INV1
Treatment of diabetic ketoacidosis in children: New perspectives on intravenous fluid protocols and risk of cerebral injury
N. Glaser1
1University of California, Davis, Davis, United States

This presentation will review data from studies of diabetic ketoacidosis (DKA) in children, focusing on the relationship of DKA treatment to risk of cerebral injury. Data from both human and animal studies will be discussed in relation to various hypotheses about causation of DKA-related cerebral injury. In addition, data from a recently completed randomized trial of intravenous fluid therapies for DKA treatment in children (the PECARN FLUID Study) will be presented along with recommendations for treatment based on these data.

INV2
Psychosocial and economic aspects in recurrent DKA
M. Harris1
1Oregon Health & Science University, Portland, United States

Diabetic Ketoacidosis (DKA) is a life-threatening condition caused by insulin deficiency and is preventable. DKA is a presentation of type 1 diabetes (T1D) but also occurs commonly after diagnosis. Once T1D has been diagnosed, ongoing diabetes review and education for the families reinforces the importance of insulin, allows recognition of risk times for DKA, gives strategies to prevent DKA and highlights the early recognition of symptoms of DKA. Diabetes teams should be vigilant for factors that indicate increased risk of DKA including rapid deterioration in glycaemic control, decreased parental involvement, lack of diabetes knowledge, failure to attend clinics, eating disorders and families using diet to limit insulin doses.

After diagnosis, DKA usually only occurs if insulin is not delivered. Although infections are a common precipitant of DKA because of the ketogenic effects of stress hormones, for significant DKA to occur then insulin omission is usually also a factor (including omission due to fear of hypoglycaemia with nausea/vomiting and adolescent behaviour).

Therefore, ongoing, education and adequate parental supervision is essential to prevent DKA events. It is not good enough for the parent to ask “have you given your insulin,” they must be involved in the insulin administration process. Doing diabetes cares at the dinner table with the parent makes insulin omission unlikely.

DKA only occurs with insulin pump therapy when there is site failure, pump failure or prolonged disconnection. Plastic cannula failure occurs within 6 hours in 3-9% of all insertions. Cannula failure is rare when steel cannulas are used.

Conclusion: Population education is a cost-effective strategy to prevent DKA at presentation. After diagnosis, prevention of DKA requires a multidisciplinary team approach which maintains diabetes management standards and parental involvement.

INV3
Prevention of diabetic ketoacidosis
B. King1
1John Hunter Children’s Hospital, Newcastle, Australia

Prevention of diabetic ketoacidosis (DKA) is a life-threatening condition caused by insulin deficiency and is preventable. DKA is a presentation of type 1 diabetes (T1D) but also occurs commonly after diagnosis. Population education has been shown to prevent DKA in newly diagnosed diabetes.

Once T1D has been diagnosed, ongoing diabetes review and education for the families reinforces the importance of insulin, allows recognition of risk times for DKA, gives strategies to prevent DKA and highlights the early recognition of symptoms of DKA. Diabetes teams should be vigilant for factors that indicate increased risk of DKA including rapid deterioration in glycaemic control, decreased parental involvement, lack of diabetes knowledge, failure to attend clinics, eating disorders and families using diet to limit insulin doses.

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DKA only occurs with insulin pump therapy when there is site failure, pump failure or prolonged disconnection. Plastic cannula failure occurs within 6 hours in 3-9% of all insertions. Cannula failure is rare when steel cannulas are used.

Conclusion: Population education is a cost-effective strategy to prevent DKA at presentation. After diagnosis, prevention of DKA requires a multidisciplinary team approach which maintains diabetes management standards and parental involvement.
INV4
Challenges around successful transition
K. Garvey1
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As young adults with type 1 diabetes (T1D) experience competing life priorities and decreased family support, adherence and glycemic control may decline. Young adults with T1D are at risk for acute and chronic diabetes complications and early mortality. Suboptimal coordination of the pediatric to adult care transition may lead to fragmentation of care delivery and increased risk for adverse outcomes. Currently, the age of transfer to adult diabetes care varies according to institutional and national regulations, the availability of adult services, and the maturity of the patient. Transition challenges in the literature include difficulties in transition preparation, gaps between pediatric and adult care, increased acute care utilization, and deterioration of glycemic control. Some interventional approaches for T1D patients have shown promising results, including dedicated young adult clinics, intensive transition coordination, and use of patient navigators. However, few randomized controlled studies have been published, and more clinical trials are needed investigating best models for T1D transition care. Meanwhile, health systems must continue efforts to strengthen transition preparation, care coordination, and patient tracking, customized to the needs of the clinical setting.

The objectives of this presentation are: (1) identify the unique health care needs of young adults with T1D and components of a successful health care transition; (2) summarize key findings from observational and interventional research on health care transition for young adults with T1D; and (3) discuss existing resources for optimizing transition care and strategies for the future. This presentation will incorporate data and guidelines from different countries and health care systems to facilitate audience reflection and dialogue on optimal approaches to T1D transition care improvement.

INV5
Developmental transition - how to determine the best time
M. Hilliard1
1Baylor College of Medicine, Houston, United States

Adolescence and early adulthood are developmental stages characterized by significant change across a number of life domains including social, financial, residential, educational, employment, and emotional functioning. This often coincides with the transition from pediatric to adult healthcare, which introduces challenges related to selecting and scheduling with an adult provider, navigating a new healthcare system, and adjusting to differences in expectations for autonomy and self-management. To meet the aim of determining the “best time” for transition, his talk will review the developmental considerations that relate to clinical care and the pediatric to adult care transition process from late adolescence through early adulthood, with a focus on family relationships and support systems that can impact transition. Features of clinical programs for transition and transfer of care that match developmental tasks of this period will be reviewed, and data on the outcomes of transition at different ages will be presented.

INV6
The adult perspective on transition
H. Gleeson1
1Queen Elizabeth Hospital, Birmingham, United Kingdom

Biopsychosocial development extends into young adulthood. Adult services should therefore have joint and equal responsibility for facilitating transitional care. Research to date has predominantly focused on care in paediatric services, using the outcome in adult services as evidence of failure or success. Adult services are also often cited as the “problem” in the process of transition, whether this is a “limiting assumption” is open to debate. There are clear differences in how healthcare is delivered between paediatric and adult services; this “difference” is accepted and in some welcomed by young people but they have called for preparation as part of a structured transition program. Adult services are uniquely placed to deliver what is described as “developmentally appropriate healthcare” (DAH), which includes the following elements:

1. Acknowledgement of young people as a distinct group
2. Understanding biopsychosocial development and holistic care
3. Adjustment of care as the young person develops
4. Empowerment of the young person by embedding health education and health promotion in consultations
5. Interdisciplinary and inter organisational work

The increased focus on DAH will hopefully result in progress in improving transitional care across paediatric and adult services which has been lacking despite decades of transition guidance. There are two key elements to assist adult services and their clinicians: training to improve the knowledge, skills and most importantly attitude to work effectively with this age group and monitoring to benchmark and edge adult services towards optimal performance.

INV7
Eating habits around the world in 2017 - From food insecurity to lifestyle diets focusing on children with type 1 Diabetes Mellitus
M. Karipidou1
1Pediatrics Clinic Mitera, Athens, Greece

Food insecurity is an international public health issue. For food insecure people, maintaining a healthy diet is very challenging. Food insecure diabetics, in particular, have poor diabetic control, increased risk for long term complications, are more likely to present with diabetic ketoacidosis at the time of diagnosis; they are significantly more likely to be hospitalized than those from food secure families. On the contrary, in high income countries where people enjoy high quality of life one would expect higher compliance to dietary guidelines and better glycemic control. Nevertheless, dietary habits refrain from being characterized as healthy. Several barriers exist concerning compliance to healthy eating recommendations, including price (access, availability), time (daily habits, time constriction to prepare/cook), competence, quality and some individual characteristics, such as taste (i.e. perceiving healthy foods as unappealing, taste preferences of family and friends, preferred foods), fondness of good food and lack of willpower. Furthermore, children with type 1 diabetes...
mellitus (T1DM) and their families may hold misconceptions about what constitutes a healthful diet for diabetes management. Many youths report that “free” foods high in total fat, cholesterol and saturated fat (such as cheese, ham, bacon, egg, steak) were good choices for their diabetes management since these foods do not contain carbohydrate.

In summary, eating habits either concerning food insecure populations either affluent societies seem to be characterized by a rather deterioration of diet quality, which also affects children with T1DM. Thus, clinicians treating children with T1DM face many challenges. They need to screen families with a child with T1DM for food insecurity and facilitate access to all of the available resources. Their impeded dietary habits mandate the need to advocate for more support for children with T1DM.

INV8
Carbohydrate counting; just a part of a bigger picture
A. Deeb1

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Carbohydrate (CHO) counting is a meal planning approach that focuses on CHO as the only nutrient affecting postprandial glycemic response. Although some children and families master the technique of CHO counting, research has shown that underestimation and overestimation of foods remains a challenge. Bigger meals with higher CHO content is commonly associated with underestimation of CHO leading to postprandial hyperglycemia. CHO counting can be distracting on major healthy eating principles and routines. It can be seen as an emphasis on one nutrient only rather than being a part of an overall dietary quality plan.

There are various drawbacks for using CHO content as the sole determinant of prandial insulin dose. The use of the glycemic index (GI) has been shown to provide additional benefit to glycemic control over that observed when total CHO is considered alone. In type 1 diabetes, it ideal to include GI with a method of carbohydrate quantification or regulation.

Fibre contents and other food characters have an impact on glucose dynamics which might be omitted on traditional CHO counting. Higher fibres-containing CHO convert to glucose more slowly. In addition, solid and cold food digest at a slower rate when compared to hot liquids. These food dynamics might alter CHO metabolism and glucose level if not taken into consideration. Fibres, fat and protein have a proven impact on postprandial glycaemia and should be considered in interpreting and optimizing postprandial glucose level.

Relying purely on CHO content on estimation of insulin dosing might lead to inaccuracy. Dietary glycemic load is found to be superior to CHO content in estimating postprandial glycaemia in healthy individuals. This is particularly the case in mixed meals in which, unlike CHO content, glycemic load was found to be the strongest predictor of postprandial glucose and insulin responses.

Proper CHO counting needs an adequate degree of understanding and it is essential that its teaching is incorporated as part of team-based approach to management. Regular knowledge revision and re-education of CHO counting is crucial for consolidating the skills of counting. Regular review is necessary as children grow and new foods are introduced. All these requirements need to be fulfilled for effective CHO counting.

Symposium III - Progress towards CURE

INV9
Age-dependent human beta-cell proliferation induced by GLP-1 and calcineurin signaling
C. Dai1, Y. Hang2, A. Shostak1, N. Hart1, G. Pfoffenberger1, N. Prasad3, S.E. Levy4, D.L. Greiner5, L.D. Shultz2, R. Bottino7, A.C. Powers12,9, S.K. Kim210

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To understand and control the mechanisms underlying age-dependent decline of human islet b-cell proliferation, we developed an engraftment strategy that maintains age-associated human islet cell replication competence. We found that Exendin-4 (Ex-4), an agonist of the Glucagon-like peptide 1 receptor (GLP-1R), stimulates human b-cell proliferation in juvenile but not adult islets. This age-dependent responsiveness does not reflect loss of GLP-1R signaling in adult islets since Ex-4 stimulated insulin secretion by both juvenile and adult human b-cells. We show that the mitogenic effect of Ex-4 requires Calcineurin (Cn) /Nuclear Factor of Activated T-cells (NFAT) signaling. Ex-4 induced expression of Cn/NFAT signaling targets including proliferation-promoting factors including NFATC1, FOXM1, and CCNA1. Ex-4-stimulated b-cell replication appears limited in adult islets by Cn-independent factors, including known inhibitors of b-cell proliferation such as p16INK4A. These studies reveal age-dependent signaling mechanisms regulating human b-cell proliferation, and elements that could be adapted for therapeutic human b-cell expansion.

C. Dai, Y. Hang, AC Powers and S Kim contributed equally for this work

INV10
Pharmacological targeting of cell type identity in the endocrine pancreas
S. Kubicek1

1Chemical Screening and Platform Austria for Chemical Biology, Vienna, Austria

The pancreatic islets of Langerhans are composed of at least five distinct endocrine cell types that develop from a common progenitor cell under the direction of master regulatory transcription factors. Mouse genetics has shown that the mis-expression of specific transcription factors from other lineages causes the transdifferentiation of these cell types. For example, alpha cells convert into beta-like cells in vivo upon expression of the beta-cell factor Pax4 or upon loss of the alpha cell factor Arx.

We are interested to characterize and modulate cell type identity in human pancreatic islets. Therefore, we use genomic and epigenomic methods to map the identities of pancreatic endocrine cells with single cell resolution, thereby being able to identify human specific properties. In mouse genetics, overexpression of master regulatory transcription factors is a powerful technique to modulate cell
INV11
Development of a stem cell-derived islet replacement for type 1 diabetes
H. Foyt
ViaCyte, San Diego, United States

INV12
New ways of educating diabetes teams
D.J. Becker
Children's Hospital of Pittsburgh of UPMC, Pittsburgh, United States

INV13
Age appropriate e-learning tools for patients and their families
K. Lange
Hannover Medical School, Hannover, Germany

INV14
App use for diabetes education: staying relevant in a changing world
H. Phelan
John Hunter Children's Hospital, Newcastle, Australia

INVITED ABSTRACTS

INV11
Development of a stem cell-derived islet replacement for type 1 diabetes
H. Foyt
ViaCyte, San Diego, United States

The tools used are known as educational technology The Association for Educational Communications and Technology denoted instructional technology as "the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning." More recent systems development is based on computer supported collaborative learning, which encourages the shared development of knowledge.

ESPE has developed these tools and invited ISPAD to collaborate with the creation of the diabetes learning modules. The initial step was to upload all the ISPAD diabetes guideline chapters into the e-learning system and provide access of ISPAD members to this system. These chapters are currently being updated. The next step was to create modules for interactive learning consisting of case studies with multiple choice questions and suggested answers. This is in process with authors and editorial committee working together.

The advantages, disadvantages and obstacles of the process will be discussed.

INV14
App use for diabetes education: staying relevant in a changing world
H. Phelan
John Hunter Children's Hospital, Newcastle, Australia

We are living through a time of unprecedented change. Mobile phone use is growing exponentially, with the current 2.6 billion smartphone users worldwide, expected to grow to 6.1 billion by 2020. At the same time there has been a rapid progression of internet access previously printed books and brochures, which are now available as e-books or on websites, to structured internet delivered diabetes self-management education for adolescents or parents. A huge number of smartphone and tablet applications are available to support carb and/or protein/fat counting, meal planning, and insulin dose calculation depending on glucose measurements.

Age appropriate stories of role models with type 1 diabetes, detailed technical instructions, and games on videos might support children's knowledge and practical skills. National diabetes associations, patient organisations and pharmaceutical companies offer these tools for the young on their websites.

Some nationwide patient organizations provide comprehensive information about all aspects of diabetes in everyday life. In addition mainly parents share their experiences in closed internet forums and provide peer support. There is insufficient evidence on the effects on relevant outcomes in children and adolescents with diabetes - but on the other hand the number of forum members and rates of access are impressive. There are advantages, especially for families in remote and undeserved regions, by improving access to care.

At least data on the effectiveness of various structured web-based diabetes education concepts are reported. They address adolescents to aid them through transition focussing on self-management, health-related self-efficacy, and patients' communication skills. Structured web-based programs for parents aim to reduce their diabetes-specific parenting stress and to support an authoritative parenting style. These effective programs were based on approved psychological concepts and monitored by psychologists specialized in childhood diabetes.

Finally strengths and limitations of web-based interventions to educate diabetes self-management are discussed.
Symposium IV - Physical activity

INV15
Fueling active youth with type 1 diabetes. Nutrition recommendations for exercise to optimise glycaemic control and sports performance
C. Hume
1London Diabetes Centre, London, United Kingdom

Physical activity is important for childhood development. Yet a fear of hypoglycaemia among caregivers may lead to less physical activity in children with type 1 diabetes. One in three children with type 1 diabetes are reported to be obese or overweight and therefore physical activity also plays an important role in weight control. Aims of nutrition recommendations for active children and adolescents include ensuring adequate energy and nutrients to support growth and development, hypoglycaemia prevention during exercise, and where appropriate nutrition advice to optimise performance in athletic endeavours.

The presentation's objectives are summarised below:
- To have an understanding on how to assess an individual's diet, eating pattern, and exercise routines in order to provide tailored advice on nutrition and insulin adjustments.
- To be able to estimate the energy and macronutrient requirements of active children and adolescents.
- To have an awareness of micronutrients often lacking in the diet and those which are particularly important for active children and adolescents.
- To have an understanding of nutrition and insulin considerations when preparing for exercise / physical activity.
- To be able to provide advice on nutrition required during exercise for prevention of hypoglycaemia and if applicable for optimal athletic performance i.e. how much, what and when.
- To have an understanding of post-exercise nutrition and insulin considerations.
- Knowledgeable on how to adapt nutrition recommendations for both planned and unplanned exercise and an appreciation for circumstances under which recommendations need adapting.
- To be able to advise young athletes on safe use of sports products and supplements.

INV16
Exercise management in type 1 diabetes
C. Taplin
2University of Washington, Seattle, United States

Exercise is an important aspect of the care of children with type 1 diabetes, promoting improved cardiovascular health, glycaemic control and participation in normal life. However, exercise presents several important challenges related to exogenous insulin delivery and risk of potentially dangerous glycemic excursions. While overall fitness and even elite level performance is possible in people with T1DM, especially in the setting of target or near-normal glycaemia, in those with poor glycaemic control exercise capacity is impaired. Numerous clinical and research challenges remain in managing exercise safely in people with T1DM, including data to direct clinical care to maintain euglycaemia (and prevent hypoglycaemia) during, and after, exercise as well as technologic advances that will better adapt insulin and counterregulatory hormone responses during and after exercise to more closely mimic the normal neuro-endocrine milieu. The objectives of this talk include a review of recommendations for exercise in youth, an update on the understanding of differential physiologic mechanisms that contribute to glycemic excursions in type 1 diabetes, and discussion of clinical and personal barriers to achieving exercise recommendations in youth with type 1 diabetes. A practical approach based on underlying physiology to facilitate safe exercise in type 1 diabetes will be discussed, with a brief discussion pertinent to the application and barriers of new technology including insulin-only and multi-hormone automated closed loop systems.

INV17
What's your Everest?
W. Cross
1Will Cross Motivates, Denver, United States

What is your Everest? is a presentation and discussion about walking to both Poles and climbing the highest peak on every continent. The accomplishment is unique, no one with diabetes has competed this goal. Will Cross has had T1D for over 40 years and wears a Tandem insulin pump during his expeditions. The talk will examine goal setting, diet, insulin management, blood glucose controls and testing in very harsh environments.
INV18
**Cardiovascular risk factors in diabetes outcome**
K.O. Schwab

University Hospital Freiburg, Freiburg, Germany

Cardiovascular events are the most frequent cause of death in type 1 diabetic patients. In adolescence, however, advanced atherosclerosis can markedly regress if the patient's cardiovascular risk factors are sufficiently controlled. This seems to be not similarly possible in adults because irreversible stages of atherosclerosis are reached. Metaanalyses illustrate that a sufficient therapy of obesity, metabolic syndrome or hypertension up to 18 years of age and an illness-free life in adulthood lead to a nearly normal cardiovascular risk because of this atherosclerosis regression in youth. In contrast, untreated patients more frequently develop type 2 diabetes, hypertension, increased intima media thickness and finally stroke and myocardial infarction. Unfortunately, the incidence of lipid lowering medication in type 1 diabetic patients is very low. 26% of pediatric type 1 diabetes patients have dyslipidemia but only 0.4% receive lipid lowering medication. Why are pediatricians so hesitant to treat their patients adequately?

One reason might be the limited experience with concern to lipid lowering medication. In order to facilitate lipid lowering therapy, we introduced the possibility to compare individual HDL-, LDL- and non-HDL-cholesterol levels with that of other type 1 diabetes patients or healthy individuals (J Pediatr. 2014;164:1079-84). Moreover, the levels of non-HDL-C can be compared with generally accepted borders. Moreover, the expected improvement of lipid profile after HbA1c improvement can be calculated (J Pediatr. 2015;167:1436-9). If these values are above the accepted non-HDL-C levels, a simultaneous introduction of both life style changes and medication has to be considered. These tools might be helpful in decision making for initiating lipid lowering medication in order to improve the cardiovascular risk of our patients. **Think earlier about later!!**

INV19
**Predictive value of albumin creatinine ratio in determining renal, retinal and CVD risk**
L. Marevecchio

University of Cambridge, Cambridge, United Kingdom

Extensive evidence indicates that urinary albumin excretion, even within the normal range, is a marker not only of renal disease but of a more generalized endothelial dysfunction and therefore a potential predictor of other vascular complications of diabetes, such as retinopathy and cardiovascular disease (CVD).

In young people with childhood-onset type 1 diabetes (T1D), early increases in urinary albumin excretion rates can occur during the first years after diagnosis and they can predict future risk of vascular complications. Data from longitudinal observational studies indicate that an albumin creatinine ratio (ACR) in the upper tertile of the normal range at the age of 11-16 years can predict up to 85% of adolescents who develop microalbuminuria, and all of those who develop proteinuria during follow-up. Recent results from the Adolescent type 1 diabetes cardio-renal Intervention Trial (AdDIT) have confirmed the value of albumin excretion as an early renal, retinal and CVD marker in young people with T1D. AdDIT participants, aged 10-16 years, with increased urinary ACR levels showed higher glomerular filtration rate (GFR) and increased CVD risk, as indicated by higher lipid levels, arterial stiffness and increased aortic intima media thickness, signs of impaired cardiac autonomic function as well signs of early alterations in the retinal microvasculature, when compared to T1D adolescents with lower albumin excretion.

These data support the concept that risk stratification using ACR during early adolescence may be critical for the early identification of patients at risk of developing renal, retinal and CVD complications and to guide the implementation of preventive and treatment strategies to reduce the burden associated with vascular complications of diabetes.

INV20
**Quality of life: an often-forgotten treatment target?**
B.J. Anderson

Baylor College of Medicine, Houston, United States

As contemporary technologies to augment diabetes treatment are increasingly being evaluated, it is vital for diabetes-specific quality of life outcomes to be assessed along with glycemic outcomes. The objectives of this presentation are: (1) Distinguish between the constructs of “quality of life” and “diabetes-specific quality of life”; (2) State 4 different domains of diabetes-specific quality of life; and (3) Identify 2 reasons why it is important to measure diabetes-specific quality of life in people living with Type 1 diabetes (T1D). The constant requirements of daily T1D management and symptom monitoring are relentless and demanding and place a clear burden on people with T1D. Elevated risk for anxiety and depressive symptoms as well as heightened diabetes distress have been well-documented in people with diabetes from childhood through adulthood. These psychological burdens detract from the diabetes-related quality of life of people with diabetes. Diabetes-specific quality of life refers to everyday well-being with respect to diabetes - its management and symptoms; its impact on the domains of school, work, relationships, leisure time, finances, and mood. Diabetes-specific quality of life includes both positive and negative aspects of daily life with diabetes. Poor diabetes-specific quality of life is of significant concern because it is strongly related to poor health outcomes (higher HbA1c’s, more frequent hospitalizations and emergency room visits). Moreover, poor diabetes quality of life has been related to high levels of family conflict, and to inadequate family involvement in diabetes management. Given the substantial psychosocial burdens of T1D on people with diabetes across the lifespan, brief, validated methods to assess diabetes-specific quality of life and effective strategies to enhance and support diabetes-specific quality of life in people living with T1D are critically important.

The development of a brief measure of diabetes-specific quality of life will be discussed, and potential clinical applications of this brief measure in patient-clinician encounters will be explored.
Symposium VI - Challenges and solutions to achieving better control in new units

INV21
Magnitude of the problem- barriers in improving care
B. Zabeen
1Diabetic Association of Bangladesh, Dhaka, Bangladesh

Diabetes Mellitus (DM) poses an enormous burden on the family and the country, as it is a lifelong condition requiring expensive treatment, and monitoring, though the numbers are not huge in Bangladesh. Societal, and financial pressures and availability of resources pose challenges to management of DM.

The wide disparities in socioeconomic levels and educational background make acceptance of diabetes and ability to manage the condition very variable. Majority of patients are from poor backgrounds and need full support to manage their condition. They often have to travel long distances for treatment, which can make attendance irregular.

Social pressures often compel families to hide the condition from school authorities. In addition families do not disclose the condition at marriage and job applications for fear of rejection.

Resources are often limited in developing countries, with erratic supply of insulin and monitoring supplies. In Bangladesh, the Diabetic Association ensures supply of insulin and monitoring materials and treatment of the poor diabetics.

Addressing the challenges will need creation of awareness amongst the public that diabetes can affect children and is an eminently manageable condition, thus removing the stigma attached to it.

Education of patient and their caregivers regarding management, emphasizing that patients are responsible for controlling their diabetes and doctors and other health workers are there to help.

Ensuring availability of insulin and monitoring and testing materials at affordable price

Involvement of the government health services in the provision of care to diabetic patients. So far the government provides mainly episodic care.

Creation of diabetes care units in district and tertiary hospitals.

Ensure supplies in these units.

Diabetes units should be multidisciplinary, consisting of diabetologist or a doctor/ paediatrician trained in childhood diabetes, nutritionist, nurse, psychologist.

Although this may seem a huge task, ensuring and mobilising resources can overcome these challenges.

INV22
Type 1 diabetes in Mali: strengthening the health system to improve data gathering
S. Besançon
1ONG Santé Diabète, Bamako, Mali

Background: Type 1 diabetes in Mali In 2003, The International Diabetes Federation (IDF) estimates that there are a total of 790 new people with Type 1 diabetes [1] in Mali. In 2004, the NGO Santé Diabète (SD) and the International Insulin Foundation (IIF) conducted the RAPIA investigation which allowed the barriers to diabetes care and the reality for the type 1 diabetes in Mali with just 10 patients a live with a life expectancy of less than 1 year after diagnosis [2].

Case description: Before improving data gathering for Type 1 Diabetes in Africa: the need to build care provision

- Strengthen human resources: 31 diabetes consultations diabetes open in 7 regions of Mali and the District of Bamako who manage more than 15 000 diabetic patients including type 1 diabetes;
- Increase access to medicine: lower prices of insulin by 48% and price of OAA divided per 10;
- Improve technical facilities and the ability to carry out biological assessments: availability for each diabetes consultations analysis equipment, educational materials and drugs;
- Develop prevention programs and therapeutic education programs
- Strengthen healthcare system governance

For the management of type 1 diabetes, the strengthening of the health system, with the support of IDF’s LFAC program, has made it possible to detect and manage many children and young adults. The active file has gone from less than 10 DT1 in 2004 to more than 450 in June 2016 [3].

The need to develop management of type 1 diabetes and to develop the tools to the gathering of data

With a real active file of type 1 diabetes, since 2015, since 2015, we started the structuration of type 1 diabetes care with the creation of a sub unit for type 1 diabetes and young adults within the endocrinology and diabetes service in the national hospital and the development of early education tools for T1D.

To really achieve better control in the new units we develop also a paper medical record and a logbook for each child to record the first data on T1D in Mali.

From record data on paper to real utilization of medical data for DT1

The final step was in 2015 when Mali join the sweet. This made it possible to computerize the paper files and to analyse the first data. Work still needs to be done with sweet to adapt the type of data to be collected for Africa.

Conclusion: In order to obtain data and develop the data collection for type 1 Diabetes in Africa, a three-step strategy must be followed:
1. Strengthening the health system to lift all the barriers to care for T1D in Africa
2. Construct data collection tools in the country adapted to the national health information system
3. To have a data collection and analysis tool that will allow to improve the care but also to improve the important data to be collected nationally

References
Meet the Experts I - How to manage toddlers and preschoolers with diabetes in different parts of the world

INV23
How to treat toddlers?
F. Sundberg¹
¹The Sahlgrenska University Hospital, Queen Silvia Childrens Hospital, Gothenburg, Sweden

Toddlers are dependent on others for all aspects of their care. For their families, this is an essential component of driving quality improvement and expectations for toddlers with type 1 diabetes. No one would disagree that supporting the family is necessary for promoting health in the toddler. Early childhood is important for establishing the salutogenic (health promoting) capacity needed for a long life with type 1 diabetes. Supporting the parents to endure the burden of intensified insulin treatment is essential.

Screening and promotion of optimal health-related quality of life should be done in toddlers with type 1 diabetes as in any child with diabetes.

INV24
Predictably unpredictable: managing food, insulin and expectations for toddlers with type 1 diabetes
M. Raymond¹
¹Boston Children's Hospital, Boston, United States

Toddlers with type 1 diabetes present with a unique array of challenges in feeding and managing blood glucose levels. These years are a time of significant growth and development when children are learning not only how to walk, talk and use the potty, but also about the dynamics of feeding and mealtimes.

When it comes to food, the toddler stage is characterized by picky eating, not finishing meals or resisting mealtimes altogether. This can be challenging for any parent, but when predictability is key to managing your toddler’s type 1 diabetes, the situation can be even more overwhelming. Despite these challenges, this is a great time for parents and caregivers to establish healthful eating practices and set the stage for proficient diabetes management throughout the years to come.

During this session, we will review general toddler feeding guidelines, common pitfalls for toddlers with type 1 and how to dynamically manage these difficult situations. We will explore topics such as picky eating, hypoglycemia, glycemic variability and physical activity.

Plenary Session III - Do We Need a Worldwide Diabetes Registry?

INV25
Advantages and pitfalls in interpreting global data
J. Warner¹
¹Noah's Ark Children's Hospital for Wales, Cardiff, United Kingdom

Many countries now collect data about process and outcomes for their pediatric diabetes populations. No one would disagree that this is an essential component of driving quality improvement and leads to a better understanding of how delivery of care can be optimised.

Although between country comparisons of outcomes are helpful, one must consider the variability throughout the world on the techniques used to collect the data from prospective registries to retrospective audits and from whole country to selective clinic based data.

Data completeness and quality also remains an issue making inter country comparisons difficult especially when data is analysed independently from one another.

Collaborative studies involving numerous different country sources of data can be helpful as it can be analysed together and adjustments made for different case-mixes. This can often provide a better understanding of inter country variability and how strategies to improve maybe different in individual nations.

This talk will explore some of the advantages to global data collection and analysis but also point out pitfalls in interpretation.

INV26
Challenges in establishing diabetes registries in developing countries: experience from India
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India has a large number pool of diabetes patient making it the diabetes capital of the world. As per IDF 2015 currently there are around 69.2 million people living with diabetes in India and is expected to rise to 123.5 million by 2040. In addition there are many more adults with impaired glucose tolerance, which puts them at high risk of developing the disease in the future. In addition to placing a large financial burden on individuals and their families due to the cost of insulin and other essential medicines, diabetes also has a substantial economic impact on countries and national health systems because of an increased use of health services, loss of productivity and the long term support needed to overcome diabetes related complications, such as kidney failure, blindness or cardiac problems. Many developing countries are still unaware of the social and economic impact of diabetes.

What is a Diabetes Registry?
- Database with demographics, illness characteristics, treatment delivered, and specialty care arranged/delivered
- Information from electronic and paper records guides care, tracks outcomes, and informs plans for improving care
Symposium VII - We are what we eat...

INV27
How can patient organisations influence political actions

J. Hitchcock

1Children with Diabetes, West Chester, United States

In "How can patient organisations influence political actions," I will share a few examples of how people living with type 1 diabetes in the United States have been able to impact legislation and policy, including codifying the rights of students in school, workplace rights for adults with type 1 diabetes, device approval by the FDA, and expanded research funding from Congress.

Symposium VIII - Social media - boon and bane

INV28
Brave new diabetes world - merits and dangers of the flood of digital data

M. Stadler

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Patient empowerment has reached a new dimension through digital media and global connectivity, entrepreneurs and health politically active groups have emerged from this development.

For example, international networks of academics are analyzing "big data" for research purposes and quality management, but there is a significant commercial interest as well, leaving a grey zone of uncertainty around data protection and data ownership.

The availability of data downloads from patients' devices can be very helpful for the clinician and the patient, but at the same time the flood of health data can be overwhelming, distracting and time-consuming, giving rise to the need for more structured consultation strategies for the diabetes care team.

INV29
Optimizing mobile technologies in diabetes self-management interventions

S. Mulvaney

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Daily diabetes self-management is influenced by a multitude of psychosocial, cognitive, and behavioral factors that are difficult to consistently identify, integrate with insulin, and blood glucose data, and then prioritize. Advances in access to diabetes management data, along with high levels of mobile phone use, provide unprecedented opportunities to support and improve patient self-management in real time.
Meet the Expert II - Communication skills in pediatrics

INV31

Team work!
D. Daneman

On a day-to-day basis, it is not an in-depth knowledge of pathophysiology that counts, but rather the behaviours (application of this knowledge) and circumstances (social determinants of health) that will determine the long-term outcome of children and teens with type 1 diabetes. The art of diabetes care is to apply the science in such a way that the person with diabetes gets to “control” their condition, rather than being controlled by it.

The focus of this session will be to dissect two of the essential components in determining health outcomes in type 1 diabetes: namely, understanding the concept of social determinants of health and the need for health equity, and listening carefully to the patient narrative. The major social determinants of health (poverty, food and shelter insecurity, lack of access to education and health care, and freedom from abuse/neglect (sense of belonging, are often overlooked in the rush to “give the facts.” A review of the literature reveals socioeconomic status to be a constant factor associated with outcome.

Simplistically, patient-health care professional interactions can be divided into two components: first, taking a history, and, second, listening to the patient’s/family’s needs. This will represent the major part of the presentation and will consist in a series of patient experiences to illustrate the richness and importance of these interactions from disease onset to transition from the children’s clinic to adult care.

INV32

The art of conversation: finding ways to bridge the gap
D. Christie, G. Griffiths

A practical demonstration of positive communication in diabetes consultations between professionals and patients.
Conversations between health care professionals and patients can be faced with equal dread by both sides. Both can feel their contribution is undervalued by the experience and expertise of the person sitting across from them resulting in frustration and a sense of irritation. The young person may expect to be criticised whilst the professional expects to be ignored.

Children, young people and parents can feel unsupported and misunderstood by their diabetes team whilst the diabetes team feel what they believe to be the best advice managing diabetes is unappreciated or ignored.

An open, person centred communication style that uses active listening can help people explore and resolve ambivalence about behaviour change and identify strengths abilities and resources. This approach ensures consultations end with health care teams feeling appreciated and patients feeling understood resulting in better long term health outcomes and improved quality of life for everyone involved (including the health care professionals).

The presentation will illustrate what can go wrong in a diabetes consultation before demonstrating a number of simple steps that can be used to structure a conversation that will leave both sides feeling positive and enthusiastic.

Participants will
- Increase their knowledge and understanding of positive communication approaches with patients.
- Have a glimpse into the minds of a doctor and a patient before, during and after a brief unsatisfactory consultation.
- Evaluate five simple steps used as part of a person centred communication style

Plenary Session IV - Looking for a Needle in a Haystack

INV33
Biobanks: what is the haystack and how can we get the right samples?
F. Betsou
1IBBL, Luxembourg, Luxembourg

The presentation will explain the biobank activities and will focus more particularly on the quality of biospecimens and associated data. Different examples will be used to highlight the impact of the collection, processing and storage methods on the analytical endpoints and the validity and reproducibility of research results. The question of sample distribution from stock versus ad hoc project-driven collections will be discussed. Finally, the concept of sample qualification will be explained.

INV34
INNODIA - what do we aim for and how to find the needle
D. Dunger
1University of Cambridge, Cambridge, United Kingdom

INNODIA is a large, exciting academic industry consortium funded through the EU IMI-2 scheme which aims to take an innovative approach towards the understanding and arresting the development of type 1 diabetes. It brings together leading clinicians overseeing T1D registries and large clinical trial centres aligned with basic science experts in beta cell pathophysiological, immunology biomarkers discovery, informatics systems biology and trial design.

The broad remit of INNODIA makes possible the discovery of novel diagnostics and biomarkers which predict progression leading to the development of new interventions and translation using innovative trial designs and the INNODIA clinical trials network.

Symposium IX - Which targets should we aim for? Debate on HbA1c

INV35
Diabetes management over the past decades: what has changed?
B. Karges
1RWTH Aachen University, Aachen, Germany

Glycemic targets of blood glucose and glycated hemoglobin (A1C) for children with type 1 diabetes have been lowered during the past 20 years. Since 1995 diabetes treatment and outcome has been documented using the Diabetes Prospective Follow-up DPV database at Ulm University, Germany. As of 2015, 446 diabetes centers from Germany, Austria and Luxembourg participate in this population-based nationwide initiative. During these 20 years of diabetes benchmarking including 63,967 pediatric patients with type 1 diabetes, the mean A1C level declined from 8.9% to 8.0%. The use of insulin pumps has substantially increased from 1% to 50%. The use of NPH insulin decreased from 93% to 20%, while usage of rapid-acting insulin analogs increased from 0.1% to 80% and of long-acting insulin analogs from 1% to 30%. The mean frequency of self-monitoring of blood glucose rose from 2 to 6 per day. Since 2016 continuous glucose monitoring is more and more used. During the past two decades a markedly reduction of severe hypoglycemia frequency by more than half was observed. The previously strong association of low HbA1c with severe hypoglycemia has significantly decreased in recent years. Insulin pump therapy as compared to multiple daily injection therapy has been associated with lower rates of severe hypoglycemia and of diabetic ketoacidosis as well as with lower HbA1c levels. In conclusion, diabetes therapy has become more intensive during the past 20 years. Current insulin treatment regimens are safe and effective. Low HbA1c is no longer a strong predictor of severe hypoglycemia, reducing the barriers to achieving and maintaining near-normal glycemic control.

INV36
A1c Targets < 7.5% CON
L. Laffel
1Joslin Diabetes Center, Boston, United States

Almost 25 years ago, the Diabetes Control and Complications Trial (DCCT) demonstrated the importance of achieving A1c values as close to the reference range as possible in order to prevent or postpone the development of advanced diabetes complications. Indeed, since the DCCT, intensive insulin therapy has become the standard of care for persons with type 1 diabetes (T1D). Therefore, it is
important for providers to optimize glycemic control for persons with diabetes. In pediatric patients, this effort often translates to a target A1c of < 7.5%. However, there may be a number of reasons why one may need to reconsider, and even avoid, the A1c target of < 7.5% in young persons with diabetes. During this symposium, at least three reasons will be discussed.

First, it is important to individualize glycemic targets for young persons with T1D, rather than offer absolute A1c or glucose targets for all. For example, consider patients struggling with high glucose values and A1c levels >10%. Such individuals should be given realistic goals, such as A1c targets < 9%. Incremental goals, such as these, can help providers as they work with patients and families to achieve improvements closer to the ‘ideal’ target range. Second, there can be numerous medical conditions or patient characteristics that would be relative or absolute contraindications to A1c values < 7.5%. For example, providers may suggest less rigid glycemic and A1c targets for patients with hypoglycemic unawareness, gastroparesis, neurocognitive deficits, or complicating medical conditions that threaten survival, among others. Finally, providers must consider outcomes beyond A1c when they formulate diabetes management programs. For instance, glucose time-in-range (glucose values 70-180 mg/dL [3.9-10 mmol]) may be a preferred target over A1c as glycosylated hemoglobin can have limitations.

Thus, for these reasons and others, it is important to avoid a dogmatic target A1c of < 7.5% and to maintain an individualized approach to care.

Symposium X - Reproductive health counselling in diabetes

INV38 Preconception counseling in youth with diabetes
D. Charron-Prochownik1

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Congenital anomalies are four times higher among offspring of women with diabetes than in the non-diabetic population due to uncontrolled blood glucose prior to and during pregnancy. Preconception counseling and care (PC) lowers this risk. The American Diabetes Association (ADA) recommends PC for all diabetic women of child-bearing potential; however, most of them never received PC and continued to have unplanned pregnancies. Our program called Reproductive-Health Education and Awareness of Diabetes in Youth for Girls (READY-Girls) served as a catalyst for the ADA to specify that PC should be given at all routine clinic visits “starting at puberty”. We will discuss the significance of a developmentally appropriate PC program for this age group; and describe the components, content and evaluation of a PC program. Our studies examined the short-term (6-12 mos) and long-term effects (12 yrs follow-up) of READY-Girls on intentions and behaviors regarding family planning vigilance and PC in the same cohort of young women. Effects on cognitive, psychosocial and behavioral outcomes and cost-effectiveness have been demonstrated. This program increased knowledge and enhanced attitudes toward seeking PC; improved use of effective family planning; initiated discussion of PC with health care providers, and delayed sexual initiation. READY-Girls was developed in partnership with the ADA and promoted to healthcare providers and consumers with diabetes. The resource utilization cost of the program is $18, a minimal expense considering the potential economic and human costs of an unplanned high-risk pregnancy.

INV39 Diabetes therapy in teenage pregnancy
H. Murphy1

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The number of pregnancies to women under 18 years of age has halved in the past 20 years, with the lowest recordable rates of pregnancies in women aged 15 to 17 since records began. However pregnancies in this age group are not without risk. Younger women have higher rates of smoking, asthma and thyroid disease and are at particular risk for inappropriate (too little) gestational weight gain and preterm delivery. Among the growing proportion of younger women with type 2 diabetes, contraception use is infrequent, with increased rates of poor glycaemic control and high BMI, which may be associated with increased congenital anomaly and poor pregnancy outcomes. More work is needed to increase use of safe effective contraception and improve health outcomes among teenagers with diabetes.
Meet the Experts III - Type 2 Diabetes in Youth

INV40
How to distinguish between type 1 and type 2 diabetes in youth
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1University of Colorado Anschutz Medical Campus, Aurora, United States

The typical image we have of the youth with T2D is that of an overweight and/or obese adolescent, more often female, in mid-puberty, likely from an economically disadvantaged minority group. While this characterization does capture the majority of youth with type 2 diabetes, it is not sufficiently universal to allow diagnosis of type 2 diabetes on clinical grounds alone. In particular, with the escalating rates of obesity and changing demographics in the population of many countries, none of the characteristics associated with type 2 diabetes in youth excludes the possibility of type 1 diabetes. Unfortunately, children with autoimmune T1D are also becoming overweight/obese making the clinical distinction between T2D and obese T1D difficult. This was illustrated in the TODAY study, among others, in which 9.8% of youth diagnosed by their pediatric endocrinologist on clinical grounds was actually antibody-positive; in other less selected populations, the rate has been as high as 75%, with the rate of antibody positivity likely dependent on the ratio of type 2 and type 1 diabetes in the background population. The distinction between youth with T2D and obese youth with autoimmune T1D is further blurred because youth with T2D can present with DKA and HHS. Yet, while the phenotype of obese antibody positive youth overlaps with antibody-negative youth, the antibody positive youth have features more characteristic of type 1 than type 2 diabetes and, most importantly, have lower insulin secretion and more rapid progression to insulin requirement. Therefore, the distinction between autoimmune Type 1 diabetes in an obese adolescent and a youth with T2D has important implications for treatment. In this talk, we will use cases to explore the approach to distinguishing diabetes type in the obese adolescent presenting with new-onset diabetes.

This discussion will include characteristics of presentation, family history, and biochemistry, as well as use of antibody measurement and consideration of disease trajectory. We will also review the treatment implications of this distinction.

INV41
Closing the loop: where are we so far?
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Continuous glucose monitoring devices and insulin pumps can be combined to form a closed loop apparatus, also known as the Artificial Pancreas, an emerging medical device which may transform management of type 1 diabetes. This promising approach differs from conventional insulin pump therapy through the use of a control algorithm which directs subcutaneous insulin delivery according to sensor glucose levels. Closed-loop prototypes have been tested extensively under controlled laboratory conditions in youth, adults and in pregnancy demonstrating reduced risk hypoglycaemia and increased time in target glucose range. Pioneering transitional and home studies have been performed to demonstrate benefits in target settings. Exercise and meal consumption present particular challenges owning to rapid changes in glucose excursions and may require user involvement, co-administration of hormone counteracting insulin action or faster insulin analogues. Focused academic-industry collaboration is required to exploit closed-loop technologies, to bridge gaps, and to accelerate transition to clinical practice. Scalability, low biological risk and innovation potential are the main appeal. In 2016, a closed-loop system has been approved in the US for the use in those 14 years and older marking a new era in glucose responsive insulin delivery. Made, and the safety and feasibility of AP systems have been demonstrated in the clinical research center and more recently extensively in outpatient “real-world” environments. It is now very clear that AP systems are technically feasible. However, it remains less certain that they will be widely adopted by clinicians and patients. Ultimately, the true success of AP systems will be defined by successful integration into the diabetes health care system and by the ultimate metric: improved diabetes outcomes.

Improved diabetes outcomes must be considered more broadly than simply improved A1c levels. The value of AP systems will be beyond A1c and should include additional glycemic outcomes such as improved time in the target glycemic range, reduction in hypoglycemia and reduction in serious events such as DKA and severe hypoglycemia. Furthermore, AP systems may improve patient reported outcomes (PRO’s) such as sleep, fear of hypoglycemia, anxiety, and depression; outcomes that are also highly valued by people with diabetes and their loved ones. For AP systems to be widely adopted, we must place higher value on improvements in these outcomes beyond A1c in regulatory approvals, in reimbursement and payment for the systems and in their clinical adoption.

The exciting promise of first generation AP systems must be widely realized by people with diabetes. Barriers to the adoption of these systems and better understanding of how to shape research to improve next generation systems will ensure that AP systems deliver upon this promise.

INV42
Moving AP systems into the clinic and improving diabetes outcomes
A. Kowalski1

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First generation hybrid closed-loop artificial pancreas (AP) systems, a long-sought quest to replicate mechanically islet physiology that is lost in diabetes, are reaching the clinic, and the potential of automating insulin delivery is being realized. Significant progress has been made, and the safety and feasibility of AP systems have been demonstrated in the clinical research center and more recently extensively in outpatient “real-world” environments. It is now very clear that AP systems are technically feasible. However, it remains less certain that they will be widely adopted by clinicians and patients. Ultimately, the true success of AP systems will be defined by successful integration into the diabetes health care system and by the ultimate metric: improved diabetes outcomes.

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INV43
Closing the loop: How to cope with data overload
K. Barnard1

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Background: Closed loop / artificial pancreas / automated insulin delivery / whatever name we assign, is associated with considerable improvements in glycaemic control and quality of life. These include reduced glycaemic variability, increased time in target range, reduced A1c and reduced frequency/severity of hypoglycaemia. From a
quality of life perspective, they include reduced anxiety, reduced diabetes burden, improved sleep quality and reassurance. In order to achieve these outcomes, there is an enormous amount of data, being rapidly produced, analysed and interpreted. The amount of this data can be overwhelming, scary and very difficult to interpret from a user’s perspective.

**Aims:**
- to explore the data, its purpose and its relevance to everyday living
- to explain why it is so difficult for some people to cope with the data, both from a purely ‘numbers’ perspective and from a ‘what does that mean for me?’ perspective

**Results:** Quantitative and qualitative data will be presented from clinical trials and examined in terms of its usefulness and meaning to users.

**Discussion:** Results will be discussed in the context of what users really want from closed loop systems and what they are willing to tolerate in order to achieve those goals.