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ORIGINAL CONTRIBUTION

Suicide among adolescents in Italy: a nationwide cohort study of the role of family characteristics

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Abstract

Suicide is a leading cause of death among adolescents and is recognized as a serious public health problem. This study aimed to investigate the relationship between family characteristics and the risk of suicide among adolescents in Italy using nationwide official data. We carried out a cohort study based on the record linkage between the 15th Italian Population Census, the Italian Population Register, and the National Register of Causes of Death. Suicides in adolescents aged 10–19 years from 2012 to 2016 were analyzed. Hazard ratios of mortality from suicide were estimated through a multivariable Cox regression model using time-on-study as the time scale. We included 8,284,359 children and adolescents (51% males, 49% females). Over the 5-year follow-up, we registered 330 deaths from suicides (74% males), mostly occurred in the age class 15–19 years (86%). The suicide rate was 1.71 per 100,000 person-years among males and 0.65 among females. We found some familial characteristics associated with a higher risk of dying by suicide, including: living in single-parent or reconstructed families (among boys), a 40-year or more age gap between mother and child (among girls), having highly educated parents, an age difference between parents greater than 5 years. Furthermore, the study showed a lower risk for boys living in urban areas and for both boys and girls living in South Italy. Our results could help in identifying adolescents at high risk of suicide who could benefit from the planning of targeted intervention strategies.

Keywords Suicide · Adolescent · Cohort study · Mortality · Italy

Introduction

Suicide is the second commonest cause of death among young people and is recognized as a serious public health problem [1]. Adolescence is a time when dramatic biological, cognitive, social and emotional changes occur. Among the various problems that emerge during this period, suicide, especially among adolescent boys, has become a significant source of concern in many countries. A recent paper highlighted that the male-to-female ratio decreased over past years among US adolescents [2].

Suicide death rates among those aged 10–19 years in the United States increased by 56% between 2007 and 2016, becoming the second leading cause of injury death in this age group [3]. In Italy, two previous studies [4, 5] investigated suicide mortality trends among adolescents aged 15–19 years and 10–17 years, respectively. The authors found excessive mortality from suicide in both studies, with suicide as the third leading cause of death among those aged 15–19 years. Furthermore, among those aged 10–17 years, these authors found a decrease in all causes of death except suicide over the four decades taken into account. However, recent data show that suicide rates for those aged 10–19 years in Italy are among the lowest in Europe [6].

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Many studies have demonstrated the association of family factors with suicidality and self-injury. One of the most explored areas of the family and suicide literature concerns the relationship between family conflicts and suicide risk [7–19]. The characteristics of the conflicts that contribute to suicide were often chronic and high level [13, 14], involving domestic violence, poor attachment and cohesion, ineffective parents, and low levels of perceived parental support [14]. Some authors suggest that good communication with mothers and fathers is associated with a lower risk of suicidal behavior [20, 21]. Child psychopathology and child-reported family conflict were the most robust risk factors for suicidality in a recent US study [22].

A psychological autopsy case–control study [23] specifically designed to examine environmental, social, and family characteristics found that psychosocial factors significantly increase the risk of suicide in children and adolescents, regardless of any psychiatric disorder present. The major psychosocial risks for adolescents were poor communication with the father, a history of police problems with the father, a family history of suicidal behaviour, disciplinary crises, recent losses (for boys), and school or work problems.

Other studies have explored how family interactions influence an individual's suicide risk. Immediate social ties [24], emotional support [25], and family cohesion [26, 27] have all been linked to a reduced risk of suicide.

Recently, the Italian National Institute of Statistics (ISTAT) started a comprehensive nationwide investigation into suicide based on data from a large census cohort. The present study represents a unique analysis of suicide among Italian adolescents by matching both epidemiological and sociodemographic variables, aiming to investigate suicide mortality among adolescents in Italy according to the main demographic characteristics of the subjects and to evaluate the relationship between family characteristics and risk of suicide in this age group.

Method

We carried out a cohort study based on individual record linkage between the 15th Italian Population Census, the Italian Population Register (IPR), and the National Register of Causes of Death (NRCoD). The record linkage was carried out within the project included in the Italian National Statistical Program "IST-2646 Analisi delle differenze socioeconomiche nella mortalità", aimed at analysing socioeconomic inequalities in mortality in Italy. All data sources and the linkage procedure were fully managed by the ISTAT.

The census collects information on demographic and socioeconomic characteristics for each Italian resident. The 15th census was conducted in 2011 (reference date: 9 October 2011), and its estimated undercoverage was 1.07% [28]. All the individuals registered by the census were linked to the emigration records included in the IPR and to the death certificates collected by the NRCoD for years 2012–2016 to track migration, vital status and cause of death. The record linkage was performed through a deterministic procedure using 'fiscal code' as the linkage key. The fiscal code is a 16-digit unique personal identifier derived from first name, surname, gender, date and birthplace of the individual. The record linkage procedure and the cohort profile have been fully described elsewhere [29, 30]. Causes of death reported on the death certificates were classified according to the 10th revision of the *International Statistical Classification of Diseases and Related Health Problems* [31].

All the individuals registered in the census and aged 5–19 years at 1 January 2012 were included in the study. As the aim of the study was to investigate the association between suicide and family characteristics, those adolescents for whom it was not possible to retrieve the parents' characteristics (i.e. missing data for both parents; classified as a single member in a private household; member of a couple or a single parent; in an institution) were excluded from the analysis ($N = 146{,}182$; 1.7%). Thus, the final cohort consisted of 8,284,359 individuals. Subjects were considered to be exposed to the risk of suicide from age 10 years to the occurrence of the event of interest (suicide), death from other causes, emigration, 20th birthday or the end of the study period (31 December 2016), whichever came first. Suicides were identified on the death certificate by reporting 'intentional self-harm' as cause of death (ICD-10 codes: X60–X84, Y87.0).

Parents of the adolescents were identified among cohabiting persons using the family code (unique identifier for the household and the family nucleus) and the family relationships recorded in the census archive.

For this study, we considered the following variables: family structure (couple with children; reconstructed couple with children; single parent), the age difference between mother and child (less than 25 years; 25–39 years; 40 years or more), the age difference between parents (0–5 years; more than 5 years), highest educational level of parents (less than upper secondary; upper secondary; tertiary), marital status of mother/father (single; married; divorced/separated; widowed), degree of urbanization of the place of residence (non-urban; urban), geographical area of residence (North-West; North-East; Centre; South; Sardinia). Sardinia, usually included in the southern area, has been analysed separately because historically it has shown higher suicide mortality rates than in the other southern regions [32].

Crude rates were calculated as the ratio between suicides and person-years at risk by age, parental and family characteristics and territory of residence. Cause-specific hazard ratios (HRs) of mortality from suicide with 95% confidence intervals (95% CI) were estimated through a

multivariable Cox regression model using time-on-study as a time scale, and censoring for other causes of death [33]. The model included terms for age, family structure, age difference between mother and child, parents' highest level of education, degree of urbanization and geographic area of residence. The parents' marital status was not included in the model because of the high correlation with family structure; furthermore, the age difference between parents was excluded because the information could not be obtained for single-parent families. All the analyses were stratified by gender.

Results

Study population

Table 1 reports the characteristics of the study population by gender. We included 8,284,359 children and adolescents (51% males, 49% females). Subjects were equally distributed among the three age classes for both genders. About 78% lived with both parents, 15% lived with a single parent and 7% lived with adults in a 'reconstructed' family. In 63% of those living with both parents, the age difference between partners is equal to or less than 5 years, with no

Table 1 Characteristics of the cohort

Characteristic	Categories	Males (*N* = 4,272,365)		Females (*N* = 4,011,994)	
		N	%	*N*	%
Age	5–9 years	1,415,140	33.1	1,334,182	33.3
	10–14 years	1,423,288	33.3	1,339,287	33.4
	15–19 years	1,433,937	33.6	1,338,525	33.4
Family structure	Couple with children	3,330,158	77.9	3,121,954	77.8
	Reconstructed couple with children	283,502	6.6	268,015	6.7
	Single parent	658,705	15.4	622,025	15.5
Marital status of mother	Single	295,463	6.9	277,656	6.9
	Married	3,426,198	80.2	3,215,527	80.1
	Divorced/separated	386,823	9.1	373,278	9.3
	Widowed	53,765	1.3	50,479	1.3
	Not available	110,116	2.6	95,054	2.4
Marital status of father	Single	188,618	4.4	177,027	4.4
	Married	3,377,263	79.0	3,163,378	78.8
	Divorced/separated	134,515	3.1	122,822	3.1
	Widowed	16,877	0.4	15,577	0.4
	Not available	555,092	13.0	533,190	13.3
Age difference between mother and child	< 25 years	603,007	14.1	565,751	14.1
	25–39 years	3,402,536	79.6	3,203,791	79.9
	40 years or more	156,706	3.7	147,398	3.7
	Not available	110,116	2.6	95,054	2.4
Age difference between parents	0–5 years	2,681,000	62.8	2,514,281	62.7
	> 5 years	926,157	21.7	869,469	21.7
	Not available	665,208	15.6	628,244	15.7
Parents' highest level of education	Less than upper secondary	1,461,380	34.2	1,364,579	34.0
	Upper secondary	1,964,608	46.0	1,850,930	46.1
	Tertiary	846,377	19.8	796,485	19.9
Degree of urbanization	Non-urban	2,897,918	67.8	2,721,122	67.8
	Urban	1,374,447	32.2	1,290,872	32.2
Geographic area of residence	North-West	1,065,613	24.9	999,164	24.9
	North-East	789,780	18.5	739,706	18.4
	Centre	776,999	18.2	728,677	18.2
	South	1,532,410	35.9	1,444,682	36.0
	Sardinia	107,563	2.5	99,765	2.5

gender differences. Differences between child and mother's age were below 25 years for 14% of the children, whereas the difference was 40 years and over in 4% of the included individuals, with no gender differences. The parents' highest level of education was more frequently upper secondary school (46%) and more than two-thirds of adolescents lived in non-urban municipalities, with no gender differences.

Suicide mortality rates

From 2012 to 2016, 330 suicides were recorded in 27,552,176 person-years of follow-up (Table 2). Most suicides occurred in males (74%) and in the age class 15–19 years (86%). The overall suicide rate was 1.2 per 100,000 person-years: 1.71 among males and 0.65 among females. For the age class 15–19 years, the suicide rate in males was threefold higher than in females (3.01 vs. 1.03 per 100,000 person-years). For both genders, suicide rates were the lowest among adolescents living with both parents and the highest among those living in 'reconstructed' families; those living with married parents had the lowest suicide rates compared with those living with one parent (separated/divorced, widowed or single). Boys with young mothers (age difference less than 25 years) had higher suicide rates (2.15 per 100,000 person-years) compared to those with older mothers, whereas among girls, the rates increased with an increasing age difference (from 0.49 to 1.48 for age difference 40 years or more). Adolescents whose age difference between parents was more than 5 years had the highest rates, both in boys and girls. Compared to adolescents whose parents were in the 'upper secondary' level of education, those who had high or less educated parents had higher suicide mortality. Boys living in non-urban municipalities had higher suicide mortality rates than those living in metropolitan areas, but this was not true for girls. The highest suicide rates were observed in Sardinia and in the North-East of Italy, while the lowest in Southern Italy.

Hazard ratios for suicide mortality

Figure 1 shows the HRs for family characteristics derived from multivariable Cox models stratified by gender. A significant association between suicide and family structure was found in male adolescents (Fig. 1a): the suicide rate was higher for boys living in reconstructed families (HR = 1.78, 95% CI 1.16–2.71) or in single-parent families (HR = 1.58, 95% CI 1.13–2.20) compared to those living with both parents, whereas no significant differences emerged among girls (Fig. 1b). Compared to children whose age difference with mother was 25–39 years, girls with older mothers (age difference 40 years and over) had rates more than twofold higher (HR = 2.25, 95% CI 1.03–4.92) whereas boys with older mothers had rates about 75% lower (HR = 0.25, 95% CI 0.06–0.99). Age differences of less than 25 years were not associated with suicide mortality. A high educational level of parents was associated with higher mortality, especially among girls: HR for living with a parent with tertiary education was 1.40 among boys (95% CI 1.00–1.96) and 2.41 among girls (95% CI 1.38–4.19). Finally, suicide rates were significantly lower in urban areas compared to non-urban areas among boys (HR = 0.54, 95% CI 0.39–0.73), but not among girls (HR = 0.95, 95% CI 0.6–1.5) (Supplementary Table 1).

Discussion

This study sought to explore how the family structure may influence the precipitation of suicide among Italian adolescents aged 10–19 years using nationwide official data. We found that some familial characteristics were associated with a higher risk of dying by suicide, including living in single-parent or reconstructed families for male adolescents; a 40-year or more age gap between mother and child (only among girls); a high educational level of parents; and an age difference between parents greater than 5 years. Furthermore, this study showed a lower risk for boys living in urban areas and for both boys and girls living in South Italy.

The increased risk of suicide that we found for male adolescents living in single-parent families is consistent with findings from previous studies. Donald et al. [34] examined parental divorce and suicide among adolescents and young adults and found that the risk of suicide attempt was higher for male offspring, proposing that the absence of a parent as a result of divorce may be particularly troublesome for males as it is typically the father who is absent. Several studies found single-parent households (especially single-mother households) to be associated with a higher risk of suicide [35]. An altered family structure has previously been reported as more related to the risk of involving adolescents in suicide attempts or other risky behaviours. Adolescents from single-parent families and with acquired parents have reported lowered self-confidence, greater anxiety and loneliness, more depressed mood, more suicidal thoughts and more suicide attempts compared to children of intact families [36]. Furthermore, research has suggested that marital instability, such as changes for parents and an increase in family conflicts, contributes to an increased risk of suicide in children [37].

However, the divorce of parents as such is only weakly associated with suicide of the children involved, and this association is probably confused by the practical, financial and socio-economic implications of living in a single-parent family or by underlying relational factors related to divorce [38].

Table 2 Suicide among adolescents aged 10–19 years, period 2012–2016: number of suicides, crude rates per 100,000 person-years and 95% confidence intervals (95% CI), by age, family characteristics, degree of urbanization of the municipality of residence and geographic area

Characteristic	Categories	Males and females			Males			Females		
		No. of suicides	Person-years	Rate (95% CI)	No. of suicides	Person-years	Rate (95%CI)	No. of suicides	Person-years	Rate (95%CI)
Overall		330	27,552,176	1.20 (1.07–1.33)	243	14,196,635	1.71 (1.50–1.94)	87	13,355,541	0.65 (0.52–0.80)
Age (years)	10–14	47	13,771,471	0.34 (0.25–0.45)	29	7,088,800	0.41 (0.27–0.59)	18	6,682,671	0.27 (0.16–0.43)
	15–19	283	13,780,705	2.05 (1.82–2.31)	214	7,107,834	3.01 (2.62–3.44)	69	6,672,870	1.03 (0.80–1.31)
Family structure	Couple with children	228	21,466,028	1.06 (0.93–1.21)	166	11,069,852	1.50 (1.28–1.75)	62	10,396,176	0.60 (0.46–0.76)
	Reconstructed couple with children	33	1,831,278	1.80 (1.24–2.53)	25	940,360	2.66 (1.72–3.92)	8	890,918	0.90 (0.39–1.77)
	Single parent	69	4,254,870	1.62 (1.26–2.05)	52	2,186,423	2.38 (1.78–3.12)	17	2,068,447	0.82 (0.48–1.32)
Marital status of mother	Single	21	1,827,358	1.15 (0.71–1.76)	14	939,682	1.49 (0.81–2.50)	7	887,676	0.79 (0.32–1.62)
	Married	241	22,132,345	1.09 (0.96–1.24)	175	11,409,562	1.53 (1.31–1.78)	66	10,722,783	0.62 (0.48–0.78)
	Divorced/separated	53	2,597,959	2.04 (1.53–2.67)	43	1,322,679	3.25 (2.35–4.38)	10	1,275,281	0.78 (0.38–1.44)
	Widowed	5	329,755	1.52 (0.49–3.54)	3	169,714	1.77 (0.36–5.16)	2	160,040	1.25 (0.14–4.51)
	Not available	10	664,759	1.50 (0.72–2.77)	8	354,998	2.25 (0.97–4.44)	2	309,761	0.65 (0.07–2.33)
Marital status of father	Single	13	1,162,180	1.12 (0.60–1.91)	11	597,433	1.84 (0.92–3.29)	2	564,748	0.35 (0.04–1.28)
	Married	238	21,801,782	1.09 (0.96–1.24)	172	11,247,755	1.53 (1.31–1.78)	66	10,554,028	0.63 (0.48–0.80)
	Divorced/separated	17	852,845	1.99 (1.16–3.19)	13	445,184	2.92 (1.55–4.99)	4	407,661	0.98 (0.26–2.51)
	Widowed	3	103,778	2.89 (0.58–8.45)	3	53,709	5.59 (1.12–16.32)	–	50,069	–
	Not available	59	3,631,590	1.62 (1.24–2.10)	44	1,852,554	2.38 (1.73–3.19)	15	1,779,035	0.84 (0.47–1.39)
Age difference between mother and child (years)	< 25	51	3,806,200	1.34 (1.00–1.76)	42	1,957,535	2.15 (1.55–2.90)	9	1,848,665	0.49 (0.22–0.92)
	25–39	260	22,107,454	1.18 (1.04–1.33)	191	11,383,190	1.68 (1.45–1.93)	69	10,724,264	0.64 (0.50–0.81)
	≥ 40	9	973,764	0.92 (0.42–1.75)	2	500,912	0.40 (0.04–1.44)	7	472,851	1.48 (0.59–3.05)
	Not available	10	664,759	1.50 (0.72–2.77)	8	354,998	2.25 (0.97–4.44)	2	309,761	0.65 (0.07–2.33)
Age difference between parents (years)	0–5	184	17,329,521	1.06 (0.91–1.23)	138	8,936,074	1.54 (1.30–1.82)	46	8,393,447	0.55 (0.40–0.73)
	> 5	77	5,926,307	1.30 (1.03–1.62)	53	3,053,009	1.74 (1.30–2.27)	24	2,873,298	0.84 (0.54–1.24)
	Not available	69	4,296,349	1.61 (1.25–2.03)	52	2,207,552	2.36 (1.76–3.09)	17	2,088,797	0.81 (0.47–1.30)
Parents' highest level of education	Less than upper secondary	118	9,402,370	1.26 (1.04–1.50)	95	4,851,348	1.96 (1.58–2.39)	23	4,551,022	0.51 (0.32–0.76)
	Upper secondary	121	12,754,551	0.95 (0.79–1.13)	89	6,564,181	1.36 (1.09–1.67)	32	6,190,370	0.52 (0.35–0.73)
	Tertiary	91	5,395,256	1.69 (1.36–2.07)	59	2,781,106	2.12 (1.61–2.74)	32	2,614,149	1.22 (0.84–1.73)
Degree of urbanization	Non-urban	251	18,694,799	1.34 (1.18–1.52)	193	9,633,249	2.00 (1.73–2.31)	58	9,061,550	0.64 (0.49–0.83)
	Urban	79	8,857,377	0.89 (0.71–1.11)	50	4,563,386	1.10 (0.81–1.44)	29	4,293,991	0.68 (0.45–0.97)

Table 2 (continued)

Characteristic	Categories	Males and females			Males			Females		
		No. of suicides	Person-years	Rate (95% CI)	No. of suicides	Person-years	Rate (95%CI)	No. of suicides	Person-years	Rate (95%CI)
Geographic area of residence	North-West	94	6,883,992	1.37 (1.10–1.67)	68	3,549,729	1.92 (1.49–2.43)	26	3,334,263	0.78 (0.51–1.14)
	North-East	82	5,104,586	1.61 (1.28–1.99)	56	2,634,085	2.13 (1.61–2.76)	26	2,470,501	1.05 (0.69–1.54)
	Centre	50	4,993,804	1.00 (0.74–1.32)	37	2,576,202	1.44 (1.01–1.98)	13	2,417,602	0.54 (0.29–0.92)
	South	87	9,884,883	0.88 (0.70–1.09)	67	5,081,112	1.32 (1.02–1.67)	20	4,803,771	0.42 (0.25–0.64)
	Sardinia	17	684,911	2.48 (1.45–3.97)	15	355,507	4.22 (2.36–6.96)	2	329,404	0.61 (0.07–2.19)

On the other hand, some studies suggest that an intact family structure and weak family functioning are significant predictors of ideation and suicidal attempts among adolescents [39–43] and studies based on Health Behaviour in School-aged Children (HBSC) survey data [44, 45] found that easy communication with parents is a more solid barrier to suicidal behaviour than living with both parents.

The majority of studies focusing on parental characteristics showed that the young age of the mother is associated with an increased risk of suicide among adolescents [35, 46, 47]. The study by Steck et al. [48] found a higher risk (not statistically significant) for adolescents living with mothers aged 35–44 years when they were born. However, none of the previous studies analysed this factor separately by gender. The study on young adults by Donald et al. [34] found distress due to problems with parents to be a significant risk factor for females only. The generational gap could be assumed to be a potential source of conflict and thus a possible explanation for the excess risk we observed for girls living with older mothers. Conflicts with parents are indeed most commonly reported to be contributing factors for suicide [14]. In particular, Brent et al. [9] found that younger suicide attempters reported more parent–child conflicts, while older adolescents were more likely to report an interruption in a romantic relationship, such as a conflict with a boy/girl [10].

We found an association between adolescent suicide risk and high educational level of parents, a result consistent with that obtained by Steck et al. for Swiss adolescents [48]. A previous Italian study [49] found a higher suicide risk for individuals (aged 15–64 years) with high educational achievement, concluding that these subjects may be more prone to suicide risk when facing failure, public shame, and high premorbid functioning. Furthermore, adolescents with highly educated parents could have more family pressure to reach and maintain high educational standards, and this could be a source of stress, leading to feelings of inadequacy. In particular, this factor seems to have a greater impact on girls, as shown by the stronger association found compared to boys. This finding suggests that girls could be more vulnerable to family pressure, such as for school achievements. The study by du Roscoät et al. [50] found a positive association between suicide attempts and grade repetition for both genders, but stronger among girls, and dropping out of school associated with suicide attempt only for girls.

Our results are in agreement with previous studies, which found that living in urban areas is a protective factor for male suicide [51, 52]. In our study, the risk among girls was instead similar in both urban and non-urban areas. This was previously reported by Cheong et al. [53], who found no significant differences in suicide mortality rates between urban and rural areas among Korean girls aged 19 years or less. Qin [52] found that in Denmark, urban living reduced

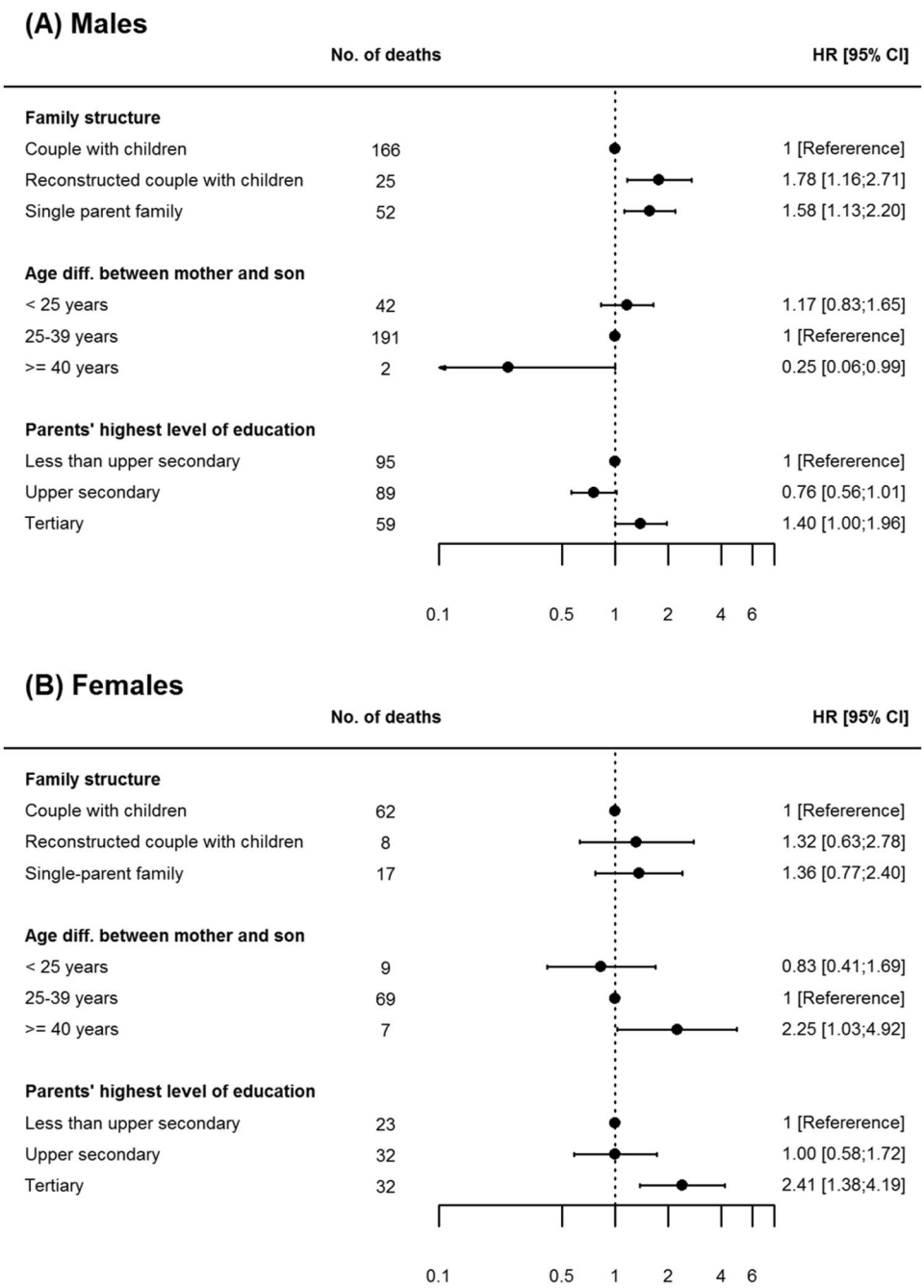

Fig. 1 Hazard ratios of suicide mortality according to family characteristics. Hazard ratios (HR) were estimated from multivariable Cox regression models, including terms for age [10–14, 15–19 years (reference category)], family structure [couple with children (reference category), reconstructed couple with children, single parent], age difference between mother and child [less than 25 years, 25–39 years (reference category), 40 years or more], highest educational level of parents [less than upper secondary, upper secondary (reference category), tertiary], degree of urbanization of the place of residence [non-urban (reference category), urban] and geographic area of residence [North-West (reference category), North-East, Centre, South, Sardinia]. Only HRs for variables relevant to the analysis of the role of family characteristics are shown

suicide risk significantly among young men, but increased the risk among women; however, for girls aged 25 years or less, the risk was similar in rural and most urban areas. The lower risk found for adolescents living in the southern area of the country, but not Sardinia, is consistent with previous Italian studies [32, 54].

The main strengths of the study are the national coverage of data and the availability of detailed demographic and socioeconomic information, both at the individual and household level, which allowed us to accurately define the family characteristics of more than 8 million adolescents. However, the study has some noteworthy limitations. First, family characteristics were collected only at baseline and, therefore, we could not take into account changes during the study period. Second, we had no information on the quality of relationships within the family, and thus we cannot investigate conflicts between the adolescents and their parents. Finally, some degree of misclassification is expected as suicide could be misclassified as an 'accidental', 'unknown' or 'undetermined' cause of death. However, this misclassification probably caused a general underestimation without affecting the comparisons across family characteristics [54].

Despite these limitations, the study provides a detailed picture of the demographic, family, and parental characteristics of the adolescents who have died by suicide in Italy in recent years. Suicide among adolescents is a rare event, but it has huge human and social costs and long-term consequences for the mental health and wellbeing of the people who belong to the relation network of the victim. Therefore, the prevention of suicides or suicide attempts in adolescents should be considered a priority by policy-makers. Identifying the sociodemographic and familial characteristics that increase the risk of suicide could help in the planning of prevention strategies, which include interventions targeted at those subgroups at higher risk.

Author contribution Study concept and design: EG, MV, MP, GA, SS; acquisition of data: LF, EG, GA; statistical analysis: EG, GA; analysis and interpretation of data: all authors; drafting the manuscript: EG, MV, MP; critical revision of the manuscript for important intellectual content and final approval of the manuscript: all authors.

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