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International Journal of Law and Psychiatry



Cost attributable to Fetal Alcohol Spectrum Disorder in the Canadian correctional system

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ARTICLE INFO

Available online 4 April 2015

Keywords:

Fetal Alcohol Syndrome

Fetal Alcohol Spectrum Disorder

Corrections

Cost

Canada

ABSTRACT

Prenatal alcohol exposure is the leading identifiable cause of intellectual disability in the Western world and may result in Fetal Alcohol Spectrum Disorder (FASD). Individuals with FASD have a higher risk of being involved in the legal system, either as offenders or as victims. Therefore, the aim of the current study was to estimate the direct cost for youths (12–17 years old) and adults (18 + years old) with FASD to the Canadian correctional system in 2011/2012. The prevalence of FASD in the Canadian correctional system, obtained from the current epidemiological literature, was applied to the average number of youths and adults in the correctional system in 2011/2012. The average daily cost for corrections was then applied to the estimated number of youths and adults with FASD in custody. The cost of corrections among youths with FASD in Canada in 2011/2012 was calculated to be approximately \$17.5 M Canadian dollars (CND; \$13.6 M CND for males and \$3.8 M CND for females) and among adults with FASD was estimated to be about \$356.2 M CND (\$140 M CND for provincial and territorial custody and \$216.2 M CND for federal custody). The study findings emphasize the need to raise awareness regarding the prevalence of FASD in the correctional system. It is crucial to incorporate FASD screening and intervention strategies as early as possible in the criminal justice process.

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1. Introduction

Despite public health prevention efforts, the prevalence of drinking during pregnancy remains high around the world. For instance, the prevalence of drinking alcohol during pregnancy among the general population has been reported to be: 14% in Canada (PHAC, 2005a), 30% in the United States (Ethen et al., 2009), 33% in the United Kingdom (Dex & Joshi, 2005), 83% in Russia (Kurianova, Bolotnikova, & Udodova, 2006), and 89% in Ireland (Donnelly et al., 2008). Alarmingly, the prevalence of binge drinking (which is the most harmful pattern of consumption) during pregnancy has been reported to be: 7.4% in Russia (Kristjanson, Wilsnack, Zvartau, Tsoy, & Novikov, 2007), 8.3% in the United States (Ethen et al., 2009), and 9.5% in Sweden

(Magnusson, Göransson, & Heilig, 2005). Moreover, the prevalence of alcohol consumption and binge drinking has been reported to be much higher among high-risk women (Jagodzinski & Fleming, 2007; Kelly et al., 2011; Muckle et al., 2011).

Prenatal alcohol exposure significantly increases the risk of adverse health outcomes for the infant, including Fetal Alcohol Spectrum Disorder (FASD). FASD is a non-diagnostic umbrella term that covers several alcohol-related diagnoses, including: Fetal Alcohol Syndrome (FAS), Partial FAS (pFAS), Alcohol-Related Neurodevelopmental Disorder (ARND), and Alcohol-related Birth Defects (Chudley et al., 2005; Stratton, Howe, & Battaglia, 1996). The unifying outcome for FASD is congenital damage to the central nervous system, which is variably associated with a wide range of disadvantageous outcomes.

The consequential neuropsychological impairments often result in increased risk for multiple adverse health and social consequences over the course of development. Most affected individuals require a wide range of assistance from multiple service systems, including health care, community organizations, remedial education, and others. In addition, individuals with FASD have an increased risk of developing secondary disabilities, such as mental health problems, trouble with the law, school drop-outs, unemployment, homelessness, and/or alcohol

Abbreviations: ARND, Alcohol-Related Neurodevelopmental Disorder; FAE, Fetal Alcohol Effects; FAS, Fetal Alcohol Syndrome; FASD, Fetal Alcohol Spectrum Disorder; IAU, inpatient assessment unit; pFAS, Partial Fetal Alcohol Syndrome.

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and other drug problems (Streissguth et al., 2004). When combined with the person's primary deficits, these secondary disabilities increase the complexity of care and result in significant social and economic costs to society (Abel & Sokol, 1987; Harwood, 2000; Legge, Roberts, & Butler, 2001; Lupton, Burd, & Harwood, 2004; PHAC, 2003, 2005b; Popova, Stade, Bekmuradov, Lange, & Rehm, 2011b, 2012a,b,b, 2014a, b; Popova, Lange, Burd, Shield, & Rehm, 2014b; Popova, Lange, Burd, Urbanoski, & Rehm, 2013b; Popova et al., 2013a; Popova, Stade, Lange, & Rehm, 2012b; Popova, Lange, Burd, & Rehm, 2012a, 2014a; Stade et al., 2009).

The connection between FASD and involvement with the juvenile/criminal justice system has not yet been rigorously studied. However, it is a well-known fact that individuals with FASD experience a wide range of primary and secondary disabilities, which may increase the risk of involvement with the legal system, either as offenders or victims (LaDue, 1993; LaDue & Dunne, 1997; Olson, Streissguth, Bookstein, Barr, & Sampson, 1994; Streissguth, LaDue, & Randels, 1988). As a consequence of organic brain damage due to prenatal alcohol exposure, individuals with FASD experience cognitive and behavioral problems, inhibition, poor judgment, and gullibility, as well as mental illness, substance abuse and dependence, unemployment, housing instability, and poverty (LaDue, 1993; LaDue & Dunne, 1997; Olson et al., 1994; Streissguth et al., 1988, 2004).

Further, the reported high prevalence of individuals with FASD within criminal justice systems supports the link between FASD and criminality (Fast, Conry, & Looock, 1999; MacPherson & Chudley, 2007; Murphy, Chittenden, & The McGeary Centre Society, 2005; Streissguth & Kanter, 1997). It has been reported that among a sample of 253 adolescents and adults (12 to 51 years old) with FASD, 60% reported having ever been in trouble with the law in their lifetime, and 35% reported having ever been incarcerated for a crime (Streissguth et al., 2004). The most frequent category of law violations was reported to be crimes against persons (45%), which included shoplifting or theft (36%), assault (17%), burglary (15%), and domestic violence (15%; Streissguth et al., 2004). The authors of the current study recently estimated that youths with FASD in Canada are 19 times more likely to be incarcerated than youths without FASD (Lange, Rehm, Bekmuradov, Mihic, & Popova, 2012; Popova, Lange, Mihic, Bekmuradov, & Rehm, 2011a).

There are only a few studies in Canada and the USA that have attempted to estimate the overall cost associated with FASD (no studies exist for any other country; Popova et al., 2011b, 2012b). In the existing cost analyses (Abel & Sokol, 1987, 1991a,b; Harwood, 2000, 2003; Harwood & Napolitano, 1985; Harwood, Napolitano, & Kristiansen, 1984; Harwood, Fountain, & Livermore, 1998; Rice, 1993; Rice, Kelman, & Miller, 1990, 1991; Weeks, 1989), the cost to correctional systems has not been included. As a result, the existing cost estimates for FASD are likely to be underestimated (Fast & Conry, 2009; Lupton et al., 2004).

The primary reason for not including the cost of law enforcement associated with individuals with FASD in previous Canadian studies is that there are no official FASD-specific data collected or reported in Canada on the prevalence of FASD in the criminal justice system or the associated cost (either by Statistics Canada or any other organization). A further challenge is that there are no widely used or standardized screening and diagnostic tools to identify the number of individuals with FASD within the justice system, along with the added difficulty of assessing adults for FASD (Boland, Chudley, & Grant, 2002; Fast & Conry, 2004). However, there are a few quick and easy to administer screening tools that have been developed and validated in this population, including the FASD checklist (Burd, Klug, Li, Kerbeshian, & Martsof, 2010) and the Asante Centre for Fetal Alcohol Syndrome Probation Officer Screening & Referral Form (The Asante Centre for Fetal Alcohol Syndrome, 2010).

The current study is part of a large economic project that is working towards estimating the overall burden and cost associated with FASD in Canada (Popova et al., 2012a, 2013a,b, 2014a,b). Until now, an

estimation of the direct cost of corrections associated with individuals with FASD has not yet been undertaken for Canada, or for any other country.

2. Method

The burden and cost of corrections associated with individuals with FAS, as the most severe form of FASD, were estimated separately. However, it is important to note that the figures presented for FASD are inclusive of those for FAS.

2.1. Youths and adults with FAS and FASD in custody of the criminal justice system in Canada in 2011/2012

In order to estimate the number of youths and adults with FAS and FASD in custody in Canada in 2011/2012, the prevalence of youths and adults with FAS and FASD in the criminal justice system, obtained from a review of the available Canadian literature (Popova et al., 2011a; Table 1), was applied to the average number of youths and adults in custody in 2011/2012 (Statistics Canada, 2013a,b,c).

The number of adults with FAS and FASD in custody was then estimated separately for provincial and territorial custody (by province and territory) and federal custody. However, given that youth offenders do not get admitted to federal custody, the number of youths with FAS and FASD in custody was estimated for in provincial and territorial custody only.

2.2. Youths and adults with FAS and FASD in custody by province/territory

The number of youths and adults with FAS and FASD by province and territory was estimated based on the reported overall distribution of offenders by provincial and territorial correctional services in 2011/2012 (Statistics Canada, 2013a,c).

2.3. Youths and adults with FAS and FASD in custody by sex

In order to estimate the number of youths and adults with FAS and FASD in custody by sex, a male-to-female ratio of 78% to 22% among youths and 89% to 11% among adults was applied to the number of youths and adults with FAS and FASD in custody, respectively (Canadian Centre for Justice Statistics, 2012a,b).

2.4. Cost of corrections

The Canadian Centre for Justice Statistics (2012a) reports that on average the daily cost in 2010/2011 to imprison an inmate was \$171 and \$357 for provincial and territorial custody and federal custody, respectively. Provincial and territorial cost estimates did not include data from the Yukon and Nunavut. Federal costs are higher than provincial and territorial costs due to the higher levels of security required at these institutions, as well as long-term specialized programming that is offered (Johnson, 2004).

Given that 2011/2012 cost data were not available, the 2010/2011 cost figures were adjusted for inflation using the inflation calculator of the Bank of Canada (<http://www.bankofcanada.ca/rates/related/inflation-calculator/>). Therefore, the cost to imprison an inmate was estimated to be \$172 per day (about \$62,930 per year) and \$360 per day (about \$131,382 per year) for provincial and territorial custody and federal custody, respectively. The assumption that youths and adults were in custody for one year was made.

All cost figures are presented in Canadian dollars.

3. Results

According to Statistics Canada, the average number of individuals in custody on any given day in 2011/2012 in Canada was 39,087 adults

Table 1

FAS and FASD prevalence estimates in the Canadian correctional system from the available literature. Adapted from: Popova et al. (2011a).

Reference	Country	Year of study	Total population of offenders/sample size; type of institution	Method	# of FAS cases	FAS prevalence per 1000	# of FASD cases	FASD prevalence per 1000
Fast et al. (1999)	Canada (British Columbia & Yukon)	1995–96	287 youths (12–18 years old); IAU of Youth Forensic Psychiatric Services	Inpatient assessment	3 (1.0%)	10.45	64 (22.3%) (52 pFAS & 12 ARND)	233.5
Murphy et al. (2005)	Canada (British Columbia)	2004	137 youths (14–19 years old); juvenile detention centers	Survey			16 (11.7%) (FAS/FAE)	116.8
MacPherson and Chudley (2007)	Canada (Manitoba)	2005–06	91 adult male offenders (19–30 years old); male-only medium-security penitentiary for adults	Interview/assessment			9 (9.9%) (1 pFAS & 8 ARND)	98.9
Rojas and Gretton (2007)	Canada (British Columbia)	1985–2004	230 youths (12–18 years old); Youth Sexual Offence Treatment Program	Client files reviewed			25 (10.9%) (FAS/FAE)	108.7

ARND: Alcohol-Related Neurodevelopmental Disorder; FAE: Fetal Alcohol Effects; FAS: Fetal Alcohol Syndrome; FASD: Fetal Alcohol Spectrum Disorder; IAU: inpatient assessment unit; pFAS: Partial Fetal Alcohol Syndrome.

(18+ years old) of whom 24,822 were in provincial and territorial custody and 14,266 were in federal custody (Statistics Canada, 2013a,b). The average number of youths (12 to 17 years old) in custody on any given day in 2011/2012 was 1457 (Statistics Canada, 2013c). Data on the average number of youths in custody was not available for Quebec in 2011/2012. Therefore, for the purposes of the current study, data from 2010/2011 was used and 219 persons were added to the average number of youths in custody during 2011/2012, for a total of 1676. In total, there were 40,763 youths and adults in custody on any given day in Canada in 2011/2012.

3.1. Youths with FAS and FASD in custody in Canada in 2011/2012

By applying a prevalence for FAS of 1.0% (Fast et al., 1999) to the total number of youths in custody (1676) it was estimated that there were 17 youths with FAS in custody in Canada in 2011/2012 (data is not shown in Table 2).

By applying a lower and upper prevalence estimate for FASD of 10.9% (lower estimate; Rojas & Gretton, 2007) and 22.3% (upper

estimate; Fast et al., 1999) to the total number of youths in custody (1676; Statistics Canada, 2013c), it was estimated that the number of youths with FASD in custody ranged from 183 to 374, with a mean of 278 (16.6%), in Canada in 2011/2012 (Table 2).

3.2. Adults with FAS and FASD in custody in Canada in 2011/2012

There are currently no studies that have estimated the prevalence of adults with FAS in custody in Canada. Therefore, the ratio of 17 to 278 (FAS to FASD) among youth offenders was used to calculate the number of adult offenders with FAS in custody. As such, it was estimated that there were 237 adults with FAS in custody in Canada on any given day in 2011/2012 (data is not shown in Table 3).

By applying a prevalence for FASD of 9.9% (MacPherson & Chudley, 2007) to the total number of adults in custody (39,087; Statistics Canada, 2013a,b), it was estimated that there were 3870 adults with FASD in custody on any given day in Canada in 2011/2012 (Table 3).

Table 2

Average number of youth offenders with FASD and the associated cost of corrections in provincial and territorial custody in Canada in 2011/2012.

Jurisdiction	Average number of youth offenders on any given day ^a	Average number of youth offenders on any given day with FASD ^b			Cost of corrections among youth offenders with FASD ^c		
		Males ^d	Females ^d	Total	Males	Females	Total
Alberta	163	21	6	27	\$1,324,679	\$373,627	\$1,698,306
British Columbia	101	13	4	17	\$820,699	\$231,479	\$1,052,178
Manitoba	295	38	11	49	\$2,402,660	\$677,673	\$3,080,333
New Brunswick	43	6	2	7	\$351,728	\$99,205	\$450,933
Newfoundland and Labrador	20	3	1	3	\$161,209	\$45,469	\$206,678
Northwest Territories	7	1	0	1	\$57,807	\$16,305	\$74,112
Nova Scotia	43	6	2	7	\$346,843	\$97,827	\$444,670
Nunavut	7	1	0	1	\$58,621	\$16,534	\$75,156
Ontario	574	74	21	95	\$4,673,422	\$1,318,145	\$5,991,567
Prince Edward Island	10	1	0	2	\$80,604	\$22,735	\$103,339
Saskatchewan	192	25	7	32	\$1,562,421	\$440,683	\$2,003,104
Quebec ^e	219	28	8	36	\$1,783,065	\$502,916	\$2,285,981
Yukon	2	0	0	0	\$18,726	\$5282	\$24,008
Total provincial and territorial	1676	217	61	278	\$13,645,741	\$3,848,799	\$17,494,540

Note. Due to rounding errors, columns and rows may not add up to the totals reported.

^a Counts are based upon the average number of youths in correctional services on any given day (Statistics Canada, 2013c).

^b Based on a prevalence of 16.6% (mean).

^c Based on a cost of \$62,930 per year for provincial and territorial custody, and \$131,382 per year for federal custody.

^d Based on a male prevalence of 78% and a female prevalence of 22% among youths in custody.

^e Quebec data on average number of youth offenders was unavailable for 2011/2012, therefore, it was substituted with 2010/2011 data.

Table 3

Average number of adult offenders with FASD and the associated cost of corrections in provincial and territorial and federal custody in Canada in 2011/2012.

Jurisdiction	Average number of adult offenders on any given day ^a	Average number of adult offenders on any given day with FASD ^b			Cost of corrections among adult offenders with FASD ^c		
		Males ^d	Females ^d	Total	Males	Females	Total
Alberta	3071	245	30	275	\$15,410,688	\$1,904,692	\$17,315,380
British Columbia	2634	210	26	236	\$13,220,489	\$1,633,993	\$14,854,483
Manitoba	2252	180	22	202	\$11,304,316	\$1,397,163	\$12,701,479
New Brunswick	422	34	4	38	\$2,116,924	\$261,642	\$2,378,567
Newfoundland and Labrador	283	23	3	25	\$1,420,317	\$175,545	\$1,595,862
Northwest Territories	273	22	3	24	\$1,370,129	\$169,342	\$1,539,471
Nova Scotia	503	40	5	45	\$2,525,956	\$312,197	\$2,838,152
Nunavut	116	9	1	10	\$582,681	\$72,017	\$654,698
Ontario	8804	702	87	789	\$44,183,898	\$5,460,931	\$49,644,829
Prince Edward Island	110	9	1	10	\$553,070	\$68,357	\$621,427
Saskatchewan	1588	127	16	142	\$7,970,336	\$985,098	\$8,955,434
Quebec	4671	373	46	419	\$23,444,261	\$2,897,605	\$26,341,866
Yukon	94	7	1	8	\$471,766	\$58,308	\$530,074
Total provincial and territorial	24,822	1980	245	2224	\$124,573,828	\$15,396,765	\$139,970,594
Federal	14,266	1465	181	1646	\$192,440,225	\$23,784,747	\$216,224,972
Total	39,087	3444	426	3870	\$317,014,054	\$39,181,512	\$356,195,566

Note. Due to rounding errors, columns and rows may not add up to the totals reported.

^a Counts are based upon the average number of adults in correctional services on any given day (Statistics Canada, 2013a,b).

^b Based on a prevalence of 9.9% (MacPherson & Chudley, 2007).

^c Based on a cost of \$62,930 per year for provincial and territorial custody, and \$131,382 per year for federal custody.

^d Based on a male prevalence of 89% and a female prevalence of 11% among adults in custody.

3.3. Cost of corrections among youths and adult with FAS and FASD in Canada in 2011/2012

The total cost of corrections among youths with FAS was estimated to be approximately \$1.1 million in Canada in 2011/2012 (approximately \$818.1 thousand for males and \$251.7 thousand for females). It was estimated that the cost of corrections among youths with FASD was approximately \$17.5 million in Canada in 2011/2012 (approximately \$13.6 million for males and \$3.8 million for females; Table 2).

The cost of corrections among youths with FAS and FASD in Ontario accounted for the highest proportion of the total cost of corrections among youths with FAS and FASD – approximately \$366.4 thousand for FAS and \$6 million for FASD, while the Yukon accounted for the lowest proportion – approximately \$1.5 thousand for FAS and \$24 thousand for FASD.

The total cost of corrections among adults with FAS was estimated to be \$21.8 million in Canada in 2011/2012 (approximately \$8.6 million for provincial and territorial custody and \$13.2 million for federal custody). It was estimated that the total cost of corrections among adults with FASD was \$356.2 million in Canada in 2011/2012 (approximately \$140 million for provincial and territorial custody and \$216.2 million for federal custody; Table 3).

In Canada in 2011/2012, males affected by FAS accounted for more than \$19.4 million in Canada in 2011/2012 (\$7.6 million in provincial and territorial custody and \$11.8 million in federal custody), while females affected by FAS accounted for more than \$2.4 million (\$941.5 thousand in provincial and territorial custody and \$1.5 million in federal custody). Males affected by FASD accounted for more than \$317 million (\$124.6 million in provincial and territorial custody and \$192.4 million in federal custody), while females affected by FASD accounted for more than \$39.2 million (\$15.4 million in provincial and territorial custody and \$23.8 million in federal custody; Table 3).

Again, the cost of corrections among adults with FAS and FASD in Ontario accounted for the highest proportion of the total cost of provincial and territorial corrections among adults with FAS and FASD – approximately \$3 million for FAS and \$49.6 million for FASD, while the Yukon accounted for the lowest proportion – approximately \$32.4 thousand for FAS and \$530 thousand for FASD.

Overall, the cost of corrections for youths and adults with FASD was estimated to be \$373.7 million (\$330.7 million for males, and \$43 million for females; \$157.5 million for provincial and territorial custody, and \$216.2 million for federal custody) in Canada in 2011/2012. This includes the cost of corrections for youths and adults with FAS, which was estimated to be \$22.8 million (\$20.2 million for males, and \$2.6 million for females; \$9.6 million for provincial and territorial custody, and \$13.2 million for federal custody) in Canada in 2011/2012.

4. Discussion

Around the world, thousands of new offenders end up in various correctional systems each year. It is essential that these individuals be screened for FASD, especially given that FASD appears to be overrepresented in this population (see, for example, Fast et al., 1999; MacPherson & Chudley, 2007).

Nevertheless, the magnitude of the impact that FASD has on the Canadian correctional system is difficult to appreciate. The current study estimated that in total there are over 4000 offenders with FASD on any given day in the correctional system in Canada, and that the daily toll on Canadian society attributable to individuals with FASD in custody is over one million dollars. To put this in perspective, in 2011 the average hourly wage in Canada was \$23.09 (Statistics Canada, 2013d); therefore, based on an 8-hour workday, the daily cost of corrections attributable to FASD is near equivalent to the daily wage of 5414 Canadians. Further, the estimated cost of corrections attributable to FASD represents 8.6% of the total cost of corrections in Canada in 2010/2011 (\$4.1 billion; Canadian Centre for Justice Statistics, 2012a). Moreover, the estimated annual cost of corrections for youths and adults with FASD (\$373.7 million) corresponds to more than half of the annual cost (\$660.4 million) of correctional services for youths and adults sentenced for all offences committed under the influence of alcohol in Canada (Patra, Rehm, & Popova, 2011; Rehm et al., 2007).

However, it must be understood that the cost of corrections is only one facet of the total direct cost of law enforcement associated with individuals with FASD. In order to fully understand the burden that FASD has on the Canadian criminal justice system, the costs of policing, courts, and probation must also be considered. In addition to these direct law enforcement costs, there are other costs to consider such as the costs incurred by their victims. However, it should be noted that some of these

will be societal costs — for example, additional costs to the health care system if medical attention is required (especially given that it has been reported that the majority of crimes committed by individuals with FASD are crimes against persons; Streissguth et al., 2004).

Furthermore, the burden that FASD places on society spans across a wide range of service sectors, and as such it is necessary to include all contributing cost components in order to get an accurate and valid estimate of the overall economic impact of FASD (see Popova, Stade, Bekmuradov, Lange, & Rehm, 2012c,d; Popova et al., 2012d for a complete list of cost components). The authors of the current study have undertaken this task in Canada (see, for example, estimates of FASD-attributable burden and cost for: specialized addiction treatment services [\$1.7 million to \$3.6 million; Popova et al., 2013c], the child care system [\$57.9 million to \$101.1 million; Popova et al., 2014a], speech-language interventions [\$72.5 million to \$144.1 million; Popova et al., 2014b]; screening and diagnosis [\$3.6 million to \$7.3 million; Popova et al., 2013a], and the health care cost of acute care, psychiatric care, day surgery, and emergency department services associated with FAS [\$6.7 million; Popova et al., 2012a]).

A portion of these costs may be avoided if standardized screening and diagnostic tools to identify individuals with FASD were standard practice within the criminal justice system. Unfortunately, nearly all offenders with FASD in the correctional system in Canada are currently undiagnosed (Burd, Martsof, & Juelson, 2004). However, the diagnosis of FASD among offenders could potentially improve insight into the degree and type of neurobehavioural impairments exhibited, which may alter sentencing programming or probation plans. It could also increase the opportunity for offenders with FASD to benefit from drug and alcohol interventions, vocational training, and in better understanding the conditions of their probation (Burd et al., 2004).

Further, effective training programs on FASD for correctional staff should be developed in order to increase the understanding and recognition of FASD. It is especially important to identify women of childbearing age with FASD in correctional systems, since many will have a history of alcohol abuse and/or dependence. These women are at higher risk for having a child with FASD themselves and thus, will place additional burden on the multiple systems impacted by FASD such as, foster care, special education, health care, and the legal system.

This study demonstrates that the cost of corrections attributable to FASD is substantial. However, it is likely that these cost estimates of corrections associated with crime committed by individuals with FASD are underestimated. The main reason for this is that in general a large portion of crime is not reported to the police. To attest to this, the 2009 General Social Survey revealed that the type of crime, the victim's age, the location at which the incident took place, and the value to the damaged or stolen goods all influence the rate at which crimes were reported to the police. The most common reasons for not reporting a crime were that it was seen as not important enough (68%), it was thought that the police could not do anything about it (59%), it was handled another way (42%), and that it was considered a personal matter (36%; Statistics Canada, 2011).

Further, it must be noted that the current cost estimates do not include any additional expenses due to the special needs of individuals with FASD in the correctional system beyond those that inmates without FASD require. It is likely, given the secondary disabilities commonly experienced by individuals with FASD, that inmates with FASD require additional services and resources (for example, mental health and addiction services) compared to those without FASD.

The quantification of the law enforcement costs associated with FASD is crucial to demonstrate for policy developers and decision makers alike, the impact that maternal alcohol use has on society, with the ultimate goal of initiating preventive interventions to address FASD. However, these estimates have several limitations, and therefore, they should be considered with caution. Firstly, as mentioned above, there are no official FASD-specific data on the prevalence of FASD in criminal justice systems or the associated costs in Canada. Therefore,

this was a modeling study, which used prevalence data from the existing epidemiological literature. Secondly, since the average period of custody of individuals with FASD in the Canadian correctional system is unknown, it was assumed that youths and adults were in custody for one year. Thirdly, the sex distribution for youth and adults with FASD was based on individuals in custody in 2011/2012, as reported by the Canadian Centre for Justice Statistics (2012a,b). This sex distribution, reflective of the general correctional population, may not reflect the true sex distribution of individuals with FASD in the correctional system.

Although this study has several limitations, it does provide a working estimate, which can be refined when data becomes available in the future.

5. Conclusion

This study emphasizes the need to increase awareness regarding the prevalence and disabilities of individuals with FASD in the criminal justice system. It is crucial to identify diversion strategies for this population. The development of improved screening, diagnosis and intervention strategies for FASD as early as possible in the criminal justice process may be helpful in reducing both the human and financial costs of FASD.

Acknowledgment

This work was supported by the Public Health Agency of Canada (PHAC).

The authors would also like to thank Dr. Ting Zhang, Research and Statistics Division, Department of Justice Canada for her thoughtful comments on the preliminary version of this paper.

References

- Abel, E. L., & Sokol, R. J. (1987). Incidence of fetal alcohol syndrome and economic impact of FAS-related anomalies. *Drug and Alcohol Dependence*, 19, 51–70.
- Abel, E. L., & Sokol, R. J. (1991a). A revised estimate of the economic impact of fetal alcohol syndrome. In M. Glanter (Ed.), *Recent developments in alcoholism: Children of alcoholics*, vol. 9. (pp. 117–125). New York: Plenum Press.
- Abel, E. L., & Sokol, R. J. (1991b). A revised conservative estimate of the incidence of FAS and its economic impact. *Alcohol Clinical and Experimental Research*, 15, 514–524.
- Boland, F. J., Chudley, A. E., & Grant, B. A. (2002). The challenge of Fetal Alcohol Syndrome in adult offender population. *Forum on Corrections Research*, 14, 61–64.
- Burd, L., Klug, M. G., Li, Q., Kerbeshian, J., & Martsof, J. T. (2010). Diagnosis of fetal alcohol spectrum disorders: A validity study of the fetal alcohol syndrome checklist. *Alcohol*, 44, 605–614.
- Burd, L., Martsof, J. T., & Juelson, T. (2004). Fetal alcohol spectrum disorder in the corrections system: Potential screening strategies. *Journal of FASD International*, 2, e1.
- Canadian Centre for Justice Statistics (2012a). *Adult correctional statistics in Canada, 2010/2011 (85-002-X)*. Ottawa, ON: Statistics Canada, Canadian Centre for Justice Statistics.
- Canadian Centre for Justice Statistics (2012b). *Youth correctional statistics in Canada, 2010/2011 (85-002-X)*. Ottawa, ON: Statistics Canada, Canadian Centre for Justice Statistics.
- Chudley, A., Conry, J., Cook, J., Loock, C., Rosales, T., & LeBlanc, N. (2005). Fetal alcohol spectrum disorder: Canadian guidelines for diagnosis. *Canadian Medical Association Journal*, 172(5 Suppl.), S1–S21.
- Dex, S., & Joshi, H. (2005). *Children of the 21st century: From birth to nine months*. Bristol: Policy Press.
- Donnelly, J. C., Cooley, S. M., Walsh, T. A., Sarkar, R., Durnea, U., & Geary, M. P. (2008). Illegal drug use, smoking and alcohol consumption in a low-risk Irish primigravid population. *Journal of Perinatal Medicine*, 36, 70–72.
- Ethen, M. K., Ramadhani, T. A., Scheuerle, A. E., Canfield, M. A., Wyszynski, D. F., Druschel, C. M., et al. (2009). Alcohol consumption by women before and during pregnancy. *Maternal and Child Health Journal*, 13, 274–285.
- Fast, D. K., & Conry, J. (2004). The challenge of fetal alcohol syndrome in the criminal legal system. *Addiction Biology*, 9, 161–168.
- Fast, D. K., & Conry, J. (2009). Fetal alcohol spectrum disorders and the criminal justice system. *Developmental Disabilities Research Reviews*, 15, 250–257.
- Fast, D. K., Conry, J., & Loock, C. A. (1999). Identifying fetal alcohol syndrome among youth in the criminal justice system. *Journal of Developmental and Behavioral Pediatrics*, 20, 370–372.
- Harwood, H. (2000). Updating estimates of the economic costs of alcohol abuse in the United States: Estimates, update methods, and data. Report prepared by the Lewin Group for the National Institute on Alcohol Abuse and Alcoholism 2000. Based on estimates, analyses, and data reported in Harwood H, Fountain D, Livermore G. *The Economic Costs of Alcohol and Drug Abuse in the United States 1992. Report prepared for the National Institute on Drug Abuse and the National Institute on Alcohol Abuse and*

- Alcoholism. National Institutes of Health, Department of Health and Human Services, NIH Publication No. 98-4327. Rockville, MD: National Institutes of Health.
- Harwood, H. (2003). *Economic costs of fetal alcohol syndrome* [Power Point presentation]. Prepared for the Lewin Group. Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism (Available at: <http://www.fasdcenter.samhsa.gov/documents/RickHarwoodPresentation.pdf>).
- Harwood, H., Fountain, D., & Livermore, G. (1998). The economic costs of alcohol and drug abuse in the United States 1992. *Report prepared for the National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism*, National Institutes of Health, Department of Health and Human Services, NIH Publication No. 98-4327. Rockville, MD: National Institutes of Health.
- Harwood, H. F., & Napolitano, D. M. (1985). Economic implications of the fetal alcohol syndrome. *Alcohol Health and Research World*, 10, 38–43.
- Harwood, H. J., Napolitano, D. M., & Kristiansen, P. L. (1984). *Economic costs to society of alcohol and drug abuse and mental illness: 1980*. Rockville, MD: Alcohol Drug Abuse and Mental Health Administration.
- Jagodzinski, T., & Fleming, M. F. (2007). Postpartum and alcohol-related factors associated with the relapse of risky drinking. *Journal of Studies on Alcohol and Drugs*, 68, 879–885.
- Johnson, S. (2004). *Adult correctional services in Canada, 2002/03. Juristat. Vol. 24, no. 10. Statistics Canada Catalogue no. 85-002-XIE*. Ottawa, ON: Statistics Canada, Canadian Centre for Justice Statistics.
- Kelly, L., Dooley, J., Cromarty, H., Minty, B., Morgan, A., Madden, S., et al. (2011). Narcotic-exposed neonates in a First Nations population in northwestern Ontario: Incidence and implications. *Canadian Family Physician*, 57, e441–e447.
- Kristijanson, A. F., Wilsnack, S. C., Zvartau, E., Tsoy, M., & Novikov, B. (2007). Alcohol use in pregnant and nonpregnant Russian women. *Alcoholism: Clinical and Experimental Research*, 31, 299–307.
- Kurianova, N. N., Bolotnikova, N. I., & Udodova, L. V. (2006). Kliniko-sotsialnaia kharakteristika zhenshchin, upotreblivavshikh vo vremia beremennosti alkohol [Clinical and social characteristics of women consuming alcohol during pregnancy]. *Uspekhi Sovremennogo Estestvoznaniia [Progress in Current Natural Science]*, 2, 36.
- LaDue, R. A. (1993). *Psychosocial needs associated with Fetal Alcohol Syndrome: Practical guidelines for parents and caretakers*. Seattle, WA: University of Washington.
- LaDue, R. A., & Dunne, T. (1997). Legal issues and FAS. In A. P. Streissguth, & J. Kanter (Eds.), *The challenges of Fetal Alcohol Syndrome: Overcoming secondary disabilities* (pp. 146–161). Seattle: University of Washington Press.
- Lange, S., Rehm, J., Bekmuradov, D., Mihic, A., & Popova, S. (2012). Risk of incarceration for individuals with prenatal alcohol exposure. *American Journal of Epidemiology*, 176, 80.
- Legge, C., Roberts, G., & Butler, M. (2001). *Situational analysis. Fetal alcohol syndrome/fetal alcohol effects and the effects of other substance use during pregnancy*. Ottawa, Canada: Health Canada.
- Lupton, C., Burd, L., & Harwood, R. (2004). Cost of fetal alcohol spectrum disorders. *American Journal of Medical Genetics Part C: Seminars in Medical Genetics*, 127C, 42–50.
- MacPherson, P., & Chudley, A. E. (2007). Fetal Alcohol Spectrum Disorder (FASD): Screening and estimating incidence in an adult correctional population. Presented at the 2nd International Conference on Fetal Alcohol Spectrum Disorder: Research, policy, and practice around the world. Victoria, BC, March 7–10, 2007 (Available at: events.onlinebroadcasting.com/fas/090707/ppts/correctional.ppt).
- Magnusson, Å., Göransson, M., & Heilig, M. (2005). Unexpectedly high prevalence of alcohol use among pregnant Swedish women: Failed detection by antenatal care and simple tools that improve detection. *Journal of Studies on Alcohol*, 66, 157–164.
- Muckle, G., Laflamme, D., Gagnon, J., Boucher, O., Jacobson, J. L., & Jacobson, S. W. (2011). Alcohol, smoking, and drug use among Inuit women of childbearing age during pregnancy and the risk to children. *Alcoholism Clinical and Experimental Research*, 35, 1081–1091.
- Murphy, A., Chittenden, M., & The McGeary Centre Society (2005). *Time out II: A profile of BC youth in custody*. Vancouver, BC: The McCreary Centre Society.
- Olson, H. C., Streissguth, A. P., Bookstein, F. L., Barr, H., & Sampson, P. D. (1994). Developmental research in behavioural teratology: Effects of prenatal alcohol exposure on child development. In S. L. Friedman, & H. C. Haywood (Eds.), *Developmental follow-up: Concepts, domains, and methods*. Orlando, FL: Academic Press.
- Patra, J., Rehm, J., & Popova, S. (2011). Avoidable alcohol-attributable criminality and its costs due to selected interventions in Canada. *International Journal of Drug Policy*, 22, 109–119.
- Popova, S., Lange, S., Burd, L., Chudley, A. E., Clarren, S. K., & Rehm, J. (2013a). Cost of Fetal Alcohol Spectrum Disorder diagnosis in Canada. *PLoS ONE*, 8, e60434.
- Popova, S., Lange, S., Burd, L., & Rehm, J. (2012a). Health care burden and cost associated with Fetal Alcohol Syndrome in Canada: Based on Official Canadian Data. *PLoS ONE*, 7, e43024.
- Popova, S., Lange, S., Burd, L., & Rehm, J. (2014a). Canadian children and youth in care: The cost of Fetal Alcohol Spectrum Disorder. *Child and Youth Care Forum*, 43, 83–96.
- Popova, S., Lange, S., Burd, L., Shield, K., & Rehm, J. (2014b). Cost of speech-language interventions for children and youth with Fetal Alcohol Spectrum Disorder in Canada. *International Journal of Speech-Language Pathology*, 1–11.
- Popova, S., Lange, S., Burd, L., Urbanoski, K., & Rehm, J. (2013b). Cost of specialized addiction treatment of clients with Fetal Alcohol Spectrum Disorder in Canada. *BioMed Central Public Health*, 13, 570.
- Popova, S., Lange, S., Burd, L., Urbanoski, K., & Rehm, J. (2013c). Cost of Specialized Addiction Treatment of Clients with Fetal Alcohol Spectrum Disorder in Canada. *BioMed Central Public Health*, 13, 570.
- Popova, S., Lange, S., Mihic, A., Bekmuradov, D., & Rehm, J. (2011a). Prevalence of Fetal Alcohol Spectrum Disorder in correctional systems: A systematic literature review. *Canadian Journal of Public Health*, 102, 336–340.
- Popova, S., Stade, B., Bekmuradov, D., Lange, S., & Rehm, J. (2011b). Economic impact of fetal alcohol syndrome and fetal alcohol spectrum disorders: A systematic literature review. *Alcohol and Alcoholism*, 46, 490–497.
- Popova, S., Stade, B., Bekmuradov, D., Lange, S., & Rehm, J. (2012c). *Economic impact of fetal alcohol syndrome and fetal alcohol spectrum disorders: A systematic literature review*. Toronto, Canada: Centre for Addiction and Mental Health (English version: http://knowledge.camh.net/reports/Documents/economic_impact_fas_litreview12.pdf; French version: http://knowledge.camh.net/reports/Documents/economic_impact_fas_litreview12_FR.pdf).
- Popova, S., Stade, B., Lange, S., Bekmuradov, D., Mihic, A., & Rehm, J. (2012d). *Methodology for estimating the economic impact of Fetal Alcohol Spectrum Disorder*. Toronto, Canada: Centre for Addiction and Mental Health (English version: https://knowledge.camh.net/reports/Documents/Popova_et alMethodologySummary_March30_12Final_E.pdf; French version: https://knowledge.camh.net/reports/Documents/Popova_et alMethodologySummary_March30_12Final_FR.pdf).
- Popova, S., Stade, B., Lange, S., & Rehm, J. (2012b). A model for estimating the economic impact of Fetal Alcohol Spectrum Disorder. *Journal of Population Therapeutics and Clinical Pharmacology*, 19(1), e51–e65.
- Public Health Agency of Canada (PHAC) (2003). *Fetal alcohol spectrum disorder (FASD): A framework for action*. Ottawa, ON: PHAC.
- Public Health Agency of Canada (PHAC) (2005a). *Make every mother and child count. Report on maternal and child health in Canada*. Ottawa, ON: PHAC.
- Public Health Agency of Canada (PHAC) (2005b). *Alcohol use and pregnancy: An important Canadian public health and social issue*. Ottawa, ON: PHAC.
- Rehm, J., Gnam, W., Popova, S., Baliunas, D., Brochu, S., Fischer, B., et al. (2007). The social costs of alcohol, illegal drugs and tobacco in Canada 2002. *Journal of Studies on Alcohol and Drugs*, 68, 886–895.
- Rice, D. P. (1993). The economic cost of alcohol abuse and alcohol dependence: 1990. *Alcohol Health and Research World*, 17, 10–11.
- Rice, D., Kelman, S., & Miller, L. (1990). *The economic costs of alcohol and drug abuse and mental illness*. 1985. DHHS publication no (ADM) 90-1694. Rockville, MD: U.S. Department of Health and Human Services.
- Rice, D., Kelman, S., & Miller, L. (1991). Estimates of economic costs of alcohol and drug abuse and mental illness, 1985 and 1988. *Public Health Reports*, 106, 280–292.
- Rojas, E. Y., & Gretton, H. M. (2007). Background, offence characteristics, and criminal outcomes of Aboriginal youth who sexually offend: A closer look at Aboriginal youth intervention needs. *Sexual Abuse: A Journal of Research and Treatment*, 19, 257–283.
- Stade, B., Ali, A., Bennett, D., Campbell, D., Johnston, M., Lens, C., et al. (2009). The burden of prenatal exposure to alcohol: Revised measurement of cost, 2007. *Canadian Journal of Clinical Pharmacology*, 16, e91–e102.
- Statistics Canada (2011). *General Social Survey, 2009 [Canada]: Cycle 23, victimization*. Ottawa, ON: Statistics Canada.
- Statistics Canada (2013a). *Table 251-0005. Adult correctional services, average counts of offenders in provincial and territorial programs, annual, CANSIM (database)*.
- Statistics Canada (2013b). *Table 251-0006. Adult correctional services, average counts of offenders in federal programs, annual, CANSIM (database)*.
- Statistics Canada (2013c). *Table 251-0008. Youth correctional services, average counts of young persons in provincial and territorial correctional services, annual, CANSIM (database)*.
- Statistics Canada (2013d). *Table 282-0007. Labour force survey estimates (LFS), by North American Industry Classification System (NAICS), sex and age group, unadjusted for seasonality, monthly (persons unless otherwise noted), CANSIM (database)*.
- Stratton, K., Howe, C., & Battaglia, F. C. (1996). *Fetal alcohol syndrome: Diagnosis, epidemiology, prevention, and treatment*. Washington, DC: The National Academy Press.
- Streissguth, A. P., Bookstein, F. L., Barr, H. M., Sampson, P. D., O'Mally, D., & Young, J. K. (2004). Risk factors for adverse life outcomes in fetal alcohol syndrome and fetal alcohol effects. *Journal of Developmental and Behavioral Pediatrics*, 25, 228–238.
- Streissguth, A. P., & Kanter, J. (1997). *The challenges of Fetal Alcohol Syndrome: Overcoming secondary disabilities*. Seattle, WA: University of Washington Press.
- Streissguth, A. P., LaDue, R. A., & Randels, S. P. (1988). *A manual on adolescents and adults with Fetal Alcohol Syndrome with special reference to American Indians* (2nd ed.). Albuquerque, NM: University of Washington.
- The Asante Centre for Fetal Alcohol Syndrome (2010). *Youth probation officers' guide to FASD screening and referral*. Maple Ridge, BC: Asante Centre for Fetal Alcohol Syndrome.
- Weeks, M. (1989). *Economic impact of Fetal Alcohol Syndrome, IR 89-100015*. Memorandum to Senator Johnne Binkeley, February 17. Juneau, Alaska: Senate Advisory Council, Alaska State Legislature.