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Posted Date: 27 April 2023

doi: 10.20944/preprints202304.1020.v1

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Pediatric Diabetes Technology Management: Italian Health Care Workers' Point of View

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Abstract: Type 1 diabetes (T1D) has shown an increase in the incidence rate of about 3% per year over the last two decades. Continuous Insulin Subcutaneous Therapy (CSII) is widely used in the paediatric population with diabetes; however, it requires more preparation by the treating team and careful selection of potential users. Prescriptive provisions vary from Region to Region and the perspective of health workers still remains an unexplored area. The aim of the research project is to explore the representations of a group of diabetologists and psychologists working in pediatric diabetology on the national territory, regarding roles, functions and activities as part of a multidisciplinary team; their views on the potential benefits of CSII and the types of individuals applying for the use of technology. A socio-anagraphic data sheet was administered and two homogeneous focus groups were conducted by profession; they were audio recorded. The transcripts produced were analysed using the Emotional Text Mining (ETM) methodology. Each of the two corpus generated three clusters and two factors: for diabetologists, a focus on the patient in different levels of care emerged, collaborating both with other health professionals and with the territory, through the proposal of an intervention where the medical aspect is often represented by technology; also for psychologists there was a representation of interdisciplinary networking, with a greater focus on the processes inherent the management of pathology, from acceptance to the elaboration and integration of diabetes in the family narrative. The understanding of the representations of health professionals working in pediatric diabetes about new technologies can contribute to the consolidation of a network of professionals through a targeted work on possible critical issues emerged.

Keywords: diabetes; paediatric psychology; health and well-being; health care service; psychology of health; health professionals

1. Introduction

Type 1 diabetes (T1D) is one of the most common metabolic and endocrine conditions in childhood, showing an incidence rate increased by 3% per year during the last two decades [1]. According to the National Institute of Health data of the five-year period 2005-2010 [2], the national average value of the incidence rate of T1D in children aged between 0- 4 years is equal to 13.4 / 100,000 / year, and is higher in boys (14.1 / 100,000 / year) than in girls (12.7 / 100000 / year) [3].

Continuous subcutaneous insulin Infusion (CSII) is widely used especially in pediatric population with diabetes, for better dosing accuracy and flexibility in insulin regulation [4]. There is a steady growth of patients switching from multi-injection therapy to CSII, with a different distribution between the various groups age of the population: CSII is recommended as the first choice of treatment for preschool children by the International Society for Pediatric and Adolescent-s [5,6]. The publication of national guidelines for the use of CSII [7] and the recent arrival on the Italian market of increasingly sophisticated insulin pumps may have further increased the propensity of caregivers and patients towards CSII [8]. Even If the scientific evidence supports its use, it requires greater preparation and education by the treating team, as well as a careful selection of potential users of the technology [9].

The optimal organization of CSII therapy management should include dedicated clinics and staff, a multidisciplinary team with experience in the management of diabetes in pediatrics, a minimum number of people in CSII followed by the facility and the guarantee of H24 contact with the patient through a preferential telephone line [7].

Therapeutic education must be carried out by an adequately multidisciplinary team trained, capable of taking into account the specific needs of children and their families, providing an adaptable and personalized service, appropriate to the individual's age, stage of diabetes, lifestyle and cultural sensitivity. In fact, children with diabetes differ from adults in many aspects, including insulin sensitivity related to sexual maturation, the ability to implement self-management, the variability of eating behaviors and physical activity. Particular attention should also be paid on family dynamics, stages of development and psychological differences related to sexual maturity [7]. The treating team training should therefore be planned in a continuous and repeated manner with respect to the educational strategies and communication with the child and family [10].

There is still no National Register; only a minority of the structures surveyed have all these requirements. A still large number of structures don't have a clinic dedicated to CSII therapy and don't have a multidisciplinary team that involves the figures of the diabetologist, the nurse, the dietician and, where possible, the psychologist. Healthcare professionals are key players in the patient care implementation process; they provide all necessary services for patients according to their needs. Such services should be safe, effective, patient-centered; accessible and well organized, however facilitate assistance and reduce health costs related to the complications of diseases. The planning of the working activity, together with the climate and organizational culture and interpersonal relationships typical of the workplace constitute a complex emotional context to which healthcare workers are exposed in the workplace [11]. In a study [12] the perception of having few professional opportunities of development and the lack of adequate training have led to experience uncertainty about one's own work and a reduction in self-esteem in healthcare professionals. Such limited work and organizational resources thus affected the quality of care offered to patients. To make the assistance service more effective, programmatic and social policies are still needed today that adequately emphasize the prevention of stress and the improvement of the professional health care operator's empowerment [12]. In literature, predominantly quantitative methodologies have been used to investigate the attitudes of physicians and nurses towards patient autonomy, the multidisciplinary approach to diabetes care, and the psychosocial impact of the disease. [13,14]. Some researchers [15] used a qualitative approach to understand the perspectives of professionals regarding the use of CSII and the strategies for identifying patients who could benefit most from this technology, highlighting the importance of exploring the views of practitioners in determining attitudes or misconceptions that may guide patient selection when proposing the use of CSII. The use of qualitative methodology to explore Health Care Workers' attitudes and opinions toward this issue has been applied in various countries, such as Ireland [16], UK [15,17] and New Zeland [18]. In Italy, studies of this kind have not yet been conducted, leaving an important gap in the literature exploring this delicate and important topic in the Italian context. Every country belongs to a different culture, which even within micro-groups such as those of professionals working with pediatric diabetes and CSII, may present possible differences. This is due to the emotional representations that characterize a particular group of people [19], which determine attitudes, emotions surrounding that topic, and consequently, behaviors and actions. It therefore seems crucial to explore the emotional representations in professionals dealing with this topic in Italy as well, in order to bring to light the latent culture that characterizes this topic.

The purpose of the research project is to explore the representations of Italian diabetologists and psychologists regarding the pediatric diabetes, the technologies as CSII, and the potential differences among these two groups.

 doi:10.20944/preprints202304.1020.v1

2. Materials and Methods

2.1. Sampling and recruitment

To explore the representation of the functions and roles of Italian diabetologists and psychologists working with pediatric diabetes, 53 Italian Pediatric Diabetes Centers were recruited through email invitations. Specifically, some critical recruitment criteria were considered for Psychologists (PSY) and Diabetologists (DIAB): at least one year of work experience with patients with T1D; belonging to the same team.

37 centers did not respond, 4 did not meet the criteria, 7 were not available. 5 Centers agreed to the research and participated, for a total of 11 people (5 DIAB and 6 PSY; Table 1). The participants are mostly women, belonging to the age group of 46-55 years, and the majority of them are from Northern Italy. The professionals took part in 2 homogeneous focus groups by profession.

Table 1. Demographics variables of participants.

	n (%)
Gender	
Male	1 (9,1%)
Female	10 (90,9%)
Age Group	
35-45	3 (27,3%)
46-55	7 (63,6%)
56-65	1 (9,1%)
Education Level	
Specialisation	9 (81,8%)
PhD/ Master	2 (18,2%)
Type of Profession	
Diabetologists	5 (45,4%)
Psychologists	6 (54,6%)
Area of Origin	
North of Italy	9 (81,8%)
Centre of Italy	2 (12,2%)
South of Italy	0 (0,0)
Years of service	
0-10	4 (36,4%)
11-20	5 (45,4%)
21-30	1 (9,1%)
31-40	1 (9,1%)

Three questions were addressed to the participants:

- What is your role within the multidisciplinary team in the field of pediatric diabetology?
- What emotions do you experience in pediatric patient therapy when using technological devices? How is your relationship with the family?
- What are the reasons that lead to recommending or not recommending the use of technological devices such as CSII?

2.2. Data collection

Diabetes centers were contacted between March and April 2022, while focus groups were conducted in May 2022. Each group lasted approximately an hour and a half. Every participant who took part in the research signed an informed consent form and completed a sociodemographic questionnaire to provide information such as their gender, age, occupation, etc. The focus groups were led by two experienced psychologists and were conducted via video call to prevent the spread

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of COVID-19. The conversations were audio recorded, transcribed, and fully anonymized. The same topics were discussed in each group.

2.3. Data analysis

The focus groups were recorded and fully transcribed. The transcriptions were collected in two small corpus, one for DIAB (token= 5292) and one for PSY (token=8391). To explore the emotional representation of these two groups of professions in the management of pediatric diabetes technology, we used the methodology of Emotional Text Mining (ETM) [19,20]. ETM is a non-supervised text mining procedure, based on a psychodynamic model and a socio-constructivist approach [21]. It allows the detection of both the semantic and the semiotic aspects transmitted by the communication. The semantic level focuses on the content of the communication while the semiotic level refers to the emotional symbolization within the communication. People emotionally symbolize an event or an object and socially share this symbolization, impacting people's behaviors, expectations and interactions through an unconscious mental processing [19,20,22]. ETM uses a statistical procedure that simulates the thinking process, starting from the semantic level (conscious) to the semiotic one (unconscious), while in human reality the process proceeds to the contrary [23]. To do this, ETM relies on a sequence of synthesis procedures, ranging from the reduction of stems type and keywords selection, to the extension into cluster and factor analysis. In this way it tries to identify the semiotic-symbolic level from the semantic matrix [20].

In order to check whether it was possible to statistically process the data using ETM, two lexical indicators were calculated for each corpus: the type-token ratio and the percentage of hapax (DIAB: TTR=0.234 and Hapax= 60.4 %; PSY: TTR= 0.225 and Hapax= 57.0 %). Data are in line with the small corpus size [24]. The corpuses of the two transcriptions were first cleaned, preprocessed and keyword selected, in order to detect associative links between the words, inferring the symbolic matrix and determining their coexistence into the texts. We classified the texts performing a cluster analysis with a bisecting k-means algorithm based on cosine similarity on the text-keyword matrix [25], limited to ten partitions, excluding all the text that did not include the co-occurrence of at least two keywords. In order to identify the optimal clustering validation measure, Calinski-Harabasz, the Davies-Bouldin and the intraclass correlation coefficient indices were considered. These indices are the most commonly used in text mining procedures [26]. A correspondence analysis [27] was then performed on the cluster per keywords matrix, detecting the symbolic matrix. In order to identify this one, the four investigators separately interpreted the factorial space according to word polarization [19], by giving a label to each factor and each polarity. Then, the cluster was interpreted according to both its location in the factorial space and the words characterizing the context units classified in the cluster, identifying the representation and attributing a label to each cluster. The labels were analyzed and discussed in order to define the final interpretation and the label.

3. Results

The results of the analysis shown that the keywords selected allowed the classification of 99.05% (DIAB) and 97.02% (PSI) of the content units. The clustering validation measures shown that the optimal solution was three clusters and two factors for both group of professionals.

3.1. Factors

As shown in Table 2, DIAB participants represented professionals working in multidisciplinary teams of Italian Pediatric Hospitals through two main symbolic categories, "Taking Charge" and "Healthcare". Each factor is composed of two polarities, which contain a series of representative words.

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Table 2. Diabetologists' factors 1 e 2 emerged from the analysis. Keywords are presented by order of percentage of absolute contribution (CA%).

Factor 1 Taking Charge				Factor 2 Healthcare			
Team	**CA%**	**Relationship**	**CA%**	**Management**	**CA%**	**Care**	**CA%**
Nurse	-6.45	Technology	9.37	Work	-12.69		
Dietitian	-5.61	Adolescents	6.55	Occupying	-6.82	Nurse	3.63
Surgery	-5.05	I think	4.54	Pediatrician	-6.82	Dietitian	3.15
Psychologist	-3.33	Choosing	4.54	Maintain	-5.45	Surgery	2.84
Department	-2.8	Put	4.03	Team	-4.87	Patients	1.82
Activity	-1.68	Pump	4.03	Relation	-3.65	Ward	1.58
Association	-1.4	Parent	2.92	diabetes	-3.53		

The first factor highlights the Diabetologist's "Taking Charge". This emotional dimension is characterized by the Team (negative polarity), in which Diabetologists are part of an healthcare facility from a teamwork perspective, and by Relationship (positive polarity), in which the therapeutic relationship is expressed through an operating mode. In Team, the relationship with the patient is not mentioned but emphasis is given to the team network, while in Relationship, the relationship is played by the lonely diabetologist who face to the family and to the decisions of using new technologies.

The second factor focused on the "Healthcare", highlighting two poles, Management and Care. On the one hand (Management) there is a dimension of coordination, a team that manages the diagnostic and therapeutic process, from which, however, some figures are excluded, those who have direct contact with the patient, those who deal with Care.

As regards of psychologists' results (Table 3), PSY participants represented their working in the same context through other two main symbolic categories: "Psychologist's Work" and "Levels of intervention".

Table 3. Psychologist's factors 1 e 2 emerged from the analysis. Keywords are presented by order of percentage of absolute contribution (CA%).

Factor 1 Psychologist's Work				Factor 2 Levels of intervention			
The process	**CA%**	**The network**	**CA%**	**Processing the pathology**	**CA%**	**Acceptance**	**CA%**
Accept	-5.89	School	4.34	Onset	-3.13	Put	7.26
Put	-5.58	Colleague	4.34	Lived	-2.34	Accept	5.95
Diversity	-4.13	Glycemia	2.31	Augment	-2.19	Diversity	4.16
Present	-2.95	Mum	1.96	Person	-2.19	Small	2.97
Happen	-2.75	Team	1.72	Anger	-2.19	Present	2.97
Sense	-2.62	Hospital	1.7	Think	-2.06	Pump	2.46
Impotence	-2.36	Work	1.67	Patient	-1.91	Impotence	2.38
Immediately	-1.77	Territory	1.58	New	-1.87	Creed	1.91

The first factor of PSY highlights the Psychologist's Work, which is characterized by the process (negative polarity) and its steps (from the diagnosis to the acceptance of diversity, impotence and the treatment), and by the network (positive polarity) that includes all the actors and contexts that relate daily to the pathological reality of the patient.

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The second factor focused on Levels of intervention, with the negative pole, Processing the pathology, and the positive pole, Acceptance. In the first one it emerges the emotional component linked to the onset of the pathology and the changes that it involves in the patient life; the second one highlights the experiences linked to the path of care and the acceptance of technology that are inserted in the relationship between psychologist and patient.

3.2. Cluster

Based on the results of the DIAB group (Table 4), the first cluster (Table 5), named Response to the need (38% of Unit Contexts) reflects the support and assistance that the different actors of care - from the health professionals to the territorial context - offer to the patient.

Table 4. Diabetologists cluster location in the symbolic space (under the factor polarity interpretation, the cluster coordinate of each factor is reported).

Cl	%UC	Factor 1 Taking Charge	Factor 2 Healthcare
1 Response to the need	38%	Team (-0.7)	Care (0.4)
2 Pathological reality	24%	Team (-0.1)	Management (-1.1)
3 Family meets Tecnhology	38%	Relationship (0.8)	Care (0.2)

Table 5. The three clusters of Diabetologists.

Cluster	Label	Keyword
1	Response to the need	Nurse Dietitian Surgery Psychologist Department Activity Need Association
2	Pathological reality	Work Diabetes Reality Pediatrics Team Occupying Pediatrician
3	Family meets Technology	Technology Adolescents Family Parent I think Choosing Onset Pump

3.2.1. Diabetologists

To support the cluster analysis, we decided to insert quotes following the TF-IDF score of Salton [28], a measure useful to estimate the importance of a lexical unit in a document:

Score (51.828) "*In my opinion, having a dietitian present in the clinic, as my colleagues described in their experience, is crucial. While calling a dietitian during a visit, which you cannot dedicate more than 20 minutes to, you have to identify the problem, call the dietitian, who may be somewhere else dealing with metabolic diseases*".

Original quote in Italian ["*Secondo me la presenza in ambulatorio, come raccontavano le colleghe prima della loro realtà, di avere una dietista sempre presente è fondamentale. Mentre a chiamata, nel contesto della visita, alla quale poi non riesci a dedicare più di 20 minuti, devi cogliere il problema, chiamare la dietista, la dietista magari è da un'altra parte che fa le malattie metaboliche*"].

The second cluster, named Pathological reality (24% of U.C.), contains everything concerning the management of the disease by a predominantly medical team (only the name of the pediatrician appears, while other professional figures such as the dietician and the psychologist appear in the first cluster). The cluster makes us reflect globally on the degree of real or imaginary conjunction existing between the different professionals within an interdisciplinary work. In addition, a key figure, the patient, is not mentioned.

Score (35.823) "*I connect to what my colleague said, it is easy to work with those who are good, with those who accept technology, with good families, very easy to work with those, once a colleague from xxx said: save one of those that goes wrong… that is your job, your satisfaction*".

Original quote in Italian ["*Mi riallaccio a quello che diceva il collega, è facile lavorare con quelli che vanno bene, con quelli che accettano la tecnologia, con le famiglie brave, facilissimo lavorare con quelli, una volta un collega di Modena disse: salvare uno di quelli che va male… quello è il tuo lavoro, la tua soddisfazione*"].

The third cluster, Family meets Technology, (38% of U.C.) underline the meeting between the nucleus of family and the technology (the pump), where the diabetologist is a spectator. There seems to be a request for help, as the professional seems to be frozen and passive in this scenario.

Score (35.257) "*So obviously the patient's choice is essential, but there is a variety of attitudes from a technological perspective, like whether to use an insulin pump or not, with different preferences for the person, the child, and the family... sometimes the family wants it but the child doesn't, and vice versa*".

Original quote in Italian ["*Quindi ovviamente la scelta del paziente è essenziale però c'è una varietà di atteggiamento dal punto di vista della tecnologia, microinfusore si, microinfusore no, con tempi diversi della persona, del bambino, della famiglia... a volte c'è una famiglia che lo vuole e il bambino no e viceversa*"].

3.2.2. Psychologists

As regards the three clusters of the PSY group, the first one, named Networking (45% U.C.) includes the spirit of fellowship, a team-work that monitors different levels of work with the patient. The aim of this work is the acceptance of the pathology and of the treatment.

Score (34.554) "*As my colleague from XXX said, the interface and balance between hospital and community care is always very delicate in a chronic condition that only comes to the hospital for a few days of admission and is mainly managed in the community. However, where we are, community intervention is mainly related to school-related activities*".

Original quote in Italian ["*Come diceva la collega di XXX è sempre molto delicata l'interfaccia, l'equilibrio ospedale/territorio in una patologia cronica che di fatto arriva in ospedale soltanto per i pochi giorni del ricovero e che si esplica, si vive tutta sul territorio, ma laddove qui da noi l'intervento del territorio è prevalentemente legato agli interventi di tipo scolastico*"].

The second cluster, Working with the patient (17% U.C.) refers to a more mature process of pathology management, including the acceptance of the disease and the feeling of impotence and the elaboration of the cure process.

Score (53.277) "*Then this episode, gestational diabetes regresses, puts at risk type 2 diabetes in the future however, the sense of diversity, when they told me about this diversity and then the sense of impotence, I am trying to help the people who are fighting, because it is not a war, it cannot be a war*".

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Original quote in Italian ["*Allora questo episodio, il diabete gestazionale regredisce, pone a rischio di diabete tipo 2 nel futuro però, il senso di diversità, quando mi parlavano di questa diversità e poi il senso di impotenza, di una lotta, tanto che adesso anche negli interventi cerco di aiutare le persone che lottano contro, perché non è una guerra, non può essere una guerra*"].

The third Psychologists cluster, Working with the family system (38% U.C.), alludes to the attention to the patient and his family: the work implies the attempt to integrate the event of diabetes within the family narrative.

Score (32.719) "*It's as if a child is born, as if there is a new one, someone tells us about before and after the onset, as if before the onset was the year 0. The onset and from there we start again, there is a new life, everything has changed and time, their life stands out precisely on a before and after. This because it marks, is a moment that marks particularly*."

Original quote in Italian ["*È come se nascesse un bambino, come se ci fosse una nuova, qualcuno ci parla di prima e dopo dell'esordio, come se prima dell'esordio fosse l'anno 0. L'esordio e da lì si riparte, c'è una nuova vita, tutto è cambiato e il tempo, la loro vita si distingue proprio su un prima e il dopo. Questo perché segna, è un momento che segna particolarmente*"].

Table 6. Psychologists cluster location in the symbolic space (under the factor polarity interpretation, the cluster coordinate of each factor is reported).

Cl	%UC	Factor 1 Psychologist's Work	Factor 2 Levels of intervention
1 Networking	44.79	The network (0.6)	Acceptance (0.2)
2 Working with the patient	17.18	The process (-1.1)	Acceptance (0.9)
3 Working with the family system	38.04	The process (-0.3)	Psychological processing of the pathology (-0.6)

Table 7. The three clusters of Psychologists.

Cluster	Label	Keyword
1	Networking	Colleague School Territory Blood sugar Hospital Mom Team
2	Working with the patient	Put Accept Pump Diversity See Small

		Present
3	Working with the family system	Debut Think about Parent Household Patient Lived Life

4. Discussion

The aim of the present study was to identify the emotional representations surrounding the topic of pediatric diabetes and the use of related technologies in a specific group of professionals, namely diabetologists and psychologists. To achieve this goal, two profession-specific focus groups were conducted, and the transcripts were analyzed using the ETM methodology. Three clusters and two factors describing the emotional dimensions and representations of each profession regarding the investigated topic emerged for each group. Diabetologists organize an emotional space characterized by two dimensions: Taking Charge (between the Team and Relationship) and the Healthcare (between Management and Care). Psychologists' dimensions are: Psychologist's Work (between the Process and the Network) and Levels of Interventions.

It is interesting to note how the first factor of both groups focuses on the type of work done for the patient. Psychologists describe a dimension of network and territory work, while diabetologists focus more on team work. The psychologist is present in the team represented by the diabetologist, but this dimension does not emerge within the results of the psychologists themselves. These results probably show a difficulty on the part of psychological figures to effectively enter into the work teams in this particular context. However, the presence of this representation within the diabetologists' factors tells a story of a starting point for building a team in which the competence and psychological figure is effectively present and participating in team work, and not just in territory work. Additionally, within the first factor of diabetologists, there is a relational dimension where the diabetologist is somehow "expelled", and the family's decisions regarding new technologies seem like a difficult and impenetrable context for the diabetologist. This aspect could be a meeting point within the team where the psychologist can not only respond to the "need", but also help the diabetologist emotionally understand what is happening to the patient and their family.

In support of this, the second factor for the Care component of the diabetologists is very scarce, as if it is difficult to enter into this dimensional perspective. A psychological component could support a vision of care not only in terms of Management, but also in terms of actual care.

Another important finding is the significance, for both professionals, of working with the family and not just with the individual. This relates to both the acceptance and management of the illness and the use of new technologies. It seems essential, for the success of a treatment that includes the use of technologies, to take into account the family system and work with them from preparation to support throughout the process. The components of the team and networking also appear crucial in this context, suggesting that the issue of pediatric diabetes and the use of related technologies should be addressed with a network perspective, not only by individual professionals but by groups of experts or those who may have an impact on the final outcome. The response to the need must therefore be addressed by a team, with a care-oriented approach and particular attention to the reference territorial network.

To this end, it seems essential to create a network of professionals at the territorial level and provide specific training to operators who can have a care approach to the family and collaborate with other professional figures.

Literature has shown how focus groups are real psychological interventions and that they have an impact thanks to the re-elaboration of concepts and the listening of other points of view expressed

by the other participants [29–31]. Therefore, we believe that this experience is a real intervention for the participants, and we hope that it may have helped the professionals who participated to have a lens of vision that can grasp the importance of working in a network.

5. Limitations

This research presents several limitations. The first is the low response rate from the Italian Pediatric Diabetes Centers that were contacted, resulting in a small sample of participants. This effect is common in qualitative research, where participants are invited to have an active role in focus groups. For future studies, it is important to establish a strong network for recruiting participants and to physically present the research in the centers to increase engagement levels.

Finally, the use of the same methodology (ETM) to explore the emotional representations of patients and their families regarding pediatric diabetes and its technology should be further investigated. In addition, it would be very interesting to apply the same investigation methodology to a sample not included in this study but essential in pediatric diabetes and its management, namely that of nurses.gement, namely that of nurses.

This section is not mandatory but can be added to the manuscript if the discussion is unusually long or complex.

Author Contributions: Conceptualization, A.T. and L.G.; methodology, A.T. and L.G.; software, S.M.; validation, A.T., L.G. and S.M.; investigation, A.T. and L.G.; data curation, A.T.; writing-original draft, A.T.; writing-review and editing, A.T., L.G. and S.M., supervision, M.D.T.; project administration, A.T.; funding acquisition, A.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research has no funding.

Institutional Review Board Statement: This study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of Department of Clinical, Dynamic and Health Study Psychology, University of Rome, Sapienza (Prot. n. 0000149 and 04/02/2022).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data available by the authors without undue reservation.

Conflicts of Interest: The authors declare no conflict of interest.

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