

Diagnosis and social network analysis:
The provision of quality care for children with Diabetes

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Title: Chronic Disease Prevention and Health Promotion. Public policies and social network analysis of the hospitals services and others health and social organizations to support joint actions for children with diabetes

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Abstract: In this paper, we would like to present a focus for comprehensive action on diabetes in Portugal. Based on an applied approach of social network, we would like to discuss and analyze the dynamics of formal networks between hospitals services and others health and social organizations to support joint actions for reducing causes and consequences of health inequalities in children with chronic disease, and to develop core strategies and standards in health promotion and the quality of care for children with diabetes type I in Portugal, focusing our attention in the case of Barreiro.

Key-words: children with diabetes, chronic disease prevention, health promotion, quality of care, social networks

Introduction

Chronic disease in children is a problematic question, not only because it interferes in the long term child's development, but also because it affects the everyday life of all the family's members, who require specific assistance and follow-up by health care providers (Ribeiro e Rocha, 2007). In fact, the problems of type 1 diabetes in children has been earning a growing importance for health care providers due to the inadequate use of health services and growing emotional, social and economic costs resulting from this disease. What sort of quality is underlying the services provided to this kind of patients? How do health services link up with social structures to guarantee the quality of the provided services?

These are some of the questions which shall be reviewed in this article, with the background of a study conducted in 2009, with health service organizations in Barreiro and their support network to children suffering from Type 1 diabetes. In this article the main features of the theoretical matrix, the methodology used in the study, as well as the main conclusions are shown. As a theoretical background, a short overview of the quality concept as far as health is concerned, a contextualization of the support network to the child with diabetes, an introduction to the concept of Social Network as well as a brief reference to the methodological operationalization of the social networks analysis are carried out. As to the methodological option, the used methodology is described. Subsequently it will come to the disclosure and discussion of the results, by means of the review of the content of the interviews and the social network analysis underlying the support network for the treatment of the child with diabetes. Finally, the conclusions of this study shall be disclosed.

1. - Type 1 Diabetes

According to WHO, chronic diseases have a long duration and progress slowly, in general. This organization also states that chronic diseases such as Heart Diseases, Myocardial Infarction, Cancer, Chronic Respiratory Diseases and Diabetes, are the main death causes in the world, accounting for about 60% of the latter (World Health Organization, 2009).

Diabetes Mellitus is among this group of diseases, involving high costs, both for the patient as for National Health Service, and therefore require a specific attention as well as a consistent and suitable intervention.

Thus, Diabetes Mellitus is a chronic disease "...which results from the deficient capability of the body to use our main energy source – glucose" (APDP, 2005, p.3). To be used as energy source glucose needs insulin (produced in the β cells of the islets of Langerhans of the Pancreas) to be carried inside the body cells. When there is no insulin production or there are changes in the production or action of the latter hyperglycemia (increase of glucose in the blood), occurs and when hyperglycemia is not treated the human body suffers severe consequences (APDP, 2005).

There are several types of Diabetes Mellitus, such as, type 1 diabetes, type 2 diabetes, gestational diabetes and other types of diabetes. Type 2 diabetes, also known as Non-Insulin Dependent diabetes, has a hereditary predominance and occurs in individuals who due to wrong life style and diets, "stress", overweight or obesity, lack of physical exercise, or who consume calories in sweets and/or fat in excess comparing with what the body spends with physical activity. They frequently have arterial hypertension, hypercholesterolemia or hyperlipidemia associated with Diabetes (APDP, 2009a). Gestational Diabetes is a sort of disease which emerges in pregnant women who had shown no previous pathology before pregnancy and, usually disappears when the pregnancy ends (APDP, 2009a). The other types of Diabetes, as for instance, MODY type, are rare conditions which affect mainly young adults, youngsters or children and are characterized for a gene mutation causing alterations to glucose tolerance (APDP, 2009a). In this dissertation as the target

population is the children and adolescents with type 1 Diabetes, it is important to make a more detailed approach of this type of pathology.

Type 1 Diabetes Mellitus, also known as insulin-dependent diabetes, affects mostly children and adolescents, and may also occur in adults. In this type of diabetes, "... β cells of the pancreas no longer produce insulin, as there is a massive destruction of these cells. (...) These diabetics need insulin therapy for the rest of their lives" (APDP, 2005, p.4). According to International Diabetes Federation, 0.02% of the total world population, between 0 and 14 years old, had diabetes in 2007, which means that, 440,000 children have diabetes around the world, with 70,000 new cases being diagnosed every year (Hanas, Donaghue, Klingensmith, & Swift, 2009).

The primary purpose of the treatment of type 1 Diabetes is "to keep the sugar (glucose) in the blood as close to the normal values as possible (diabetes tight control), so that patients may feel well, that is, with no symptoms; to prevent the development of late manifestations of diabetes – eyes and kidney diseases, loss of sensitivity and bad circulation of the lower limbs and cardiovascular diseases (myocardial infarction and cerebral thrombosis); to reduce the risk of acute decompensation – hyperglycemia and ketoacidosis" (APDP, 2009b, p.1). Therefore, the treatment comprises the use of insuline, suitable diet, physical exercise and the education of the person suffering from diabetes (self-surveillance and self-control) (APDP, 2009b).

As a chronic disease which develops mostly during childhood, type 1 diabetes requires a long lasting surveillance and treatment, as it has numerous associated complications which may become more serious depending on the suitability of the treatment and surveillance of these patients. It is incumbent on the health system to implement strategies based on these patients and this type of chronic diseases which have quite high costs for society (Guerra, 2006).

According to data of two studies (DIAMOND of WHO and EURODIAB), the incidence of type 1 Diabetes in Portugal, in the 90's would be between 5 and 9.9 cases for every 100,000 inhabitants per year. On the other hand, data from "Inquérito Nacional de Saúde" (National Health Interview Survey), have shown a predominance of type 1 Diabetes of 4.7% in 1999 and of 6.7%, in 2006 which accounts for a growing trend, estimating a 8.2% percentage for 2007 and 9.8% for 2025 (DGS, 2007).

In this context Directorate General for Health has prepared the Programa Nacional de Prevenção e Controlo da Diabetes (PNPCD) (national program for the prevention and control of diabetes), in November 2007, with the purpose of developing strategies that aim "...to obtain the epidemiologic knowledge of diabetes, its distribution among the Portuguese population, to reinforce the organizational capacity of the services providing health care and improve the good practices models in the disease management and to reduce the incidence of diabetes and its complications ..." (DGS, 2007, p.6). Programa Nacional de Controlo da Diabetes which existed already in the 70's was updated in 1992 and reviewed in 1995, and the need of another review was asserted, in 1998, so as to enable a closer compliance with the integrated management model of diabetes and the establishment of partnerships among all the intervening parties in the surveillance process of the disease (DGS, 2007).

In this PNPCD the health intervention strategies should be based on a solid health infrastructure, so as to guarantee: "duly trained health care providers to meet the quality requirements of the care to be provided; information technologies available to facilitate the timely access to information indispensable to the management of the Program; organizational response of the leaderships of the services providing the health care" (DGS, 2007, p.7). In this context, this plan results from a set of strategies of intervention, training and collection and analysis of information with the major purpose of promoting the quality of the health care provision to the person with diabetes, improving his/her life quality,

reducing the disease costs both for the individual and the health system (DGS, 2007).

As it is a chronic disease which starts in childhood / adolescence and stays with the patient for life, the better the patients can adapt to the disease the less complications they will have in the future. Therefore the person with diabetes should have ...”training “on diabetes management making them capable of taking on responsible therapy attitudes. (...) Diabetes treatment is based on diet, insulin and physical exercise. However, the major connecting factor among the three components of the treatment is the education of the diabetic patient, this being a key-element in treating diabetes” (APDP, 2005, p.161). Therefore, the therapeutic education consists on the diabetic’s training regarding the different elements necessary for the disease treatment, characterized by a transfer of responsibilities to the patient regarding the management of his/her disease, in a perspective of making him/her more autonomous and a partner of the multidisciplinary team (APDP, 2005).

In fact, there is a whole health care multidisciplinary team, which should support the treatment of this disease, but in this team the primary element shall always be the child / adolescent with diabetes and his/her family who through their attitudes and behaviours are the major responsible actors for their health and respective management (APDP, 2005).

In this context and according to the age when the disease is diagnosed, therapeutic education of a child poses a challenge, the parent’s attitude being of critical importance. On an early stage the latter will have to know how to manage the disease, treatment and surveillance, 24 hours a day, 365 days a year (Pina, 2007). Through systematic and planned therapeutic education of the child and family the health care providers should focus their efforts “...on the optimization of the quality of the assistant care so as to get a good control of diabetes capable of preventing future complications, and, concurrently, guarantee the child goes through, in an adjusted manner, all the stages of his/her and

psychomotor, social and emotional growth and development” (Pina, 2007, p.12).

According to the new guidelines set up by International Society for Paediatric and Adolescent Diabetes (ISPAD), the universal principles of the therapeutic education should be based on the premise that all child / adolescent has the right to a structured, professional and comprehensible education, in order to enable the former as well as his/her family to take control of his/her disease (Swift, 2009). In this sense, they advocate that “children / adolescents as well as their family should have an easy access to and be included in the therapeutic education process; education should be provided by professionals with a clear awareness of the special needs of the children and their family in their different growth and development stages; (...) diabetes educators (doctors, nurses, dietitians and others) should have access to ongoing and specialized training on education and methods on diabetes therapy education” (Swift, 2009, p.52).

Therefore, there are four fundamental criteria in a suitable therapeutic education program: to be structured and agreed by everyone, to be used by trained educators, to ensure the quality of the care and, finally, having the possibility of being audited. To make this feasible it is necessary that the interdisciplinary team keeps a good articulation among everyone to make everyone’s language consistent (Swift, 2009).

Ultimately these new guidelines advocate that children and adolescents’ care should be provided in an ambulatory scheme, in highly specialized health centres and by a strongly trained and specialized in diabetes team. They also advocate that in case the children and adolescents live very far from these large centres, they must have the support of the local health team, which should always be in contact with the specialized centres so as to be assisted by the latter with the suitable follow-up of the users and their family (Pihoker, Forsander, Wolfsdorf, & Klingensmith, 2009).

2 – The concept of social networks

The concept of social network is being more and more the object of the study of researchers and professionals in the field of social sciences. (Serrano, 2007)

The concept of network (“rede”, in Portuguese) derives from the Latin word “rete” which means trap or loop. A social network may be defined as a set of actors establishing ties among themselves, may include more or less actors, many or few relations. Mitchell (1969) quoted by Serrano (2007:81) describes as “a specific set of connections among a certain group of people, with the peculiarity that the connections as a whole may be used to construe the social behaviour of the involved people”; Bott (1971) quoted by Serrano (2007:81) states that the net is the whole or some of the social units which a certain individual or group gets in touch with. This concept has been used in social and human sciences according to different manners and meanings. In a metaphoric manner, it represents the idea of society, in so far as the latter is built with networks of interpersonal or intergroup relations. (Fialho, 2007)

In another context, social networks have emerged as an organizational pattern, in recent years, with the capability of expressing, through its structure of relations, innovative political and economic ideas, with the mission to help solving some problems. (Fialho, 2007) These are responsible for the sharing of interpersonal ideas, of common interests and purposes and may be taken as a social policy measure, aiming at fighting against problems, are the result of cultural manifestations, translate the organizational pattern of a new way of knowing, thinking, and do politics. (Fialho, 2007)

A social network is a set of people, organizations, etc., establishing a connection with one another by means of a group of specific social relations, and in this way, the structure of any organization may be studied and understood taking their multiple networks of internal and external relations as an analysis point. (Fialho, 2007)

According to Mitchell and Trickett (1980) quoted by Serrano (2007) the criteria to identify who is a member of a network vary according to three dimensions:

- The list of all the elements of the social network
- The contact degree with the target
- The frequency of contacts which should occur for an individual to be considered as an active element of the network.

In this context, the network may present structural characteristics, regarding the quality of the network (size or extension, network density; relationship degree) and individual characteristics, the connections among elements (Intensity, durability, multidimensionality, directivity and reciprocity, relation density, dispersion, frequency, homogeneity).

According to Hanneman (2000) to understand a social network involves a full and accurate description of its architecture, which led to the design and use of a suitable method, social networks analysis.

We can find three different elements for the perception of the networks' borders, from the operationalization point of view.

- **ECONOMIC** which takes into account the activities and resources which foster the interchange in the networks;
- **SOCIAL** where we can consider the networks' actors and the trust relationships they establish among them;
- **STRATEGIC** which is associated with the value produced in the framework of the networks.

In a more operational perspective the net is associated with the logic of flow and articulation in which communication, transport and telecommunications networks can be included.

According to this line of reasoning, Loiola and Moura (1997) quoted by Fialho (2007) come up with two sorts of network: that of unidirectional flow, where the starting and arrival point are well defined, and that of multidirectional nature, where flows exist without a centre. The

competitiveness in the health industry led to the increase of uncertainty and insecurity within the organizations, which need to structure new processes of flexibility, such as articulations among them, making resources profitable and minimizing expenses to be able to remain in the labour market. (Fialho, 2007) In fact, the call for new responses leading to technological and management innovation practices result from the strategic need of organizations to consolidate their bases in the field of unavoidable changes. (Silva & Fialho 2006).

Based on the above statements we come to the conclusion that it is important to have a further knowledge of a social network because:

- It provides operational means to learn about people's daily lives
- The connection among the actors of networks provides a theoretical basis for the development of preventive interventions.
- It suggests a way of developing and articulate formal and informal resources.

In short, the hospital system is a master key in this context. However, after a period of hospital centrism, the necessary evolutions emerge with much difficulty due to acquired "habits" of technical intervention in the treatment logic of the services provision. "The non articulation between the mission of the hospital and that of its partners led to dysfunctions in the hospital mission itself." (Honoré, 2002:125) The hospital reached an overcrowding stage which is not favourable to the development of shift alternatives to its culture. It is becoming more and more necessary to reformulate hospital logics by means of interinstitutional training networks to better ensure the quality of health care.

3.1 – Social networks analysis

The methodology of social networks analysis looks at the specific relations between particular elements such as, people, groups, organizations, event, processing the relational data; relational data is

understood as the existence of a specific tie between a pair of elements. This methodology is widely used in various countries but it is hardly used in Portugal, “The network analysis requires structural analysis logic based in two core objectives: the identification of certain social interaction patterns and on the other hand, the understanding of the influence of those patterns in the behaviour of the social actors. It is an inductive matrix process which grows from objective social relationships and moves towards relationship patterns which form the social structure of a particular system. These relationship patterns may be mathematically measurable by the graph theory, statistics and probabilistic theory and through algebraic models”. (Wasserman e Faust, 1994; Lazega, 1998; Varanda, 2000 quoted by Fialho 2007: 29/30).

To understand any network it is critical to identify three elements:

- **Nodes or actors** – are the people or groups who meet due to a joint objective. Usually the sum of the nodes represents the size of the network (Fialho 2007)
- **Ties or relationships** – are the existing ties between two or more actors, and are represented by lines.(Fialho 2007)
- **Flows** – indicate the direction of the tie, and may take on various names: unidirectional or bidirectional. On its turn, if no sort of flow exists **between** with a specific actor this means this is a loose node within the network. (Fialho 2007)

The purpose of the social network analysis consists, generally, on the measurement of the degree of association or chance among the variables. The variables are entered in a spreadsheet with lines and columns, that is, the construction of the actor – actor adjacency matrix. This sort of representation is very frequent in structural analysis, in so far as it is associated with the construction of graphs. (Lemieux e Ouimet, 2008)

The matrix, is defined as a table with **M** lines and **N** columns represented under the form of table used for the construction of graphs. A graph is defined as a set of points (*vertexes*) connected by straight lines

(edges), and is very useful for the representation of real life problems, in various professional fields.

In the matrix the actors are arranged in lines and columns. When there is a relationship between the two actors the researcher writes **1**, otherwise a **0** is ascribed. In the relationship between **A** and **A** an **X** is ascribed, in so far as there is no link or reflexive relation of an actor with himself. It is important to mention that in a matrix, lines represent the source of addressed ties and the columns their destination. (Fialho, 2007)

Although the matrix may contain binary data, meaning the existence or inexistence of the relationship, it is possible to enter data belonging to more than two categories. This procedure is used to reveal the intensity of a relationship. (Lemieux e Ouimet, 2008)

The way individuals, organizations are connected may be critical for the comprehension of their attributes and behaviours. Well connected individuals may have a more influential role or be more influenced by the other actors, claiming to be a factor of core importance, and therefore being a key indicator for the comprehension of the complexity of network. An actor can have few or many ties, and thus be “strong” in relationships, or “holes” are likely to be found, meaning that they do not receive or emit.

Granovetter quoted by Fialho (2007) classified the nature of social ties:

- **Strong tie** – “happens between two individuals and requires a considerable level of time and relationship effort, emotional nature, trust and reciprocity. It is a relationship built over time.” (Fialho, 2007:96)
- **Weak tie** – “emerges in the opposite position and involves occasional transactions among actors, in which the identity of the individuals has less importance.” (Fialho, 2007:96) In this sort of tie the trust and reciprocity levels are minimum.

Size can be a critical factor to understand a network’s structure, as the larger the group, the higher the density of the ties, which can lead to the emergence of new groups. The distance between actors should also be

taken into consideration, since the larger the distance between the actors, the longer the information flow will take, meaning that this shall take more time to be spread around. (Fialho, 2007)

The geodetic distance (distance between an actor and the other actors) has been widely used in social network analysis studies, and represents the number of relationships between the actors through the shortest path. (Fialho, 2007)

In the field of networks structural analysis, the centrality of the actors is important to understand the positions within the network. In this context Freeman, quoted by Fialho (2007) presented three centrality measures:

- **Degree** – the estimate of the number of adjacency connections for each actor. A larger number of direct connections, provides a greater activity within the network.(Fialho, 2007)
- **Closeness** – has to do with the closeness of an actor regarding all the others, including direct and indirect connections, showing how susceptible he is to receive information, power, prestige and influence.
- **Betweenness** – The degree according to which the actors are located among pairs of other actors. As such the actor may have a favourable position, in so far as he is in a mandatory crossing point, meaning he holds a key position. (Fialho 2007).

In any social network there also ties establishing a closer relationship, referred to as cliques, that is, groups of actors to which each one is directly and strongly connected to the others (Marteleto, 2001).

3 – Methodological Option

The diagnosis and analysis of existing social networks emerges in this context as something innovative and complex which will enable the comprehension of the characteristics of the social network supporting the child with diabetes.

In this context we think it is pertinent to verify and analyze which are the limitations of the existing social networks, to look for gaps and to adopt the strategies to maximize the quality of the nursing care.

The general purpose of this article is to analyze the existing social networks for the support to children with type 1 diabetes on Barreiro municipality and identified by HNSR EPE.

Specific purposes are the following:

- To analyze the existing potential and limitations to the action of health actors in the social network.
- To characterize the profile of the existing social networks which support these children.
- To identify the critical factors enabling HNSR to promote the improvement of articulation of the care provided to these children.

The used methodology is based essentially on a qualitative approach, although and for a better comprehension of the issues under review, a quantitative approach is also used, by means of accounting the units of record and analysis of social networks.

In this manner we tried to describe and analyze the existing social networks to support children with type 1 diabetes, followed in HNSR.

The option on the sort of study falls on a case study, in so far as our intention is to study a well defined entity, social networks for the support of children with diabetes, aiming at getting a deep knowledge on the phenomenon under research. (Sampieri, et al 2007) The case study aims at looking into a specific situation, allegedly focusing on a particular population, the information to be obtained being unique in this context, the study having an exploratory and descriptive nature.

HNSR has been provided since 11 November 2008 with Paediatric Diabetes Outpatient Consultation, with the purpose of providing teaching and a therapy plan suitable for the child with diabetes covering all its aspects: insulin therapy, diet, physical exercise and psychotherapy assistance.

The selection of the respondents was based on the objectives of the study, which means they were selected intentionally aiming at understanding the existing social network in the support to the child with diabetes, its limitations and potential.

The following entities were chosen as the venues to carry out this study: Hospital Nossa Senhora do Rosário and Centro de Saúde do Barreiro.

In this context, a group with the inherent previous requirements was outlined, and eleven health care providers working in the above mentioned entities have been selected and are included in the following list:

Profession	Institution	Duties in the Organization	Years of service
Nurse	HNSR	Nursing director	23 years

Nurse	HNSR	Coordinating nurse Paediatrics Emergency	10 years
Nurse	HNSR	Paediatric Diabetes Outpatient consultation	16 years
Nurse	HNSR	Diabetes Consultation	19 years
Nutrition	HNSR	Nutrition Consultation	7 years
Doctor	HNSR	Director Paediatrics	17 years
Doctor	HNSR	Diabetes Consultation	2 years
Nurse	HNSR	“Crescer” Partnership	22 years
Psychologist	HNSR	Psychology Consultation	5 years
Nurse	CSB	Health at School	7 years
Nurse	CSB	Child health	10 years

Structural analysis of social networks was selected as the method to describe and explain the relationships between social actors.

As for tool for collecting information we chose the interview survey and an observation grid with quantitative indicators on the network relation and interaction (how it keeps relationships and the intensity of the relationship among the members) and afterwards for the processing of the collected information, a statistical software, Ucinet version 6, to analyze social networks was used, to explore the centrality, betweenness, intensity, closeness of netdraw under review.

4 – Analysis of Social Network of the Treatment of the Child with Diabetes

The analysis of social networks is a tool enabling to recognize the interactions among individuals, starting from qualitative and quantitative data in an illustrative and pleasant manner. (Alejandro e Norman, 2006)

The structure analysis may be considered against various centrality indicators, the network's connectivity degree, individuals with more or less number of interactions, betweenness of some actors in relationships among individuals. (Alejandro e Norman, 2006)

In this study, the interaction among actors is considered as a fundamental factor for the definition of acting strategies, in view of the treatment.

The network for the treatment of the child with diabetes shows a 0.7143 moderate weighted density and a 45% moderate binary density, which means that in a framework of 100% of possible relationships, these happen in 45 cases. However, this moderate density may be explained by some limitations mentioned in the interviews, namely the availability of the professionals, regarding the schedule of the paediatric diabetes consultation, the time availability of the professionals to articulate with several specialties.

Table 1.- Densities in Support Network for the treatment and Control of Diabetes

	Paediatric Emergency Unit	Diabetes consultation	Paediatrics Inter.	Nutrition	Psychology	Health in Schools	Child Health
Paediatric Emergency Unit		2	0	1	0	0	2
Diabetes Consultation	1		1	2	2	1	1
Paediatrics Inter.	1	2		0	0	0	2
Nutrition	0	2	0		1	0	0
Psychology	0	2	0	1		0	0
Health in Schools	0	2	0	0	0		2
Child Health	0	2	0	0	0	0	

Note: 1 = whenever respondents mentioned they articulate with this resource, or allocate it a lower relationship level; 2= whenever respondents mentioned do it more frequently; 0= no mention

Weighted Matrix:

Density (matrix average) = 0.7143

Standard deviation = 0.8532

Binary Matrix

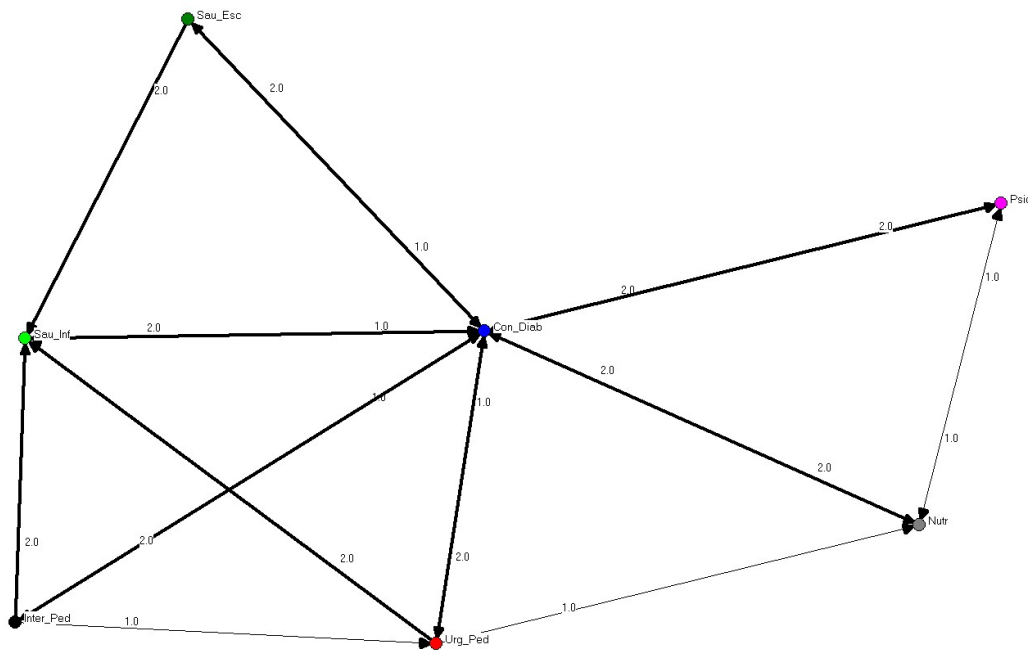
Density (matrix average) = 0.4524

Standard deviation = 0.4977

Graph 1 shows a graphic distribution of resources identified by health care providers in the community, as well as the articulation among them. From the graph analysis we may conclude that:

1. The amount of established flows reveals a matrix of moderate intensity, which shows that within the network some relationships are established among the actors.
2. No actor is excluded from the relationships network, therefore there are flows emitted among all actors,
3. There is an actor in the network who has a privileged, central position within the network.
4. We can also see in the graph the predominance of strong ties.

Graph 1 – “Weighted” Network of formal contacts in the treatment of the Child with Diabetes



What can be reported in graph 1, in so far as Child Health establishes only bi-directional flow with the paediatric diabetes outpatient consultation, the other flows being unidirectional. And Health in Schools with Child Health and with Paediatric Diabetes Outpatient Consultation. Therefore, there is the need to develop the consistency of health care in order to optimize the communication between “Health Care Centre” and “Hospital”, information exchange being scarce or nonexistent, in so far as unidirectional flows are preferably established. However, through “a priori” analysis of the graph, it is legitimate to support that a deficient articulation / circulation of information is reported.

In the network it is obvious that there is a greater percentage of input flows (75%) than output flows (36%). This fact may result from the way the information flow is carried out, in health care provision to the child with diabetes, described by some of the respondents:

“ in practice at an external level no articulation is made. Only when the child is discharged, when we the children come here, first you make an articulation with outpatient consultation, just at the moment of the discharge, (...) then an articulation is made with health care centres.” (E1)

“As for health care centres it was established that from the moment when this child is discharged a discharge letter, or a slip with care articulation is sent to the health care centre, where the nurse responsible for child health will keep it going, and, if necessary, there will be some home care as she will do as she has already done” (E6)

Centralities of Support Network in the Treatment and Control of Diabetes

FREEMAN'S DEGREE CENTRALITY MEASURES

	1	2	3	4	
	OutDegree	InDegree	NrmOutDeg	NrmlnDeg	
2 Diab_Con	8.000	12.000	66.667	100.000	
1 Ped_Emer	5.000	2.000	41.667	16.667	
3 Ped_Inter	5.000	1.000	41.667	8.333	
6 Sch_Health	4.000	1.000	33.333	8.333	
4 Nutr	3.000	4.000	25.000	33.333	
5 Psyc	3.000	3.000	25.000	25.000	
7 Child_Health	2.000	7.000	16.667	58.333	

DESCRIPTIVE STATISTICS

	1	2	3	4
	OutDegree	InDegree	NrmOutDeg	NrmInDeg
1 Mean	4.286	4.286	35.714	35.714
2 Std Dev	1.829	3.692	15.246	30.769
3 Sum	30.000	30.000	250.000	250.000
4 Variance	3.347	13.633	232.426	946.712
5 SSQ	152.000	224.000	10555.556	15555.556
6 MCSSQ	23.429	95.429	1626.984	6626.984
7 Euc Norm	12.329	14.967	102.740	124.722
8 Minimum	2.000	1.000	16.667	8.333
9 Maximum	8.000	12.000	66.667	100.000

Network Centralization (Outdegree) = 36.111%

Network Centralization (Indegree) = 75.000%

Paediatric Diabetes Consultation has reported to be an entity with a privileged position regarding the flows reception, showing an indegree of 12 for a standard indegree of 100%; this is obvious in so far as it was pointed out by the respondents as the main articulation resource in the treatment of the disease.

This resource is an important actor within the network, because it relates directly with all the other actors, which can be important for the development of prevention and professionals' training strategies, as it establishes strong ties with the other actors.

Relatively, the network's betweenness degree is high, 72%, although the consultation, which appears to be the main actor with which all other actors relate shows a low betweenness degree of 22%, as the flows are mostly unidirectional ones.

Betweenness

FREEMAN BETWEENNESS CENTRALITY

Un-normalized centralization: 131.000

	1	2
	Betweenness	nBetweenness
2 Diab_Con	22.000	73.333
1 Ped_Emerg	0.500	1.667
4 Nutr	0.500	1.667
3 Ped_Inter	0.000	0.000
5 Psyc	0.000	0.000
6 Sch_Health	0.000	0.000
7 Ch_Health	0.000	0.000

DESCRIPTIVE STATISTICS FOR EACH MEASURE

	1	2
	Betweenness	nBetweenness
1 Mean	3.286	10.952
2 Std Dev	7.643	25.477
3 Sum	23.000	76.667
4 Variance	58.418	649.093
5 SSQ	484.500	5383.333
6 MCSSQ	408.929	4543.651
7 Euc Norm	22.011	73.371
8 Minimum	0.000	0.000
9 Maximum	22.000	73.333

Network Centralization Index = 72.78%

Which can derive from the fact of few human resources, pointed out by two of the respondents as limitations of the network for the treatment of the child with diabetes.

“ for the treatment of children here in our service, but I think there should be more people integrated in that (...) part of this group would manage, everything according to what is established by the group. There is a gap in this part.”(E3)

“Limitations existing at the consultation level, at this moment I think there is a great limitation which is the fact of only one doctor is appointed for the outpatient consultation, with this specific training ...” (E8)

In short, the results suggest that in any social network there are also ties establishing a closer relationship, called subgroups (cliques). In this study four subgroups were identified in the intervention in the field of quality assurance of health care provided to children with Diabetes:

- Paediatric Emergency Unit – Diabetes Outpatient Consultation – Paediatric Hospitalization – Child Health
- Paediatric Emergency Unit – Diabetes Outpatient Consultation – Nutrition
- Diabetes Outpatient Consultation – Nutrition – Psychology
- Diabetes Outpatient Consultation – Health at School – Child Health

Sub-groups

4 cliques found.

- 1: Ped_Eme Diab_Con Paed_Inter Ch_Health
- 2: Ped_Eme Diab_Con Nutr
- 3: Diab_Con Nutr Psyc

4: Diab_Con Heal_Sch Child_Heal

Clique Proximities: Prop. of clique members adjacent that each node is adjacent to

	1	2	3	4
1 Paed_Eme	1.000	1.000	0.667	0.667
2 Diab_Con	1.000	1.000	1.000	1.000
3 Paed_Inter	1.000	0.667	0.333	0.667
4 Nutr	0.500	1.000	1.000	0.333
5 Psyc	0.250	0.667	1.000	0.333
6 Sch_Health	0.500	0.333	0.333	1.000
7 Chil_Health	1.000	0.667	0.333	1.000

Conclusion

Social networks become innovating in so far as they have the capability of expressing, through their relationships structure, innovating political and economical ideas, with the mission to help solving some problems.

The success of any human undertaking depends on the way professionals communicate among themselves, because a faulty communication is responsible for organizational flaws.

A suitable and efficient articulation of health care providers is fundamental, as if there is no certainty about the objectives and treatments, contradictory information shall make the situation worse.

In this study the diabetes consultation, although recently set up, is mentioned by the respondents as the main intra-hospital resource and the health care centre as the main resource existing in the community.

In this context the main stressed limitations were: insufficient human resources and the need for a suitable training of professionals for intervention and within the network, some relating this event to the recent opening of paediatric diabetes consultation.

However it is important to mention that regardless of the difficulties felt for information management and articulation leadership, the professionals

have shown a growing involvement, aiming at the improvement of quality of care and a better articulation.

In this context, the desired and recommended success may not be achieved by “Programa de Prevenção e Controlo da Diabetes” (program for the prevention and control of diabetes) in so far as institutions can only succeed if they are developed within a solid public health infra-structure involving organizational capacity, health care providers with necessary training to meet the quality requirements of the care to be provided (Candeias *et al* 2008).

With regard to the efficiency of articulation of human resources with the treatment of the child with diabetes about half the interviewed health care providers have defined it as good or effective, however some consider it as less effective, as to what concerns the child monitoring regarding child health, the families’ awareness and the articulation with the health centre.

As for the limitations of the network for treatment, the availability of the health care providers is pointed out as the major limitation, regarding the paediatric diabetes outpatient consultation schedule, the time availability of the care providers to articulate with the different specialties and provide suitable and effective education.

In order to get a suitable sharing among the different areas, it is necessary to clearly define the information that should be documented and shared.

The defective articulation/circulation of information, does not allow for a suitable response to the needs, that is, an effective and efficient monitoring of the child with diabetes.

The ongoing improvement of the quality involves an organized system based on a specific problem-solving methodology of the resources intervening in this support network, aiming at the development and implementation of an intervention plan in this field.

The care follow-up requires a timely response, which was not reported in this study, assuring the effectiveness of the reception and provision of services and an ongoing improvement quality of care.

To meet this purpose paediatric diabetes outpatient consultation takes on a core role in the establishment of strong ties with all the intervening parties which requires a considerable level of time and effort for the relationship, emotional nature, trust and reciprocity.

According to the centrality principle paediatric diabetes outpatient consultation claims to be a core actor, with a decision position in the network, and yet an actor with a low level of betweenness, meaning that it cannot exert its influence through the alliances with the other actors. In this study it also became obvious that there were ties establishing a closest relationship, referred to as cliques; in this study four cliques were identified, with paediatric diabetes outpatient consultation being present in the four of them, showing, thus, its major importance in this network.

Figure 1 – Formal network for the treatment of the child with diabetes

Source: authors

In view of the results of the study, it becomes obvious that organizations need a set of systems for information management, team work and mainly a strong leadership in the management of the structure, processes and results. Communication difficulties are predominantly due to unsuitable procedures, and therefore, when research is done, it is necessary to check for the effectiveness of the systems, that is the communication standards as well as the suitable means, providing solutions, such as the ongoing information transfer, favouring the creation of a trust atmosphere for the ongoing improvement of the quality of care. Therefore, we suggest that a warning system should be set up, as well as a reinforcement of the circuit for the network treatment and monitoring of the child with diabetes. In truth, the objective for the existence of a care circuit is to achieve a greater articulation and effectiveness of care. However, in order to define,

understand and quantify the quality of care it is fundamental to assess and audit the procedures of the organizations and health care services involved in the problems with the management of the chronic disease in children with diabetes.

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