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INVITED ABSTRACTS

Plenary Session I - Prevention and Treatment of DKA

INV1

Treatment of diabetic ketoacidosis in children: New perspectives on intravenous fluid protocols and risk of cerebral injury

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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. Harris[1]

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DKA is the most common reason for hospitalization and mortality in youth with T1D, and resulted in 2,361 deaths in adults age 20 years and older in 2010. Readmission for DKA is common, as approximately 20% of DKAs in youth per year are readmissions, further exacerbating the economic burden of this complication. For example, the mean cost for one DKA hospitalization is estimated to be range between $7,000 USD and $15,000 USD. In the US, DKA accounts for an estimated total cost of $2.4 billion per year.

There is a subgroup of youth with T1D who are repeatedly hospitalized for DKA and as a result are responsible for a disproportionate amount of healthcare expenditures. Many of these youth reside in families experience a high degree of social complexity and vulnerability. The social complexity and vulnerability experienced by these families superimposed on having a child with a complex medical condition like T1D make management of their child's diabetes overwhelming and near to impossible. And as a result of the multitude of life stressors, life challenges, and life demands on these families, this subgroup of youth experience repeated DKAs and represent unnecessary and avoidable costs to the healthcare system.

Because social complexity and vulnerability factors tend to drive problems with diabetes management and resulting DKA in this subgroup of youth with T1D, there is a need for interventions that extend outside of the hospital environment, into their homes, schools, and communities. However, our current interventions and care models do not meet the needs for this vulnerable population and exist in healthcare systems that are difficult to navigate where healthcare providers operate in silos and where communication across various health services, systems and providers is poor at best.

The objective of this talk will be to describe Novel Interventions in Children's Healthcare (NICH) developed to address youth with T1D who are repeatedly hospitalized for DKA. This talk with demonstrate how obstacles to care are identified and how interventions that address the lived experience of youth with T1D are crafted and implemented. Finally, data will be presented regarding the program's success at reducing ED visits, hospitalizations, hospital day stays, and healthcare expenditures.

INV3

Prevention of diabetic ketoacidosis

B. King[1]

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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.

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% in 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.

Symposium I - Transition - Bridging the Gap

INV4
Challenges around successful transition

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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 deficiencies 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. Hilliard[1]

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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. Gleeson[1]

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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.

Symposium II - Nutrition - debate PRO and CON carb counting

INV7
Eating habits around the world in 2017 - From food insecurity to lifestyle diets *focusing on children with type 1 Diabetes Mellitus*

M. Karipidou[1]

[1]*Pediatrics 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

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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 post prandial 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 glycemia and should be considered in interpreting and optimizing postprandial glucose level.

Relying purely on CHO content on estimation of insulin dosaging might lead to inaccuracy. Dietary glycemic load is found to be superior to CHO content in estimating postprandial glyemia 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

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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 p16^{INK4A}. 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

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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 identity by transdifferentiation. However, translatability to the clinic is limited, and the protein structures of transcription factors make them hard to target pharmacologically, to the extent that they are often deemed "undruggable". We therefore use chemical, functional genomic and genetic screening to identify compounds and additional targets for the induction of insulin expression in alpha cells. Recently, we discovered the antimalarial compound class of artemisinins to impair alpha cell identity, by affecting GABA receptor signaling and glucagon secretion. Here we will describe the molecular mechanism of action of these compounds, as well as other protein targets in alpha cell transdifferentiation.

INV11

Development of a stem cell-derived islet replacement for type 1 diabetes

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ViaCyte is a privately-held regenerative medicine company developing novel cell replacement therapies as potential long-term diabetes treatments to reduce the risk of hypoglycemia and diabetes-related complications. ViaCyte's product candidates are based on the derivation of pancreatic progenitor cells, which are then implanted in a durable and retrievable cell delivery device. Once implanted and matured, these cells are designed to secrete insulin and other pancreatic hormones in response to blood glucose levels. ViaCyte has two products in development. The PEC-Direct™ product candidate delivers the pancreatic progenitor cells in a non-immunoprotective device and is being developed for type 1 diabetes patients who have severe hypoglycemic episodes, extreme glycemic lability, and/or impaired awareness of hypoglycemia. The PEC-Encap™ (also known as VC-01) product candidate delivers pancreatic progenitor cells in an immunoprotective device and is currently being evaluated in a Phase 1/2 trial in patients with type 1 diabetes who have minimal to no insulin-producing beta cell function.

Plenary Session II - e-Learning - Novel Tools for Diabetes Education of Healthcare Professionals and Patients

INV12

New ways of educating diabetes teams

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The global access to the internet has created the opportunity to reach and interact with colleagues around the world -even in remote areas. E learning is an evolving teaching and learning concept with a history spanning over 3 decades. The accepted definition of *eLearning* is *learning* utilizing electronic technologies to access educational curriculum outside of a traditional classroom with the program delivered completely online via electronic media, typically on the Internet.

“Successful e-learning depends on the self-motivation of individuals to study effectively”

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.

INV13

Age appropriate e-learning tools for patients and their families

K. Lange[1]

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During the last decade, several electronic tools to support paediatric patient education were developed. The range extends from 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 from 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.

INV14

App use for diabetes education: staying relevant in a changing world

H. Phelan[1]

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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 globally with half of internet connections made through mobile devices. The mobile phone has become a personalised communication hub, a key source to access media and a gateway to tailored real-time information. Diabetes is a unique condition in that staying well requires a substantial investment of time and energy and a high level of engagement with self-management behaviours. Management is generally self-directed with persons with diabetes required to make day-to-day and moment-to-moment management decisions, understand and use technologies and apply complex treatment plans. Diabetes self-management education must be a collaborative process, tailored to individual needs and circumstances and responsive to change. Engaging with current technologies and utilising the opportunities afforded by the accessibility of mobile technology is necessary to remain relevant as a diabetes educator. This presentation explores the use of mHealth (mobile health) to educate and engage with consumers with diabetes. Current scientific literature will be presented along with some practical guidance on the use of mHealth in clinical practice. A number of diabetes education apps will be reviewed and the John Hunter Children's Hospital experience in developing and rolling out a mobile app (DiSiDa) aimed at assisting people with treatment decisions during sick days, will be presented.

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[1]

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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 to 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 / training program 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[1]

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Exercise is an important aspect of the care of children with type 1 diabetes, promoting improved cardiovascular health, glycemic 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 glycemia, in those with poor glycemic 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 euglycemia (and prevent hypoglycemia) 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[1]

[1]*Will 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.

Symposium V - Beyond A1c - other markers for patient well-being

INV18

Cardiovascular risk factors in diabetes outcome

K.O. Schwab[1]

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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 borderlines. 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 decisionmaking 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[1]

[1]*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[1]

[1]*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[1]

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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[1]

[1]*ONG 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

After this RAPIA study, from 2005 to 2014, Santé Diabète, in collaboration with the Ministry of Health of Mali and the local specialists, developed a comprehensive strategy to address 5 barriers to develop diabetes care in Mali:

- 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 diabetology 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

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

INV23

How to treat toddlers?

F. Sundberg[1]

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Toddlers are dependent on others for all aspects of their care. For the families of toddlers with type 1 diabetes, their diabetes teams, and other caregivers, including day care staff members and babysitters, treatment is a constant challenge. Yet, it is important to strive for normoglycemia, as current knowledge about the implications of dysglycemia makes prevention of complications imperative from diabetes onset.

Optimizing glycemic control for children in this age group often requires treatment strategies that differ from those used for older children with type 1 diabetes. These strategies need to take into consideration the immaturity of toddlers as well as their small body size and growth pattern.

In addition to their dependence on others for insulin administration and glucose monitoring, toddlers are also dependent on others for aspects of their lifestyle related to healthy eating and engagement in physical activity. Lifestyle choices and preferences established during early childhood provide a window of opportunity for ingraining healthy habits that will remain throughout the child´s life. Providing education and support of lifestyle changes requires that the diabetes team uses a family-based approach.

Supporting the family is necessary for promoting health in the toddler with type 1 diabetes. 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. Raymond[1]

[1]*Boston 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. Warner[1]

[1]*Noah's Ark Children's Hospital for Wales, Cardiff, United Kingdom*

Many countries now collect data about process and outcomes for their paediatric 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

B. Saboo[1]

[1]*Dia Care - Diabetes Care & Hormone Clinic, Ahmedabad, India*

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

- Supports proactive care by facilitating care planning, sharing of information with other providers, and generating patient reminders
- Generates charts and graphs to support illness self-management
- Generates reports to monitor team and system performance
- Overall goal is to improve adherence to treatment guidelines and self-management

Diabetes registries can be used as an important epidemiological tool: to monitor the prevalence and incidence of diabetes, provide a sampling frame for epidemiologic and clinical studies, provide information to health service providers and planners on risk factors and complications, and assist in the overall monitoring of diabetes control program.

In India, the first diabetes registry was set up in Goa as a public private partnership, with the aim of population based disease management

To set up a population‐based register, we need to notify the public health authorities, publicize the registry, and establish arrangements for access to data, data security, and accountability (in terms of reporting and feedback). Efforts to achieve improved outcomes for diabetes require an organized population‐based approach to diabetes management using all of the components of the chronic illness care model.

The six essential elements of a health‐care system are the community, the health system, self‐management support, delivery system design, decision support, and clinical information systems.

To develop a registry it is first most essential that the community should be aware the disease and its complications. Despite better awareness and new developments in treatment of type 1 and type 2 diabetes and prevention of type 2 diabetes, in many part of the world especially in developing countries like India diabetes is diagnose in late stage and more than half of the people remains undiagnosed.

The healthcare system in many developing countries including India is divided into government, semi-government, public private partnership and private sectors with no uniform system of notification for the disease. . Though each sector has their own system of data management which differs from each other and final compilation of the data is not possible. . Health care providers are not trained for data collection and data management.

Symposium VII - We are what we eat...

INV27

How can patient organisations influence political actions

J. Hitchcock[1]

[1]*Children 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[1]

[1]*King's College London, London, United Kingdom*

The digital revolution, due to increasing digitalization of information, mobility of data and improved connectivity is transforming our daily life: Three billion people are able to access the internet, we are surrounded by "the internet of things", are engaging in "quantified self" activities, smartphones have become ubiquitous and more than 90% of the world data have been produced in the last 2 years, just to give a few examples.

We are going to explore the effects of the flood of digital data on diabetes management and diabetes care, from the perspectives of research, medical care provision and from the individual's perspective (patient, doctor) in the here and now.

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.

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

Many questions will be left open for critical discussion and will provide food for thought:

How are diabetes doctors and people with diabetes going to deal with the flood of digital data? How can we keep up-to-date with the digital world our patients are involved in?

Where are the chances and where are the problems in big data analysis?

INV29

Optimizing mobile technologies in diabetes self-management interventions

S. Mulvaney[1]

[1]*Vanderbilt University, Nashville, United States*

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.

Using new data collection methods, effective health communication techniques, integrative feedback and social learning via a mobile phone, we can identify novel and actionable foci for problem identification and then support guided mastery of and contextual support of skill building and implementation. Evidence-based behavior change techniques may be feasibly translated into mobile diabetes data collection and communication systems in order to integrate blood glucose with critical behavioral, contextual, and psychosocial data.

In this presentation approaches to enhancing patient problem solving through the use of mobile technologies, specifically to integrate blood glucose and behavioral data for problem solving, will be reviewed. Specific techniques to support assessment, patient engagement, pattern recognition, causal inference, goal setting, implementation, and evaluation will be reviewed. These processes should be personalized and adapted over time for each individual, providing behavioral personalized medicine in diabetes.

Currently available techniques for the integration of momentary or passively collected data for adaptive systems will be reviewed. This type of approach shows great potential to identify novel relationships between blood glucose, behavior, and contextual influences on glycemic control. However, challenges exist in utilizing mobile technologies including maintaining engagement, difficulty integrating meaningful human relationships, ethical considerations, and sustainability.

INV30

"Youtuber" and blogger: the new peer group

F. Debong[1]

[1]*mySugr GmbH, Vienna, Austria*

Are online and technology based solutions taking over, as the in person peer groups are declining?

Our view of diabetes cannot be limited to merely medications and technology; those living with the disease are human beings, and social by default. Behaviour and health outcomes are "contageious" within social groups. (1)

The needs addressed through peer groups in diabetes are highly individual, but often can be summarized as questions of knowledge, behaviour and the ability to socialize without the perceived stigma. Peer groups within diabetes, seen as quasi-interventions, does show impact among some adults, but the evidence is still seen as too limited and inconsistent to support firm recommendations (2).

To form an understanding of this field, going beyond personal experience, available literature was reviewed and three experts were interviewed.

Study of the effect and communication within online peer groups, such as the Diabetes Online Community (#DOC) have taken place since their inception. In summary they offer a great opportunity for direct feedback and having questions answered (3), assistance and understanding of both clinical and day-to-day issues is offered (4) - yet, just as in face-to-face peer groups there is a lack of accountability or source critique, even if the community self-polices (3). People participating often come back since they feel understood and less alone (5). The focus in studies rather lies on emotional well being, diabetes distress and coping - less on the more clinical side of the equation. Involvement by health care professionals within peer groups seems to be welcome, but primarily as moderators or observers, and only if transparent (6). Even if it seems to have an effect, not every person is addressable - the use and impact of peer groups is highly individual.

Communities on the internet can and do definitely act as peer groups, either as replacements or extensions thereof - with all the baggage that comes with the medium and concept.

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Meet the Expert II - Communication skills in pediatrics

INV31

Team work!

D. Daneman[1]

[1]*The Hospital for Sick Children, Toronto, Canada*

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 interaction 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[1], G. Griffiths[2]

[1]*University College London Hospitals NHS Foundation Trust, London, United Kingdom,* [2]*DiAthlete, London, United Kingdom*

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 felling 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[1]

[1]*IBBL, 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[1]

[1]*University 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[1]

[1]*RWTH 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[1]

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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 it important to individualize glycemic targets for young person 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.

INV37

Debate: which targets should we aim for - pro HbA < 7.5%

J. Wales[1]

[1]*Lady Cilento Children's Hospital, South Brisbane, Australia*

The England & Wales NHS NICE 2015 guidance has set the team target for HbA as 48 mmol/mol (6.5%) or less for children and young adults with type 1 and type 2 diabetes. The evidence shows that this is associated with a reduction in morbidity and that, continuing below this value, there is a health advantage in even lower levels of glycosylation.

There is much more to diabetes care than HbA1c and all *individual* targets must be set in conjunction with the young person and families taking into account their medical and social circumstances. But it is also important to inform the young people and families from the time of diagnosis of the team goals, to set their expectations. It is clear that having a goal *for the team* to try to achieve near normoglycaemia and a consistent message of how this may be achieved drives a steady improvement in standards.

Proponents of setting a higher value have argued that this level of control is unachievable, or that it places too great a strain on individuals and families or that there will be increased hypoglycaemia. These arguments are unsustainable and the proposer in this debate will show evidence for this assertion.

"We aim above the mark to hit the mark." (Ralph Waldo Emerson).

Symposium X - Reproductive health counselling in diabetes

INV38

Preconception counseling in youth with diabetes

D. Charron-Prochownik[1]

[1]*University of Pittsburgh, Piitsburgh, United States*

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) recommended 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*), targets PC for teens with T1D and T2D before sexual debut. In 2009, *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 mons) 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. Murphy[1]

[1]*Norwich Medical School, Norwich, United Kingdom*

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

P. Zeitler[1]

[1]*University 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.

Plenary Session V - Closing the Loop

INV41

Closing the loop: where are we so far?

R. Hovorka[1]

[1]*University of Cambridge, Cambridge, United Kingdom*

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 academia-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.

INV42

Moving AP systems into the clinic and improving diabetes outcomes

A. Kowalski[1]

[1]*JDRF, New York, United States*

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.

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.

INV43

Closing the loop: How to cope with data overload

K. Barnard[1]

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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.