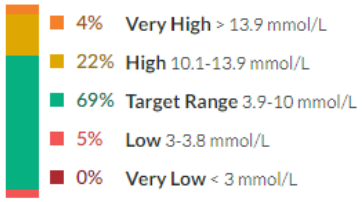
- Growth
- Pubertal status
- Complications
- Mental health issues
- Menstrual health/ pregnancy plans/contraception
- Alcohol /Drugs/ work/ driving
- Disordered eating
- Pump setting/insulin doses

BACKGROUND

- JA - 21 year old female
- Date of Diabetes Diagnosis 2017
- Omnipod Dash started in 2020
- Eating disorder diagnosed 2022
- ASD Diagnosis 2022
- Transferred care to GSTT YPC in November 2022
- Admitted to ED unit on 7th December 2022 – Discharged 21/08/2023
- Deteriorated at home from ED perspective.
- Re-admitted September 2023 to general ward
- Transferred to another IP eating disorders unit 18/12/2023

PRIOR TO SECOND INPATIENT ADMISSION

Glucose (CGM)



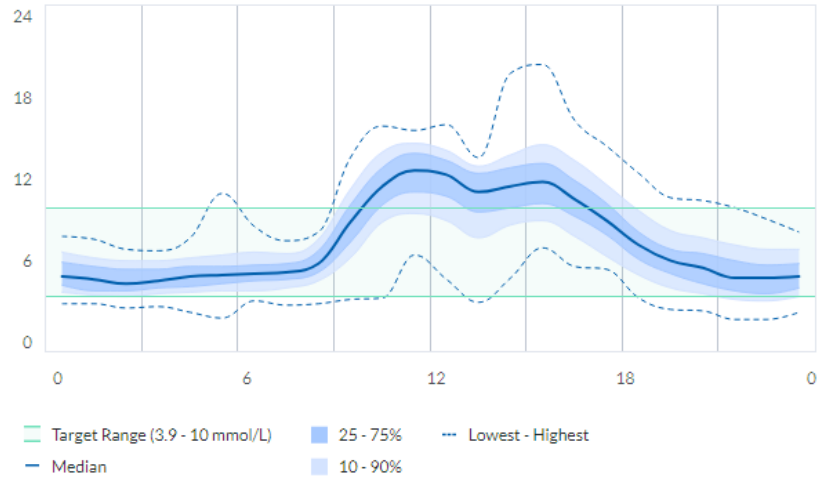
4%	**Very High** > 13.9 mmol/L
22%	**High** 10.1-13.9 mmol/L
69%	**Target Range** 3.9-10 mmol/L
5%	**Low** 3-3.8 mmol/L
0%	**Very Low** < 3 mmol/L

% Time CGM Active	**97.7% (30.3 days)**

GMI	6.6% (48.3 mmol/mol)
Average	7.6 mmol/L
SD	3.2 mmol/L
CV	42.2%
Median	6.4 mmol/L
Highest	20 mmol/L
Lowest	LO mmol/L

AGP

Glucose (mmol/L) What is AGP?



Insulin - Device

From Insulin Pump

91% 6.9 units Basal/Day

9% 0.7 units Bolus/Day

Insulin/day	7.6 units
Overrides (%)	0% (0 boluses)
# Bolus/Day	0.3

Diet

1 Jul - 31 Jul, 2023

22.5 g Carbs/Day	1 Entries/Day

Activity

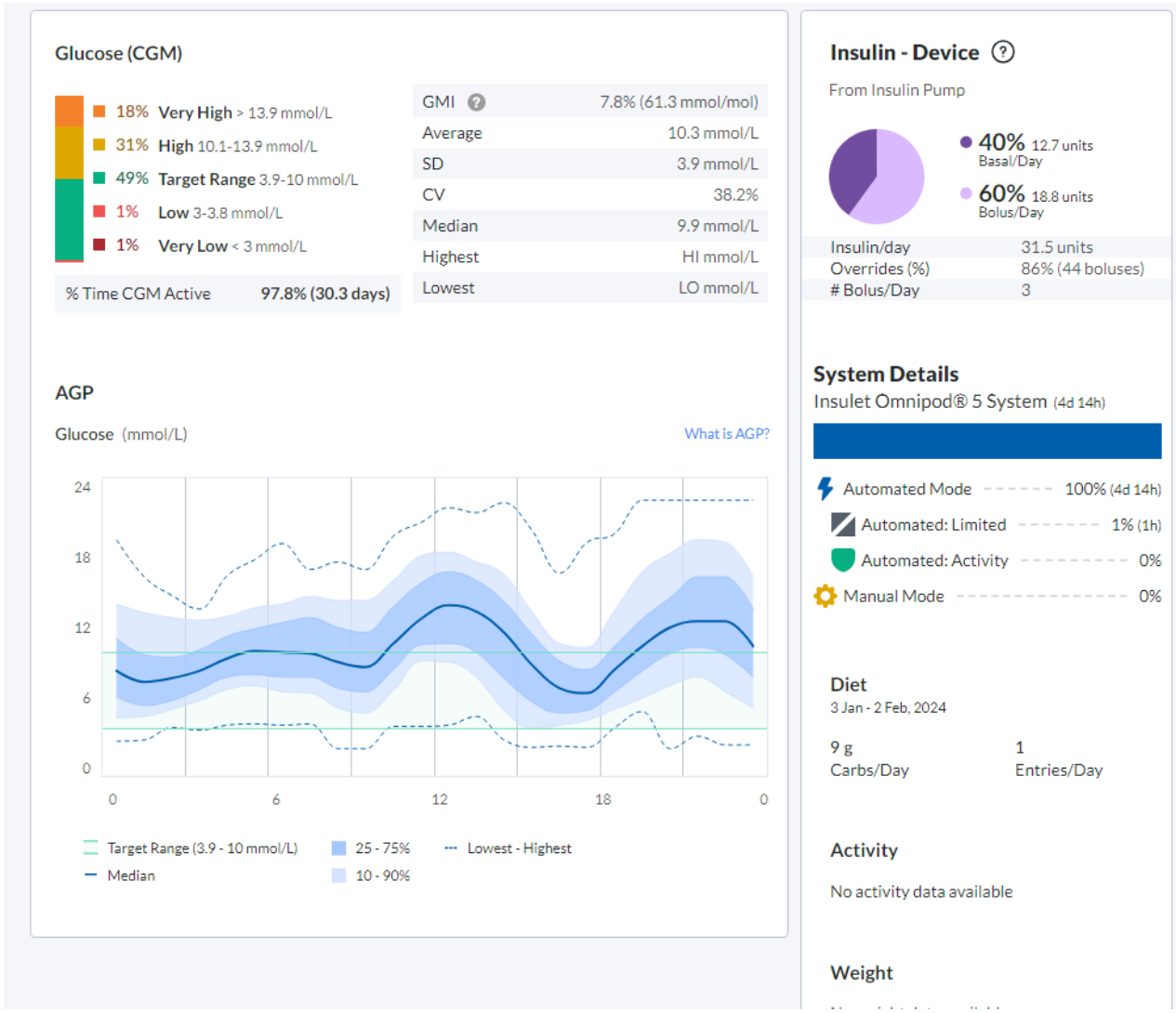
No activity data available

Weight

No weight data available

Blood pressure

No blood pressure data available



MANAGEMENT ON OMNIPOD DASH

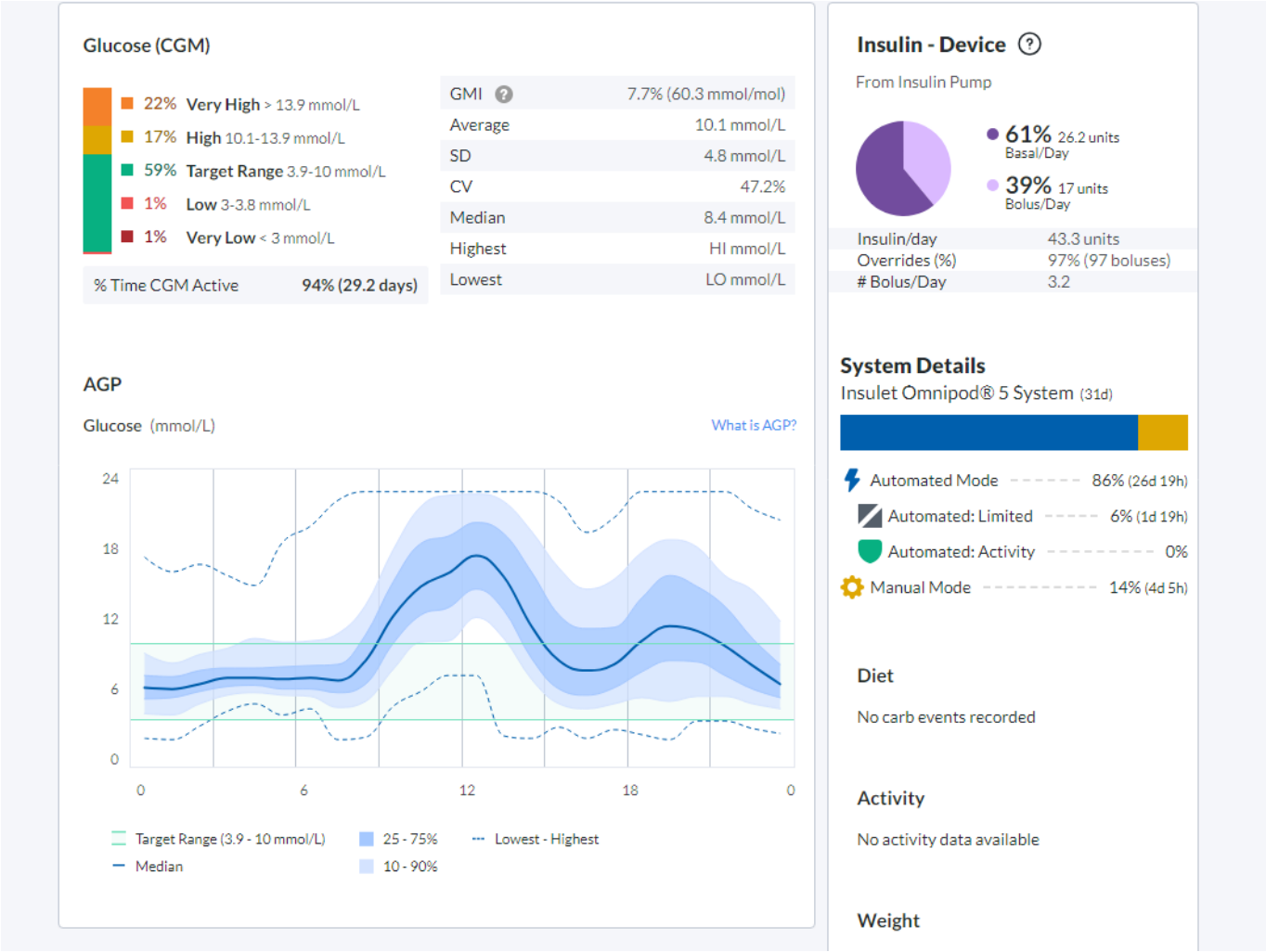
Bolus feeding on IP eating disorders unit

Bolus feeding via NG as preference due to JA finding feeds distressing

Limited knowledge of diabetes from ED staff

Fixed boluses on Omnipod Dash handset – administered by staff as JA found inputting carbs distressing

JA finds hyperglycaemia distressing



OMNIPOD 5 SWITCH

Omnipod 5 switch 29/01/24

Settings transferred unchanged from previous pump

Target glucose 6.1mmol/L

IAT 3 hours

Continue to use fixed bolus doses for feed

Increased time in range, reduced variability and same amount of hypoglycaemia

However problem of bolus feeding causing hyperglycaemia still remained

Discussed about reduction in glucose content of supplements with dietitian. Also complicated by multiple food intolerances

- Clinical working definition for severe T1DE: King's Health Partners definition of type 1 diabetes and disordered eating (T1DE)

- Core criteria
- 1. Type 1 diabetes
- 2. Pervasive fear of insulin as weight gaining
- 3. Omission of insulin to control weight Severity indicators HbA1c ≥ 10% for at least the past 12 months recurrent DKA defined as >1 admission for DKA in past 2 years
- Recurrent severe hypoglycaemia BMI ≤ 15 kg/m2

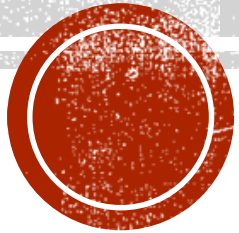
Ismail K., Diabetes-UK fact sheet Severe T1DE means that risk for biomedical complications is high and imminent

LEARNING POINTS

- Close working with ED MDT can help improve care and provide teaching for both teams involved
- JA found discussing carbohydrate management in clinic triggering and did not wish to know her weight. Presented challenges with Epic
- Not without challenges – expectations of realistic glucose targets different for diabetes team, ED team and JA
- Sadly JA re-admitted December 2024 to ED unit – not always smooth sailing

Aim of our service

- Engage and retain young adults with highest risk
- Improve outcomes for young adults
- Create with users an accessible, age appropriate service
- Develop a skilled resilient workforce



An international model of best practice Diabeter – Rotterdam, Netherlands

KEY features

- Environment
- Skilled workforce
- Clinician continuity
- Technology
- Cloud based
- computer software analyses
- Quality based outcomes

Youth Empowerment Skills

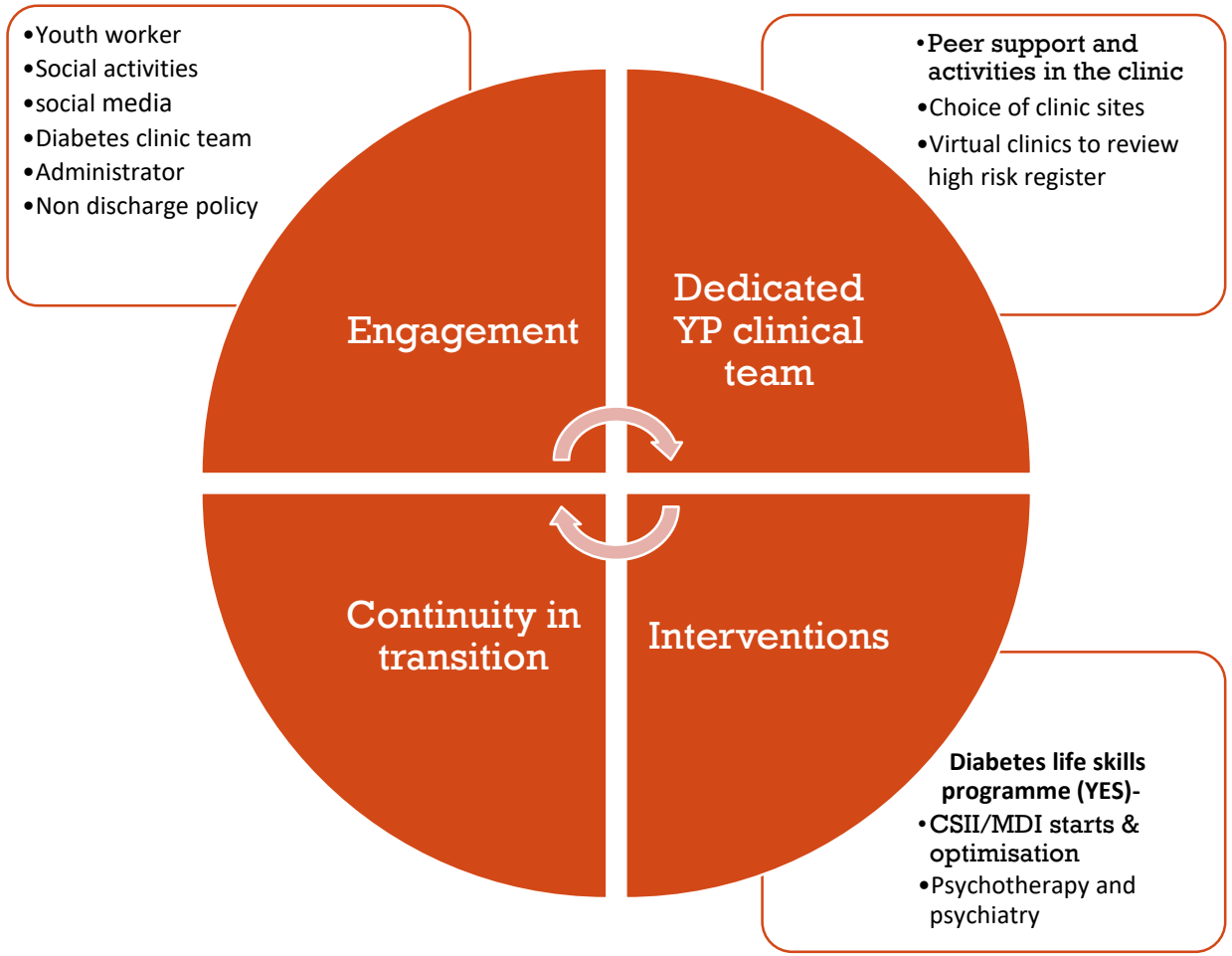
SERVICE PHILOSOPHY

A failure to do this =
may set patterns for long-term poor outcomes

THE YP MDT IS A FAMILY

The clinic is a secure base . A safe place for young people to be heard and experience care

Young Adult Model of care



Skill set

Clinician engagement skills

Communication skills
Motivational interviewing
CBT
Care planning
Debriefing
Mindfulness
A desire to work as part of an MDT with YP

Adolescent health

Biological, developmental and social context
Role and responsibilities of a caring adult

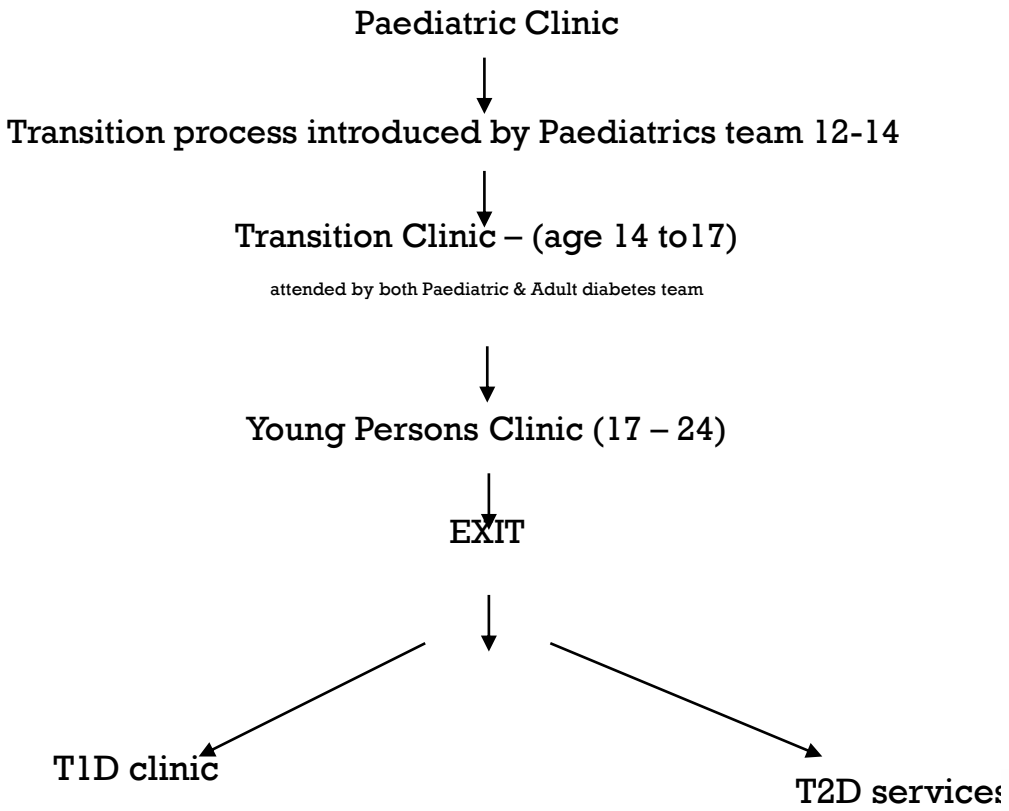
Clinical skills

Use of Insulin during adolescences
Eating behaviour
Risk taking behaviour

Technology

Virtual clinics/Skype
BG data and insulin pump interpretation
and sensors
Social media
(FB, Twitter,
Youtube)

DIABETES CARE PATHWAY FOR YOUNG PEOPLE



Youth Empowerment Skills

MDT MEETINGS

- 4 team meetings a month
- Non-hierarchical (All voices heard equally)
- Virtual clinic to review Young persons database
- Paediatric team attend monthly
- Database criteria review, including an at risk register
- Key worker assignment
- Non-discharge process to follow up DNAs
- Youth Work engagement in community
- Late clinics

Youth Empowerment Skills

Transition: information and contact details

This is only a start

This leaflet is designed to get you to start thinking about adult services and the transition process.

For every person, this process will be slightly different but your healthcare team should be able to provide you and your family with information about it.

By talking about transition early, you should have plenty of time for discussions and questions, ensuring that you are fully prepared when the time comes to make the move to adult services.

Ask your healthcare team about the Ready Steady Go programme

You may like to use this section to jot down any questions you have about your transition.

My key worker is:

Contact details:

NHS

Transition:
moving into adult care

Information for young people and families

Youth Empowerment Skills

BEFORE, DURING, AND AFTER CLINICS

Clinic preparation	• Text reminder and tel reminder • Access to young person agenda based questionnaire • Virtual clinic preparation and DNA follow up • Non-discharge policy
Clinic Environment	• Cancel other clinics and ensure music /TV is available • Choice of hospital sites • Continuity of administrator and MDT
One stop service	• Access to agenda based clinician including psychiatrist • Access to point of testing, DECS, Sexual health advice • Access to data downloads via Diasend/Carelink/LibreView/Skype
Youth worker activity	• Room space for group activity i.e: the Wii/table tennis • Socialise in a group with music /one to one with youth worker/plan social activities prior to YES course

Agenda setting cards for Young people

Lifestyle: Please tick any issue you wish to discuss today. If there are several, please number your top 3 priorities

	YES	Anything Specific ?
Travel and holidays		
Sex, pregnancy, pre-conception care		
Alcohol		
Festivals		
Nagging by friends and family		
What info resources are available?		
Drugs		
Tattoos and body piercings		
Sport and activity		
Food		
Smoking		
Informing friends		
Hormones		
I can't be bothered!		
Driving		
Illness and monitoring blood/ketones		
Leaving home		
Weight		
Trials		
Other		

Glycaemic Control:

	YES	Anything Specific ?
Hypos		
Insulin pumps		
Current patterns of glucose levels		
Insulin regimen		
Carbohydrate assessment and insulin		
Missing injections		
Injection sites and needles		
HbA1c		
Other		

Examples of social activity during the clinic

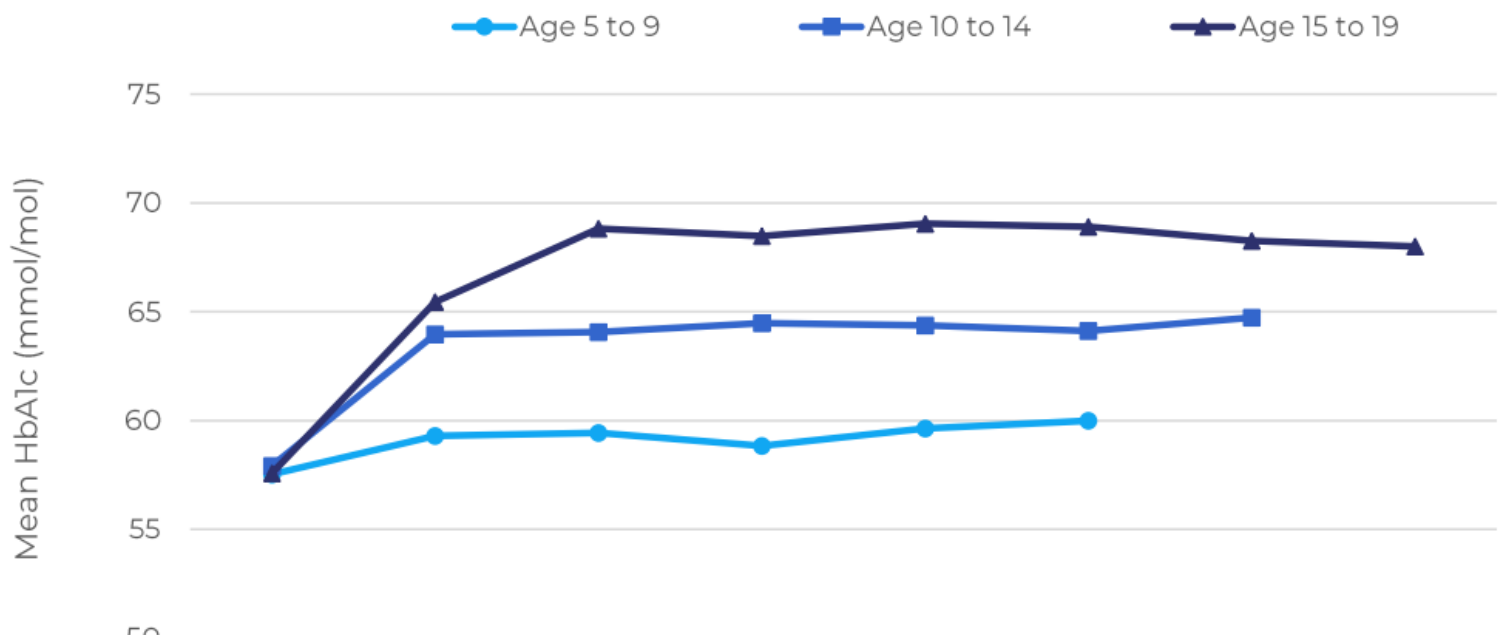
Youth Empowerment Skills

RISK OF COMPLICATIONS AND SCREENING

- Growth and pubertal development
- BP -24 Hour BP monitor
- ACR – repeat samples and early morning samples
- Lipids
- Cholesterol
- Pre-conception
- Contraceptive
- Feet
- Eyes
- Drugs and alcohol
- Mental health
- Eating disorders

3.3.3 HbA1c outcomes by age and duration of diabetes (Type 1)

Figure 29 shows mean unadjusted HbA1c by duration of diabetes in 2022/23. Children and young people of all age groups had higher HbA1c from two years following diagnosis, with the exception of those aged 0-4 years. After the first year following diagnosis, those aged 15-19 had consistently higher HbA1c than other age groups.



	Less than 1 year	1-2 years	2-3 years	3-4 years	4-5 years	5-10 years	10-15 years	15+ years
Age 5 to 9	57.5	59.3	59.4	58.8	59.6	60.0		
Age 10 to 14	57.9	64.0	64.1	64.5	64.4	64.1	64.7	
Age 15 to 19	57.6	65.4	68.8	68.5	69.0	68.9	68.2	68.0

MORTALITY AND COMPLICATIONS IN TYPE 1 AND TYPE 2 DM

- Life expectancy for individuals diagnosed with Type 1 diabetes before age of 10 years is
  - 16 years shorter compared to people without diabetes
  - 10 years shorter than those diagnosed at an older age
- (Average life expectancy has improved and recent data from UK – 8 years and Australia 12.2)

- Excess mortality is due to CV disease and this is independent of duration of Diabetes.

- principal causes of morbidity and mortality of T1DM are diabetic nephropathy and cardiovascular disease, which tend to occur 10–30 years after diagnosis (1,2)
- In addition, sight-threatening retinopathy has emerged as an important complication that occurs from the second decade after diagnosis

1.Secrest, A. M. et al. Cause-specific mortality trends in a large population-based cohort with long-standing childhood-onset type 1 diabetes. Diabetes 59, 3216–3222 (2010).
.2.Bjornstad, P., Donaghue, K. C. & Maahs, D. M. Macrovascular disease and risk factors in youth with type 1 diabetes: time to be more attentive to treatment? Lancet Diabetes Endocrinol. 6, 809–820 (2018).

3. Barrett, E. J. et al. Diabetic microvascular disease: an Endocrine Society Scientific Statement. J. Clin. Endocrinol. Metab. 102, 4343–4410 (2017).

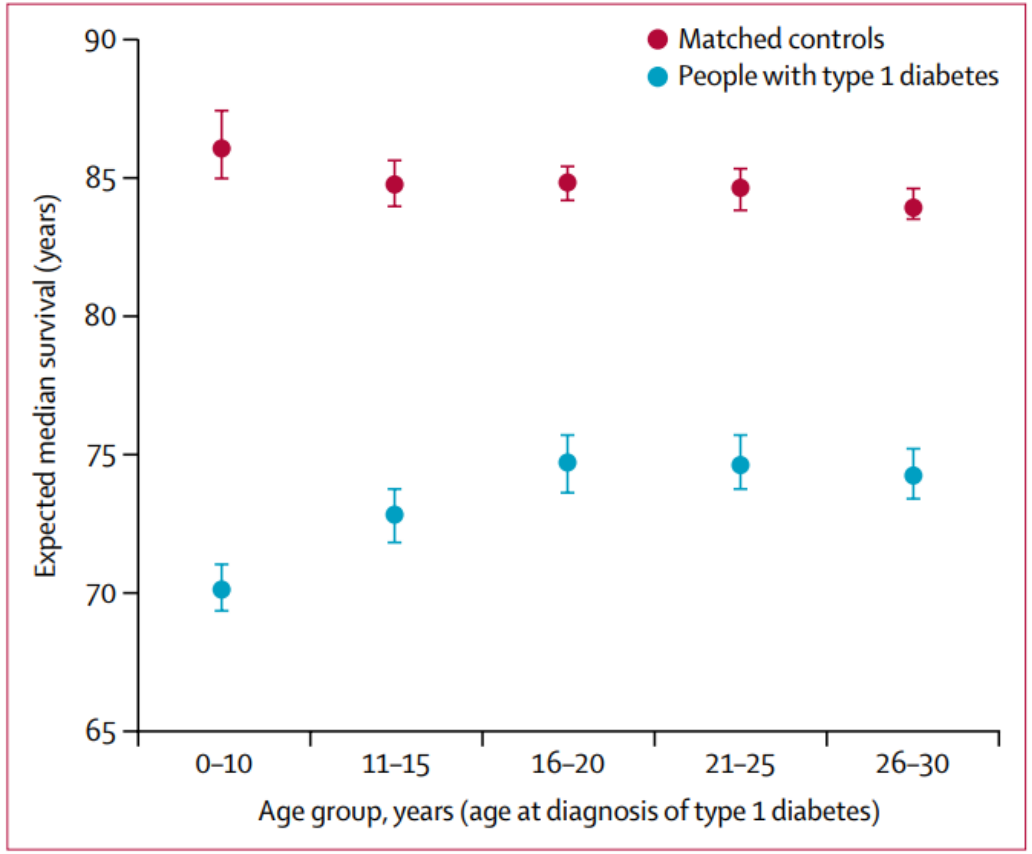


Figure 1: **Life-years lost in relation to age at onset of type 1 diabetes**
Loss of life-years was estimated by use of separate Cox regression analyses fitted to individuals with type 1 diabetes and their matched controls within each age group. Conditional median survival was estimated from the upper limit of each age interval. Life-years lost because of diabetes were calculated as the difference in the expected median survival between people with type 1

CV RISK IN TYPE 1

- 30 x greater risk of CV disease if diagnosed before 10 compared to 6x if diagnosed after 25 years.
- 7 x more likely to die from a CV cause compared to general population.

- Life expectancy and complication risks are markedly worse for women than men
  - 60fold higher risk of heart disease –compared to non diabetes and 90x increased risk of MI
  - 17 times higher risk of a heart disease and 15 times increase risk of heart attack

  - Mean age at FU was 29 years!

Rawshani A *et al* *Lancet 2018;392:477-86* [2]

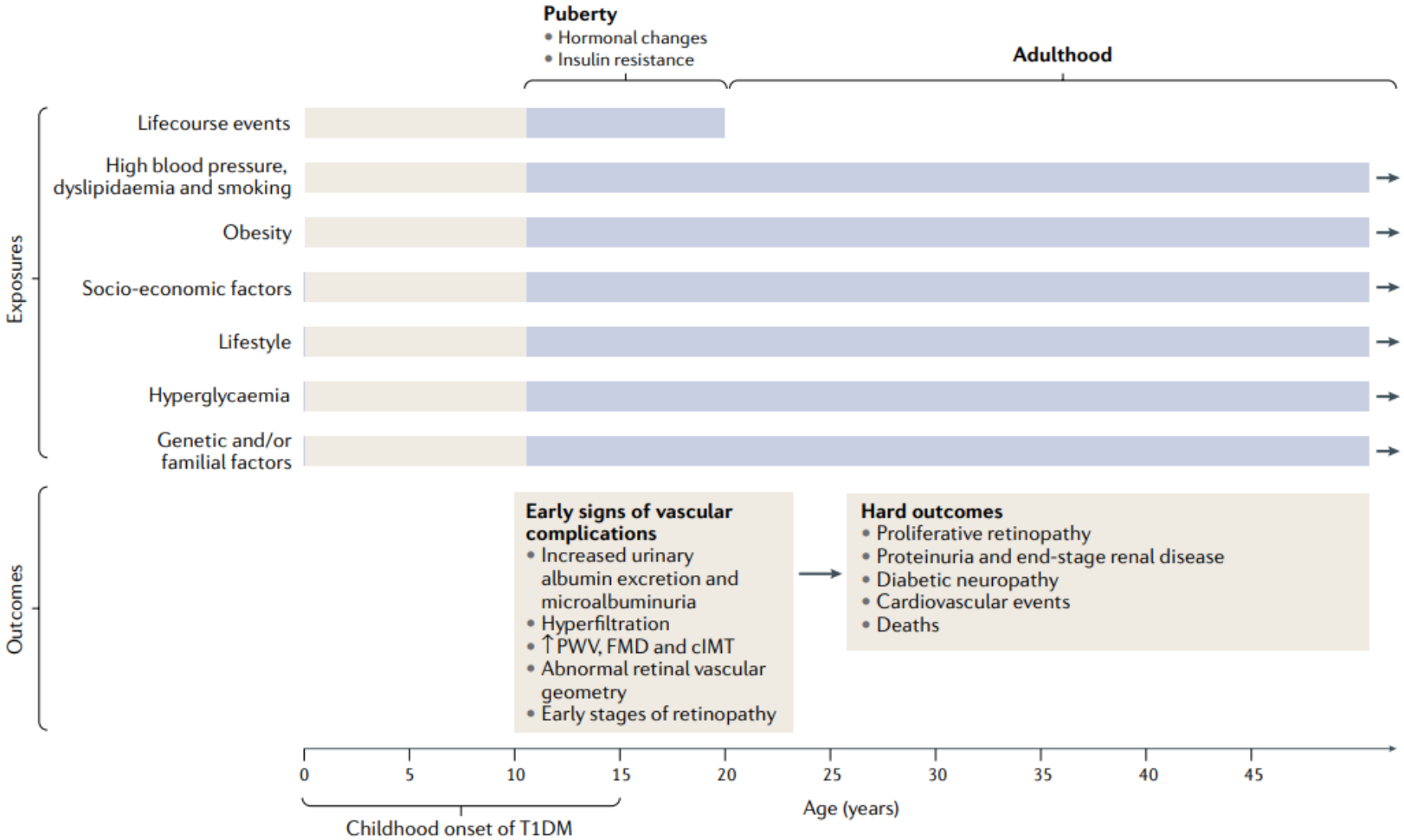
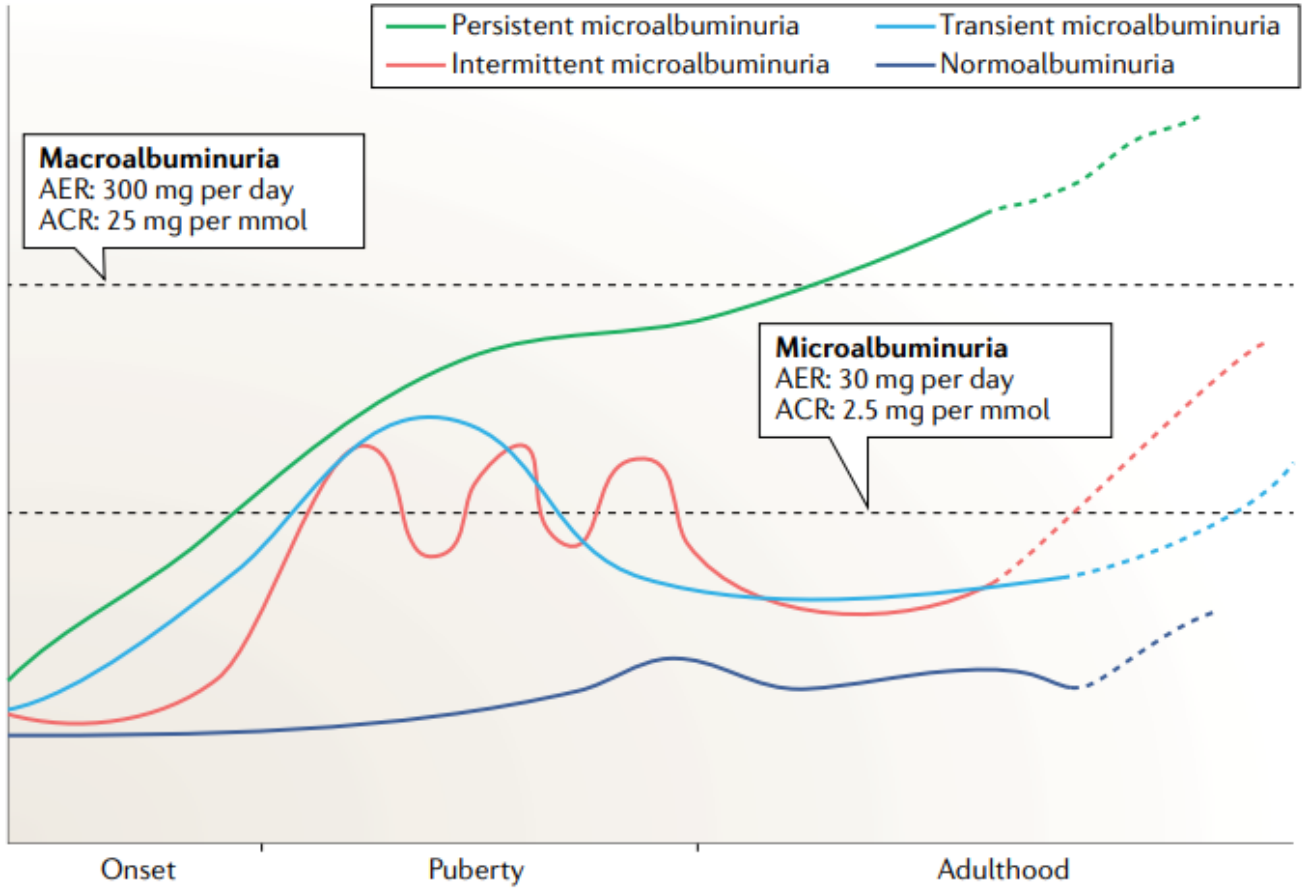


Fig. 1 | **Development and progression of vascular complications of childhood-onset T1DM.** This graph shows the main factors (exposures) contributing to the development of early signs of vascular complications during puberty and their continuing effect during adulthood, when overt manifestations (hard outcomes) of vascular complications occur. The graph highlights two unique pubertal contributors, represented by hormonal changes and insulin resistance. cIMT, carotid intima–media thickness; FMD, flow-mediated dilation; PWV, pulse wave velocity; T1DM, type 1 diabetes mellitus.



AdDit Study – Adolescent Type 1 diabetes Cardio-renal intervention trial

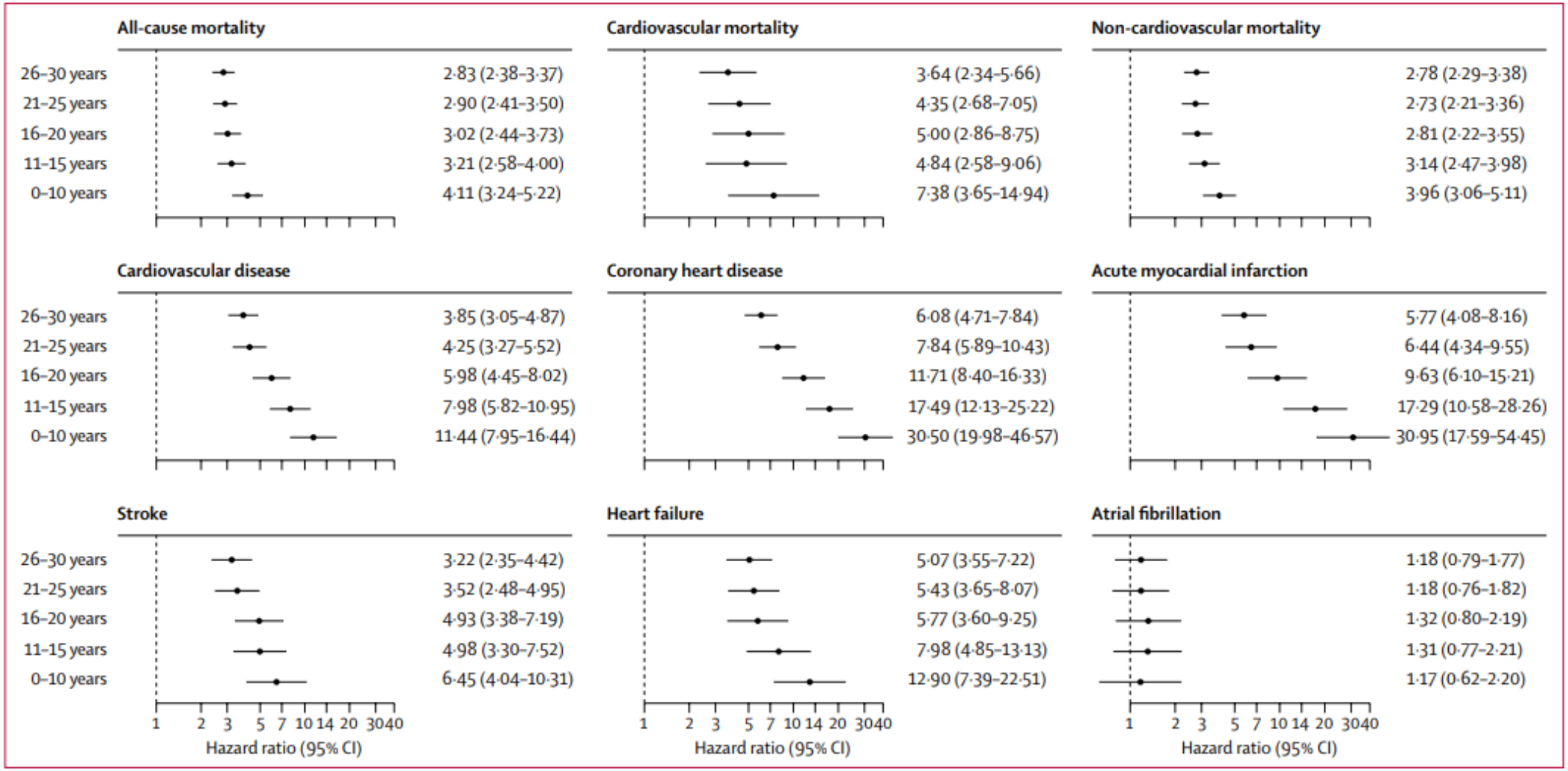


Figure 2: **Adjusted hazard ratios for all outcomes, according to age at type 1 diabetes diagnosis**

Analyses were based on Cox regression and adjusted for pre-existing comorbidities, calendar year, income, country of birth, marital status, educational attainment, and duration of diabetes. Matched controls served as a reference group for all models.

ASSOCIATED MULTIMORBIDITY

- Early onset diabetes is associated with multi-morbidity
- 20% has hypertension at the time of diagnosis and increase to 48% within 10 years of diagnosis
- 20% of young people with type 2 diabetes had depression and anxiety
- Increased frequency of diabetes related cancers in the younger cohort than older people with T2DM
- NAFLD
- PCOS

Overall life expectancy if you are diagnosed with T2DM between 20-40 years is

- **16 years less for females**
- **14 years less for males**

TODAY Study Group, Zeitler P, Hirst K, Pyle L, Linder B, Copeland K, et al. A clinical trial to maintain glycemic control in youth with type 2 diabetes. N Engl J Med. 2012

NATIONAL DATA FOR YP WITH TYPE 2 DIABETES

- Steeper rise in those <40yrs(18.7%) compared to 40-79(11.4%)
- Number of young adults with Type 2 DM (mostly in 25-39 age group) now exceeds the number of Type 1 DM in England
- In NDA data 84 595 has type 1 DM with 121 220 with type 2 Diabetes .
- High % of Young adults aged 19-25 years with T2DM were female (61.3% were female in 2021-22) with equal proportions of males and females in those ages 26-39 years old .This will have implications on pregnancy outcomes.
- Highest increase in Early onset TY2 DM is seen in Asian population.

NDA –National Young people with T2DM audit - 2021

DISEASE MECHANISM AND RISK FACTORS

- Type 2 Diabetes in the young is different to type 1 Diabetes as well as Type 2 diabetes in older people

  Though the mechanisms are similar speed of onset , severity and interplay between reduce insulin production and insulin resistant may be different compared to adult onset T2DM

1. Faster loss of β cell function
   - 20-25% annual decline in β cell function (in 10-19 year olds) compared to 7% in older individuals with T2DM(TODAY) .Therefore , more aggressive course with faster loss of beta cell causing insulin dependence within 5 years of diagnosis
   - Faster progression is not related to inadequate glycaemic control.(RISE)

Bacha F, Gungor N, Lee S, Arslanian SA. Progressive deterioration of à-cell function in obese youth with type 2 diabetes. *Pediatr Diabetes* 2013;

MICROVASCULAR COMPLICATIONS

- Compared to Type 1 diabetes much higher rates of microvascular complications in early onset T2DM
- 3x higher risk of neuropathy
- Retinopathy

- **In the TODAY study 80% of adolescent had developed at least 1 complication by the age of 26**

PREGNANCY OUTCOMES

PREGNANCY OUTCOMES ARE IMPROVING FOR TYPE 1 DM

- More women with T2DM than T1DM get pregnant in the UK .There outcomes are worse than T1DM outcomes
- UK national registry data
  - Higher rates of perinatal death
  - Less likely to receive pre-conception folic acid
  - Less likely to receive contraceptive advice
  - Compared to T1DM , higher rates of perinatal deaths
  - TODAY study
    - 1/3 had hypertension by the time they got pregnant
    - 1/3 had a Hb1A1c higher than 8%(64mM/mol)

Murphy HR, Howgate C, O'Keefe J, et al. Characteristics and outcomes of pregnant women with type 1 or type 2 diabetes: a 5-year national population-based cohort study. *Lancet Diabetes Endocrinol* 2021;

Risk Factors .....

2.**Obesity** – Major risk factor with 90% of children and adolescent with T2DM living with obesity. Earlier and cumulative exposure to obesity is a risk factor [1]

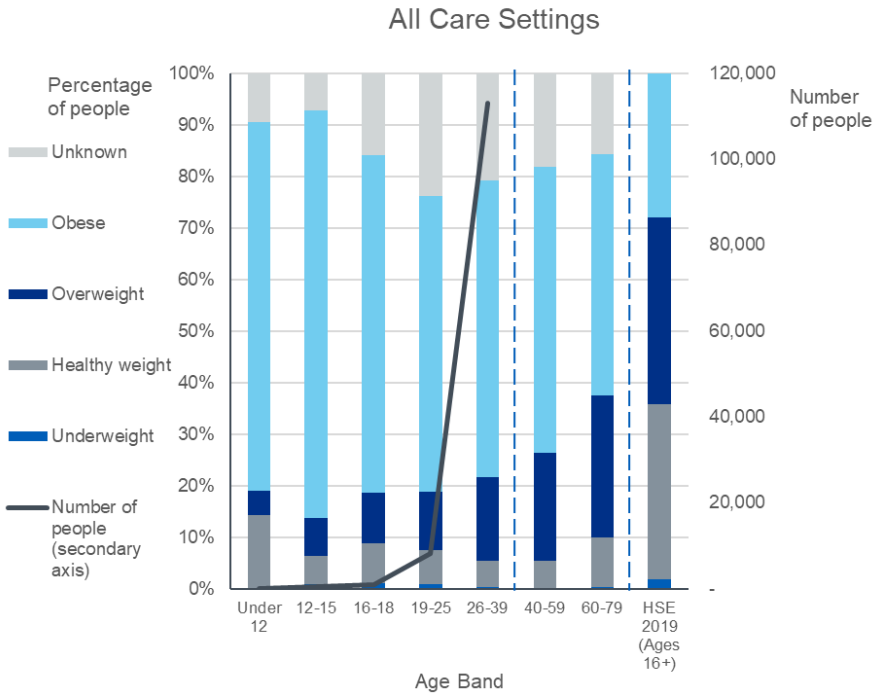
3 **Family history –** More than 80% of adolescence report a family history of T2DM with 56-71% having a first degree relative.[1]

Shared genetic risk

Similarities in home environment and lifestyle.

4. Pre-natal exposure - Maternal undernutrition, Obesity and Maternal diabetes –increases risk of obesity and diabetes in off-spring

SEARCH study Maternal Diabetes OR 5.7(CI 2.4-13.4) – associated with early onset diabetes.[2]

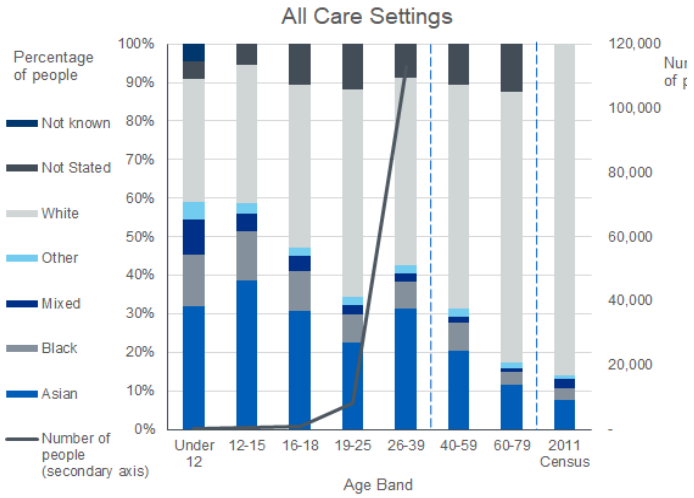


1.Shield JPH, Lynn R, Wan KC, Haines L, Barrett TG. Management and 1 year outcome for UK children with type 2 diabetes. *Arch Dis Child* 2009;

2. Dabelea D, Mayer-Davis EJ, Lamichhane AP, et al. Association of intrauterine exposure to maternal diabetes and obesity with type 2 diabetes in youth: the SEARCH Case-Control Study. *Diabetes Care* 2008; **31:** 1422–26.

ETHNIC DIFFERENCES IN DIABETES

- Over representation of ethnic minorities ,especially Asians in all younger age groups(<40 years) compared to older age.
- South Asian and Chinese populations might be predisposed to accelerated β cell loss.
- Indians had more than x2 the prevalence of early onset T2DM with normal BMI and a higher proportion of insulin deficiency than people from White ethnicity(53-67% vs 24-26%)

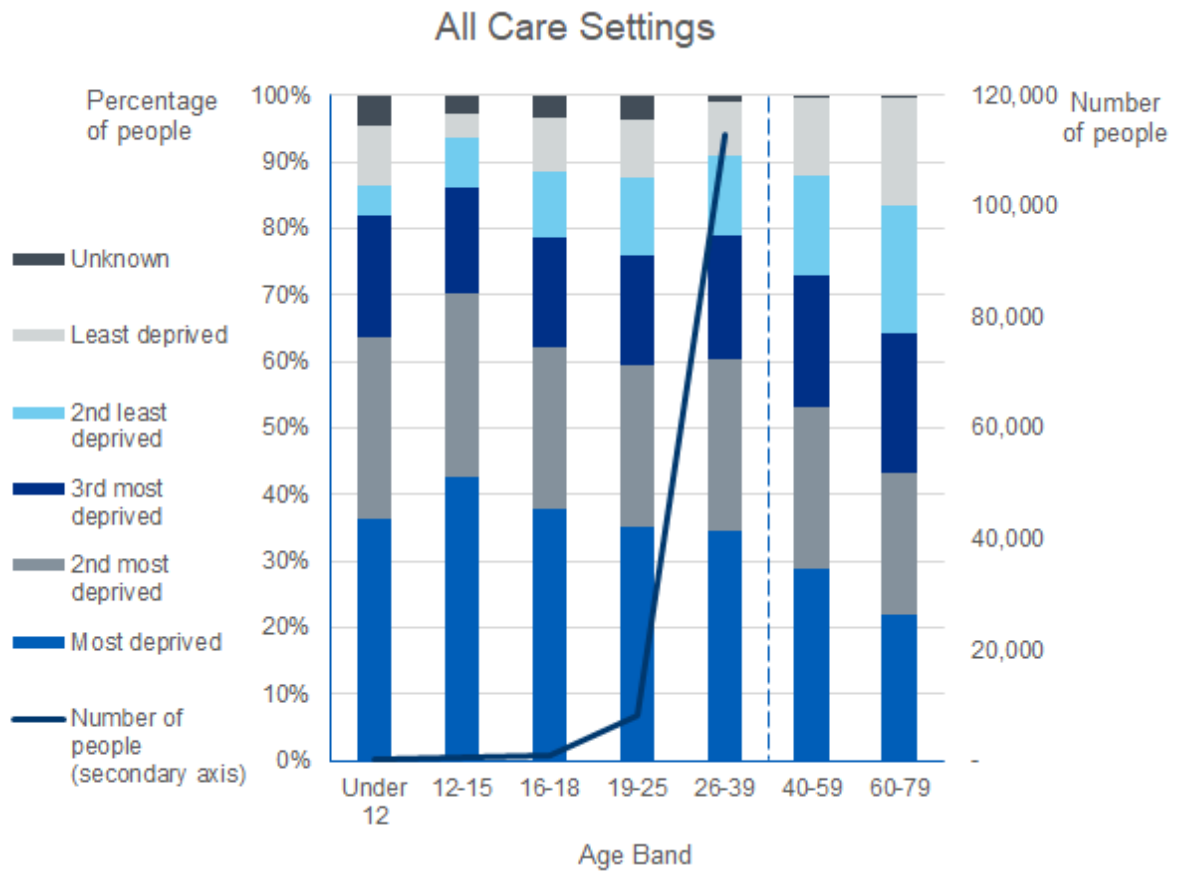


The percentage breakdown of young people with type 2 diabetes in England, by age group and ethnicity, 2019-20

- 7 genetic loci identified in GWAS studies.(*TCF7L2, MC4R, CDC123,KCNQ1,IGFBP2,LC16A11 , PHF2)* – *Both common and rare variant association contributed to early onset T2DM than adults.*

54.Prasad RB, Asplund O, Shukla SR, et al. Subgroups of patients with 77 young-onset type 2 diabetes in India reveal insulin deficiency as a major driver. *Diabetologia* 2022; **65:** 65–78.

SOCIAL DEPRIVATION



NDA Young people with Type 2 DM -2021

COMPLICATIONS

BURDEN OF COMPLICATIONS HIGHER THAN FOR T1DM OR LATE ONSET T2DM

- High risk of compilations in this group due to
  - More aggressive pathophysiology with difficult to manage glycaemia
  - Longer exposure to glycaemic burden
  - Concurrent Cardiometabolic risk factors
  - Period of unrecognised hyperglycaemia before the diagnosis

- Structural barriers -
  - racial discrimination
  - Socio economic deprivation
  - Therapeutic inertia
  - Concurrent mental health problems
  - Self management capacity
  - Reduce engagement with services

Morbidity and Mortality in Young-Onset Type 2 Diabetes in Comparison to Type 1 Diabetes: Where Are We Now? Jencia Wong & Maria Constantino & Dennis K. Yue :Curr Diab Rep (2015) 15:566

CARDIO-RENAL DISEASE

- Risk of MI – 14 x higher than somebody without diabetes(in later onset diabetes it is only 2-4 x)
- 30-50% increased risk of renal disease and CV disease compared to late onset DM
- Higher rate of albuminuria at the time of diagnosis in Early onset T2DM (16.3%) compared to T1DM(9.8%)
- After 10 years of diagnosis prevalence of microalbuminuria was higher in Early onset T2DM than T1DM (47.4%vs 15.3%)
-
- 4x higher risk of renal failure compared to type 1 DM after controlling for age at diagnosis,HbA1c, BMI, Era of diagnosis

SEARCH study

- Learning – Always question the Diagnosis
- Type 1/Type 2 / Genetic forms
- Family history
- Examination
- Other medical diagnosis
- Assessment of Growth
- Assessment of Pubertal status
- Psychological/ Social history
- Communication skills is the key