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Diagnosis of type 1 diabetes within the first five years of life influences quality of life and risk of severe hypoglycaemia in adulthood.

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Abstract
Progressive adaptation to disease is paramount to improve quality of life (QoL) and other psychological dimensions in type 1 diabetes (T1DM). This study aimed at identifying possible correlations between QoL, Locus of Control (LoC) and clinical variables in patients with T1DM followed up for 16 years. Fifty-nine patients (27 women) with T1DM, part of a cohort of 112 followed since 1996, accepted to participate. Patients were divided into those in whom onset of T1DM had been during the first 5 years of life (n=16) or later. They were also stratified into Worsened, Stable and Improved, based on whether their HbA1c had increased/decreased by 1 percentage point between baseline and last follow up visit.
QoL was measured by the Diabetes Quality Of Life questionnaire (DQOL), translated into Italian and re-validated. The LoC was measured by the Peyrot and Rubin specific questionnaire. Patients who developed T1DM before age 5 had a better total DQOL score than those who developed it later in life, mainly due to the Satisfaction dimension, and a tendency to decreased fatalism in adult age. All subjects whose HbA1c had worsened from baseline had had their diagnosis after age 5 and reported more frequent episodes of hypoglycaemia. Onset of diabetes after age 5 and more frequent hypoglycemia were more likely in subjects with worsened HbA1c (ORs 7.6, $p<0.10$ and 20.3, $p<0.01$, respectively, from a multivariate logistic model with HbA1c, dichotomized in 'Worsened' vs all others, as dependent variable).
Onset of T1DM during the first 5 years of life may result in better QoL and less fatalism in the long term. Presumably, these patients have no memory of disease onset, which may reduce trauma and facilitate adaptation to managing life with diabetes.

Keywords: type 1 diabetes, quality of life, age of diagnosis, locus of control.

Background

Disease adaptation is paramount to improve quality of life and other psychological dimensions in type 1 diabetes (T1DM). Adaptation is defined as the degree to which an individual responds both biologically, through metabolic control, and psychosocially, vis a vis quality of life, to the stress of living with a chronic illness. It is viewed as a complex process involving internal and external factors that influence the initial response and level of adaptation (1).
Accepting one's illness may be seen as a bereavement for the loss of health. It is not easy to accept, especially if not curable. The adaptation process requires a lot of personal determination in the patient with diabetes (1).

The primary goals of treatment are to maintain blood glucose levels and quality of life as close as possible to those of non-diabetic people. Intensified insulin therapy improves metabolic control and reduces the incidence of complications (2) but, to fully benefit from it, patients need knowledge and skills that enable them to make informed choices to facilitate appropriate behavioral changes and ameliorated quality of life.
This study aimed at identifying the possible correlations between quality of life, ability to internalize the control of disease and clinical variables in a cohort of patients with T1DM followed for 16 years.

Patients, material and methods.
Fifty-nine patients (27 women) with T1DM, aged 31.3±2.0, with duration of disease 23.0±3.6, were studied for quality of life, locus of control, metabolic control over time and frequency of severe hypoglycemia 16 years after a baseline assessment. Patients afferent to different centers within the region. Demographic and clinical variables were collected by a semi-structured interview. Severe hypoglycaemia was defined as requiring third-party help, i.e., glucagons injection, i.v. glucose and/or hospital admission.
The patients were divided into: *a)* those who developed T1DM before age 5 (n=16) versus all others, and *b)* with worsened (n=7), stable (n=23) or improved (n=27) control, based on whether their HbA1c had increased or decreased by 1 percentage point between baseline and the last follow up visit (60±1.8 to 81±1.9; 62±0.8 to 61±0.8; and 84±1.4 to 60±0.8, respectively).

Psychological evaluation
Quality of life was measured by the Diabetes Quality of Life questionnaire (DQOL) translated into Italian and re-validated (3). The DQOL questionnaire was designed by the DCCT Research Group and contains 46 items which patients rank on 5-point Likert scales ranging from 1 to 5 (1 never, all the time). Four subscales measure diabetes impact on daily life (20 items, range 20-100), diabetes-related worries (4 items, range 4-20), satisfaction (15 items, range 15-75), and social worries (7 items, range 7-35). The DQOL score is the algebraic sum of the four scores and ranges between the minimum value of 46, corresponding to the highest level of quality of life, and a maximum of 230, corresponding to the lowest level of quality of life.
The Locus of Control was measured by the Peyrot & Rubin specific questionnaire also revalidated in Italian (4). This questionnaire includes a set of 18 statements measuring expectancies of Internal, ‘Powerful Others’ and Chance control over diabetes-related health outcomes, drawing upon the MHLC scale (4). The final questionnaire consists of six items in each of three domains measuring the degree to which subjects consider their diabetes to be under their own control (diabetes-specific Internal Locus of Control), dependent on Others (Powerful Others), or dependent on Chance or Fate (Chance). The items were constructed to make the instrument appropriate for older children, adolescents, and adults, and for subjects with either Type 1 or 2 diabetes.

Statistical Analysis
Variables have been described as mean±SD for quantitative variables and as absolute/relative frequencies for categorical variables. Comparison between means has been carried out by t-test for independent groups. ORs have been computed on the basis of a logistic regression analysis, where HbA1c (dichotomized as ‘worsened’ vs ‘all others’) was taken as dependent variable and age of diabetes onset (dichotomized as ‘0-5 years’ vs ‘>5 years’), frequency of hypoglycemic episodes (‘0-1’ vs ‘>1’), gender, school level and years from disease onset were taken as dependent variables. The Firth correction was applied to the model to overcome the separation problem due to the small-sparse sample with highly predictive covariates. Significance was assumed at the .05 level.

Results
Five patients had completed middle school, 32 high school and 18 had a university degree. HbA1c was 73±1.7 at baseline and 64±1.2 at year 16.
Patients who developed T1DM before age 5 had a lower (better) total DQOL score (69.3±8.4 vs 81.0±18.3, p=0.022) than those who developed it later in life, mainly due to the Satisfaction

dimension (25.0±4.0 vs 30.3±7.8, p=0.016). they also showed a tendency to decreased fatalism (Role of Chance, 8.4±3.0 vs 10.5±4.0 p<0.06) in adult age (Table 1).
All subjects whose HbA1c had worsened from baseline had had their diagnosis after age 5 and reported more frequent episodes of hypoglycaemia. Onset of diabetes after age 5 and more frequent hypoglycemia were more likely in subjects with worsened HbA1c (ORs 7.6, p<0.10 and 20.3, p<0.01, respectively, from a multivariate logistic model where the Firth correction was applied, with HbA1c, dichotomized in 'Worsened' vs all others, taken as dependent variable).

Discussion

Type 1 diabetes is a chronic condition and its impact will unfold over time and persist for life. Not only does the impact of illness change over time, in terms of symptoms, course, and treatment but also in terms of developmental expectations. Accepting one's illness means reorganizing one's life according to the personal problem arisen. Such process of acceptance, or psychological maturation, takes time and each individual, irrespective of his/her social or professional status, goes through intermediary phases before coming to accept the embarrassment of a permanent handicap (1-3).
We observed that people who developed type 1 diabetes during the first 5 years of life may end up, in the long term, with better quality of life and less fatalism than those who experienced diabetes onset later in life. Presumably, these patients have no memory of a time before the onset of their disease, which may reduce trauma and facilitate adaptation to managing life with diabetes (5). As a result, persons who become diabetic during the early years of life, when the self is being structured, manage better to include the disease among other aspects of everyday life. In contrast, onset in later years may be associated with more problematic management of diabetes, including more frequent hypoglycaemias and a tendency to worsening metabolic control.

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Table 1. Questionnaires results. Quality of life and Locus of Control

Age of diagnosis	DQOL Total	DQOL - Satisfaction	DQOL - Impact	DQOL- Diabetes Related Worries	DQOL- Social Vocational Worries	LoC Internal	LoC Role of Chance	LoC Powerful Others
0-5	69.33±8.4	25.0±4.0	29.5±5.5	8.4±2.0	6.3±1.0	27.5 ±4.3	8.4±3.0	19.2±4.0
>5	81.0±18.3	30.3±7.8	32.3±7.0	10.6±5.1	7.5±3.0	27.7±5.0	10.5±4.0	21.5±5.0
p value*	p=0.022	p=0.016	NS	NS	NS	NS	p=0.06	NS

* t-test for independent groups