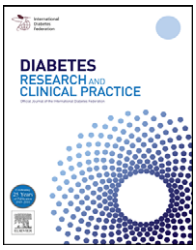
Contents lists available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

International Diabetes Federation



The impact of health insurance coverage on pediatric diabetes management

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ARTICLE INFO

Article history:
Received 22 March 2009
Received in revised form
6 May 2010
Accepted 10 June 2010
Published on line 13 July 2010

Keywords:
Insurance
Insulin
Diabetes type 1

ABSTRACT

Aims: To examine the association between health insurance coverage, insulin management plans, and their impact on diabetes control in a pediatric type 1 diabetes mellitus clinic population.

Methods: Retrospective cohort design drawn from the medical records of the Pediatric Endocrinology Clinic at the University of Louisville, Kentucky.

Results: Out of 701 patients, 223 had public insurance, and 478 had private insurance. 77% of publically insured used two or three injections per day vs. 40% private. Conversely, 58% of privately insured used a multiple daily injection (MDI) plan or insulin pump (vs. 21%). 84% of MDI patients had private insurance with 93% using insulin pens compared with 38% of publically insured. Mean HbA1c was 8.6% for privately insured vs. 9.8% public, $p < 0.0001$. Privately insured MDI and pump patients had the lowest HbA1cs.

Conclusions: Insurance type had a significant effect on the insulin management plan used and was the most significant factor in overall diabetes control. Limitations on insulin pen use and number of glucose test strips may play a role in the decreased use of MDI/insulin pumps by publicly insured patients. Addressing factors related to insurance type, including availability of resources, could substantially improve diabetes control in those with public insurance.

1. Introduction

Diabetes affects approximately 7% of the population of the United States with more than 186,000 affected individuals falling under 20 years of age [1]. Approximately 1 out of every 500 children in the U.S. is affected by this lifelong condition, many of whom struggle with a lack of education, parental, social, and financial support, all of which may limit their access to care [1]. While the long-term health consequences of diabetes are severe, studies suggest that improved control of the disease, at the earliest possible time, may limit and delay the onset of complications [2–6]. In 1993, the report from the Diabetes Control and Complications Trial (DCCT) demonstrated that long-term microvascular complications could be reduced in adolescents and adults by intensive diabetes management [7]. These results led to a significant shift in the treatment paradigm, prompting physicians and patients to become more aggressive with glucose monitoring and insulin treatment. In addition to increasing basic glucose monitoring practices, additional resources, including insulin pen devices,

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0168-8227/$ – see front matter
doi:10.1016/j.diabres.2010.06.013

Table 1 – Insulin management plans.

Injection plan	Definition	Description	Minimum glucose monitoring requirement
BID	Twice per day	NPH insulin mixed with either regular insulin or a fast-acting analog (i.e. aspart or lispro) at breakfast and dinner	Before meals and at bedtime
TID	Three times per day	Similar NPH mix as a BID plan at breakfast, with only a fast-acting analog or regular insulin given at dinner and NPH only at bedtime	Before meals and at bedtime
MDI	Multiple daily injections	A long-acting analog insulin (i.e. glargine or detemir) given once or twice per day as well as a fast-acting analog given with meals and snacks	Before meals and snacks and at bedtime
Insulin pump	Insulin pump	Involves the use of a fast-acting analog insulin infused via a continuous subcutaneous insulin infusion pump	Before meals and snacks and at bedtime
Other	Pre-mixed insulin	Pre-mixed insulin given two to three times per day	Before meals and at bedtime

subcutaneous insulin infusion pumps, and subcutaneous interstitial glucose monitoring sensors may be used for more intensive glucose management. With the estimated annual cost associated with diabetes care climbing to more than $174 billion [1], developing improved methods for long-term diabetes control remains a medical research priority.

In the face of the growing cost of caring for diabetes complications, some state managed public health insurance plans place limitations on the use of certain diabetes supplies for pediatric patients in an apparent attempt to affect significant cost savings. As opposed to most private health insurance plans, many public government health insurance plans in some states, including Kentucky, restrict access to insulin pen devices and limit the frequency of blood glucose monitoring, typically to an average of no more than three test strips per day. Both of these are factors that have been identified as being linked to improvements in glycemic awareness in patients who have diabetes, and to enhanced adherence to the management regimen [8–10].

To investigate the potential effect that insurance coverage has on provider prescribing practices and the resultant diabetes control, we performed a large, detailed retrospective chart review of our type 1 diabetes outpatient clinic population.

2. Materials and methods

The study was a retrospective cohort design drawn from the medical records of the Pediatric Endocrinology Clinic at the University of Louisville in Louisville, Kentucky in 2008. The clinic includes both a rural and urban population of patients with diabetes. During the study inclusion period, the clinic was served by 2 pediatric endocrinologists, 3 pediatric nurse practitioners, 1 diabetes educator, and 1 diabetes educator/nutritionist. After IRB approval, all of the charts from our diabetes patients were reviewed. Variables including age, weight, height, sex, race/ethnicity, diagnosis, most recent HbA1c, medical insurance coverage, and insulin administration method from the most recent clinic visit were gathered and placed in a password protected, encrypted database for statistical analysis.

Medical insurance was classified as public if the patient's primary insurance plan was State government supported. These include the Kentucky Medicaid program and the Passport Health Plan. The Passport Health Plan, administered by AmeriHealth Mercy Health Plan, is limited to patients qualifying for Medicaid who reside within 16 counties in Kentucky.

Five different insulin management plans were categorized; twice daily insulin (BID), three time daily insulin (TID), multiple daily injections (MDI) of insulin, insulin pumps, and other (Table 1).

All patients with a diagnosis of type 1 diabetes were included in the analysis. However, those diagnosed within the previous 6 months were excluded to reduce the influence of endogenous insulin production on the analysis. HbA1c was used as a global marker of diabetes control.

2.1. *Statistical analysis*

To determine the association between HbA1c level and insulin management plan, *t*-tests were used to compare the mean differences between subgroups for continuous variables and X^2 tests were used for categorical variables. To assess the impact of insurance type and management plan on HbA1c while controlling for potentially significant demographic variables, an ANOVA model was developed. The analysis was performed using SAS version 9.2.

3. Results

3.1. *Patients*

A total of 781 charts of patients with a diagnosis of diabetes were reviewed. Of these, 748 (95.8%) were diagnosed with type 1 diabetes, 25 (3.2%) with type 2 diabetes, and 8 (1.0%) did not yet have an established diagnosis or were missing confirmatory information. After excluding those diagnosed within the previous 6 months, 701 patients with type 1 diabetes were included in the subsequent analysis.

3.2. *Patient demographics, insurance type*

Of the 701 eligible patients (mean age 13.5 years; range 2–24), 223 had public insurance, and 478 had private insurance (Table 2). There was a significant difference in insulin treatment profiles between the 2 insurance classes. 77% of publically insured patients used a conventional insulin plan