

From Childhood to Adulthood:

Young Adult Transitions in Diabetes Care

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Outline

- **Challenges: Glycemic control and transition**
 - Epidemiology of diabetes: increasing occurrence
 - ADA glycemic targets Vs attained A1c outcomes
 - Adolescents/young adults and the DCCT
 - Factors related to glycemic outcomes
 - Early co-morbidities
- **Opportunities: Optimizing health outcomes**
 - Prevent loss-to-follow-up
 - Approaches to transition: Joslin, NDEP
 - BG monitoring / continuous glucose monitoring

Epidemiology

- 15,000 youths/year are diagnosed with T1D
- 3,700 youths/year are diagnosed with T2D
- T1D occurs equally among males and females; T2D occurs 1.6x more often in females than males
- T1D is more common in whites than non-whites; T2D occurs more often in racial/ethnic minorities
- ~75% of T1D is diagnosed in people <18 years old; majority of T2D is diagnosed in adults
- The majority of people with T1D are adults
- 192,000 total youth with diabetes in 2007

1. SEARCH Writing Group, JAMA 2007; 297:2716
2. NIDDK. Available <http://diabetes.niddk.nih.gov/dm/pubs/statistics/index.htm> 2010.
3. ADA. Diabetes Care. 2010 33:S11861.
4. ADA. Diabetes Care. 2008; 31:1-20

Time trends in the incidence of type 1 diabetes in Finnish children: a cohort study

Valma Harjutsalo, Lena Sjöberg, Jaakko Tuomilehto

Lancet 2008; 371: 1777-82

Summary

Background Finland has the highest incidence of type 1 diabetes worldwide, reaching 40 per 100 000 people per year in the 1990s. Our aim was to assess the temporal trend in type 1 diabetes incidence since 2000 in Finnish children aged younger than 15 years and to predict the number of cases of type 1 diabetes in the future.

Methods Children with newly diagnosed type 1 diabetes in Finland who were listed on the National Public Health Institute diabetes register, Central Drug Register, and Hospital Discharge Register in 1980–2005 were included in a cohort study. We excluded patients with type 2 diabetes and diabetes occurring secondary to other conditions, such as steroid use, Down's syndrome, and congenital malformations of pancreas.

Findings 10737 children—5816 boys and 4921 girls—were diagnosed with type 1 diabetes before 15 years of age during 1980–2005. The average age-standardised incidence was 42.9 per 100 000 per year (95% CI 42.6–44.3) during this period, increasing from 31.4 per 100 000 per year in 1980 to 64.2 per 100 000 per year in 2005. The age-specific rates per 100 000 per year were 31.0, 50.5, and 50.6 at ages 0–4 years, 5–9 years, and 10–14 years, respectively. We noted a significant non-linear component to the time trend ($p < 0.0003$). In children aged 0–4 years, the increase was largest, at 4.7% more affected every year. The overall boy-to-girl ratio of incidence was 1.1; at the age of 13 years, it was 1.7 (1.4–2.0). The predicted cumulative number of new cases with type 1 diabetes before 15 years of age between 2006 and 2020 was about 10 800.

Interpretation The incidence of type 1 diabetes in Finnish children is increasing even faster than before. The number of new cases diagnosed at or before 14 years of age will double in the next 15 years and the age of onset will be younger (0–4 years).

Incidence trends for childhood type 1 diabetes in Europe during 1989–2003 and predicted new cases 2005–20: a multicentre prospective registration study

Lancet 2009; 373: 2027–33

Christopher C Patterson, Gisela G Dahlquist, Eva Gyürüs, Anders Green, Gyula Soltész, and the EURODIAB Study Group

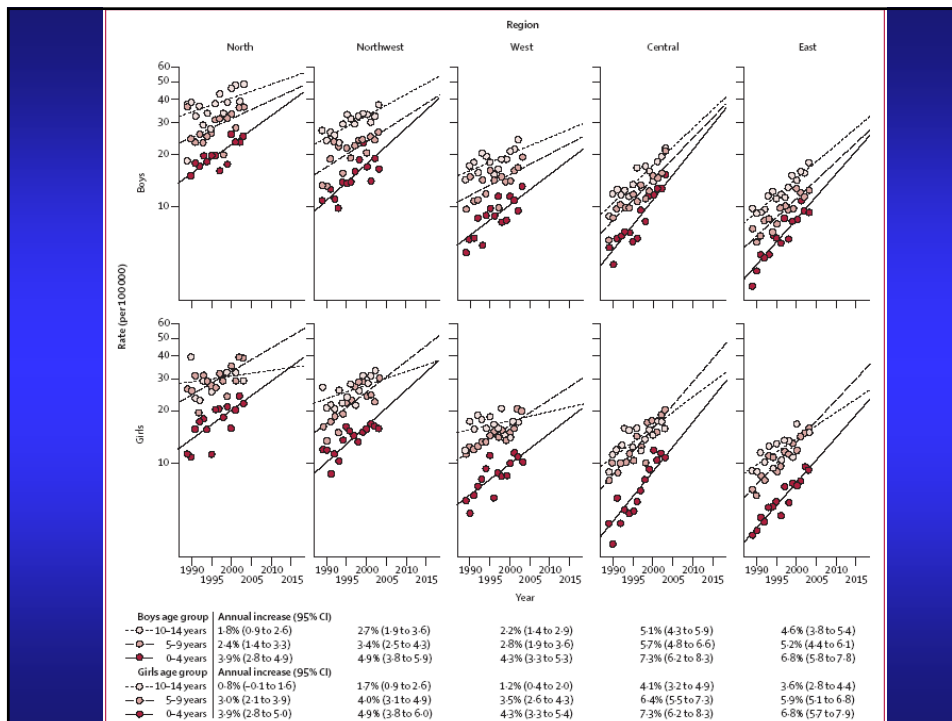
Summary

Background The incidence of type 1 diabetes in children younger than 15 years is increasing. Prediction of future incidence of this disease will enable adequate fund allocation for delivery of care to be planned. We aimed to establish 15-year incidence trends for childhood type 1 diabetes in European centres, and thereby predict the future burden of childhood diabetes in Europe.

Methods 20 population-based EURODIAB registers in 17 countries registered 29 311 new cases of type 1 diabetes, diagnosed in children before their 15th birthday during a 15-year period, 1989–2003. Age-specific log linear rates of increase were estimated in five geographical regions, and used in conjunction with published incidence rates and population projections to predict numbers of new cases throughout Europe in 2005, 2010, 2015, and 2020.

Findings Ascertainment was better than 90% in most registers. All but two registers showed significant yearly increases in incidence, ranging from 0·6% to 9·3%. The overall annual increase was 3·9% (95% CI 3·6–4·2), and the increases in the age groups 0–4 years, 5–9 years, and 10–14 years were 5·4% (4·8–6·1), 4·3% (3·8–4·8), and 2·9% (2·5–3·3), respectively. The number of new cases in Europe in 2005 is estimated as 15 000, divided between the 0–4 year, 5–9 year, and 10–14 year age-groups in the ratio 24%, 35%, and 41%, respectively. In 2020, the predicted number of new cases is 24 400, with a doubling in numbers in children younger than 5 years and a more even distribution across age-groups than at present (29%, 37%, and 34%, respectively). Prevalence under age 15 years is predicted to rise from 94 000 in 2005, to 160 000 in 2020.

Interpretation If present trends continue, doubling of new cases of type 1 diabetes in European children younger than 5 years is predicted between 2005 and 2020, and prevalent cases younger than 15 years will rise by 70%. Adequate health-care resources to meet these children's needs should be made available.



ADA Standards of Diabetes Medical Care January 2011

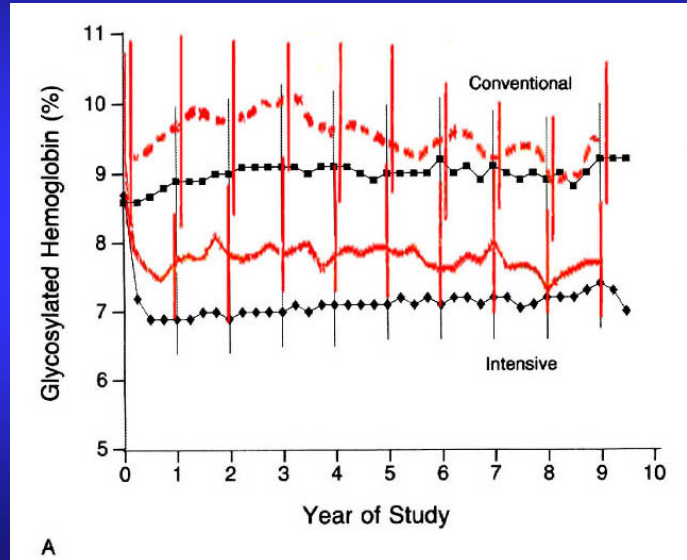
Table 10—Summary of glycemic recommendations for many nonpregnant adults with diabetes

	Plasma blood glucose goal range (mg/dl)		A1C (%)	Rationale
	Before meals	Bedtime/overnight		
Toddlers and preschoolers (0–6 years)	100–180	110–200	<8.5	<ul style="list-style-type: none"> • Vulnerability to hypoglycemia • Insulin sensitivity • Unpredictability in dietary intake and physical activity • A lower goal (<8.0%) is reasonable if it can be achieved without excessive hypoglycemia
School age (6–12 years)	90–180	100–180	<8	<ul style="list-style-type: none"> • Vulnerability to hypoglycemia • A lower goal (<7.5%) is reasonable if it can be achieved without excessive hypoglycemia
ISPAD Guidelines	90–145	80–180	<7.5%	
Adolescents and young adults (13–19 years)	90–130	90–150	<7.5	<ul style="list-style-type: none"> • A lower goal (<7.0%) is reasonable if it can be achieved without excessive hypoglycemia

Key concepts in setting glycemic goals

- Goals should be individualized and lower goals may be reasonable based on benefit-risk assessment.
- Blood glucose goals should be modified in children with frequent hypoglycemia or hypoglycemia unawareness.
- Postprandial blood glucose values should be measured when there is a discrepancy between pre-prandial blood glucose values and A1C levels and to help assess glycemia in those on basal/bolus regimens.

DCCT – Adult & Adolescent Cohorts



Adults
Adolescents

DCCT:
N Engl J Med.
1993
J Peds, 1994

DCCT: Adolescents Vs Adults

- significantly higher A1c's:
 - intensive- 8.1 vs 7.1%
 - conventional- 9.8 vs 9.0%
- significantly more hypoglycemia:
 - intensive- 86 vs 57/100-pt-yrs
 - conventional- 28 vs 17/100-pt-yrs
- had significantly more DKA than adults:
 - intensive- 2.8 vs 1.8/100-pt-yrs
 - conventional- 4.7 vs 1.3/100-pt-yrs

Risk of Hyperglycemia

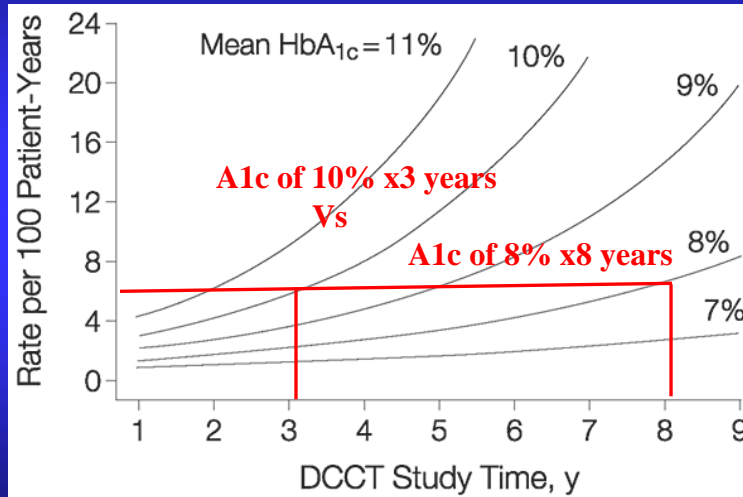
- Due to intensity of exposure

Intensity = degree of hyperglycemia

X

duration of hyperglycemia

Risk of Retinopathy Progression According to A1c



JAMA 2002:287

EDIC: Adolescents Vs Adults

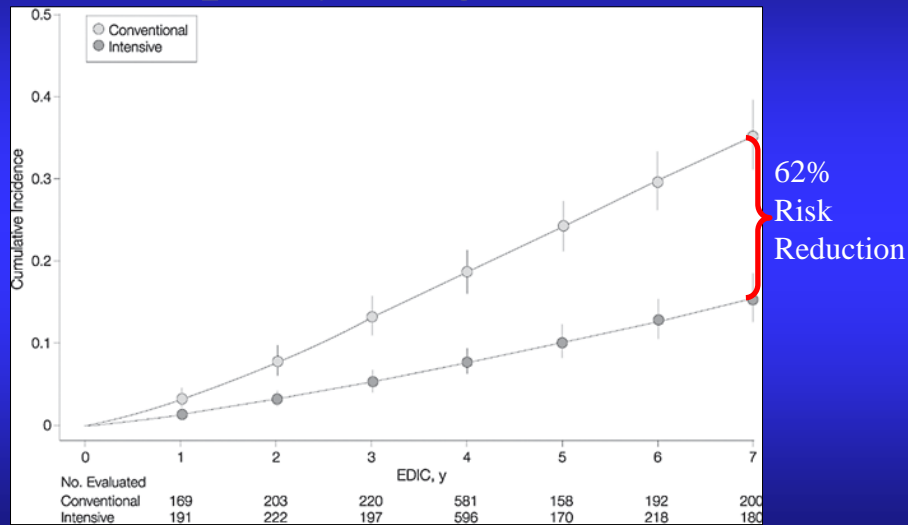
- less f/u participation in EDIC by adolescents:
90% of adolescents Vs 96% of adult cohort
- less adoption of intensive Rx by adolescents:

intensive-	90% Vs 95%
conventional-	66% Vs 76%
- less separation in A1c during EDIC f/u:

adolescent cohort-	8.4% Vs 8.5% (NS)
adult cohort-	7.9% Vs 8.3%

BUT SUSTAINED RISK REDUCTIONS!

Cumulative Incidence of Retinopathy Progression - EDIC



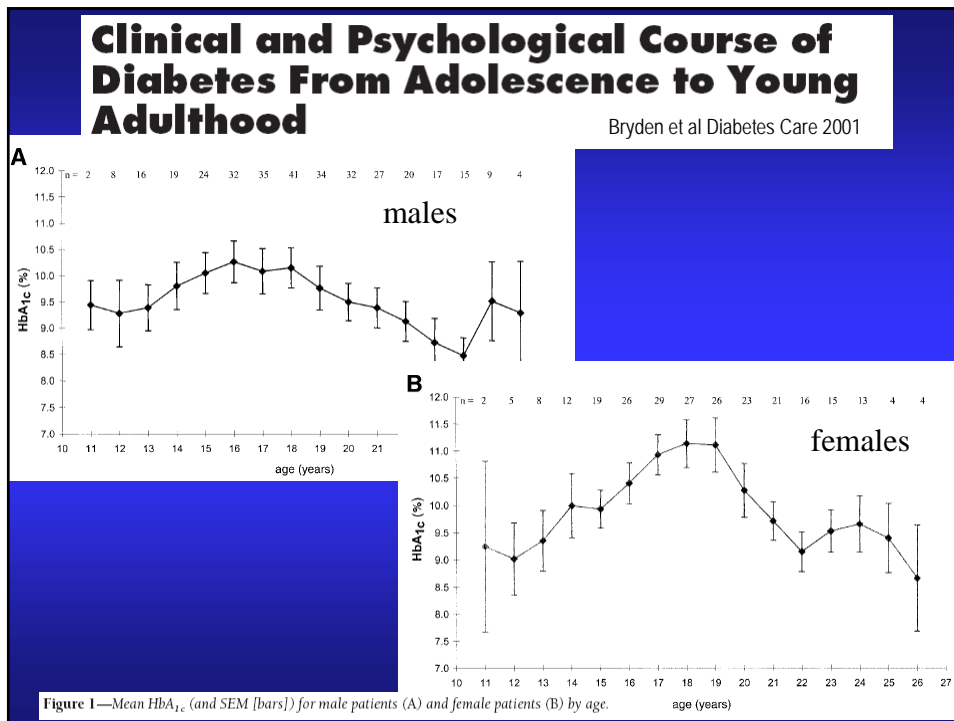
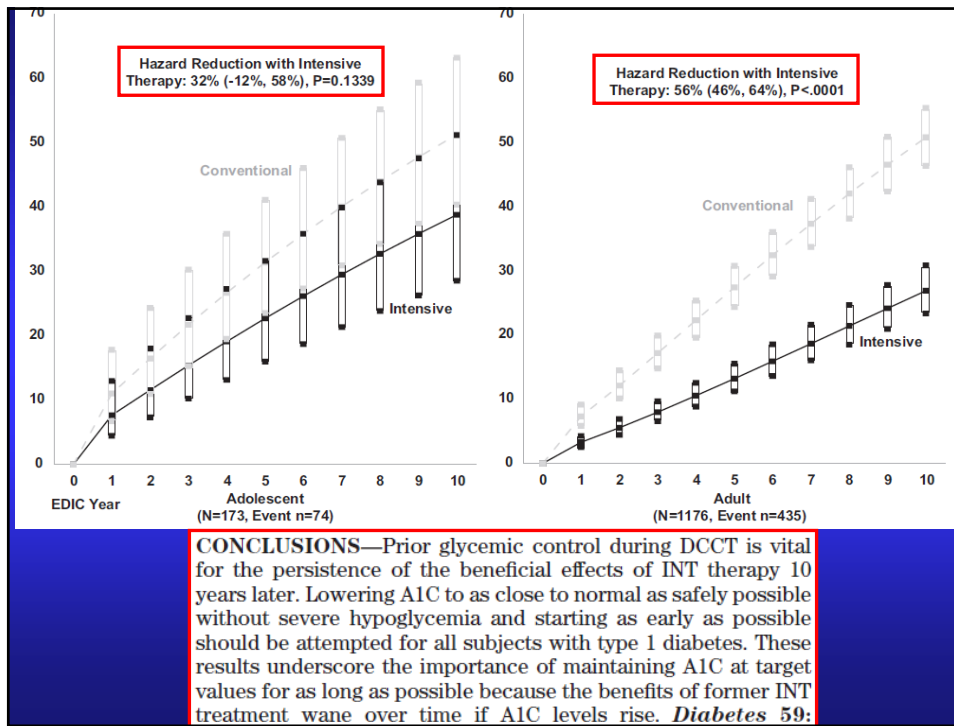
JAMA 2002:287

Effect of Prior Intensive Therapy in Type 1 Diabetes on 10-Year Progression of Retinopathy in the DCCT/EDIC: Comparison of Adults and Adolescents

Neil H. White,¹ Wanjie Sun,² Patricia A. Cleary,² William V. Tamborlane,³ Ronald P. Danis,⁴ Dean P. Hainsworth,⁵ and Matthew D. Davis,⁴ for the DCCT-EDIC Research Group*

DIABETES, VOL. 59, MAY 2010

RESULTS—During 10 years of follow-up, HbA_{1c} (A1C) was similar between original intensive (INT) and conventional (CON) groups and between former adolescents and adults. At EDIC year 10, adults in the former INT group continued to show slower progression of diabetic retinopathy than those in the CON group (adjusted hazard reduction 56%, $P < 0.0001$), whereas in adolescents this beneficial effect had disappeared (32%, $P = 0.13$). Seventy-nine percent of observed differences in the prolonged treatment effect between adults and adolescents at year 10 were explained by differences in mean A1C during DCCT between adolescents and adults (8.9 vs. 8.1%), particularly between INT adolescents and adults (8.1 vs. 7.2%).



Risk in the Young Adult T1DM

- UK registry, T1D diagnosed 1978-2004, aged 0-29 years (N=4246):
 - Patients diagnosed at age <30 years had a 4.7-fold excess mortality risk; 2.5% of cohort died
 - 47/108 deaths (44%) occurred from diabetes complications:
 - 32 deaths were attributed to acute complications
 - DKA (14)
 - Hypoglycemia (8)
 - Hyperglycemia (2)
 - Other causes (8)
 - 15 deaths from chronic complications
 - 71% of deaths in males; 16% of deaths due to drug misuse
 - 3.7% of DCCT cohorts died after ~19 years of follow-up

Feltbower RG, et al. *Diabetes Care*. 2008;31:922-926. DCCT/EDIC, *Arch Int Med*. 2009; 169:1307-1316

Transitioning Teens/Young Adults

Teens/emerging adults on way to adulthood:

- **Accept responsibility**
- **Make independent decisions**
- **Have financial independence**
 - May no longer want to see (or be able to see) their pediatric diabetes healthcare team
 - May be leaving home for school/work, independence
 - May become pregnant and must receive care from adult diabetes healthcare team

Emerging Adulthood

The New York Times

- Long Road to Adulthood Is Growing Even Longer
- By [PATRICIA COHEN](#) Published: June 12, 2010
- *Baby boomers have long been considered the generation that did not want to grow up, perpetual adolescents even as they become eligible for social security. Now, a growing body of research shows that the real Peter Pans are not the boomers, but the generations that have followed. For many, by choice or circumstance, independence no longer begins at 21.*
- *People between 20 and 34 are taking longer to finish their educations, establish themselves in careers, marry, have children and become financially independent, said Frank F. Furstenberg, who leads the [MacArthur Foundation Research Network on Transitions to Adulthood](#), a team of scholars who have been studying this transformation. “A new period of life is emerging in which young people are no longer adolescents but not yet adults,” Mr. Furstenberg said.*

“Emerging Adulthood” (Arnett)

- Cultural trends in the US have led to young adults taking on adult roles later (work, marriage, parenting)
- Period of feeling unsettled which can lead to anxiety and uncertainty
- May vary among cultures and societies (i.e. lower SES may have fewer opportunities for exploration, urban vs. rural)

“Emerging Adulthood” (Arnett)

- First phase (18-24): Desire for and fear of independence, moving away from home, managing finances, etc.
- Second phase (25-30): maturing sense of identity, more “adult-like” roles in society (relationships, employment)
- Need to consider these phases when working with young adults with T1D

Why some patients may have difficulties with transition?

- Fear of leaving their pediatric-care team
- Not prepared sufficiently by their pediatric-care team to complete the transition
- Lack of trust in adult healthcare
- Loss or lack of insurance
- Saying goodbye to their healthcare team from early childhood can be difficult for patients, and can become a barrier to transition to adult-oriented medicine.

Too busy, too fearful, too tired

Possible Outcomes of the Transition From Pediatric to Adult Care

- In a Canadian survey completed by young adults with T1DM (N=154):
 - 24% left their pediatric clinic without being referred elsewhere
 - 31% had a lapse of over 6 months (but <12 months) between their last pediatric visit and their first adult visit
 - 11% were lost to follow-up
 - 52% had either experienced a problem, had a delay of >12 months between their transition of care, or had no current follow-up

Pacaud D, et al. *Canadian Journal of Diabetes*. 2005;29:13-18.

Evaluation of Patients' Opinion and Metabolic Control after Transfer of Young Adults with Type 1 Diabetes from a Pediatric Diabetes Clinic to Adult Care

Hormone Research 2007
Leipzig, Germany

F.P. Busse^b P. Hiermann^a A. Galler^a M. Stumvoll^b T. Wiessner^b W. Kiess^a
T.M. Kapellen^a

Abstract

Background: Transferring adolescents with diabetes from pediatric to adult care remains a challenge and the outcome is often unknown. The aims of this study were to determine the patients' perception of transfer arrangements and to analyze health care use and metabolic control. **Methods:** A telephone questionnaire was conducted for patients who had been transferred from the pediatric clinic to adult care between 1995 and 2003. Of 161 identified patients, 101 (58 females, 43 males, mean age 22.1 ± 2.4 years) were interviewed. Pediatric case notes and, if available ($n = 44$), current notes were analyzed to validate answers from the interview. **Results:** After transfer, 52.5% of patients changed their health care provider at least once. The mean frequency of changes was 1.47. There was a significant decrease in clinic attendance rate after transition (8.5 ± 2.3 /years vs. 6.7 ± 3.2 /years). Patients criticized the lack of arrangements, poor information about transfer and the specific age for transition (18 years) set by legislation. The transfer was considered a negative experience by 58 patients. The patients assumed their metabolic control (HbA1c) was better than it really was

($7.5 \pm 1.3\%$ vs. $8.3 \pm 1.6\%$, $p < 0.05$). Actual HbA1c from case notes pre- and post-transfer did not change significantly ($8.5 \pm 1.5\%$ vs. $8.4 \pm 1.7\%$, $n = 44$, $p = 0.441$). **Conclusion:** The establishment of transition clinics and closer cooperation between specialists in pediatric and adult medicine is mandatory. Such changes are demanded by patients and would ensure better uptake of health care services after transfer.

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Table 2. Reasons reported by patients for their decision for a particular health care provider (more than one answer was possible)

Reasons for choosing a particular doctor	Frequency of answers, %*
Geographical location close to home	33.6
Medical competence and knowledge	7.1
Recommendations of the pediatrician	38.8
Recommendations of others (e.g. friends or family)	25.5
Other reasons (e.g. telephone book, homepage of German Diabetes Association, by chance)	19.4

* 3 patients left the health care system and had no doctor, therefore n = 98.

Poor Prognosis of Young Adults With Type 1 Diabetes

Diabetes Care 26:1052–1057, 2003

A longitudinal study

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DAVID B. DUNGER, FRCP²
RICHARD A. MAYOU, FRCPsych³

ROBERT C. PEVELER, FRCPsych⁴
H. ANDREW W. NEIL, FRCP¹

- N=113 (51 male, 62 female)
- Ages 17-25 years
- Longitudinal assessments over 11 years

RESULTS — There was no significant improvement between baseline and follow-up in mean HbA_{1c} levels (8.5 vs. 8.6% in men, 9.3 vs. 8.7% in women). The proportion of individuals with serious complications (preproliferative or laser-treated retinopathy, proteinuria or more severe renal disease, peripheral neuropathy, and autonomic neuropathy) increased from 3–37% during the 11-year period. Women were more likely than men to have multiple complications (23 vs. 6%, difference 17%, 95% CI 4–29%, $P = 0.02$). Psychiatric disorders increased from 16 to 28% (20% in men, 36% in women at follow-up, difference NS), and 8% had psychiatric disorders at both assessments. Baseline psychiatric symptom scores predicted follow-up scores ($\beta = 0.32$, SE $[\beta] 0.12$, $P = 0.008$, 95% CI 0.09–0.56) and recurrent admissions with diabetic ketoacidosis (odds ratio 9.1, 95% CI 2.9–28.6, $P < 0.0001$).

Outcomes of Poor Transition Care

- Sense of disengagement from healthcare
- Young people with diabetes disengage from the system
- Young people may become confused and disillusioned with the adult-care system
- No specialist follow-up completed and a primary care provider is seen only for insulin prescriptions
 - Ultimately, an issue occurs, such as diabetic ketoacidosis or pregnancy, that cannot be managed by a non-specialist
- Emergence of complications may go undetected, and untreated

**NON-ADHERENCE
and loss to F/U care**

McGill M. *Horm Res.* 2002;57(suppl 1):66-68.

Adherence to insulin treatment, glycaemic control, and ketoacidosis in insulin-dependent diabetes mellitus

Andrew D Morris, Douglas I R Boyle, Alex D McMahon, Stephen A Greene, Thomas M MacDonald, Ray W Newton, for the DARTS/MEMO Collaboration

Lancet 1997; **350**: 1505–10

Methods We studied 89 patients, mean age 16 (SD 7) years, diabetes duration 8 (4) years, and glycosylated haemoglobin (HbA_{1c}) 8.4 (1.9)%, who attended a teaching hospital paediatric or young-adult diabetes clinic in 1993 and 1994. The medically recommended insulin dose and cumulative volume of insulin prescriptions supplied were used to calculate the days of maximum possible insulin coverage per annum, expressed as the adherence index. Associations between glycaemic control (HbA_{1c}), episodes of diabetic ketoacidosis, and all hospital admissions for acute complications and the adherence index were modelled.

Interpretation We found direct evidence of poor compliance with insulin therapy in young patients with IDDM. We suggest that poor adherence to insulin treatment is the major factor that contributes to long-term poor glycaemic control and diabetic ketoacidosis in this age group.

DARTS
(Diabetes Audit and Research
Tayside, Scotland)
MEMO
(Medicines Monitoring
Unit Collaboration)
N=89, mean age 16±7 years

Adherence to Insulin Rx, Glycemic Control, and DKA

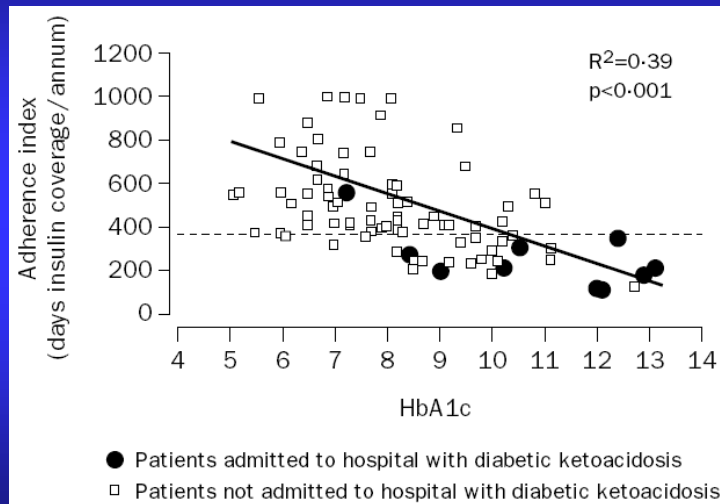


Figure 1: Linear regression of the association between glycaemic control (HbA_{1c}) and adherence index

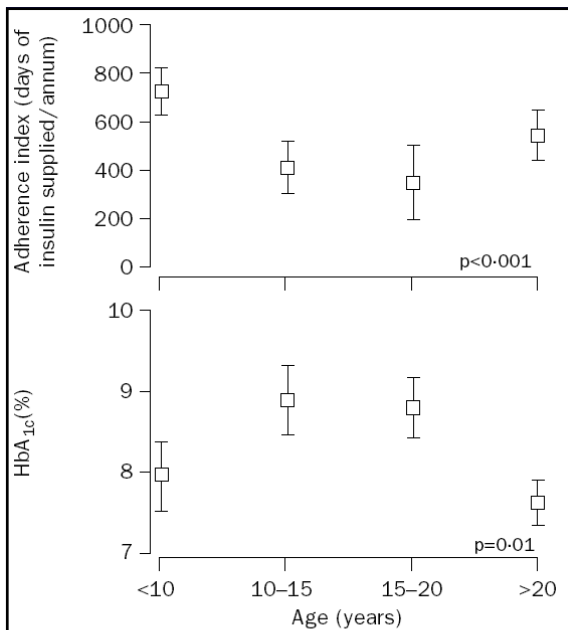


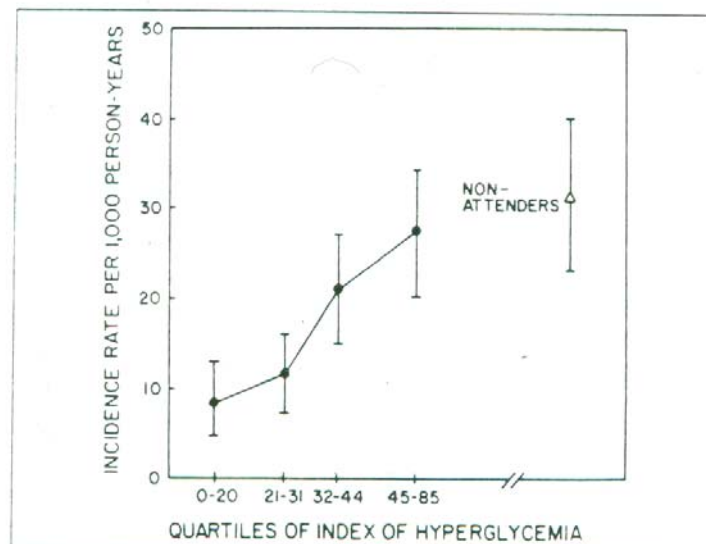
Figure 2: Association of age to glycaemic control (bottom panel) and age to adherence index (upper panel)
Data are mean (SD).

**Age Predicts
Adherence
and HbA_{1c}**

Risk Factors for Complications

- **UNCONTROLLED DIABETES**
 - high A1c, age at onset, attained age
- **Infrequent follow-up diabetes care**
 - Non-attenders, drop-outs, irregular/interrupted care; loss-to-F/U during transition
- **Identify & overcome modifiable risk factors & barriers to care** – with education & support
- **Implement intensive Rx as early as possible to optimize glycemic control** - with education & support

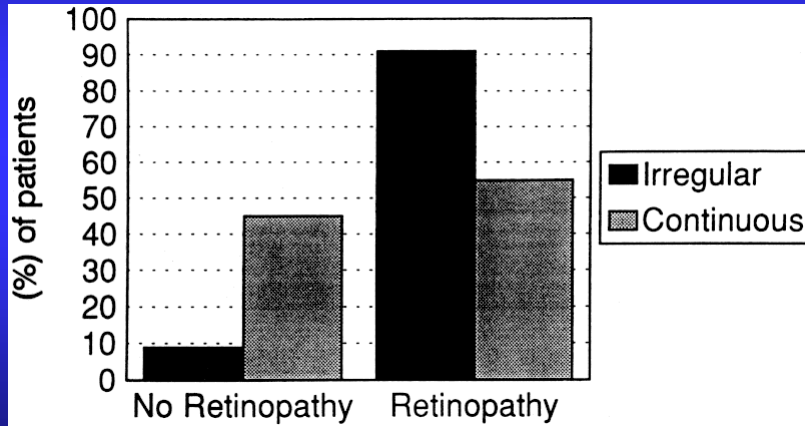
Risk of Nephropathy Greatest among Clinic Non-attenders



Am J Med 1985; 78:785-94

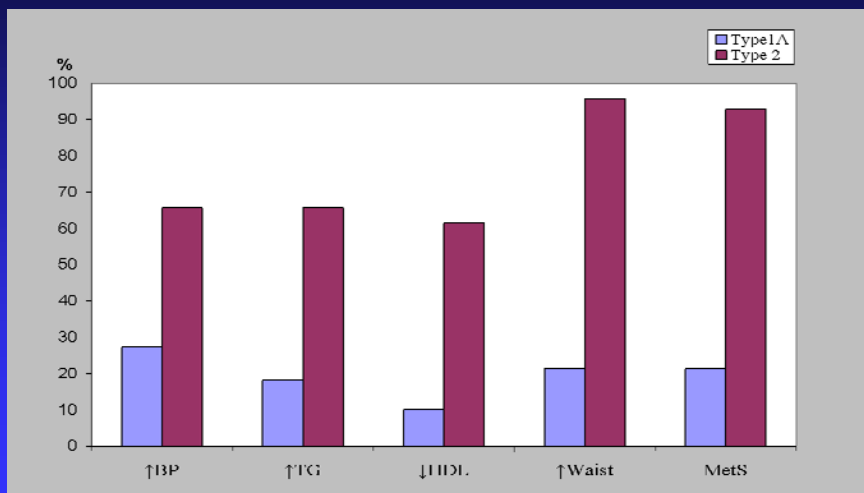
Krolewski et al.

% of patients with retinopathy after 10 years greatest in group with irregular f/u



Jacobson: J Pediatr, Volume 131(5).November 1997, 727-733

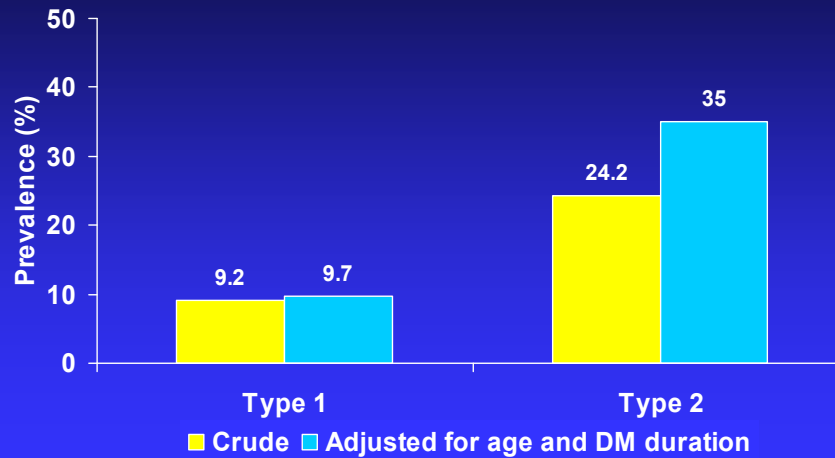
Prevalence of Cardiovascular Risk Factors in Youth with Diabetes



MetS: ≥ 2 CVD risk factors

Rodriguez et al, Diabetes Care, 2006

Prevalence of Microalbuminuria by Diabetes Type



Maahs et al Diabetes Care 2007

ADA Standards of Diabetes Medical Care January 2011

e. Transition from pediatric to adult care

As they approach the young adult years, older adolescents are at increasing physical, behavioral, and other risks (333,334). As they leave both their home and their pediatric diabetes care providers, these older teens may become disengaged from the health care system, leading to lapses in medical care and deterioration in glycemic control (335). Though scientific evidence is limited to date, it is clear that early and ongoing attention be given to comprehensive and coordinated planning for seamless transition of all youth from pediatric to adult health care (336,337). The National Diabetes Education Program (NDEP) has materials available to facilitate this transition process (<http://ndep.nih.gov/transitions/>).

Approaches for Successful Transition

- Pediatric team
 - Begin the process during adolescence according to the developmental needs of the patient
 - Work with the patient and family to create a plan:
 - Consider patient's/family's needs and requests
 - Provide info on adult diabetes care teams
 - Review insurance issues
 - Identify adult diabetes health care teams interested in working with the young adult with diabetes
 - Create transition clinic days, combining pediatric and adult diabetes care team members
- Adult team
 - Interact with pediatric diabetes team
 - Consider needs of young adults; possibly including family members/parents as requested by patient

Weissberg-Benchell J. *Diabetes Care*. 2007;30:2441-2446. ISPAD

ISPAD Recommendations for Successful Transitions

- Negotiation and liaison between pediatric-care and adult-care services including, when possible, the organization of joint clinic days
- Decision on the optimal age and stage of development for transition to adult care, depending on local services and agreements
- Prepare adolescents and their families for transfer in advance, ensuring that there is no hiatus in care at the time of transfer and that the young people are not lost to follow-up care

ISPAD Guidelines, Pediatric Diabetes, Sept 2009

Pediatric to Adult Health Care Transition Planning and Checklist - NDEP

- Transitioning from teenage years to adulthood can be stressful for teens with diabetes and their families.
- Teens and young adults need to assume more responsibility for diabetes self-management and make more independent judgments about their health care needs.
- This checklist helps the health care provider, young adult, and family discuss and plan the change from pediatric to adult health care.
- While a variety of events may affect the actual timing when this change occurs, below is a suggested timeline and topics for review.

<http://ndep.nih.gov/transitions/PlanningChecklist.aspx>

1 to 2 years before transition

- Introduce the idea that transition will occur in about 1 year
- Encourage shared responsibility between the young adult and family for:
 - Making appointments
 - Refilling prescriptions
 - Calling health care providers with questions or problems
 - Making insurance claims
 - Carrying insurance card
- Review how smoking, drugs, and alcohol affect diabetes

6 to 12 months before transition

- Discuss health insurance issues and encourage family to review options
 - Assess current insurance plan, e.g. length time on family health insurance plan, COBRA, pre-existing conditions
 - Explore new insurance options – college, employer
 - Consider making an appointment with a case manager or social worker
 - Discussion of career choices in relationship to insurance issues
- Encourage family to gather health information to provide to the adult care team (*Clinical Summary*)
- Review health status: diabetes control, retina (eye), kidney and nerve function, teeth and mouth, lipids (cholesterol), blood pressure, smoking status
- Discuss issues of independence, emotional ups and downs, depression, and how to seek help

3 to 6 months before transition

- Review the above topics
- Suggest that the family find out the cost of current medication(s)
- Provide information about differences between pediatric and adult health systems and what the young adult can expect at first visit
 - Patient's responsibilities
 - Other possible health care team members
 - Confidentiality/parental involvement (e.g., HIPAA Privacy Act and parents need permission from young adult to be in exam room, see test results, discuss findings with health care providers)
- Help identify next health care providers if possible or outline process (*online resources*)
- Discuss upcoming changes in living arrangements (e.g., dorms, roommates, and/or living alone)

Last few visits

- Review and remind of above health insurance changes, responsibility for self-care, and link to NDEPs list of resources
- Obtain signature(s) for release for transfer of personal medical information and for pediatric care providers to talk with the new adult health care providers
- Identify new adult care physician
 - If known – request consult (if possible) and transfer records
 - If unknown – ask teen to inform your office when known to transfer records and request consult
- Review self-care issues and how to live a healthy lifestyle with diabetes
 - Medication schedules
 - Meal planning, carb ctg, etc
 - Crisis prevention, SDR, lo/hi BG
 - Care of the feet
 - Need for vision/eye exams
 - Immunizations
 - Self-monitoring of BG schedule
 - Physical activity and effects on BG
 - Wearing/carrying diabetes ID
 - Oral/dental care
 - Preconception care (pregnancy/baby)
 - Up-to-date with care and technology
- Suggest options for a diabetes “refresher” course

Joslin’s Approach to Transition-1

- A process – not an event
- Always, multi-disciplinary team approach
- Increasing sharing of diabetes care responsibilities
- Interdependence in care and at visit interactions (part with family/part private)
- Discussions of interdependence in care
 - Begin with puberty (often middle school/early HS)
 - PE performed with patient/without parents
 - Allows discussion of ‘sex, drugs, rock n roll

Joslin's Approach to Transition-2

- A process – not an event
- Overall, multi-disciplinary team approach
- Timing of transition

- Pediatric and adult providers together
- Adult endocrinologist/diabetes specialist attends pediatric clinic with pediatric multi-disciplinary team members
- To assist with transition, young adult alternates visits with adult provider and pediatric nurse/NP

Continuous Glucose Monitoring and Intensive Treatment of Type 1 Diabetes

The Juvenile Diabetes Research Foundation Continuous Glucose Monitoring Study Group*

N Engl J Med 2008;359.

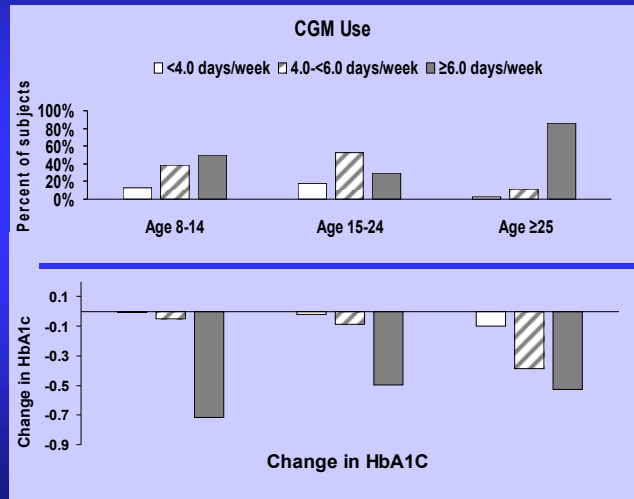
RESULTS

The changes in glycated hemoglobin levels in the two study groups varied markedly according to age group ($P=0.003$), with a significant difference among patients 25 years of age or older that favored the continuous-monitoring group (mean difference in change, -0.53% ; 95% confidence interval [CI], -0.71 to -0.35 ; $P<0.001$). The between-group difference was not significant among those who were 15 to 24 years of age (mean difference, 0.08 ; 95% CI, -0.17 to 0.33 ; $P=0.52$) or among those who were 8 to 14 years of age (mean difference, -0.13 ; 95% CI, -0.38 to 0.11 ; $P=0.29$).

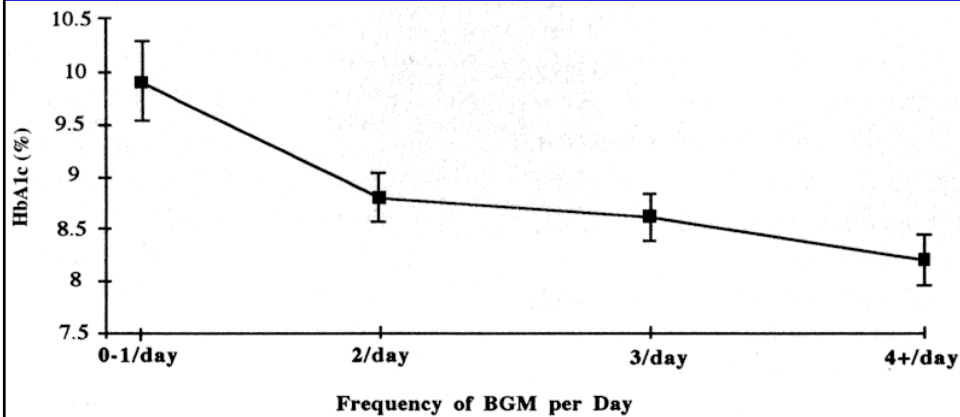
CONCLUSIONS

Continuous glucose monitoring can be associated with improved glycemic control in adults with type 1 diabetes. Further work is needed to identify barriers to effectiveness of continuous monitoring in children and adolescents. (ClinicalTrials.gov number, NCT00406133.)

Relationship Between Change in HbA1c and Frequency of CGM Use



BG Monitoring Improves HbA1c



$P < 0.02$

Anderson: J Peds, 1997
 Levine: J Peds, 2001
 Laffel: J Peds, 2003

THANK YOU!

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