Comorbidity, Prevalence and Cost of Fetal Alcohol Spectrum Disorder

Presented by
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OVERVIEW

• Prevalence of alcohol consumption during pregnancy in general population around the world

• Prevalence of FASD in different populations (general population, Aboriginal communities, children in care and corrections) around the world

• Comorbidity of FAS/FASD

• Economic cost of FASD
Prevalence of Alcohol Use During Pregnancy and FASD


Objective: To investigate the prevalence of alcohol use during pregnancy and FAS/FASD by country, WHO region, and globally

Methodology (innovative, evidence-based)

• Literature search: not limited geographically or by language of publication and included studies published between January 1984 and June 2015

• Meta-analyses: For those countries with 2 or more studies, assuming a random-effects model

• Data prediction: For those countries with no empirical studies (or less than 2), using fractional response regression modelling (for AC) and Monte Carlo simulation (for FAS/FASD)

• The country-specific explanatory variables: gender inequality index, gross domestic product, % of Muslims, % of Buddhist, study year, total per capita consumption of alcohol overall and among women and WHO region.
Pooled Prevalence of Alcohol Use During Pregnancy in General Population for Select Countries
(any amount of alcohol consumed and at any point during pregnancy)

*The prevalence for countries with an asterisk are based on actual data

Popova et al., submitted
Prevalence of Alcohol Use During Pregnancy in General Population by WHO Region and Globally, 2012


Popova et al., submitted
Prevalence of Alcohol Use During Pregnancy in Canada
(any amount, and at any point during pregnancy)

General Population
(Range: 0.5% to 30.1%)

Northern Communities
(Range: 24.3% to 60.5%)
Prevalence of Alcohol Use During Pregnancy (cont’)

Discussion

- Alcohol consumption during pregnancy is a significant public health concern worldwide and an established cause of FASD.

- FASD is theoretically, largely preventable.

- However, FASD may increase in the near future due to two reasons:

  1) the rates of alcohol use, binge drinking and drinking during pregnancy appear to be increasing among young women in a number of countries; and

  2) a vast majority of pregnancies are unplanned.
Prevalence of FASD

Flow chart for systematic literature search on prevalence of FAS/FASD

11,089 records identified through database searching

21 additional records identified through other sources

11,100 records found

5,135 duplicates removed

5,965 records screened

5,535 records excluded

430 full-text articles assessed for eligibility

368 full-text articles excluded; lack of relevant data or did not meet the inclusion criteria

64 articles identified as including relevant data from 19 countries [African Region (South Africa, 9 studies), European Region (Croatia, 2 studies; Denmark, 1 study; France, 7 studies; Germany, 1 study; Ireland, 1 study; Italy, 3 studies; Netherlands, 1 study; Portugal, 1 study; Spain, 1 study; Sweden, 2 studies; Switzerland, 1 study; and United Kingdom, 3 studies), Region of the Americas (Canada, 2 studies; United States, 24 studies; and Uruguay, 1 study), and Western Pacific Region (Australia, 7 studies; New Zealand, 1 study; and Republic of Korea, 1 study)]
## Prevalence of FASD in General Population by WHO Region and Globally, 2012

<table>
<thead>
<tr>
<th>Region</th>
<th>Prevalence (per 10,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR</td>
<td>198.2</td>
</tr>
<tr>
<td>AMR</td>
<td>87.9</td>
</tr>
<tr>
<td>AFR</td>
<td>78.3</td>
</tr>
<tr>
<td>WPR</td>
<td>67.4</td>
</tr>
<tr>
<td>SEAR</td>
<td>14.1</td>
</tr>
<tr>
<td>EMR</td>
<td>0.01%</td>
</tr>
<tr>
<td>Global</td>
<td>77.3</td>
</tr>
</tbody>
</table>


Popova et al., submitted
Prevalence of FASD in Canada

General Population vs. Northern Communities

Asante & Nelms-Matzke, 1985
PHAC, 2003
Thanh et al., 2014

5.3
9.0
11.7

General Population
(Range: 5.3 to 11.7 per 1,000)

Asante & Nelms-Matzke, 1985
Robinson et al., 1987
Kowlessar, 1997
Werk et al., 2013

32.8
95.0
101.1
7.0

Northern Communities
(Range: 7.0 to 189.7 per 1,000)
The Prevalence of Children with FASD in Various Child Care Systems
The Prevalence of Children with FASD in Various Child Care Systems (cont’)

Literature Review

• In total, 33 studies were identified and included in the analysis (Lange et al., 2013, Pediatrics; 132: e980-e995)

• Data on the prevalence of FAS/D in child care systems are available from only 11 countries/regions, including: Brazil, Chile, Canada, Eastern Europe (Romania, Ukraine, Moldova), Israel, Russia, Spain, Sweden, and USA

• The prevalence was reported for six major settings: boarding schools, child welfare agencies, foster care, homes for children with mental deficiencies, orphanages, and mixed-care settings
The Prevalence of Children with FASD in Various Child Care Systems (cont’)

- Wide Ranges -

- The prevalence of FAS ranges from 5 per 1,000 (child welfare system, USA; Ringeisen et al., 2008) to 680 per 1,000 (orphanage for children with special needs, Russia; Palchik & Legonkova, 2011)

- The prevalence of FASD ranges from 37 per 1,000 (foster care, USA; Astley et al., 2002) to 521 per 1,000 (adoptees from Eastern Europe, adopted in Sweden; Landgren et al., 2010)
The Prevalence of Children with FASD in Various Child Care Systems (cont’)

Prevalence of FAS: Child Welfare, Foster Care, Orphanages

<table>
<thead>
<tr>
<th>Country</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>3.2%</td>
</tr>
<tr>
<td>Chile</td>
<td>6.2%</td>
</tr>
<tr>
<td>Israel</td>
<td>2.0%</td>
</tr>
<tr>
<td>Russia</td>
<td>15.1%</td>
</tr>
<tr>
<td>USA</td>
<td>1.5%</td>
</tr>
</tbody>
</table>
The Prevalence of Children with FASD in Various Child Care Systems (cont’)

Prevalence of FAS: International Adoptees

- Canada: 3.5%
- Spain: 11.0%
- Sweden: 29.6%
- USA: 2.4%
The Prevalence of Children with FASD in Various Child Care Systems (cont’)

- The pooled prevalence of FAS in child care settings is approximately 70 times higher than the prevalence of FAS in the general population of Canada.

- Screening for FASD in this high-risk population is necessary, in order to facilitate early diagnosis!
Prevalence of FASD in Canadian Correctional System

(Range – youths: 10.9% to 23.4%, adults: 9.9% to 17.5%)

Youths with FASD are *nineteen times* more likely to be incarcerated than youths without FASD in any given year (Popova et al., 2011)

More Rigorous Epidemiological Prevalence Studies are Needed!

- To understand the severity and impact of FASD
- To plan policies and programs that will benefit people with FASD and to prevent children from being born with these conditions
- Data on the incidence/prevalence of FASD are completely absent for the majority of countries
- Existing data are outdated and have many methodological limitations
- FASD is expensive!
- Urgently need to monitor and lower the rate of these conditions effectively throughout the world

• FASD is related to numerous comorbidities due to the permanent effects of prenatal alcohol exposure on the fetus

• However, the existing comorbid conditions and their prevalence among individuals with FASD remained to be established
OBJECTIVES

• The objectives of the current study were to:
  1) Identify the comorbid conditions that occur among individuals with FASD, and
  2) Estimate the pooled prevalence of comorbid conditions found to occur among individuals with FAS

• The latter objective was limited to FAS because FAS is the only expression of FASD in the *International Classification of Diseases* (ICD):
  • ICD, version 9 – *Alcohol affecting foetus or newborn via placenta or breast milk* - 760.71
  • ICD, version 10 – *Fetal alcohol syndrome (dysmorphic)* - Q86.0
METHODS

Systematic Literature Review

- A systematic literature search was performed in multiple electronic bibliographic databases in order to locate original published studies that reported on the comorbidity among individuals with diagnosed FASD
- The search was not limited geographically
- All comorbid conditions were coded according to the ICD-10
- Meta-analyses were performed, assuming a random-effects model
RESULTS

Systematic Literature Review

Records identified through database searching (n = 5,016)

Additional records identified through other sources (n = 52)

Duplicates removed (n = 2,144)

Records screened (n = 2,924)

Records excluded (n = 2,625)

Full-text articles assessed for eligibility (n = 299)

Articles included in qualitative synthesis (n = 127)

Studies included in quantitative synthesis (meta-analyses; n = 33)
  Canada (6); Germany (4); Ireland (1); Italy (1); Norway (1); Portugal (1); Scotland (1); South Africa (3); Sweden (3); USA (12)

Full-text articles excluded; lack of relevant data/did not meet the inclusion criteria (n = 172)
428 comorbid conditions, spanning across 18 (out of 22) chapters of the ICD-10

The most prevalent disease conditions were:

- **Congenital malformations, deformities and chromosomal abnormalities** (Q00-Q99; Chapter XVII), and
- **Mental and behavioural disorders** (F00-F99; Chapter V)
RESULTS (Con’t)
Percentage of conditions found to occur among individuals with FASD by ICD-10 chapter

- 6%: Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)
- 1%: Mental and behavioural disorders (F00-F99)
- 1%: Diseases of the nervous system (G00-G99)
- 1%: Diseases of the eye and adnexa (H00-H59)
- 1%: Diseases of the ear and mastoid process (H60-H95)
- 1%: Diseases of the circulatory system (I00-I99)
- 1%: Diseases of the respiratory system (J00-J99)
- 1%: Diseases of the digestive system (K00-K93)
- 2%: Diseases of the skin and subcutaneous tissue (L00-L99)
- 3%: Diseases of the musculoskeletal system and connective tissue (M00-M99)
- 1%: Diseases of the genitourinary system (N00-N99)
- 4%: Certain conditions originating in the perinatal period (P00-P99)
- 4%: Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)
- 3%: Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)
- 4%: External causes of morbidity and mortality (V01-Y98)
- 3%: Factors influencing health status and contact with health services (Z00-Z99)

Popova et al., 2016, The Lancet
Meta-analyses

- 33 studies reported data on frequency of at least one disease condition and were eligible to be included in the meta-analyses
- Contained 1,728 subjects with diagnosed FAS
- Reported frequencies for 183 comorbid conditions coded in ICD-10
- In order to estimate pooled prevalence, 183 meta-analyses were performed; one for each comorbid condition found to occur among individuals with FAS
Comorbid conditions with a pooled prevalence over 50% among individuals with FAS

Mental and behavioural disorders (F00-F99)
- Conduct/behavioural problems/disruptive behaviour/impulsivity (F91)
- Receptive language deficit (F80.2)
- Expressive language deficit (F80.1)
- Developmental/cognitive disorder: delayed development/retarded speech development/speech defects/attention deficit disorder (F80.9)
- Alcohol dependence/drug dependence (F10.2/F19.2)
- Attention deficit hyperactivity disorder/attention deficit disorder (F90.0)
- Central hearing disorder (H90.5)
- Conductive hearing loss (H90.2)
- Chronic/recurrent (serous) otitis media (H65.2)
- Chronic/recurrent (serous) otitis media (H65.0)
- Intrauterine growth retardation (P05.9)
- Pre-mature birth/born prematurely/preterm birth (P07.3)

Diseases of the eye and adnexa (H00-H59)
- Refractive error(s) (H52.6)
- Subnormal/decreased visual acuity/problems/visual impairment (H54)
- Chronic/recurrent (serous) otitis media (H65.2)
- Chronic/recurrent (serous/suppurative) otitis media (H65.0)
- Intrauterine growth retardation (P05.9)
- Pre-mature birth/born prematurely/preterm birth (P07.3)

Diseases of the ear and mastoid process (H60-H95)
- Conductive hearing loss (H90.2)
- Central hearing disorder (H90.5)
- Conductive hearing loss (H90.2)
- Chronic/recurrent (serous/suppurative) otitis media (H65.0)
- Intrauterine growth retardation (P05.9)
- Pre-mature birth/born prematurely/preterm birth (P07.3)

Certain conditions originating in the perinatal period (P00-P99)
- Intrauterine growth retardation (P05.9)
- Pre-mature birth/born prematurely/preterm birth (P07.3)

Congenital malformations, (Q00-Q99)
- Coccygeal fovea (Q14.1)
- Congenital fusion of cervical vertebrae/cervical spine fusion (Q76.4)

Symptoms, signs and abnormal clinical and lab findings (R00-R99)
- Abnormal retinal function - ERG records (R94.1)
- Failure to thrive (R62.8)

Popova et al., 2016, The Lancet
RESULTS (Con’t)

Pooled prevalence of comorbid conditions in individuals with FAS vs the general population of the USA

<table>
<thead>
<tr>
<th>Condition</th>
<th>FAS</th>
<th>General Population</th>
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<tbody>
<tr>
<td>Conduct disorder (F91)</td>
<td>9.5 times</td>
<td>10.3 times</td>
</tr>
<tr>
<td>Receptive language disorder (F80.2)</td>
<td>11.1 times</td>
<td>77.0 times</td>
</tr>
<tr>
<td>Chronic serous otitis media (H65.2)</td>
<td>97.5 times</td>
<td>5.6 times</td>
</tr>
<tr>
<td>Expressive language disorder (F80.1)</td>
<td>31 times</td>
<td>128.7 times</td>
</tr>
<tr>
<td>Unspecified disorder of psychological development (F89)</td>
<td>126.2 times</td>
<td></td>
</tr>
<tr>
<td>Other preterm infants (P07.3)</td>
<td></td>
<td>4.4 times</td>
</tr>
<tr>
<td>Visual impairment including blindness binocular or monocular (H54)</td>
<td>7.6 times</td>
<td></td>
</tr>
<tr>
<td>Sensorineural hearing loss, unspecified (H90.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conductive hearing loss (H90.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol and drug dependence (F10.2 &amp; F19.2)</td>
<td></td>
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<tr>
<td>Disturbance of activity and attention (F90)</td>
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Popova et al., 2016, The Lancet
Cost of FASD in Canada

Percentage of main cost components attributable to FASD in Canada in 2013

Total annual cost: $1.3 B - $2.3 B

- Health Care: 10.2% ($128.5 M - $226.3 M)
- Productivity Losses Due to Morbidity and Mortality: 42.2% ($532 M - $1.2 B)
- Corrections: 30.0% ($378.3 M)
- Children in Care: 4.7%
- Special Education: 4.3%
- Supportive Housing: 1.8%
- Long-term Care: 6.2%
- Prevention and Research: 0.6%

DISCUSSION

• The presented data will raise awareness of harmful effects of PAE and draw attention to the need for screening and early diagnosing.

• Improving screening and diagnosis would promote access to interventions and resources that may subsequently reduce burden and cost.

• The harmful effects of alcohol on a fetus, representing many cases of preventable disability, should be recognized globally as a large public health problem. The presented results clearly demonstrate the need for such recognition.
Research on comorbidity was a part of “Economic Cost of FASD” project, supported by the Public Health Agency of Canada.

Many people worked on these projects!
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