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Early-adult outcome of child and adolescent mental disorders as evidenced by a national-based case register survey

A.C. Castagnini [a,*], L. Foldager [b], E. Caffo [c], P.H. Thomsen [d]

[a] Centre for Psychiatric Research, Aarhus University Hospital, Risskov, Denmark
[b] Unit for Behaviour and Stress Biology, Department of Animal Science, and Bioinformatics Research Centre, Aarhus University, Denmark
[c] Department of Clinical and Diagnostic Medicine and Public Health, University of Modena and Reggio Emilia, Modena, Italy
[d] Centre for Child and Adolescent Psychiatry, Aarhus University Hospital, and Department of Clinical Medicine, Aarhus University, Denmark

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ABSTRACT

Background: Mental disorders show varying degrees of continuity from childhood to adulthood. This study addresses the relationship of child and adolescent mental disorders to early adult psychiatric morbidity.
Methods: From a population at risk of 830,819 children and adolescents aged 6-16 years, we selected all those (n = 6043) who were enrolled for the first time in the Danish Psychiatric Register with an ICD-10 F00-99 diagnosis in 1995-1997, and identified any mental disorder for which they received treatment up to 2009.
Results: Neurodevelopmental and conduct disorders were the principal diagnostic groups at 6-16 years and exhibited a characteristic male preponderance; while affective, eating, neurotic, stress-related and adjustment disorders were more common in girls. Over a mean follow-up period of 10.1 years, 1666 (27.6%) cases, mean age 23.4 years, were referred for treatment to mental health services, and they had a markedly higher risk than the general population (RR 5.1; 95% CI 4.9-5.4). Affective, eating, neurodevelopmental, obsessive-compulsive and psychotic disorders had the strongest continuity. Heterotypic transitions were observed for affective, eating, neurodevelopmental, personality and substance use disorders.
Conclusions: These findings suggest that individuals with psychiatric antecedents in childhood and adolescence had a high risk of being referred for treatment in early adulthood, and many mental disorders for which they required treatment revealed both homotypic and heterotypic continuity.

1. Introduction

Mental disorders with onset in childhood and adolescence show varying degrees of continuity over time [1,2], and individuals referred for treatment in early adulthood are most likely to have a previous diagnosis of mental disorder [3-6], pointing out that a large part of the disease burden from psychiatric disorders arises by adolescence [7].

In keeping with developmental psychopathology, there are two models of continuity: "homotypic continuity", that is the same disorder persists over time; and "heterotypic continuity", also called sequential comorbidity, when clinical features tend to change with age, an effect which may result from the interaction of common genetic factors and environmental exposures [2].

Existing studies suggest that attention-deficit hyperactivity disorder (ADHD), anxiety, depression and antisocial personality disorders have higher continuity than other conditions [4,8,9], and nearly half of cases with emotional disorders are likely to recover by early adulthood [1]. Evidence also supports heterotypic patterns between conduct/oppositional disorders and later anxiety, depression, antisocial personality disorder and/or substance misuse [4,8]; between adolescent anxiety and depression in young adulthood [4,8,9]; and between earlier emotional and/or behavioral features and psychotic disorders [4,10]. Further studies revealed that vulnerability factors affecting the early stages of brain development are involved in causation of psychotic disorders [1,2], and that putative genetic alterations towards schizophrenia and affective disorders overlap with those for autism spectrum

* Corresponding author at: School of Child Neuropsychiatry, University of Modena and Reggio Emilia, Modena, Italy.
E-mail address: augusto.castagnini@unimore.it (A.C. Castagnini).

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disorders and ADHD, challenging the basis of current psychiatric classifications [11]. However, only few population-based surveys examined continuity of a broad range of mental disorders from childhood to adult life [1,12]. It is the aim of this study to address the relationship of child and adolescent mental disorders to early-adult psychiatric morbidity in community-based mental health services in Denmark.

2. Methods

This study draws its data from the Danish Psychiatric Central Register (DPCR), which has stored information - with appropriate protection for anonymity - about all in-patients since 1969 and outpatient mental health services since 1995 [13]. Data are used for national statistics, mental health planning and research. DPCR records include details from case-notes and, since 1994, diagnosis coded according to the ICD-10 Classification of Mental and Behavioural Disorders, Diagnostic Criteria for Research (ICD-10) [14]. The quality of psychiatric assessment is enhanced by uniformity of training throughout the country, including supervisions and courses which provide tuition in ICD-10 and related diagnostic instruments. All those living in Denmark are entitled to free treatment under the National Health Service, and no private psychiatric facilities exist.

2.1. Case identification and relevant diagnostic categories

We selected all children and adolescents aged 6-16 years, whether admitted to hospital or treated as outpatients, who were listed for the first time in the DPCR with an ICD-10 F00-99 diagnosis between 1st January 1995 and 31st December 1997. Their admission/contact patterns were checked to identify any subsequent diagnosis they received when referred for treatment to mental health services up to the end of 2009. The age for transition from child-adolescent to adult psychiatric services is usually 18 years.

In selecting mental disorders to be included in our study, we relied on the following ICD-10 categories: F0-09 "organic mental disorders"; F10-19 "psychoactive substance use disorders" (SUD); F20-29 "schizophrenia and related disorders" (i.e. F20 "schizophrenia", F21 "schizotypal disorder", F22 "persistent delusional disorder", F23 "acute and transient psychotic disorders", F24 "induced delusional disorder", F25 "schizoaffective disorder", F28-29 "other and unspecified non-organic psychotic disorders"); F30-39 "affective disorders" (F30 "manic disorder", F31 "bipolar disorder", F32 "depressive disorder", F33 "recurrent depression", F34 "persistent affective disorders", F38-39 "other and unspecified affective disorders"); F40-48 "neurotic, stress-related and somatoform disorders" (F40 "phobic disorders", F41 "panic and generalized anxiety disorders", F42 "obsessive-compulsive disorder" [OCD], F43 "reaction to severe stress and adjustment disorders", F44 "dissociative disorders", F45 "somatoform disorders", F48 "other neurotic disorders"); F50-51 "eating and sleeping disorders"; F60 "personality disorders"; F70-79 "mental retardation"; F80-89 "psychological development disorders" (F80-82 "specific developmental disorders of speech and language, scholastic skills and motor function"; F84 "pervasive development disorders" [PDD]; F88-89 "other and unspecified psychological development disorders"); F90-99 "childhood and adolescent behavioral and emotional disorders (F90 "hyperkinetic disorders"; F91-92 "conduct disorders" [including oppositional defiant disorder, ODD]; F93 "emotional disorders"; F94 "attachment and social functioning disorders"; F95 "tic disorders"; and F98-99 "other and unspecified behavioral and emotional disorders of childhood and adolescence").

2.2. Data analysis

Incidence rates (IR), 95% confidence interval (CI), were expressed as the number of cases per 100,000 person-years using the Danish population at risk born between 1st January 1978 and 31st December 1991. Mantel-Haenszel combined sex-incidence rate ratio (IRR; 95% CI) were also calculated, and stratified by birth cohort.

The relative risk (RR; 95% CI) for children and adolescents with psychiatric antecedents at 6-16 years developing any mental disorder for which they required treatment in early adulthood was estimated as risk ratio by direct standardization, dividing the risk they had in their last admission/contact after the age of 18 years by that observed in the general population, stratified by birth cohort and gender. The sex risk ratio was calculated by indirect standardization, and stratified by birth cohort.

To address the relationship between child-adolescent and adult mental disorders, we compared the main ICD-10 diagnosis of children and adolescents in 1995-1997 to that they received when referred for treatment in their last admission/contact after the age of 18 years. Odd ratios (OR) with 99.5% CI were calculated using Bonferroni's method for 10 tests and adjusted for statistically significant diagnostic categories (P value = 0.05) by a forward inclusion/backward elimination procedure.

2.3. Ethical issues

Ethical approval for this study was not required because the DPCR data comply with appropriate protection standards for anonymity.

3. Results

From a population at risk of 830,819 children and adolescents (a total of 1,914,922 person-years), there were 6043 cases aged 6-16 years (58.7% males) who were first listed in the DPCR between 1995 and 1997. The mean age for boys was 11.0 years (SD 3.0), and that for girls 13.1 years (SD 3.1), respectively.

Nearly two-thirds were diagnosed as having "childhood and adolescent behavioral and emotional disorders" and "psychological developmental disorders". Neurodevelopmental disorders (i.e. specific developmental disorders, PDD and hyperkinetic disorders), conduct disorders and psychotic disorders were the principal diagnostic groups in boys; while affective disorders, eating disorders, emotional disorders, and neurotic, stress-related and adjustment disorders occurred more often in girls. Other diagnostic categories common at 6-16 years were social functioning and attachment disorders, and mixed conduct and emotion disorders. The residual categories "other" and "unspecified behavioral and emotional disorders" accounted for about 10% of the total (Table 1).

Three thousand five hundred and ninety (59.4%) children and adolescents attended inpatient and/or outpatient psychiatric services on at least one subsequent occasion over a mean follow-up period of 10.1 years (SD 3.2). Of these, 1666 (27.6%), mean age 23.4 years (SD 3.5), were referred for treatment in their last admission/contact. They had a risk 5.1 (95% CI 4.9-5.4) times higher than the general population, and the sex-specific risk was greater for males (6.2; 95% CI 5.7-6.7) than females (4.4; 95% CI 4.1-4.6). The principal conditions for which young people with psychiatric antecedents at 6-16 years required treatment had significantly raised RR (Table 2), and their frequency was as follows: personality disorders (17.0%), psychotic disorders (15.5%), stress-related and adjustment disorders (12.2%), affective disorders (10.9%), neurotic disorders (8.6%), hyperkinetic disorders (7.3%), eating disorders (6.1%) and PDD (5.5%).

Table 1
Overall incidence rates (IR) per 100000 person-years (95% confidence interval [CI]), and male to female incidence rate ratio (IRR; 95% CI) in 6043 cases aged 6-16 years with an ICD-10 F00-99 first-admission/contact diagnosis in 1995-97.

ICD-10 category	*n* (%)	IR (95% CI)	IRR (95% CI)
F0 organic disorders	33 (0.5)	2 (1-2)	1.6 (0.7-3.3)
F1 substance use disorders	45 (0.7)	2 (2-3)	4.0 (2.1-7.5)
F2 schizophrenia/related disorders	115 (1.9)	6 (5-7)	2.0 (1.4-2.9)
F3 affective disorders	135 (2.2)	7 (6-8)	0.7 (0.5-1.0)
F32-39 depressive disorders	124 (2.1)	6 (5-8)	0.7 (0.5-1.1)
F4 neurotic/stress-related disorders	1220 (20.2)	64 (60-67)	0.6 (0.6-0.7)
F40-41 phobic/panic/generalized anxiety	103 (1.7)	5 (4-6)	0.6 (0.4-0.9)
F42 obsessive-compulsive disorder	153 (2.5)	8 (7-9)	1.1 (0.8-1.5)
F43 stress reaction/adjustment disorders	878 (14.5)	46 (43-49)	0.6 (0.5-0.7)
F5 eating and sleeping disorders	370 (6.1)	19 (17-21)	0.2 (0.1-0.2)
F50 anorexia and bulimia nervosa	353 (5.8)	18 (17-20)	0.1 (0.1-0.2)
F6 personality disorders	265 (4.4)	14 (12-16)	1.0 (0.8-1.3)
F7 mental retardation	165 (2.7)	9 (7-10)	0.9 (0.7-1.2)
F8 psychological development disorders	921 (15.2)	48 (45-51)	2.3 (2.0-2.7)
F80-83 specific/mixed developmental disorders	404 (7.0)	21 (19-23)	1.8 (1.4-2.3)
F84 pervasive developmental disorders	471 (7.8)	25 (22-27)	2.9 (2.3-3.7)
F9 childhood and adolescence disorders	2774 (45.9)	145 (139-150)	1.4 (1.3-1.5)
F90 hyperkinetic disorders	411 (6.8)	21 (19-24)	3.1 (2.3-4.1)
F91 conduct disorders	419 (6.9)	22 (20-24)	2.4 (1.9-3.0)
F92 conduct and emotion disorders	333 (5.5)	17 (16-19)	1.8 (1.4-2.3)
F93 emotional disorders	556 (9.2)	29 (27-31)	0.8 (0.7-0.9)
F94-95 attachment/social functioning disorders	414 (6.9)	22 (20-24)	1.1 (0.9-1.4)
F98-99 other/unspecified	641 (10.6)	33 (31-36)	1.2 (1.1-1.5)
Total	6043	316 (308-324)	1.1 (1.0-1.2)

A further analysis here undertaken (Table 3), comparing child-adolescent and adult psychiatric disorders, revealed that SUD, psychotic disorders, affective disorders, OCD, eating disorders, PDD and hyperkinetic disorders had the strongest continuity; while anxiety disorders (phobic, panic and generalized anxiety) and personality disorders had a smaller, but significantly high diagnostic specificity. Heterotypic patterns were observed for the following categories: SUD was preceded by conduct disorders; bipolar disorder involved earlier affective and psychotic disorders; eating disorders were associated with affective disorders, neurotic, stress-related and childhood emotional disorders; personality disorders involved previous affective disorders and SUD; PDD in early adulthood were preceded by psychotic disorders, hyperkinetic disorders anxiety and childhood emotional disorders; hyperkinetic disorders involved social functioning and attachment disorders. No adult mental disorder was predicted by specific and/or mixed developmental disorders.

4. Discussion

To our knowledge, this is the first study comprehensive of ICD-10 mental disorders of childhood and adolescence treated in secondary-care settings throughout an entire country which addressed their relationship to early-adult psychiatric morbidity. These findings enhance not only the knowledge of the diagnostic categories currently used to classify child and adolescent mental disorders, but also have implications for prevention of adult psychiatric morbidity, as many mental disorders arise by adolescence [1-5,15], and it is desirable that efforts be made towards early identification and intervention in young people.

Our study's findings suggest that neurodevelopmental disorders, conduct disorders and psychotic disorders have a characteristic male preponderance, while affective disorders, emotional disorders and eating disorders are more common in girls, and compare favorably with previous reports showing that the frequency of mental disorders varies by age and gender [16]. High rates of neurodevelopmental disorders may be related to the introduction of the ICD-10 category of PDD, and the broadly defined concept of "hyperkinetic disorders" subsuming "hyperkinetic conduct disorder", which shares common features with conduct disorder. Besides changes in diagnostic classification, other factors are likely to have contributed to recognition of neurodevelopmental disorders such as the availability of pharmacological treatments and increased general awareness [17-19].

Table 2
Relative risk (RR, 95% confidence interval [CI]) and male to female risk ratio (M/F RR; 95% CI) for the main mental disorders for which 1666 cases with a psychiatric diagnosis at 6-16 years were referred for treatment in early adulthood.

ICD-10 category	*n* (%)	RR (95% CI)	M/F RR (95% CI)
F1 substance use disorders	81 (4.9)	4.2 (3.0-5.8)	2.4 (1.4-3.9)
F2 psychotic disorders	258 (15.5)	8.4 (7.1-10.0)	1.4 (1.1-1.8)
F20 schizophrenia	166 (10.0)	8.9 (7.1-11.1)	1.5 (1.1-2.0)
F3 affective disorders	181 (10.9)	2.8 (2.3-3.5)	0.7 (0.5-1.0)
F30-31 bipolar disorder	35 (2.1)	7.4 (4.6-11.9)	0.9 (0.4-1.7)
F32-39 depressive disorders	146 (8.8)	2.4 (1.9-2.9)	0.7 (0.5-1.0)
F40-41 phobic/panic/generalized anxiety	87 (5.2)	3.3 (2.5-4.3)	0.5 (0.3-0.8)
F42 obsessive-compulsive disorder	56 (3.4)	5.4 (4.0-7.1)	0.7 (0.4-1.2)
F43 stress-related/adjustment disorders	203 (12.2)	3.6 (2.9-4.3)	0.5 (0.4-0.7)
F50 anorexia and bulimia nervosa	101 (6.1)	4.5 (3.5-5.7)	0.1 (0.0-0.2)
F6 personality disorders	283 (17.0)	5.7 (4.9-6.6)	0.4 (0.3-0.6)
F84 pervasive developmental disorders	91 (5.5)	16.1 (11.3-22.9)	4.4 (2.4-8.0)
F90 hyperkinetic disorders	121 (7.3)	8.9 (6.6-11.8)	4.1 (2.4-7.1)
Total	1666	5.1 (4.9-5.4)	0.8 (0.8-0.9)

Table 3
The relationship of the main ICD-10 diagnostic categories from childhood and adolescence to early adulthood (Odds ratios with 99.5% confidence interval after Bonferroni adjustment).

Child-adolescent mental disorders	Early-adult mental disorders										
	F10-19	F20-29	F30-31	F32-39	F40-41	F42	F40-48	F50	F60-69	F84	F90
F10-19 SUD	12.1 (3.4-43.4)[c]	0.6 (0.1-3.1)	–	2.2 (0.3-16.7)	–	–	1.0 (0.1-7.7)	–	3.7 (1.1-11.9)[a]	–	2.4 (0.1-44.0)
F20-29 psychotic disorders	1.3 (0.2-10.0)	13.9 (7.7-25.4)[c]	11.2 (3.4-37.0)[c]	0.7 (0.1-3.7)	1.6 (0.2-12.7)	–	0.8 (0.2-3.3)	1.5 (0.1-25.8)	1.7 (0.6-4.6)	8.7 (1.2-61.5)[a]	0.9 (0.1-16.3)
F30-39 affective disorders	–	1.1 (0.5-2.5)	11.1 (3.5-35.3)[c]	8.3 (3.8-18.1)[c]	2.2 (0.4-11.6)	3.7 (0.5-30.2)	1.8 (0.7-4.6)	5.6 (1.2-25.6)[a]	2.6 (1.2-5.7)[b]	–	–
F40-F41/F93 anxiety and emotional disorders	0.4 (0.1-1.6)	0.2 (0.1-0.5)	0.2(0.0-2.9)	0.6 (0.3-1.4)	4.7 (2.3-9.7)[c]	6.6 (2.0-21.9)[c]	2.5 (1.6-4.0)[c]	4.3 (1.3-13.8)[b]	1.1 (0.6-1.8)	4.0 (1.0-15.5)[a]	0.7 (0.1-3.0)
F42 OCD	1.5 (0.3-7.9)	0.4 (0.1-1.2)	–	1.1 (0.3-3.6)	1.8 (0.3-9.9)	43.3 (19.6-95.6)[c]	6.6 (3.7-11.8)[c]	2.3 (0.3-17.9)	0.5 (0.1-2.2)	1.6 (0.1-31.7)	–
F40-48 neurotic, stress-related/ somatoform disorders	1.2 (0.6-2.6)	0.3 (0.2-0.5)	0.6 (0.2-2.1)	1.7 (1.0-2.8)	2.7 (1.5-5.0)[c]	6.8 (3.1-14.7)[c]	3.0 (2.2-4.2)[c]	1.8 (0.6-4.9)	1.0 (0.6-1.5)	0.4 (0.1-1.4)	1.3 (0.4-3.7)
F50 eating disorders	0.2 (0.0-3.1)	0.3 (0.1-0.7)	0.3 (0.0-5.1)	0.6 (0.2-1.6)	1.4 (0.4-5.1)	–	1.3 (0.7-2.6)	39.0 (21.1-72.1)[c]	1.4 (0.7-2.7)	–	–
F60-69 personality disorders	2.1 (0.7-6.4)	0.7 (0.3-1.4)	0.4 (0.0-7.0)	1.5 (0.5-4.2)	1.1 (0.2-5.6)	2.9 (0.5-16.8)	1.7 (0.8-3.4)	1.3 (0.2-10.0)	2.2 (1.2-4.1)[b]	0.9 (0.0-17.3)	1.2 (0.2-6.9)
F80-83 SDD	0.9 (0.2-3.4)	0.2 (0.1-0.5)	–	0.3 (0.1-1.1)	0.7 (0.1-3.6)	–	0.6 (0.2-1.3)	0.4 (0.0-6.8)	0.2 (0.1-0.9)	3.6 (0.8-15.4)	2.4 (0.8-7.1)
F84 PDD	0.2 (0.0-2.5)	0.2 (0.1-0.5)	0.2 (0.0-3.7)	0.2 (0.1-1.0)	0.2 (0.0-3.1)	0.5 (0.0-8.2)	0.4 (0.1-1.0)	–	0.2 (0.0-0.7)	22.7 (8.4-61.8)[c]	0.9 (0.2-4.1)
F90 HD	0.7 (0.2-3.0)	0.1 (0.0-0.3)	0.3 (0.0-4.8)	0.3 (0.1-1.1)	0.4 (0.1-3.2)	–	0.6 (0.3-1.4)	0.4 (0.0-6.7)	0.4 (0.1-1.0)	4.1 (1.0-16.6)[a]	9.3 (5.4-16.1)[c]
F91-92 conduct disorders	2.2 (1.0-4.6)[a]	0.3 (0.2-0.6)	0.1 (0.0-2.6)	0.4 (0.2-0.9)	0.6 (0.2-2.2)	0.3 (0.0-4.8)	0.9 (0.5-1.6)	0.6 (0.1-3.5)	1.3 (0.8-2.1)	3.2 (0.9-11.3)	2.1 (0.9-5.3)
F94 social functioning and attachment disorders	1.0 (0.3-3.8)	0.3 (0.2-0.8)	–	0.4 (0.1-1.4)	0.5 (0.1-3.7)	1.3 (0.2-10.4)	1.1 (0.6-2.3)	0.4 (0.0-7.6)	0.9 (0.4-1.9)	2.0 (0.3-12.6)	3.0 (1.0-8.4)[a]

F10-19 "psychoactive substance use disorders" (SUD); F30 "manic disorder" and F31 "bipolar disorder"; F32-39 "depressive disorders"; F40-41 "phobic, panic and generalized anxiety disorders"; F42 "obsessive-compulsive disorder" (OCD); F40-48 "neurotic, stress-related and somatoform disorders"; F80-83 "specific developmental disorders of speech and language, scholastic skills and motor function" (SDD); F84 "pervasive developmental disorders" (PDD); F90 "hyperkinetic disorders" (HD); F93 "emotional disorders.

[a] $P = 0.005$ after Bonferroni adjustment for 10 diagnostic categories in early adulthood.

[b] $P = 0.0005$ after Bonferroni adjustment for about 100 combinations of child-adolescent and adult diagnostic categories.

[c] $P = 0.00005$.

It was also found that around one in four children and adolescents with a psychiatric diagnosis at 6-16 years were referred for treatment on average 10 years later, and that they had a risk 5 times higher than the general population. The principal conditions for which they required treatment had not only striking continuities to those previously experienced, but many also involved heterotypic transitions. Although these findings support the view that people with psychiatric antecedents in childhood and/or adolescence have an increased risk of being referred to mental health services in early-adult life, and common psychiatric disorders have both homotypic and heterotypic continuity, they cannot be extended to the whole population as in identifying cases for this study we relied on those attending psychiatric services with an ICD-10 diagnosis of mental disorder for which they received treatment. Moreover, differences in classificatory systems, study design and length of follow-up make meaningful comparisons with earlier studies in terms of specific diagnostic patterns difficult.

Copeland et al. [12] pooled data from the three population-based surveys, i.e. the Christchurch Health and Developmental Study [20], the Dunedin Multidisciplinary Health and Development Study [4], and the Great Smoky Mountains Study [21], totting up 3722 cases aged 9-32 years, and found that having a DSM-IV diagnosis of mental disorder in childhood or adolescence increased over three times the risk for common psychiatric disorders in early adulthood. The greatest diagnostic continuity was observed for ADHD and conduct disorder from childhood to adolescence, and for anxiety, depression and SUD from adolescence to early adulthood. There was also evidence of cross-prediction between anxiety and depression from adolescence to early adulthood, and SUD was associated with both behavioral disorders and previous substance misuse, while neither anxiety nor depression were preceded by behavioral disorders. Our findings add weigh to the diagnostic continuity of anxiety, depression and SUD, as well as to heterotypic transitions between conduct disorders and later SUD, but failed to support any relationship between anxiety and depression. In addition, behavioral disorders such as hyperkinetic disorders were not associated with an increased risk of early-adult anxiety, depression and other mental disorders.

Although ICD-10 has been developed in parallel with DSM-IV [22], the classification and definition of anxiety disorders overlap only partly [23], thereby causing differences in case identification for these conditions [24]. Also depression, ADHD/hyperkinetic disorders and OCD exhibit different diagnostic features in the two classificatory systems [25-27].

To distinguish separation, phobic and social anxiety of childhood from adult neurotic disorders, ICD-10 introduced the category of "emotional disorders", which differ from "normal" states only in degree of severity and seldom persist into adult life. ICD-10 listed a further category designated "disorders of social functioning with onset specific to childhood and adolescence", including "attachment disorder". This probably accounts for the fact that in our study anxiety disorders have a relatively low continuity, and heterotypic transitions to early-adult mental disorders involved neither previous emotional nor attachment disorders, except for PDD. Moreover, eating disorders were preceded by both emotional and affective disorders in childhood and adolescence.

As regards less common mental disorders, Kim-Cohen et al. [4] reported that early-adult mania and schizophreniform disorder were significantly associated with depression, and emotional and behavioral disorders in adolescence, respectively. They also found that DSM-IV conduct disorders/ODD were likely to precede not only antisocial personality disorder and SUD, but also anxiety, affective disorders, eating disorders and schizophreniform

disorder [4]. While the DSM [28] has, since its fourth edition, set ODD as a category distinct from conduct disorder, it has been classified in ICD-10 as a subtype of conduct disorders. Our study findings suggest that only SUD was preceded by conduct disorders, personality disorders involved earlier affective disorders and SUD, and bipolar disorder was associated with previous affective and psychotic disorders. Yet, less clear would be heterotopic patterns for psychotic disorders either in terms of child-adolescent behavioral or emotional disorders, owing probably to the heterogeneity of diagnostic categories and the relatively small number of cases.

Furthermore, hyperkinetic disorders and PDD tended to persist into early adulthood. Follow-up studies reported varying rates of stability for ADHD/hyperkinetic disorders from childhood to adult life, and that they converted more often into adult personality disorders, schizophrenia and SUD [29-32]. Outcome prediction of PDD seems to vary as a function of the severity of autistic symptoms, and association with mental retardation [18,33].

4.1. Methodological issues

The limitations of our study are those inherent to case register-based surveys, which draw on data collected routinely about in- and outpatients attending mental health services, and clinical diagnoses coded using ICD-10. In the DPCR, the validity of the following diagnoses was assessed for epidemiological research: bipolar and depressive disorders [34], schizophrenia [35], PPD [33], conduct disorders/ODD and hyperkinetic disorders [36].

Further limitations are the relatively short follow-up period, and the small sample size of some diagnostic categories as reported in the local population. The lack of adequate numbers of cases and the heterogeneity of the ICD-10 categories used to classify child and adolescent mental disorders precluded evaluation of continuity over time for some diagnostic categories. In addition, high rates of mixed, other and unspecified behavioral and emotional disorders, and adjustment disorders are likely to reflect the lack of clearly defining clinical features.

Another possible issue hinges on the fact that, although our study's findings showing that people with psychiatric antecedents in childhood and/or adolescence have an increased probability of being referred for treatment in early adulthood, and many psychiatric disorders have both homotypic and heterotypic continuity are consistent with those reported in similar surveys, to address the relationship between child-adolescent and adult mental disorders we relied on the main ICD-10 diagnosis received by patients in their first and last admission/contact, and were unable to determine the potential confounding effect of comorbid disorders. Also the risk associated with specific conditions needs to be considered cautiously owing to variance in the frequency of mental disorders in the population. The low frequency of some conditions contributed to large confidence intervals.

Lastly, the true rate of those who need treatment in early adulthood is probably higher as adolescents may be lost in transition to adult mental health services because of differences in service provision, professional training [37], and availability of alternative care for common mental disorders.

5. Conclusions

Children and adolescents with a psychiatric diagnosis at 6-16 years had a markedly higher risk of being referred for treatment in early adulthood than the general population. The principal conditions for which they required treatment had both homotypic and heterotypic continuity.

Disclosure of interest

The authors declare that they have no competing interest.

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