

Socioeconomic status and its impact on the prevalence of severe ADHD in the Maltese Islands

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Abstract

Attention deficit hyperactivity disorder (ADHD) is a common disorder which presents in childhood. The core symptoms include; hyperactivity, impulsivity and reduced attention. If left untreated this may possibly lead to various impairments of function in other areas of one's life, such as lack of educational attainment, increased risk of accident-prone behaviour, substance misuse and antisocial behaviours. Although the exact aetiology is still not fully understood, various studies have demonstrated the presence of both a genetic and an environmental component. ADHD is highly heritable, demonstrating a strong genetic component (0.75). Furthermore, increased rates of ADHD have been linked with a low socioeconomic status.

The islands of Malta have traditionally been divided for statistical purposes into 6 districts, with certain districts more often being associated with low socioeconomic demographics.

The main aim of this study was to assess whether higher prevalence rates of ADHD were present in the districts, which are classically associated with a low socioeconomic status. All persons aged 0 to 18 years attending the governmental clinics, having a documented diagnosis of severe ADHD and therefore being prescribed pharmacotherapy were identified and included in this study. Nine young people were living in institutional care and were therefore excluded from statistical analysis since this would skew that data in this study. A significant difference ($p < 0.0001$) in the point prevalence of ADHD between the six Malta districts was found, with higher rates of ADHD occurring in the harbour districts. Though not statistically significant, a positive correlation was demonstrated between the ADHD prevalence and a number of socioeconomic variables, these included; the rate of smoking ($p = 0.111$), number of people classified as at-risk-of-poverty per district ($p = 0.397$), and number of people with no schooling per district ($p = 0.156$). The overall point prevalence for ADHD in Malta obtained was 0.85, a value which is less than the average prevalence noted worldwide. The authors believe this value is an underestimation since the data collection in this study did not include ADHD cases off pharmacological treatment and any ADHD cases assessed and treated in the private sector.

Keywords

ADHD, prevalence, Malta, low socioeconomic status

Introduction

Attention deficit hyperactivity disorder (ADHD) is the commonest childhood-onset mental disorder which manifests itself with symptoms of inattention, hyperactivity and impulsivity, with males being affected more than females.¹ This condition can have serious effects on the overall

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functioning of a child, since it can influence the child's education attainment together with his/her behaviour.² ADHD symptoms can persist in adulthood with prevalence rates as high as 4.4% in the community.³ Evidence suggests that this condition is highly heritable⁴, several studies in different countries have demonstrated that ADHD is more prevalent in socioeconomically disadvantaged groups.⁵

The Maltese archipelago consists of 3 main islands: Malta, Gozo and Comino. It is traditionally divided for statistical purposes into six districts, namely the Southern Harbour area, Northern Harbour area, the South-Eastern region, Western region, Northern region, and the 2 smaller islands Gozo & Comino being considered as one district. The harbour regions, are considered less affluent areas with greater social deprivation and poverty.⁶ In published literature it was reported that people living in the harbour areas have higher rates of psychosis.⁷

The Government of Malta has set up two clinics that assess and treat children and adolescent with mental disorders. These are the Child and Young People's services (CYPS) located at St Luke's Hospital, Malta and the Gozo Psychiatry outpatient's clinic. A number of independent psychiatry clinics are also found throughout the Maltese islands. Government based child and adolescent clinics accept referrals for youngsters aged 0 till 18. Patients may be referred by any doctor working both in the private and government sector, including general practitioners, psychiatrists and paediatricians. After the age of 18, patients followed at these clinics are referred to mainstream adult psychiatry services.

The aims of this study included:

1. to retrospectively estimate the point prevalence of severe ADHD in children aged 0 to 18 years on treatment attending governmental clinics as per February, 2017, both in general and at district level
2. to assess whether a significant difference exists in the point prevalence of severe ADHD between the six districts in Malta.
3. to assess whether a correlation exists between rates of severe ADHD in those ages 0 to 18 years per district and a number of socioeconomic variables, including:
 - a. smoking
 - b. education
 - c. employment
 - d. population density
 - e. being classified at risk of poverty
 - f. being reared by a single mother
 - g. number of nights spent abroad as a measure of affluence

Methodology

Ethical approval and data collection

A retrospective study was designed with the aim of calculating the point prevalence of severe ADHD in every district in Malta respectively. Ethical approval was obtained from the Ethics board of the University of Malta and permission for data handling was obtained from the Data Protection Office for Mental Health Services of Malta, located at Mount Carmel Hospital.

This project did not involve any direct contact with patients, their carers nor their attending physicians. Data accessed throughout this project involved a retrospective case note review of the patients clinical files as well as clinic databases (where available). This demographic data collected, included; the name and identification number, age of the patient and address as well as diagnosis and treatment modality being used as per February 2017. All data were stored on a password protected private computer with confidential access throughout the whole project as per data protection law of the laws of Malta (DPA chapter 440).

Records of all patients under 18 years of age, who ever attended these clinics (included discharged patients), were studied. All patients who received a diagnosis of ADHD by a psychiatrist were highlighted for further analysis. Although these clinics do not have established written protocols for the diagnosis of ADHD, literature suggests that treatment should only be initiated in severe cases.⁸ Hence, in order to aim for high specificity, only patients receiving treatment were selected implying the presence of severity of ADHD. Cases where a diagnosis of ADHD was done but was not sufficient enough to warrant a pharmacological intervention were excluded.

All data were imputed in a confidential Microsoft Excel[®] file, containing demographic data as well as diagnosis and treatment modality. In order to protect identification of patients all patients' names and identification numbers were converted to a generated personalised identification system, which was subsequently used throughout

the whole project. Patients' addresses were examined and every patient was allocated to one of the six districts, as per Census of Populations and Housing of 2011.⁹

Patients living in institutional care were excluded from the study in view of their current living address being unreflective of the original demographic address. It was acknowledged that a number of families do move home and change their address. However, following discussions with the medical statistician, in view that the number of inter-district translocations tends to be mutual and random it was deemed unnecessary to exclude patients whose family changed address before February 2017.

It was also acknowledged that a small number of children are reared in foster families. However, following discussions with the medical statistician since the number of fostered children in Malta and Gozo is very low, it was considered too small as to influence data collected. A number of foreign families decide to move to Malta for different reasons, including educational and employment opportunities. Foreign families tend to choose their accommodation according to their level of affluence. It was decided that foreign patients living permanently in Malta were not to be excluded from this study since these families will tend to distribute throughout the Maltese islands according to their social and economic status.

Data from the private / independent sector was not obtained for this research project. The extensive number of private clinics, together with non-uniformity in record keeping was a limitation in accessing this information and was considered beyond this project.

Socioeconomic variables

Previous studies have implied the existence of an association between ADHD and a number of socioeconomic variables, which include: low maternal and paternal education^{10,4} being raised by a single parent⁴, being born to a younger mother¹¹, and low family income.^{4,5,12} The association of ADHD with parental occupation has also been studied with conflicting results.¹³⁻¹⁴

Higher smoking levels has been demonstrated to be associated with poverty and low socio-economic status. In a recent US publication, it has been demonstrated that the number of smokers in

people considered below the poverty line is double the amount of people considered at or above the poverty line.¹⁵ Hence smoking can be considered a factor associated with low socio-economic status.

Demographic data of the Maltese islands

Information related to the demographic data of the Maltese islands was obtained from the last National census carried out in 2011 with results published preliminarily in 2012 and with the final official report published in 2014.⁹ These publications can be accessed freely on the internet from the National Statistics Office as well as purchased from the above-mentioned office itself. Data collected from the census included, total population according to the Maltese districts, including population per age group, population density per district, level of education and employment for individuals aged 15+. Further information was obtained about the lifestyle of the Maltese population, including number of smokers per district aged 18+, number of nights spent abroad aged 18+ (being assumed to be a level of affluence), and life satisfaction of all individuals aged 18+. This data was obtained freely from the Lifestyle survey 2007, with results being published by the National Statistics Office in 2009.¹⁶

Data were also obtained on the number of Maltese families at risk of poverty per district. This information was also accessed freely from the Statistics on income and living conditions 2010, published by the National statistics office in 2012.¹⁷ Data regarding the number of single mothers per district was also extracted from a recent report on disadvantaged women in the Maltese islands.¹⁸

Results

Case population

As per Table 1, out of all patients attending the child psychiatry governmental clinics, till February 2018, 709 patients aged 0 to 18 years were diagnosed with severe ADHD by a psychiatrist and were receiving pharmacological treatment. Nine patients were residing in institutional care and were therefore excluded as per exclusion criteria mentioned above. The address of the selected 692 cases were analysed and allocated to the 6 districts. 179 patients were living in district 1, 194 patients were living in district 2, 94 were living in district 3, 93 were living in district 4, 83 in district 5 and 44 were living in district 6.

Table 1: Number of ADHD cases on treatment per district

District number	Total number of ADHD patients on treatment per district
1	179
2	194
3	94
4	93
5	83
6	44

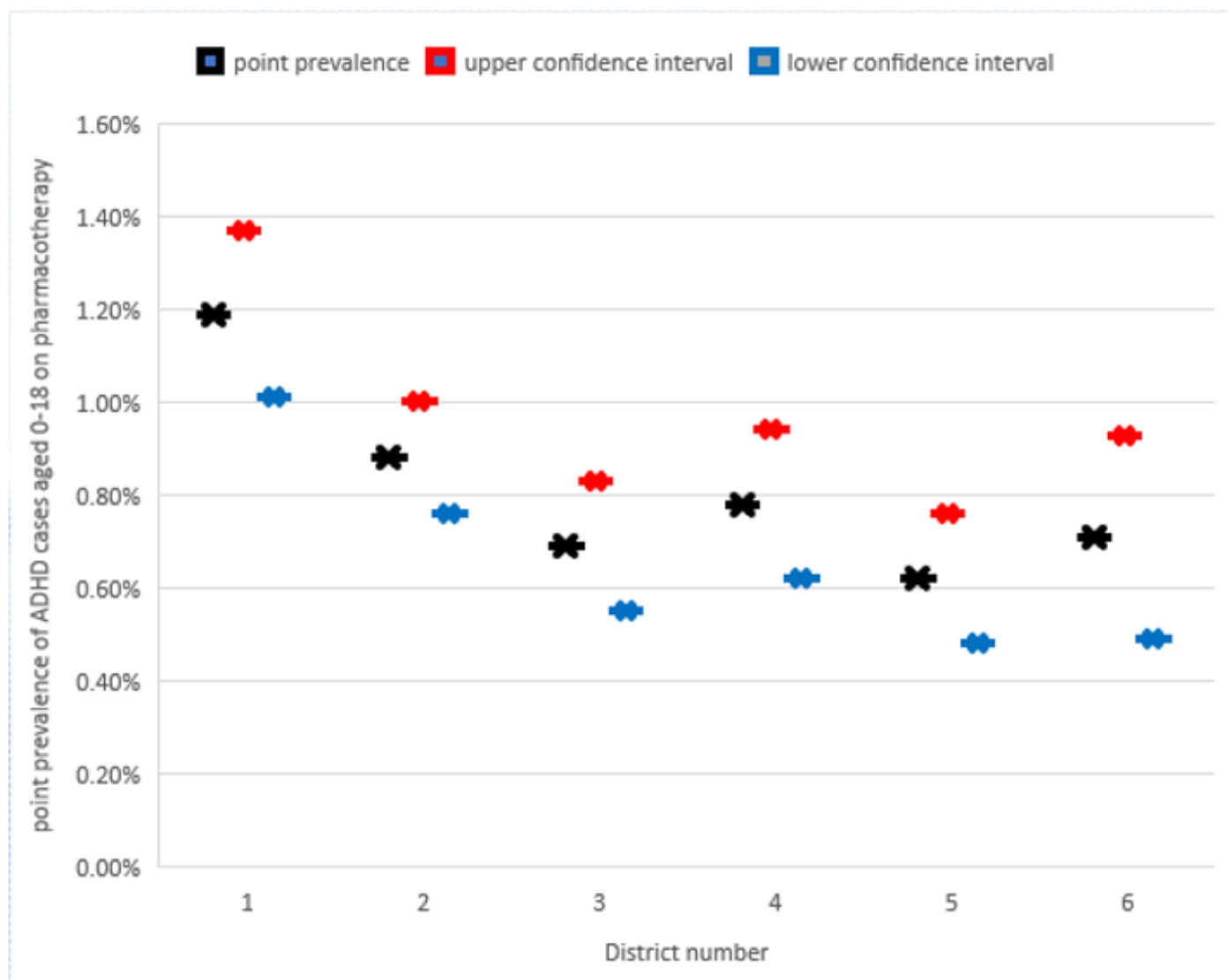
Data analysis

The chi-squared test was employed to assess whether there is significant difference between the prevalence of severe ADHD cases requiring medication. As per table 2 and figure 1, the highest point prevalence obtained was in the Northern Harbour District with a value of 1.19% (CI = 1.37% - 1.01%) followed in descending order by the Southern Harbour district (0.88%, CI = 1.0% - 0.76%), Western district (0.78%, CI = 0.94% -

0.62%) and the islands of Gozo and Comino (0.71%, CI = 0.93% - 0.49%). The two districts that demonstrated the lowest point prevalence were the South-Eastern district (0.69%, CI = 0.83 - 0.55%), and the Northern district (0.62%, CI = 0.76% - 0.48%). On comparing the six districts all together, the result obtained was statistically significant with *p* being less than 0.0001.

Table 2: Prevalence of severe ADHD patients (age 0-18 on pharmacotherapy), standard error and confidence intervals for each district

	District					
	1	2	3	4	5	6
Total population per district aged 0 – 18	15,046	21,986	13,719	11,869	13,473	6,232
No of patients diagnosed with ADHD requiring medication	179	194	94	93	83	44
Point prevalence of severe ADHD patients aged 0-18 on treatment	1.19%	0.88%	0.69%	0.78%	0.62%	0.71%
$SE = \sqrt{\frac{p(1-p)}{n}}$	0.0009	0.0006	0.0007	0.0008	0.0007	0.0011
CI = $p \pm 1.96 (SE)$	1.37%	1.00%	0.83%	0.94%	0.76%	0.93%
	1.01%	0.76%	0.55%	0.62%	0.48%	0.49%

Figure 1: Point prevalence, upper confidence interval and lower confidence interval for each district

The point prevalence rates of severe ADHD on treatment for every district were then compared with the confidence intervals of every district respectively as per table 3. Values that lied outside a confidence interval of another district were considered to be statistically significant. The Southern Harbour district obtained a significantly much higher point prevalence value compared to the other districts. In fact, the 1.19%-point prevalence obtained lied outside the confidence intervals of all the other five districts. The Northern Harbour district demonstrated a statistically significant difference when compared to district 3 and district 5. No statistical significance was noted when the point prevalence of district 2 was compared to the Western district as well as with Gozo and Comino Islands. No statistical significant

difference was demonstrated when the point prevalence of district 3 was compared to districts 4, 5 and 6. On the contrary significant difference was obtained when the point prevalence of district 3 was compared to districts 1 and 2. The Western district, demonstrated a significant difference when compared to districts 1 and 5 but no statistical significance was noted in the difference between district 4 and districts 2, 3 and 6. The Northern district which demonstrated the lowest point prevalence rates of severe ADHD on treatment within the Maltese Islands, showed statistically significant difference to districts 1 and 2 but not to districts 3, 4 and 6. Similarly, Gozo and Comino, demonstrated significant difference to the Harbour districts but not to the other districts (districts 3, 4 and 5).

Table 3: Table comparing prevalence of ADHD cases aged 0-18 on treatment per district with the confidence interval of every district respectively, prevalence values that lie outside a confidence interval of a given district are considered to be statistically different.

			District confidence intervals											
			1		2		3		4		5		6	
			1.37%	1.01%	1.00%	0.76%	0.83%	0.55%	0.94%	0.62%	0.76%	0.48%	0.93%	0.49%
Point prevalence per district	1	1.19%		Significant difference	Significant difference	Significant difference	Significant difference	Significant difference	Significant difference	Significant difference	Significant difference	Significant difference		
	2	0.88%	Significant difference		Significant difference	No significant difference	Significant difference	No significant difference	Significant difference	No significant difference	No significant difference	No significant difference		
	3	0.69%	Significant difference	Significant difference		No significant difference	No significant difference	No significant difference	No significant difference	No significant difference	No significant difference	No significant difference		
	4	0.78%	Significant difference	No significant difference	No significant difference		Significant difference	No significant difference	No significant difference	No significant difference	No significant difference	No significant difference		
	5	0.62%	Significant difference	Significant difference	No significant difference	No significant difference		No significant difference	No significant difference	No significant difference	No significant difference	No significant difference		
	6	0.71%	Significant difference	Significant difference	No significant difference	No significant difference	No significant difference		No significant difference	No significant difference	No significant difference	No significant difference		

Correlation analysis with variables

It was further evaluated whether a correlation exists between the prevalence of severe ADHD in patients aged 0 to 18 years on treatment per district and the number of socioeconomic status variables specified below. These variables per district included population density, total number of people aged 0-18, smoking in individuals aged 18+, number of people with no schooling aged 15+, unemployment in people aged 15+, total number of people at risk of poverty, number of single mother families and number of individuals having experienced at least 1 holiday abroad during the previous 12 months. Data were analysed using the Spearman correlation test.

As per Table 4, although no correlation obtained displayed statistical significance, positive

correlation was noted between the prevalence of ADHD cases on treatment aged 0 to 18 years and a number of variables, which included: number of smokers aged 18+ per district ($p=0.111$) and number of people with no schooling per district ($p=0.156$). A weaker positive correlation was noted between prevalence of severe ADHD on treatment per district with population density per district ($p=0.329$) and number of people classified as at-risk-of-poverty per district ($p=0.397$). The weakest correlation obtained was noted to occur between severe ADHD on treatment and the number of people unemployed ($p=0.872$). A negative correlation was obtained between prevalence of ADHD on treatment (population aged 0 to 18) and number of holidays spent abroad with p value of 0.787.

Table 4: Correlations obtained using the Spearman's test between prevalence of ADHD patients on treatment aged 0-18 and factors: total population, population density, unemployment, tobacco consumption, no schooling, number of individuals at risk of poverty, number of single mother families and holidays abroad (at least 1 night) in the previous 12 months.

			ADHD Prevalence
Spearman's rho	Average of smoking	Correlation Coefficient	.714
		Sig. (2-tailed)	.111
		N	6
	Average of Holiday abroad	Correlation Coefficient	-.143
		Sig. (2-tailed)	.787
		N	6
	Average of no schooling	Correlation Coefficient	.657
		Sig. (2-tailed)	.156
		N	6
	Average of population 0-18 total	Correlation Coefficient	.486
		Sig. (2-tailed)	.329
		N	6
	Average of unemployment	Correlation Coefficient	.086
		Sig. (2-tailed)	.872
		N	6
	Average of Population density per km ²	Correlation Coefficient	.486
		Sig. (2-tailed)	.329
		N	6
	Average of at risk of poverty	Correlation Coefficient	.429
		Sig. (2-tailed)	.397
		N	6
	Average of single mother households	Correlation Coefficient	.429
		Sig. (2-tailed)	.397
		N	6
	Average of Total population per district	Correlation Coefficient	.486
		Sig. (2-tailed)	.329
		N	6

Discussion

Prevalence of severe ADHD in Maltese children

The overall calculated point prevalence of severe ADHD in children aged 0 to 18 years on treatment attending government-based clinics was 0.84% with values ranging from 0.57% in District 5 to 1.12% in District 1. However, this value could be an underestimation of the true point prevalence of ADHD in Maltese children, given that this study aimed for high specificity rather than high sensitivity and in view of a number of limiting factors, such as the unavailability of records for children attending private clinics.

Moreover, the prevalence of ADHD obtained in our study possibly includes referral bias, with

potential cases being missed, either due to lack of awareness about ADHD both by professionals, as well as parents. Further psycho education about ADHD can enhance the pick up rate of cases and potentially a prevalence study of ADHD in Malta can be considered.

The above results only include children and adolescents who were severe enough to warrant pharmacological treatment, thus cases that were managed using other techniques such as behavioural therapy or in the case where parents refused medications were not included. Unfortunately, not all patients were under the care of the same psychiatrist, posing a further limitation in the way children were assessed and diagnosed

with mild, moderate or severe.

Data obtained from the Malta Health Regulation Authority for the authorisation of methylphenidate prescribing, indicates that there is a total of 1,244 people aged 0 to 18 years who had a permit for methylphenidate prescribing. This indicates, that a high proportion of people prefer to attend to psychiatrists privately without consulting governmental based clinics. This information suggests that further epidemiological research should be developed in order to estimate the true prevalence rate of ADHD in Malta.

Being small islands, both Malta and Gozo offer the advantage of increased availability and free access to clinics, therefore further promotion of services as well as further awareness can result in further detection of ADHD cases. Schools might be the optimal places where children could be observed and signs and symptoms of ADHD picked up. Hence, further education campaigns to both parents and teachers might increase awareness. In view that this study has demonstrated higher prevalence rates in the harbour districts, further resources might be offered in these districts so as to offer further support and potentially minimise behaviours associated with this disorder such as illicit substance misuse and crime.

Severe ADHD and low socioeconomic status in the Maltese islands

Rates of ADHD were noticed to be higher in districts that are classically associated with low socioeconomic status, that is primarily the Northern and Southern Harbour areas. Both Northern and Southern harbour areas are associated with high population numbers and density as well as lower levels of education compared to the other districts of Malta.⁹ The northern harbour region is also associated with higher rates of smoking in those aged 18+ and also excluding Gozo (district 6), citizens of the Northern Harbour area were the least to have travelled and spent at least 1 night abroad in the previous 12 months.¹⁶ The Harbour districts also demonstrate higher numbers of single mother families¹⁸ as well as a larger number of individuals economically considered at risk of poverty.

Though not achieving a statistically significant result, positive correlations using the Spearman's test were demonstrated between prevalence of ADHD on treatment in those aged 0-18 and a number of socioeconomic variables as per below.

Smoking: A positive correlation was noted between number of smokers per districts aged 18+ and point prevalence of severe ADHD on treatment. Higher smoking levels has been demonstrated to be associated with poverty and low socio-economic status. In a recent US publication, it has been demonstrated that the number of smokers in people considered below the poverty line is double the amount of people considered at or above the poverty line.¹⁵ Nigg, 2013 also reports that people suffering from ADHD are at a higher risk of developing addictions, including smoking.¹⁹ This study suggests correlation, though not statistically significant between smoking and ADHD, although this does not necessarily imply causation, that is that smoking causes ADHD.

Education level: This study has demonstrated the existence of a positive correlation (though not statistically significant) between rates of severe ADHD on treatment per district and the number of people with no schooling ($p=0.156$). Several studies have demonstrated the association between parental education and the risk of ADHD in offspring.^{10,4}

Population density: A weaker positive correlation was demonstrated between the rates of severe ADHD on treatment and population density per district ($p=0.329$). Population density can be considered a marker of affluence, since richer people will tend to have bigger houses. As per Census of population and housing of 2011, higher population densities are located within the Northern (5,014 per kilometre squared) and Southern (3,035 per kilometre squared) harbour districts. These two districts are associated with smaller houses and a higher number of social housing.⁹

People considered 'at-risk-of-poverty': A positive correlation, though not statistically significant was also obtained between the number of people considered at risk of poverty per district and rates of severe ADHD on treatment ($p=0.397$). Several studies have demonstrated the association between poverty and risk of ADHD.^{4, 5, 12}

Unemployment: A weak positive correlation was obtained between rates of unemployment in people aged 15+ per district and rates of severe ADHD in those aged 0 to 18 on treatment ($p=0.872$). Ford et al 2004 found no associated between ADHD in off spring and parental occupation class.¹³ Similarly, Al Hamed et al 2009, also demonstrated no association between paternal occupation and ADHD phenotype in offspring.

However, Al Hamed et al 2009, found that mothers who reported to be housewives had a higher prevalence of ADHD phenotype (OR2.85, 95% CI 2.02-4.03 $p<0.01$).¹⁴ This finding suggests that further research could be performed in Malta so as to identify whether a similar association exists between ADHD and maternal occupation, specifically in mothers who are unemployed.

Single mothers: A positive correlation was obtained, though not statistically significant, between rates of ADHD and the number of single mother families per district ($p=0.397$). The relationship between single mothers and ADHD phenotype offspring has been already documented in previous studies.⁴

Number of nights spent abroad: A weak negative correlation was obtained (though not statistically significant) between number of nights spent abroad and prevalence of severe ADHD phenotype per district ($p=0.787$). This variable was selected as a measure of income, being postulated that richer families would tend to have more disposable income to spend on travelling. According to the Lifestyle survey 2007, compared to other districts, people living in the Northern district were the ones who mostly reported to have spent at least one night abroad.¹⁶ One must still take into consideration that not all affluent families would consider travelling abroad as a means of recreation due to personal choice.

Low socioeconomic status: Although as expected rates of ADHD were significantly higher in the districts associated with a low socioeconomic status, it is also possible that more affluent families, particularly those residing in the Northern regions of Malta prefer to attend private clinics rather than make use of the governmental clinics. The correlation between increased rates of mental illness and low socioeconomic status has been widely described in literature.²⁰ Similarly, Camilleri et al. 2010, have reported a higher incidence of psychosis in the areas of Malta associated with a lower socioeconomic status, that is Southern and Northern harbour areas.⁷ This study has also demonstrated the impact of socioeconomic status on the prevalence of ADHD in the Maltese islands and therefore further suggests the possibility of having more mental health resources allocated to these areas together with further education campaigns and improvement of socioeconomic factors such as good housing, education and employment

opportunities.

Relatively high ADHD prevalence rates, though less than districts 1 and 2, were also obtained in district 4 which is associated with areas that are developing steadily such as the villages of Attard, Żebbug and Lija. Traditionally, district 4 is also associated with areas considered high class, example Mdina, being the old capital city of Malta, is considered the home town of nobility. People in this district might be more aware of ADHD symptoms and would therefore more readily seek professional advice.

Changing demographic trends

It is well recognised that certain regions of Malta that have classically been described as 'poor' are now becoming more affluent, particularly since rich foreigners are recently settling in old historic cities. Birgu (Citta Vittoriosa), for instance, though classically considered a poor area is now slowly being converted into an attractive place to settle in, with old historic buildings being converted into luxury homes. Moreover, investment by the local government is resulting in an increase of luxurious facilities such as yacht marinas etc.²¹ On the other hand, St Paul's bay, which traditionally was considered to be a summer resort for the more affluent families is now becoming populated by socially deprived families, single mother families and immigrants.²² These changes might eventually affect the prevalence rates of mental health conditions, therefore epidemiological studies must be dynamic and reflect the social trends.

Conclusions

This study has statistically demonstrated that there is a significant difference in the prevalence of severe ADHD cases in children aged 0-18 on treatment between the 6 districts of the Maltese islands, with higher values obtained in the districts that are traditionally known to be associated with a low socioeconomic status such as the Northern Harbour district and least in the Northern district of Malta. Such finding could be of assistance to the local policy makers in order to tailor the child psychiatry services better and possibly allocating more resources to districts that are associated with higher rates of ADHD.

Though not statistically significant, this study has also further implied an existence of a correlation between ADHD and a number of

socioeconomic factors, such as smoking, increased population density, poverty, lack of education and being raised by a single mother. though results obtained were not powerful enough to achieve statistical significance, these results can help policy makers in addressing a number of factors that potentially influence the development and maintaining of various psychiatric conditions, including ADHD.

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