POTENTIAL IMPACTS OF THE ALBERTA FETAL ALCOHOL SPECTRUM DISORDER SERVICE NETWORKS ON SECONDARY DISABILITIES: A COST-BENEFIT ANALYSIS

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ABSTRACT

Objectives
To estimate the break-even effectiveness of the Alberta Fetal Alcohol Spectrum Disorder (FASD) Service Networks in reducing occurrences of secondary disabilities associated with FASD.

Methods
The secondary disabilities addressed within this study include crime, homelessness, mental health problems, and school disruption (for children) or unemployment (for adults). We used a cost-benefit analysis approach where benefits of the service networks were the cost difference between the two approaches: having the 12 service networks and having no service network in place, across Alberta. We used a threshold analysis to estimate the break-even effectiveness (i.e. the effectiveness level at which the service networks became cost-saving).

Results
If no network was in place throughout the province, the secondary disabilities would cost $22.85 million (including $8.62 million for adults and $14.24 million for children) per year. Given the cost of network was $6.12 million per year, the break-even effectiveness was estimated at 28% (range: 25% to 32%).

Discussion
Although not all benefits associated with the service networks are included, such as the exclusion of the primary benefit to those experiencing FASD, the benefits to FASD caregivers, and the preventative benefits, the economic and social burden associated with secondary disabilities will "pay-off" if the effectiveness of the program in reducing secondary disabilities is 28%.

Key Words: *Fetal alcohol spectrum disorder, secondary disabilities, cost-benefit analysis, Alberta FASD Service Networks*

Fetal alcohol spectrum disorder (FASD) refers to a spectrum of disorders including Fetal Alcohol Syndrome (FAS), partial Fetal Alcohol Syndrome (pFAS), alcohol related neurodevelopmental disorders (ARND), and alcohol-related birth defects (ARBD). Based upon the prevalence rate of 1%[1], in Alberta, we expect FASD affects approximately 36,000 residents[2], and costs the province about $520 million per year.[3] There is no cure for FASD, and those who are affected face lifelong difficulties and will require substantial supports. Difficulties arise from both the primary disabilities associated with FASD, as well as secondary disabilities, which are the repercussions that result from the interactions between primary disabilities and the social and physical environmental conditions.[4]

To address FASD in Alberta, the provincial government has implemented 12 FASD service networks (SN) across the province. The

aim of the SN are to diagnose people with FASD, provide continuous support to FASD affected individuals throughout their life, raise awareness about FASD, and provide targeted FASD prevention initiatives. Specific services provided through the SN include assessment and diagnosis of FASD, enhanced support for at-risk women, community-based support for those affected by FASD, education and awareness, and life-skills programs for youth and adults living with FASD. The total number of people with FASD served by the SN from 2008/9 to 2010/11 was 1275, of which the number of children and adults were 804 and 471, respectively.[5]

When an individual enters the SN for a diagnosis, they are assessed for any secondary disabilities which may be present. The assessment examines deficits in education, language, mental health and addictions, sensory issues, financial constraints, employment, issues with housing, homelessness, sexual health, health, learning abilities, attention and memory disorders, and guardianship.[6] If a FASD diagnosis is given, the clinic creates a management and support plan based upon the secondary disabilities identified, which will be tailored to the unique needs of the individual. Support could include parenting and lifestyle counseling, and/or linking the individual to other community-based support programs.[7] The clinic may also make referrals to other community partners, which could include mental health services, healthcare, housing and income support, addiction services, employment and educational training, legal support, food bank referrals, respite services, detoxification treatment, classroom management, referrals to FASD support groups, and transportation referrals.[5] Diagnosis occurs at one of the diagnostic clinics included in the SN, and utilizes a multidisciplinary team over the course of two days.

The aim of this study was to economically evaluate the SN in reducing occurrences of secondary disabilities associated with FASD. We applied a cost-benefit analysis, in terms of a threshold analysis which estimates a "break-even" effectiveness level.

METHOD

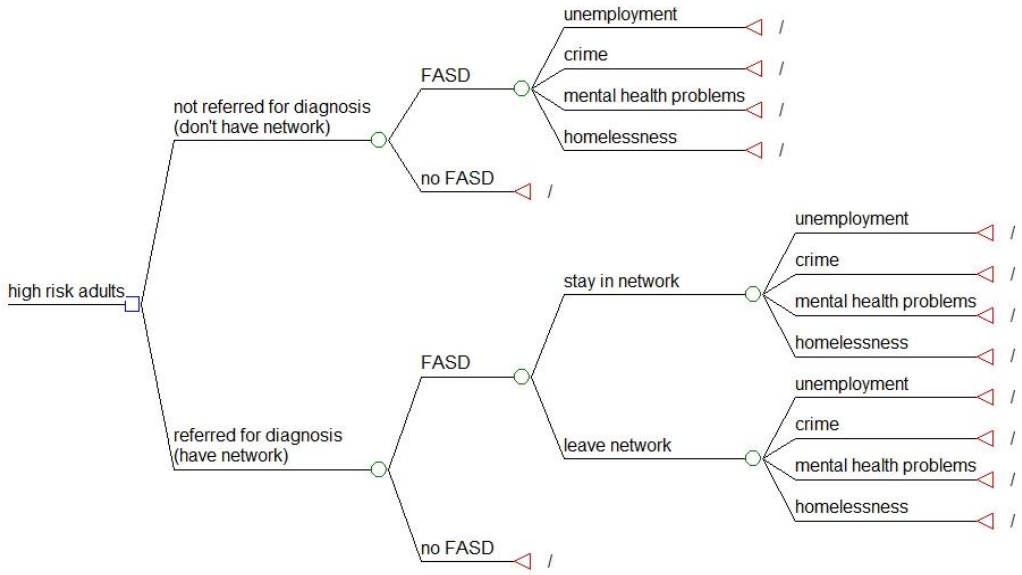
As actual data were not available, we developed a model which was devised to approximately actual situation.

The secondary disabilities addressed within this study included crime, homelessness, mental health problems, and school disruption (for children) or unemployment (for adults). A cost-benefit analysis (CBA)[8] was conducted where the monetary value associated with a secondary disability (e.g. costs of homelessness) were contrasted with the cost of the SN program. A societal perspective and a 1-year time horizon for the analysis were used.

Benefits of the SN (i.e. intervention) were based upon a decision analytic model which compared the costs of two approaches: 1) having the 12 SN across Alberta, and 2) having no SN in place across the province. Benefits included in this study were savings in costs from a reduced numbers of occurrences of secondary disabilities among people with FASD. Costs were the SN program costs.

The study population included high-risk individuals who were referred to the SN for diagnostic services[5], and those who were diagnosed with FASD outside of the SN but were referred to the SN for support services, during the 3 years from 2008/9 to 2010/11. Because of the difference in secondary disability outcomes (school disruption or unemployment), children (<18 years old) and adults (≥18 years old) were analyzed separately.

FIG. 1 Decision analytic model for high-risk adults (for high-risk children, unemployment is replaced by school disruption)



Model Structure

Within the model, presented in Figure 1, high-risk individuals entered the model at the time of diagnosis where they can either be 1) referred for diagnosis and receive support services offered by the SN, or 2) not be referred for diagnosis and not receive support services offered by the SN. In the scenario without the SN, individuals with FASD are at an increased risk for unemployment, crime, mental health problems, and homelessness compared to the scenario with the SN. Conservatively, it is assumed that individuals who leave the SN are at the same risk for secondary disabilities as the scenario where the SN is not present. The model for children is identical to the model for adults with the exception that unemployment is replaced with school disruption.

The secondary disabilities included in the model were crime, homelessness, mental health problems, and school disruption (for children) or unemployment (for adults). The costs attributed to each secondary disability include:

- **Crime:** Any occurrence/trouble with the criminal justice system, including being charged or convicted of a crime. All costs incurred by the criminal justice system were included in analysis (for example correctional institutions, publically funded legal costs, community supervision, and police services) and averaged out. Any private costs or victimization costs were excluded.
- **Homelessness:** Any occurrence when an individual accessed emergency shelters, independent living shelters, temporary emergency housing, and other shelter options. The cost of housing and shelter were included in analysis, with any costs relating to support or medical care excluded.
- **Mental health**: Any occurrence utilizing health care services to treat mental health problems. The costs included in the analysis were the direct costs to the healthcare system, including mental health hospitalization and community expenditures. Any out of pocket expenses were

excluded from analysis (for example the cost of medications).

- **School disruption**: Any occurrence resulting in a suspension or expulsion from school, or any instance when the individual dropped out of school. The direct cost to Alberta Education for the education of students with FASD was included in the analysis. Any out-of-pocket costs, health, and social support costs were excluded from analysis.
- **Unemployment**: Any occurrence when an individual is not employed. The costs associated with lost productivity, based upon average Alberta wages for 2011, were included in analysis.[9]

Model inputs

Inputs for the model are shown in Table 1.

TABLE 1 Model Inputs

Names of inputs	Means	Range	Data Sources
Probability of FASD among high-risk individuals who are referred to the SN for diagnosis	67.5%	60-75%	Assumption
Probability of unemployment among adults with FASD	79%	69-87%	[4,11]
Probability of school disruption among children with FASD	60%	54-66%	[4, 11]
Probability of crime among FASD	60%	54-66%	[4, 11]
Probability of mental health problems among FASD	94%	91-96%	[4, 11, 12]
Probability of homelessness among FASD*	15%	14-16%	[13]
Probability of staying in the SN**	97%	94-99%	[5]
Productivity cost of unemployment***	$7,152	$5,364-$8,940	[9]
Shelter cost of homelessness	$14,398	$7,854-$20,943	[15]
Educational cost of school disruption	$8,424	$6,318-$10,530	[17]
Criminal justice cost of crime****	$14,935	$11,201-$18,669	[15]
Medical cost of mental health problems	$1,634	$1,225-$2,042	[16]

* probability of homelessness among mental illness.
** probability of staying in the SN among PCAP women
*** average wage per person per 2 months
**** cost of crime among homeless people

Probabilities

Probabilities of secondary disabilities were retrieved from a systematic literature search of MEDLINE, EMBASE, PsycINFO, and SocINDEX, which was conducted by an information specialist in May 2012. The search was restricted to English language studies, but not limited by publication type, date of publication, or methodological filter. The search used an extensive combination of subject headings and keywords to describe FASD and the secondary disabilities associated with FASD. The search identified the rates of following secondary disabilities among FASD people: educational

attainment/ school dropouts; unemployment; homelessness; mental health problems; and crime. The search indicated that there was a limited number of publications in this area (details on the systematic search are available upon request).

Multi-year probabilities were converted to a 1-year probability by using an exponential function when appropriate.[10] Probabilities that reflect a secondary disability occurring at least once in an individual's lifetime were treated as yearly probability in the analysis. For example, the life-time probability of crime among people with FASD is estimated at 60% by Streissguth et al.,[11] which was treated as a 1-year probability of crime among people with FASD. Probabilities of the occurrence of unemployment (79%), school disruption (60%), committed crimes (60%), and mental health problems (94%) were retrieved from studies by Streissguth et al.[11] As the probability of homelessness among persons with FASD was not available, we used the probability of the occurrence of being homeless among people with mental illness (15%) as a proxy.[12] This was deemed acceptable because more than 90% of people with FASD have mental health problems.[11,13,14] The probability of staying in the SN for women who participate in the prevention component of the SN was used as a proxy for people with FASD. This was based on the data from the Alberta FASD Services Network and the probability was 97%.[5] Probability of having FASD among high-risk individuals who are referred to the SN for diagnosis was assumed to be 67.5% (60-75%).

Program Effectiveness

Currently there are no data on program effectiveness in the Alberta databases nor are there any comparable programs which have been reported on in the literature. We therefore conducted a threshold analysis to estimate an effectiveness at which the program breaks even given program costs and secondary disability costs.

Costs

Costs of the secondary disabilities were retrieved from Alberta or Canadian sources (if Alberta sources were not available). To avoid double counting, the cost of each secondary disability was treated as being mutually exclusive. For example, cost of homelessness was restricted to shelter cost but excludes costs of mental health care and correctional services for homeless people.

Specifically, the shelter cost per homeless person per year was estimated by subtracting the costs of health, social, and criminal services from the total cost of homelessness based on the study on the costs of homelessness in British Columbia.[15]

The average wage per person for 2 months in Alberta (retrieved from Alberta Human Services)[9] was used as the cost of unemployment. This was based on the assumption that the SN could lead to benefits for people with FASD of an additional 2 months of employment per year compared to no SN. The cost of mental health problems was restricted to medical costs. We used the incremental cost between a person with and without mental illness reported by Lim et al.,[16] and used a sample weight to estimate the incremental cost per person with mental illness.

The cost of school disruption was restricted to the education system cost and was retrieved from a study on cost of FASD to Alberta Education by Calder et al.[17] Since the cost of crime per person with FASD per year is not available we used the annual cost of criminal justice services per homeless person as a proxy.[15]

Costs of the SN were the actual spending of the SN. The annually actual spending of the SN is $8.65 million (personal communication with the Senior Manager of FASD Initiatives/Children's Mental Health at Alberta Child and Youth Services). Of this, diagnostic services accounted for 19%, support services 40%, prevention services 23%, and operational 18%. After equally allocating the operational costs to the other types of services and excluding the costs for prevention, the costs for diagnosis and for support services were estimated to be $2.12 million and $4.00 million, respectively, totaling $6.12 million per year.

Sensitivity Analysis

A sensitivity analysis was performed to assess how changes in input parameters changed the estimates of net benefits. For input probabilities, they were varied within the 95% confidence intervals reported in the original study. For cost inputs, they were varied by ±25% (except the shelter cost of homelessness which was estimated based on the range of total cost reported in the original study).

All the costs were converted to 2012 Canadian dollars by the Bank of Canada Inflation Calculator which was based on the Statistics Canada Consumer Price Index.[18] TreeAge Pro 2009 and Excel 2003 were used for analysis.

RESULTS

In Table 2 we present the numbers and costs of secondary disabilities if there were no SN implemented in Alberta. These numbers were based upon our population of 471 adults and 804 children served within the SN. With no SN in place, we can expect 372 adults will be unemployed, 282 will engage in crime, 442 will experience mental health problems, and 71 will be homeless. Likewise, we can expect 482 children will experience school disruption, 482 will engage in crime, 756 will experience mental health problems, and 121 will be homeless. This equates to a total cost of $22.85 million (including $8.62 million for adults and $14.24 million for children).

Based on our model, 28% program effectiveness will reduce the costs of secondary disabilities by $6.12 million, which is exactly equal to program costs. This results in an achievement of a break-even (Table 3).

To see how the benefits were dependent on the effectiveness levels we assumed that the program effectiveness was from 40% to 80%. If so, the network benefits would range from $8.87 million to $17.73 million. Comparisons between the costs and the benefits found the social return would be from $1.5 to $2.9 for every $1 invested in the SN (Table 3).

The sensitivity analysis showed the break-even effectiveness (i.e. the effectiveness level at which the SN became cost-effective) varied between 25% and 32%.

TABLE 2 Numbers and costs of secondary disabilities per year if the SN is not present

Numbers	**Adults**	**Children**	**All ages**
Number of unemployment occurrences	372		372
Number of occurrences of school disruption		482	482
Number of occurrences of a committed crime	282	482	765
Number of mental health problems	442	756	1198
Number of occurrences of homelessness	71	121	191
Costs (millions of dollars)			
Cost of unemployment occurrences	$ 2.66		$ 2.66
Cost of school disruption occurrences		$ 4.06	$ 4.06
Cost of committed crime occurrences	$ 4.22	$ 7.20	$ 11.42
Cost of mental health problems	$ 0.72	$ 1.23	$ 1.96
Cost of homelessness occurrences	$ 1.02	$ 1.74	$ 2.75
Total	$ 8.62	$ 14.24	$ 22.85

TABLE 3 Net benefits (millions of dollars) and benefit-to-cost ratios of the SN by effectiveness levels

	Effectiveness levels			
	28%	40%	60%	80%
Benefits (B)	$6.12	$8.87	$13.30	$17.73
Costs (C)	$6.12	$6.12	$6.12	$6.12
Net (B-C)	$0.00	$2.75	$7.18	$11.61
Ratio (B:C)	1.0	1.45	2.17	2.90

DISCUSSION & CONCLUSION

We provided an exploratory economic assessment of the potential impact of the SN focusing on secondary disabilities associated with FASD. The results indicated the break-even effectiveness at which the SN can pay for itself was 28% (range: 25% to 32%).

The economic analysis does not consider all economic benefits associated with the SN. The analysis excludes the primary benefits to those experiencing FASD (for example, improvement to general levels of adaptive functioning), the benefits to FASD caregivers, and the preventative benefits associated with FASD support.

If an economic evaluation of the program were to be conducted in the future, the analysis should include all benefits resulting from the program. What the current results do show, however, is that the economic and social burden associated with secondary disabilities is significant and there are economic opportunities to reduce the resource burden on social resources and programs, while improving services for persons with FASD.

There are several limitations that need to be considered before interpreting the results. Limited data was available to conduct the economic analysis, for example, data was not available to inform the effectiveness of the SN on secondary disabilities. Furthermore, the analysis does not account for factors such as having reliable differential diagnosis, access to service, compliance with program, baseline health status and other influencers.

As a result, the analysis can be regarded as a conservative estimate, and shows that a moderate reduction in utilization associated with secondary disabilities will allow a break-even result.

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