



Profiling acquired pedophilic behavior: Retrospective analysis of 66 Italian forensic cases of pedophilia

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ABSTRACT

Neurological disorders can be mis-diagnosed as psychiatric ones. This might happen to pedophilia emerging as a symptom of brain insult (i.e. acquired pedophilic behavior). This paper aims to delineate a behavioral profile that might help to identify defendants whose pedophilic behavior is likely to be the consequence of a neurological disorder. Through a systematic review of the literature, seventeen clinical and behavioral variables of the modus operandi and victimology that can distinguish between acquired and developmental pedophilic behavior have been collected. Seven of these were found to be consistent behavioral indicators (i.e. red flags) for acquired pedophilia. Cluster hierarchical analysis on the seventeen variables collected through the systematic review of the literature on cases of acquired pedophilic behavior was applied to a new dataset including 66 Italian closed cases of pedophilia. Stepwise regression and correlation analyses were carried out to further examine the differences between the clusters identified in the cluster analysis. Results revealed that the new sample was partitioned into two clusters. Individuals with ascertained acquired pedophilia were grouped together. The clusters widely differed for the prevalence of red flags (mean number of red flags in each cluster: 2.14 ± 0.79 vs 4.96 ± 0.93 , $p < 0.001$), while no between cluster difference emerged for the other clinical and behavioral variables. Regression analysis provided a robust model that included the three most significant red flags that explain over 64.5% of the variance (absence of masking, spontaneous confession and offenders older age). An organic origin of pedophilic behavior should be suspected if red flags are present in a defendant charged with pedophilia. In those cases, an in depth trans-disciplinary neuroscientific investigation is advocated. The behavioral profile identified might help to provide a proper assessment of defendants.

"If I were to order a general to fly from one flower to another like a butterfly, or to write a tragedy, or to change himself into a sea-bird, and if the general did not carry out the order, which one of us would be at fault?"

The Little Prince

1. Introduction

Despite it is now widely known that neurological disorders are commonly associated with psychiatric symptoms, it is more difficult to accept that a number of neurological disorders, because of their predominantly behavioral and sometimes bizarre presentation, are sometimes mistakenly diagnosed as psychiatric (Butler & Zeman, 2005; Keshavan & Kaneko, 2013). This might be the case of acquired pedophilic behavior, a medical condition known for many years (Miller,

Cummings, McIntyre, Ebers, & Grode, 1986; Simpson, Blaszczyński, & Hodgkinson, 1999) that recently gained attention for its medical and legal consequences (Farisco & Petrini, 2014; Gilbert & Focquaert, 2015; Gilbert & Vranic, 2015; Sartori, Scarpazza, Codognotto, & Pietrini, 2016; Scarpazza, Pellegrini, Pietrini, & Sartori, 2018). The first case of acquired pedophilic behavior is to track back to 1862, when a 78 years-old man (H.) without previous criminal record, was charged with child abuse (von Krafft-Ebing, 1897). H. was described as impaired in many cognitive functions: his speech was not clear, his memory was severely impaired, he did not understand the charges he was accused of.

So far, however, forensic consultants working in the delicate field of child sex abuse are still devoid of a reliable way to identify offenders whose pedophilic behavior is likely to be of acquired rather than of developmental origin. Its identification is of the utmost importance for the selection of the most effective therapy and/or the most adequate

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punishment.

Acquired pedophilic behavior differs from developmental pedophilic disorder in many aspects: etiology, underlying neural correlates, possible therapies, *modus operandi* and legal consequences.

Regarding etiology, developmental pedophilic disorder is considered to be a psychiatric disorder included within the paraphilias in the DSM-5 (Beech, Miner, & Thornton, 2016). In DSM-5 pedophilia is de-pathologized as the manual underlines that pedophilia, which is defined as a sexual preference toward pre-pubertal children ((Seto, 2009), while *hebephilia* refers to sexual attraction toward pubescent), must be seen separately from sexual offenses against children (Tenbergen et al., 2015). Pedophilia becomes a disorder when the sexual attraction toward children is paired with a significant distress and impairment by fantasies and urges, or the acting out on behavioral level. In developmental pedophilia, the pedophilic interest would appear to be stable across the individual's lifespan (Hanson, Steffy, & Gauthier, 1993) and it typically first appears in adolescence (Tenbergen et al., 2015). Frequently developmental pedophilia has comorbidities with psychiatric disorders: for instance, 60% of pedophiles also qualified for a personality disorder (Fagan, Wise, Schmidt Jr., & Berlin, 2002; Green, 2002; T. H. Kruger & Schiffer, 2011; Raymond, Coleman, Ohlerking, Christenson, & Miner, 1999). Literature suggested that child sexual offending is characterized by emotional disturbances and high rate of psychopathology (T. H. Kruger & Schiffer, 2011; Tenbergen et al., 2015), high rate of social anxiety, less social engagement, low self-esteem and decreased ability to socially assert oneself (Geer, Estupinan, & Manguno-Mire, 2000; Hall & Hall, 2007). Research regarding the etiology of pedophilia also suggests the presence of a complex and multifactorial phenomenon in which the influences of genetics (T. H. C. Kruger et al., 2019), stressful life events (Jespersen, Lalumiere, & Seto, 2009), testosterone exposure, neurochemical impairment (mainly serotonergic disturbances) (Gilbert & Focquaert, 2015) as well as subtle brain alterations, may generate this specific phenotype of sexual preference (Cantor et al., 2008; Schiffer et al., 2007; Schiltz et al., 2007; Tenbergen et al., 2015). Early theories also considered the influence of psychological mechanisms such as the "abused-abuser" theory (Freund & Kuban, 1994; Freund, Watson, & Dickey, 1990; Hall & Hall, 2007) on the pedophile's sexual preference. Indeed, the numbers reported for pedophiles who were abused as children range from 28% to 93% vs 15% for non pedophiles controls (Cohen & Galynker, 2002; Greenberg, Bradford, & Curry, 1993) (Hall & Hall, 2007).

Contrarily, acquired pedophilic behavior refers to a sexual urge toward children that emerges later in life as a consequence of a neurological condition with clear etiology (e.g. frontotemporal dementia (M. F. Mendez, 2010), brain tumor (Burns & Swerdlow, 2003), clivus chordoma (Sartori et al., 2016), surgical lesions (Devinsky, Sacks, & Devinsky, 2010), hippocampal sclerosis (M. Mendez & Shapira, 2011)), thereby causing a "behavioral fracture" in the overt behavior manifested prior and after the brain disease insurgence (Scarpazza, Pellegrini, et al., 2018; Scarpazza, Pennati, & Sartori, 2018). No comorbidities with psychiatric disorders have been described so far, and no influence of psychological and/or genetic factors has been postulated so far.

Thus, while developmental pedophilia is categorized within psychiatric disorders, acquired pedophilia clearly has a neurological origin.

The neural basis of the two forms of pedophilic disorders are different as well. As suggested by the literature and summarized in two recent reviews (Mohnke et al., 2014; Tenbergen et al., 2015), developmental pedophilia is characterized by brain functional alterations or subtle structural alterations without evident neuroanatomical abnormalities (as for instance, brain tumors or lesions) (Mohnke et al., 2014). For instance, white (Cantor et al., 2008; Cantor & Blanchard, 2012) as well as grey matter reduction (Poepl et al., 2013), identified only after complex statistical analysis of magnetic resonance images data, have been described in developmental pedophilia ((Schiffer et al., 2007), for reviews see (Mohnke et al., 2014; Tenbergen et al., 2015)).

These alterations seem to be congenital or to emerge very early during life, encompassing brain regions involved in sexual arousal (Tenbergen et al., 2015), such as the amygdalae and the hypothalamus. Researches on the neural basis of pedophilia have the important shortcoming of relying on data based on cases of pedophiles with a high comorbidity with psychiatric disorders. It is thus still difficult to disentangle whether the described abnormalities are related to pedophilia itself or to the associated psychiatric disorder.

On the contrary, evident structural brain alterations emerging later in life are pivotal for the diagnosis of acquired pedophilic behavior. The neural network involved in the onset of this pathological behavior is still not fully understood, as it includes the right orbitofrontal cortex (Burns & Swerdlow, 2003; Fumagalli, Pravettoni, & Priori, 2015), the right amygdala (Devinsky et al., 2010), the right globus pallidus (M. Mendez & Shapira, 2011), the hypothalamus (Frohman, Frohman, & Moreault, 2002; Miller et al., 1986; Sartori et al., 2016), the hippocampus bilaterally (M. Mendez & Shapira, 2011; M. F. Mendez, 2010; M. F. Mendez, Chow, Ringman, Twitchell, & Hinkin, 2000), the basal ganglia bilaterally (M. Mendez & Shapira, 2011). These regions seem to be associated with a network involved in diminished behavioral control (Mohnke et al., 2014).

We argue that thus, while developmental pedophilia is associated with subtle structural and functional alterations measurable only at a group level, acquired pedophilia is causally linked to macroscopic structural alterations that are evident in every single individual.

Regarding possible treatments, there seems to be no evidence to suggest that developmental pedophilia can be changed and no treatment has proven to be effective unless the pedophile is willing to engage in the treatment (Hall & Hall, 2007; Stone, Winslade, & Klugman, 2000). Psychotherapeutic interventions are designed to increase voluntary control over sexual arousal, reduce sex drive, or teach self-management skills to individuals who are motivated to avoid acting upon their sexual interests (Seto, 2009). Despite psychotherapy being an important aspect of treatment, there is a debate concerning its overall effectiveness for a long-term prevention of new offenses (Hall & Hall, 2007; Hanson, Morton, & Harris, 2003; Hanson & Morton-Bourgon, 2005; Langton, Barbaree, Harkins, & Peacock, 2006). For this reason, psychotherapy is often coupled with androgen deprivation therapy (ADT) (Thibaut et al., 2010), or with the administration of selective serotonin reuptake inhibitors, which represent a non-hormonal treatment suggested for paraphilias in general including pedophilia (Hall & Hall, 2007; Schober et al., 2005; Stone et al., 2000). Nevertheless, researchers suggested that after a year of combined psychotherapy and pharmacotherapy, pedophiles still show sexual interest for children, whereas the frequency of urges decrease (Hall & Hall, 2007; Schober et al., 2005). It seems that offenders with developmental pedophilia rarely comply with psychological and medical treatments (Blanchard, 2010; Fagan et al., 2002; Raymond et al., 1999; Stone et al., 2000) being at high risk of sexual recidivism (Hanson, 2002; Hanson & Morton-Bourgon, 2005; Raymond et al., 1999; Seto, 2009; Seto, Harris, Rice, & Barbaree, 2004).

On the contrary, acquired pedophilia can be addressed by treating the underlying medical condition (Sartori et al., 2016). For instance, pedophilia can recede after surgical resection of the tumor causing it (Burns & Swerdlow, 2003; Gilbert & Vranic, 2015; Sartori et al., 2016). If pedophilia emerges as a side effect of antidopaminergic drugs (Solla, Floris, Tacconi, & Cannas, 2006), drug removal or dosage reduction may eliminate pedophilic behavior. However, successful treatment is not always granted, as sometimes acquired pedophilia emerges as a symptom of neurodegenerative disorders such as frontotemporal dementia (M. F. Mendez et al., 2000; Rainero et al., 2011; Scarpazza, Pennati, & Sartori, 2018) or hippocampal sclerosis (M. F. Mendez et al., 2000). In these cases, however the ADT might be taken into consideration to avoid further offending. Notably, sexual recidivism has never been described in acquired pedophiles after being treated.

Thus, while developmental pedophilia is the primary condition that

needs treatment, acquired pedophilia, being a symptom, can recede by treating the underlying neurological disorder.

The *modus operandi*, widely differs between developmental and acquired pedophilia. Literature suggests that individuals experiencing developmental pedophilia are described as active searches of victims, good organizers of their action and, if caught, they might deny their behavior (Fagan et al., 2002; Hall & Hall, 2007). They often intentionally try to place themselves in a position where they can meet children and have the opportunity to interact with them in an unsupervised location (Cohen & Galyner, 2002; Hall & Hall, 2007; Murray, 2000). Developmental pedophiles might obtain access to children through means of persuasion, friendship and behavior designed to gain the trust of the child and parents (Hall & Hall, 2007; Murray, 2000). Furthermore, after the sexual abuse, they try to mask their abusing behavior, enforcing victim's silence and using psychological and physical violence (Hall & Hall, 2007; Miranda & Corcoran, 2000).

Contrarily, individuals with acquired pedophilia show lack of premeditation (Gilbert & Focquaert, 2015; Sartori et al., 2016) and thus they usually do not actively search for children or attempt to disguise their criminal behavior (Burns & Swerdlow, 2003; M. Mendez & Shapira, 2011; Sartori et al., 2016; Scarpazza, Pellegrini, et al., 2018; Scarpazza, Pennati, & Sartori, 2018). For instance, sexual abuses have been described to be carried out in a school, leaving the door open (Sartori et al., 2016) or in a school garden, potentially in front of teachers and people passing by (Scarpazza, Pennati, & Sartori, 2018). These behavioral differences might reflect the impulse dis-control that characterizes patients with acquired pedophilia (Mohnke et al., 2014).

Thus, the *modus operandi* of developmental pedophiles is characterized by a highly predatory style, whereas the one used by acquired pedophiles seems to be not organized and it is characterized by an impulse discontrol.

Finally, legal consequences are different as well. While, according to the legal principle of *actio libera in causa*, the legal consequences for developmental pedophilic individuals are severe, while legal punishment might not be the most effective solution for acquired pedophiles.

Crucially, both the ability to understand the moral and social value of one's own action and the ability to exert control over impulses are pivotal to the capacity for self-determination. As individual with acquired pedophilia usually lack in these abilities, insanity becomes a relevant so far controversial issue in these cases (Gilbert & Focquaert, 2015). For these reasons, individuals with acquired pedophilia might be considered not fully liable for their pedophilic behavior (Burns & Swerdlow, 2003; Devinsky et al., 2010; Gilbert, 2013; Gilbert & Vranic, 2015; Gilbert, Vranic, & Viaña, 2016; Scarpazza, Pennati, & Sartori, 2018). For instance, the 1867 patient, H., was diagnosed with dementia and was not held responsible for the criminal offenses he was charged with (von Krafft-Ebing, 1897).

Although the distinction between developmental and acquired pedophilic behavior, based on the description provided so far, seems to be intuitive, the identification of an underlying medical or iatrogenic cause in a defendant presenting with pedophilia can be diagnostically challenging, thereby the importance of a trans-disciplinary approach has been advocated (Scarpazza, Pennati, & Sartori, 2018). Indeed, the neurological impairment causing pedophilia may pass unobserved without a neurological examination, as pedophilia might be the first overt symptom of a serious disease (e.g. Burns & Swerdlow, 2003; Rainero et al., 2011; Sartori et al., 2016).

The aim of the current research is thus to identify a measurable behavioral profile that might help clinicians and psychiatric consultants to identify defendants whose pedophilia is more likely to be the consequence of a neurological insult. In the cases identified as possible acquired pedophiles, an in-depth neuroscientific investigation is advocated, possibly including a brain magnetic resonance images (MRI), to assess the possible brain damage and identify the most effective therapy and/or the most adequate punishment. To this aim, we

systematically review the literature to identify possible behavioral predictors of acquired pedophilic behavior (i.e. red flags) to generate an a priori hypothesis on acquired pedophilic behavior profiling. Using a falsificationist approach, the profile will then be tested through additional analysis conducted using unsupervised methods on a new dataset of individuals convicted for pedophilia.

2. Methods

2.1. Systematic review

A systematic review of cases of acquired pedophilic behavior was conducted with the aim to a priori identify its possible behavioral, clinical and demographic red flags. The systematic review was conducted in accordance with the PRISMA guidelines (Moher, Liberati, Tetzlaff, Altman, & Group, 2009). Papers were included in the subsequent analysis if they described new cases of late onset pedophilic behavior emerging as a symptom of a neurological condition. The papers screening procedure is reported in the PRISMA flow chart available within the Supplementary Materials (A).

For each case of pedophilic behavior identified in literature, data regarding the demographic information, the clinical status, the *modus operandi* and the victimology have been extracted from the source literature. In particular, the demographic characteristics of the offender recorded are the following: gender, age, education, marital status, profession in contact with children. As for the clinical status, the presence of previous psychiatric symptoms (excluding the paraphilia) and the underlying neurological disorder responsible for acquired pedophilia have been recorded. Regarding the *modus operandi*, we included the following information: premeditation, attempt of masking, sense of guilt, confession, previous criminal sex offense, severity of the abuse, length of the abuse, place of the abuse. Finally, regarding the victimology, the number and gender of the victims and the relationship between the offender and the victim were recorded. This systematic review is crucial to identify the variables that are consistently reported in the literature, hereafter referred as "red flags", as our a priori hypothesis to be tested in a new sample is that these variables will indeed help in discriminating acquired from developmental pedophilic behavior.

2.2. New subjects

This study involves a retrospective cross-sectional study based on the re-analysis of closed criminal cases of pedophilic behavior. As in Italy there is no archive for crimes and criminals such as the Violent Crime Linkage Analysis System (<http://www.rcmp-grc.gc.ca/to-ot/cpcmec-cpede/bs-sc/viclas-salvac-eng.htm>), the authors asked the authorities the access to the criminal registry of four regional court archives in the North of Italy (i.e. Verona, Ferrara, Reggio Emilia and Padova). The access was granted to examine the court documentation related to closed cases of defendant charged with pedophilia. The authors signed a declaration agreeing to respect the privacy of the defendants and to not disclose any individual personal data. This research is conformed with the Declaration of Helsinki and its later amendments and was approved by the Ethical Committee of the Department of General Psychology, Padova, Italy.

Documentation regarding 76 closed cases of pedophilic behavior occurred between 2005 and 2015 were collected. Five cases were subsequently excluded as the information available was not complete enough. Five additional cases were excluded as the offense was disconfirmed and the defendants were not charged with pedophilia. The final database thus included 66 cases of pedophilic behavior involving a sexual offense against at least one victim aging 13 or younger, according with the most restrictive definition of pedophilia (Frances & First, 2011; Tenbergen et al., 2015). All the offenders were pursued by the law and convicted for pedophilia. For all the cases included, the

same information regarding the demographic variables, clinical status, modus operandi and victimology collected for the systematic review were recorded as well and stored in a centralized dataset.

2.3. Statistical analyses

In order to investigate whether acquired pedophilic behavior can be identified basing on the data included in the centralized dataset, a hierarchical cluster analysis was performed using all the 17 variables listed in the “systematic review” paragraph. Cluster analysis is an unsupervised way of classification that requires no predefined classes and that is used to find hidden patterns within the data. Cluster analysis generates classes based on the co-occurrence of relevant variables and it is considered to be the most adequate bottom-up method to find similarities between cases. Using cluster analysis, squared Euclidian distances were obtained using the Ward method (Ward, 1963), which applies the most conservative approach. These Euclidian distances are subsequently used to identify relevant clusters based on minimal Euclidean distances between the selected variables.

In order to investigate possible between cluster differences in the red flags and variables prevalence, chi squared tests have been performed for each variable, using Cluster (1 or 2) as independent variable. Furthermore, correlation analyses for dichotomous variables were performed using the phi coefficient to investigate the association between all red flags and variables that significantly differs between the two clusters. Correlations were considered significant if they survived the Bonferroni multiple comparisons correction.

Finally, to further explore the differences between the two resulting clusters, a multiple regression analysis (stepwise method) was performed using the 17 variables. Since the model involves a step-by-step method, only the variables or predictors that increase variance explanation are included in the final model, and highly correlated variables are ignored.

3. Results

3.1. Systematic review

The systematic review identified 15 papers reporting original cases of acquired pedophilic behavior (Alnemari, Mansour, Buehler, & Gaudin, 2016; Burns & Swerdlow, 2003; Devinsky et al., 2010; Frohman et al., 2002; Fumagalli et al., 2015; Gilbert & Vranic, 2015; Lesniak, Szymusik, & Chrzanoski, 1972; M. Mendez & Shapira, 2011; M. F. Mendez et al., 2000; Miller et al., 1986; Rainero et al., 2011; Regestein & Reich, 1978; Sartori et al., 2016; Scarpazza, Pennati, & Sartori, 2018; Solla et al., 2006), including a total of 22 cases from 1972 to 2018. The cases included are summarized in the table available within the Supplementary Information (B).

All the offenders showing acquired pedophilic behavior reported in the literature are men. They are > 50 age in 17 out of 22 cases (77.27%), reflecting the increased risk for neurological disorders during the senescence. Other demographic information is not completely reported, but 6 out of 9 (66.66%) patients have > 8 years of education and 11 out of 14 (78%) are married. Interestingly, only 2 out of 9 (22.2%) have a profession that put them in contact with children.

Regarding the clinical status, 13 out of 16 (81.2%) of them have a negative history for previous psychiatric conditions, while 3 out of 16 previously suffered with major depression. Tautologically, all of them presented with a neurological condition that accounts for the insurgence of pedophilic behavior ($n = 8$ neoplasm; $n = 4$ behavioral variant of frontotemporal dementia; $n = 2$ traumatic brain injury; $n = 1$ bilateral hippocampal sclerosis; $n = 1$ multiple sclerosis involving the orbitofrontal cortex; $n = 3$ Parkinson's disease; $n = 1$ frontal variant of Alzheimer's disorder; $n = 1$ vascular dementia involving the globus pallidus; $n = 1$ Huntington's disease).

Critically, the *modus operandi* is characterized by the absence of

premeditation in all cases (10 out of 10), the absence of any attempt to mask the sexual assault (11 out of 12, 91.6%), an immediate confession upon arrest (8 out of 8), the presence of sense of guilt (6 out of 8, 75%) and the absence of previous criminal sex offense (18 out of 18). The severity of the abuse ranged from no abuse at all (only pornography) to severe abuse with a complete sexual intercourse. The places where the sexual assault took place were heterogeneous as well as they range from the offender's house to open spaces.

The victimology is highly inconsistent between different cases as the number of victims range from 0 (pornography only) to many; the gender of the victim varies across cases. Finally, the sexual offenders could be relatives or strangers to the victims ($n = 9$ strangers, $n = 8$ relatives, $n = 1$ neighbor; $n = 1$ pediatrician).

Thus, the systematic review of the literature suggests a profile of acquired pedophilic behavior characterized by old age, absence of previous psychiatric disorders and sex related crimes, absence of premeditation and masking, presence of spontaneous confession and sense of guilt. These seven out of 17 variables are hereafter referred as “red flags”. We do not consider the presence of a neurological disorder as a way to profile acquired pedophilic behavior because it would have been a circular reasoning.

3.2. New subjects

Although we included cases of pedophilic behavior involving a sexual offense against at least one victim aging 13 or younger, six of the individuals included in the study offended also pubescent victims aging 14 to 17 years.

Critically, out of 66 cases included in the new analysis, 7 were cases of ascertained acquired pedophilia and the juridical documentation was complete enough to identify the underlying neurological disorder and to assess the causal link between the neurological disorder and the pedophilic behavior onset. These brain disorders included: 2 cases of behavioral variant of fronto-temporal dementia; 1 case of fronto-parietal meningioma; 1 case of neoplasm of the notochord; 1 case of ischemic stroke involving the left temporal lobe; 1 case of advanced dementia and 1 case of right temporal lobe atrophy. The neurological origin of pedophilic behavior was recognized during the trial in these cases. For these 7 cases, the variable “presence of a neurological disorder” was positive, while for all the other cases included in the database ($n = 59$), the same variable was negative as these offenders never received a neurological diagnosis because they were never tested for that.

3.3. Clusters analysis

The cluster analysis partitioned the sample in two large clusters, graphically represented in Fig. 1, including a bigger cluster of 41 subjects (Cluster 1) and a smaller cluster of 25 subjects (Cluster 2). Notably, the seven offenders with ascertained acquired pedophilic behavior clustered together in Cluster 2. Even more interestingly, the same seven offenders are not grouped together in a small, distinguishable cluster, but are homogeneously widespread across Cluster 2.

A *t*-test on the number of red flag in each cluster revealed that the two clusters widely differ for the number of red flags: Cluster 1 mean number of red flags = 2.14 (dev standard 0.79); Cluster 2 = 4.96 ± 0.93, two independent sample *t*-test = 13.06, $p < 0.001$.

3.4. Between cluster differences

Table 1 reported the prevalence of each variable in each cluster. The mean age in the two clusters is 40.7 ± 10.6 and 55.3 ± 13.8 for Cluster 1 and 2, respectively (two independent sample *t*-test = -4.92, $p < 0.001$). Of note, six out of seven of the red flags identified throughout the systematic review were statistically more represented in the smaller cluster compared to the larger one. The only red flag whose

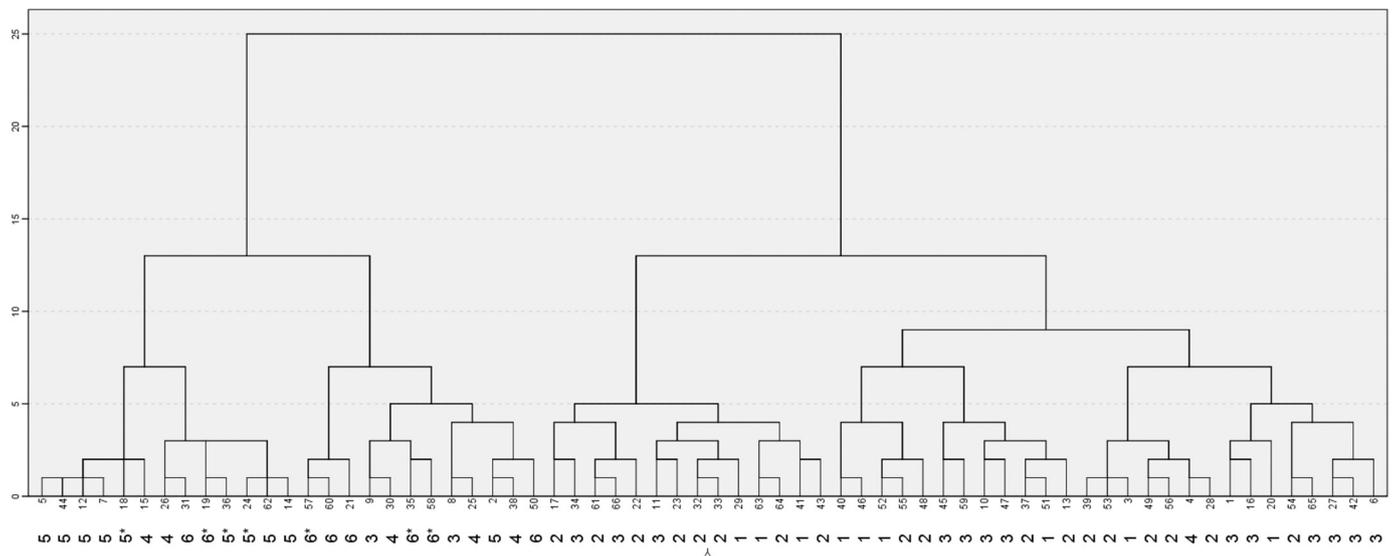


Fig. 1. Cluster Analysis results. The image represents the results of the cluster analysis: subjects were partitioned into two large clusters. The higher row on the x axis denotes each case identification number. The numbers (ranging from 1 to 6) on the lower row on the x axis refers to the number of red flags that are present for each offender. Asterisk (*) denotes offender's with confirmed acquired pedophilia as evidence of a neurological disorder was provided and a causal link between the neurological disorder and the pedophilic behavior has been assessed in each of them. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

prevalence did not differ between the two cluster relates to the absence of previous psychiatric disorders. This is likely to be due to the low prevalence of psychiatric disorders in the general population or to the fact that personality disorders, that are often in comorbidity with

paraphilias (Garcia & Thibaut, 2011), are ego-syntonic and thus individuals do not seek medical attention. Unexpectedly, a higher percentage of individuals that classified in the second cluster rather than the first one is married. This is likely due to the lower prevalence of

Table 1
Between Clusters Differences.

Variable	Cluster1 n=41	Cluster2 n=25	Chi squared	p
<i>Demographic features</i>				
Older age (> 50 years)	8 (19.51%)	16 (64%)	13.28	<0.001
Low Educational level (<8 years)	39 (35.1%)	23 (92%)	0.226	0.606
Marital Status (Married)	13 (31.7%)	22 (88%)	19.75	<0.001
Profession in contact with children (yes)	5 (12.19%)	3 (12%)	0.002	0.981
<i>Clinical Status</i>				
Absence of previous psychiatric disorders	39 (95.12%)	24 (96%)	0.028	0.868
Ascertained neurological disorder	0	7 (28%)	13.28	<0.001
<i>Modus Operandi</i>				
Premeditation (no)	12 (29.26%)	20 (80%)	16.003	<0.001
Masking (no)	7 (17.07%)	21 (84%)	28.47	<0.001
Spontaneous Confession (yes)	1 (2.43%)	10 (40%)	15.77	<0.001
Sense of Guilt (yes)	0	8 (32%)	14.93	<0.001
Previous Criminal sex offenses (no)	21 (51.21%)	25 (100%)	17.49	<0.001
Abuse mild (yes)	14 (34.14%)	5 (20%)	1.51	0.218
Repeated Abuse (no)	24 (58.53%)	14 (56%)	0.41	0.840
Place of the abuses (public spaces)	11	9	0.618	0.432
<i>Victimology</i>				
Number of victims (>1)	12 (29.26%)	10 (40%)	0.805	0.370
Sex of the victims (assault to both genders)	10 (24.39%)	6 (24%)	0.001	0.971
Relationship with the victims (stranger)	5 (12.19)	5 (20%)	0.736	0.391

Numbers represent the raw number (percentages). Red Flags (i.e. variables emerged from the systematic review of the literature as potentially useful to discriminate developmental from acquired pedophilic) are highlighted in grey.

Table 2
Correlation analyses.

	Older age	Marital Status	Absence of previous psychiatric disorders	Premeditation	Masking	Confession	Sense of Guilt	Previous Criminal sex offenses
Older age	1							
Marital Status	0.234	1						
Absence of previous psychiatric disorders	-0.014	-0.086	1					
Premeditation	-0.401	-0.245	-0.225	1				
Masking	0.013	0.316	0.254	-0.394	1			
Confession	0.085	0.258	0.098	-0.217	0.192	1		
Sense of Guilt	0.105	0.257	-0.081	-0.197	0.245	0.457	1	
Previous Criminal sex offenses	0.019	-0.172	0.144	0.310	-0.366	-0.206	-0.245	1

Number denotes phi coefficient for dichotomous correlations. The colors denote the following: Blue = Correlation not statistically significant; Light red = statistically significant correlation at $p < 0.05$; Dark Red = statistically significant correlation after multiple comparison correction.

married individuals within the developmental group, reflecting their inherent paraphilia.

3.5. Correlations between variables and red flags

Correlation analyses were conducted between 7 red flags and one variable (being married). Thus, 28 correlations were performed setting the new statistical threshold to $p = 0.0017$ ($0.05/28$). The results are reported in Table 2. Three correlations only resulted statistically significant: older defendants are characterized by lower premeditation ($p = 0.001$); defendants who lack in premeditation are those who did not try to disguise their own acts ($p = 0.001$); defendants who spontaneously confess their criminal acts are those who feel guilty ($p < 0.001$).

3.6. Regression analysis

The multiple regression output presents a final model including the three most significant red flags and explaining 64.5% of the variance in the case distribution between Clusters 1 and 2. The first and most significant red flag is the Absence of masking, which explains 42.3% of the variance in the case cluster distribution. The second predictor is spontaneous confession, which explains the 13.1% of the variance. The last significant predictor in the model is age older than 50, which contributes to 9.1% of the variance. Results are reported in Table 3. The regression analysis did not include premeditation and sense of guilt.

Table 3

Stepwise multiple regression analysis, final model. Dependent variable *Cluster*, n. cases 66, 17 variables and predictors entered and removed from the resulting final model.

Independent variable	B	R ² adj.	B stand.	t	Sig.
Masking Absent	0.490	0.423	0.499	6.394	< 0.001
Confession	0.478	0.554	0.367	4.875	< 0.001
Age	0.233	0.645	0.318	4.140	< 0.001

These red flags are however highly correlated with absence of masking and spontaneous confession, respectively, as reported in Table 2. The final interpretative model is represented in Fig. 2.

4. Discussion

Results from the systematic review on acquired pedophilic behavior cases led to suggest that individuals whose paraphilia emerged as a result of neurological disorders behave differently from individuals with developmental pedophilia. These observations are supported by the main analysis on a dataset of 66 juridical cases of pedophilia. Using an innovative combination of statistical methodologies, we have been able to draw a profile of individuals with acquired pedophilic behavior based on information derived from previous medical evidences, offender's history and *modus operandi*. In particular, we identified six red

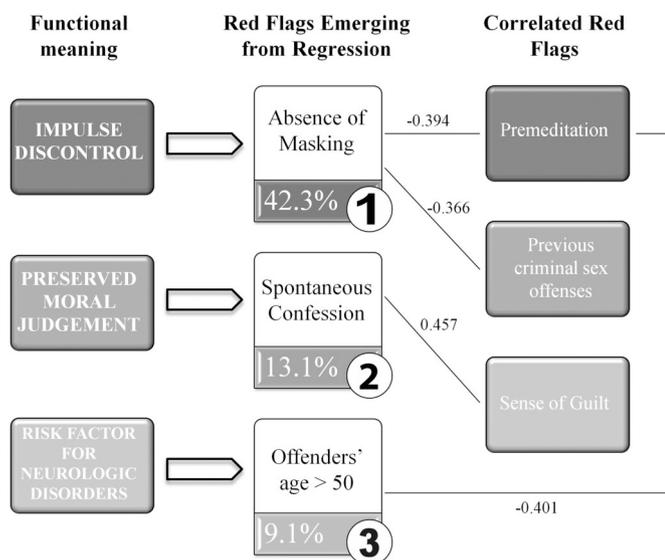


Fig. 2. Final Interpretative Model. Diagram showing the link between the functional domains affected in acquired pedophilia and the red flags suggesting the suspect acquired pedophile profile. On the middle column, the three predictors emerged from the stepwise multiple regression are represented; number denotes the percentage of individual contribution to regression variance. On the left side column, the functional meaning of these red flags is highlighted. On the right-side column, the red flags significantly correlated with the three main ones are reported. On the horizontal lines the Phi correlation coefficients between the main red flags and the other one is reported. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

flags of acquired pedophilic behavior that can be summarized as follow: i) no evidence of masking; ii) no premeditation, iii) no previous sexual criminal records, iv) spontaneous confession; v) sense of guilt with and vi) age older than 50.

The following results are of particular relevance. First, the cluster analysis classified the offenders into two big clusters that widely differ in the number of red flags. In particular, the first cluster includes individuals showing four or more (with two exceptions) red flags, while the second one includes individuals showing three or less red flags. If confirmed by future studies, this information might be included in future diagnostic criteria. Second, the offenders with ascertained acquired pedophilic behavior are homogeneously widespread across the smaller cluster and no difference is evident between offenders included in this cluster besides the presence of a neurological disorder in offenders with acquired pedophilic behavior and the absence of neurological disorder in offenders classified in the same cluster, who were never tested for the presence of neurological disorders. This led us to speculate that those offenders might have had an unrecognized acquired origin for their pedophilic behavior. This hypothesis is in line with a very early study suggesting that the prevalence of acquired organic origin for sexual crimes against children is higher than previously expected (14.4%) (Henn, Herjanic, & Vanderpearl, 1976). The current results, thus, indicate that the case of acquired pedophilic behavior represents a small but significant proportion of individuals among the number of child sex offenders in general.

Furthermore, the regression analysis provides a robust model that included the three most significant red flags that, together, explain over 64% of the variance (absence of masking, offenders older age > 50 and spontaneous confession). Finally, the correlation analysis highlights that different red flags are strongly correlated with the three main red flags emerged by the regression analysis. For instance, premeditation strongly correlates with absence of masking, both of which are the behavioral expression of impulse control disorder (Gilbert & Focquaert, 2015; Scarpazza, Pellegrini, et al., 2018). In addition, Spontaneous

confession strongly correlates with sense of guilt, as both of them pertain to the moral aspect of behavior and reflect a preserved moral judgment (Gilbert & Focquaert, 2015).

Expanding the functional meaning of the six red flags, two out of the six red flags are indicative of the acquired nature of the altered sexual interests: older age, absence of previous criminal sex offense. Older age, which is considered one of the most significant predictors, reflects the relative high prevalence of patients with late onset dementia in the acquired pedophilia group. Age is also an high risk factor for other neurological disorders, as brain tumors and stroke (Bonita, 1992). On the contrary, developmental pedophilia is characterized by early onset (Beech et al., 2016; Hanson & Morton-Bourgon, 2005) and significant criminal comorbidities (Garcia & Thibaut, 2011; Hanson & Morton-Bourgon, 2005; Stone et al., 2000).

Two out of the six red flags reflect the impulse dis-control that characterized acquired pedophiles (Burns & Swerdlow, 2003; Devinsky et al., 2010; Miller et al., 1986; Sartori et al., 2016; Scarpazza, Pennati, & Sartori, 2018): absence of premeditation and of tentative to disguise the criminal behavior. This explains their strong correlation. Indeed, if a behavior is driven by the *hic and nunc* sexual impulse, it should appear dis-organized. For instance, these offenders assaulted the victim at hand in open spaces, occasionally even in front of possible witnesses. In contrast, the *modus operandi* of developmental pedophiles is described as characterized by a predatory, fully organized and premeditated behavior, for instance they might lure the victim out of sight of parental control. In addition, a lot of effort is put into trying to mask the sexual abuses, for instance enforcing victim's silence and using psychological and physical violence (Hall & Hall, 2007; Miranda & Corcoran, 2000).

The last two predictors, spontaneous confession and sense of guilt, are slightly more difficult to interpret. Both of them might be explained by a spared moral judgment that would make the pedophilic behavior ego-dystonic (Burns & Swerdlow, 2003; Devinsky et al., 2010; Frohman et al., 2002; Solla et al., 2006). In contrast, in developmental pedophilic disorder, the sexual attraction to children is perceived as ego-syntonic (MacMartin & Wood, 2005). However, at least in some cases, the juridical "ability to understand" is impaired as well (Lesniak et al., 1972; M. F. Mendez et al., 2000; Sartori et al., 2016; Scarpazza, Pennati, & Sartori, 2018) and the defendants are not able to understand what is morally wrong. In these cases they tend to easily confess their crimes as they cannot see anything wrong in them, but the sense of guilt is absent. In one peculiar case (Sartori et al., 2016; Scarpazza, Pellegrini, et al., 2018) upon arrest the defendant was completely incapable to understand the moral disvalue of his acts, but a strong sense of guilt emerged after the surgical resection of the tumor.

It is here important to underline that the presence of these red flags cannot lead to a clinical diagnosis of acquired pedophilia. Rather, their presence should prompt a rapid neuro-scientific evaluation including at least a brain imaging scan and a comprehensive neurological examination (Scarpazza, Pellegrini, et al., 2018; Scarpazza, Pennati, & Sartori, 2018). The adoption of these behavioral red flags as a way to profile acquired pedophilia might be extremely useful to better inform sentencing and to reduce controversies in forensic setting. Furthermore, it is also worth to highlight that we are not suggesting that the identification of a neurological disorder in a defendant charged with pedophilia could be per se sufficient to claim his lack of accountability. Whether or not an offender manifesting acquired pedophilic behavior should be held responsible needs to be cautiously assessed on a case by case basis (Gilbert, 2013; Gilbert & Focquaert, 2015). This assessment should address how neurobiological evidences affect the individual's capacity to exert control on his behavior; to rationally evaluate what is wrong or not and decide and act accordingly; to emotionally feel the moral wrongness of an action, etc. For this assessment to be effective all relevant information (i.e. behavioral, psychological, neurobiological etc) should be taken into account. The timely differential diagnosis between developmental and acquired pedophilic behavior is of the utmost importance to adequately prevent further child abuse. Indeed,

these individuals might benefit more from a medical treatment (i.e. tumor surgical resection) rather than from an exclusive retributive punishment involving incarceration without treatment (Gilbert & Focquaert, 2015). For this reason, if a defendant with acquired pedophilic behavior is misdiagnosed with developmental pedophilia, he will be denied the possibility to receive the right treatment and once released, he will be at higher risk to re-enact the child offensive behavior.

Despite the innovative approach adopted, this study is not devoid of drawbacks, first of all its cross-sectional retrospective nature due to the restrictions to data access that prevents the inclusion of the follow up data in the analysis. Thus, it is not possible to ensure whether the offenders classified in the same cluster as the acquired pedophilic individuals received a neurological diagnosis or not. Interestingly, these cases shared the same red flags of acquired pedophilia, suggesting that their impulse control brain network is somehow disrupted. Despite the absence of follow up data is an insurmountable limitation, this makes the aim of the current paper even more important as it suggests that the prevalence of acquired pedophilia might be higher than expected (Henn et al., 1976). Future longitudinal studies should use the profile of acquired pedophilic behavior described in this study to gradually enhance the scientific knowledge on acquired pedophilia and integrate and enrich defendant's assessment and evaluation.

5. Conclusion

In conclusion, the identification of an underlying medical or iatrogenic cause in a defendant presenting with pedophilia can be diagnostically challenging (Butler & Zeman, 2005). In the current paper we identified six red flags that could suggest an organic origin of pedophilia in sexual offenders. We therefore suggest that any pedophilic case showing four or more of the following red flags should receive further neurological investigation to assess the acquired rather than developmental nature of pedophilic behavior: i) no evidence of masking, ii) no premeditation, iii) no previous sexual criminal records, iv) spontaneous confession, v) sense of guilt, vi) age older than 50. Four of these profiling elements are related to the crime (i.e. premeditation, absence of masking, sense of guilt and confession), one is demographic (i.e. offender's age over 50) and one is clinical (i.e. absence of previous sex offenses). As the current study is based on 66 cases, including only 7 cases of confirmed acquired pedophilia, the results should not be considered as conclusive. Clinical vigilance, meticulous observations of clinical progression and legally irrelevant symptoms (Scarpazza, Pellegrini, et al., 2018) are of utmost importance for the diagnosis, management and legal implication of acquired pedophilic behavior.

Declaration of Competing Interest

The authors declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijlp.2019.101508>.

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