The Epidemiology of Liver Disease in Canada

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Outline

• Epidemiology 101
• Review the Canadian epidemiology of
  – Chronic Hepatitis C (HCV)
  – Chronic Hepatitis B (HBV)
  – Fatty liver disease (EtOH + NAFLD)
  – Primary Liver Cancer
  – Cirrhosis

What is ‘Epidemiology’

• Derived from the greek language
  – Epi: ‘among’ or ‘upon’
  – Demos: ‘population’ or ‘people’
  – Logos: ‘scientific study’

• The study of the distribution and determinants of health-related states or events in a specified population and the application of the study to control health problem

Last JM 1998
Goals of Epidemiology

- To describe and analyze disease occurrence and distribution in human populations
- To identify etiological factors in disease pathogenesis
- To provide data essential to planning, implementation, and evaluation of services for the prevention, control, and treatment of disease

International Epidemiological Association

Key Concepts in Epidemiology

- **Incidence**
  - Number of **NEW** cases occurring in a defined population during a specified period of time

- **Prevalence**
  - Number of **TOTAL** cases (new and old) in a defined population during a specified period of time

- **Mortality**
  - Number of **DEATHS** in a defined population during a specified period of time
Understanding the Epidemiology of Liver Disease is Important

- Chronic liver disease is estimated to affect 1 in 4 Canadians

- Despite this, there is no strategy for chronic liver disease in Canada

- In order to develop chronic disease prevention and management strategies, a comprehensive understanding of disease burden is essential

Sherman et al. CLF 2013
Understanding the Epidemiology of Liver Disease is Important

- The landscape in chronic liver disease is dynamic
  - Treatments for viral hepatitis
  - Immigration of populations with higher prevalence of viral hepatitis
  - New kid on the block – NAFLD
  - Changes in ability to diagnose and manage cirrhosis

Epidemiology of Chronic Viral Hepatitis
HCV Incidence – Canada

Payne E et al, Canadian Communicable Disease Report 2014

HCV Incidence – Canada

Payne E et al, Canadian Communicable Disease Report 2014
HCV Incidence – Canada

MALES

Incidence of HCV is increasing most in younger birth cohorts, especially in females.

Payne E et al, Canadian Communicable Disease Report 2014

HCV Prevalence – Canada

- Overall Canadian population estimates
  - HCV Ab +: 0.96%
  - HCV-RNA +: 0.71%

- Estimates vary greatly depending on the underlying population of interest
  - Age
  - Sex
  - Ethnicity
  - PWID status
  - Incarceration status

Trubnikov M et al., Canadian Communicable Disease Report 2014
HCV Ab + Prevalence - Canada

Trubnikov M et al., Canadian Communicable Disease Report 2014

Population-based estimate of hepatitis C virus prevalence in Ontario, Canada

PLoSOne 2018
Impact of HCV - Canada

- Using estimates anti-HCV + prevalence of 0.96%

Myers RP et al.  Can J Gastro Hep 2014
Impact of HCV - Canada

- Total costs
  - 2013: $164 million
  - Hypothetical male aged 35-39 in 2013
    - Total lifetime cost: $64,694
    - F0: $51,946
    - Liver transplant: $327,608
- Total costs in 2032: $258 million
  - Mostly secondary to the cost associated with decompensated liver disease and liver transplant

Myers RP et al. Can J Gastro Hep 2014

Acute HBV Incidence - Canada

Acute HBV: HBsAg + and HBeAb IgM + OR HBsAg + and cleared within six months

Payne E et al, Canadian Communicable Disease Report 2014
Chronic HBV Incidence – Canada*

Chronic HBV: HBsAg + > 6 months OR HBV DNA > 6 months

Payne E et al, Canadian Communicable Disease Report 2014
* Excludes data from Ontario

Epidemiology of Fatty Liver Disease

Alcohol

NAFLD
Alcohol-related Liver Disease in Canada

- No studies have been able to define the burden of EtOH-related liver disease in Canada

- However, we can estimate how many Canadians might be at risk for EtOH-related liver disease based on alcohol consumption patterns

Alcohol use in Canada

- Canadian Alcohol and Drug Use Monitoring Survey (CADUMS)
  - Ongoing population-based survey of drug and EtOH use in Canada – last update 2011
  - 90% had used alcohol at some point
  - 78% had used in the past year
  - Average age to start drinking – 16 years old

Canada Healthy Drinking Guidelines

Up to 20% of Canadians who use alcohol exceed Canada’s low-risk drinking guidelines and are at risk for EtOH-related liver disease.

15% of The General Population

Deaths from Alcoholic Cirrhosis or Alcoholic Hepatitis - Canada

Sherman M et al. Canadian Liver Foundation, 2013
NAFLD - Canada

• No data on NAFLD in the general Canadian population
• Incidental CT findings of hepatic steatosis
  – All CT scans performed during off-duty hours in London, Ontario from January to July 2011
  – CT reports were reviewed and those where the radiologist commented on the presence of hepatic steatosis underwent a formal chart review
  – 24% had evidence of hepatic steatosis


Epidemiology of Primary Liver Cancer
Primary Liver Cancer - Canada

- Incidence and Mortality of Liver Cancer in Canada increasing

Intrahepatic Cholangiocarcinoma

- Incidence and Mortality of IHCC increased in Ontario from 1994 – 2012
Epidemiology of Cirrhosis

Cirrhosis: The final common pathway

Primary Biliary Cholangitis

NAFLD

HCV

HBV

Hemochromatosis

Crypotgenic

Primary Sclerosing Cholangitis

Autoimmune Hepatitis

Alcohol
Cirrhosis Incidence - Ontario

- Population-level data from Ontario from 1997-2015
- A cohort of ~200,000 patients with cirrhosis identified
- 62% male, median age 57 years (IQR 46-67)
- Stratified based on birth cohort
  - <1925: Greatest Generation
  - 1925-1944: Silent Generation
  - 1945-1965: Baby-boomers
  - 1966-1979: Generation X
  - >1980: Millennial’s

Flemming JA et al. Manuscript under review.

Cirrhosis Epidemiology - Ontario

- + 148% from 1997 to 2015
- + 71% from 1997 to 2015

Flemming JA et al. Manuscript under review.
At age 32, you are more likely to be diagnosed with cirrhosis if you are a “Gen Xer” or a “Millennial” than a “Baby-boomer”

Flemming JA et al. Manuscript under review.
Cirrhosis Incidence - Ontario

- Age-Period-Cohort modeling
- Describe the independent risk of cirrhosis based on birth year adjusted for
  - Age at diagnosis
  - Period of diagnosis (changes in fibrosis assessment)

Flemming JA et al. Manuscript under review.

Risk of Cirrhosis

Flemming JA et al. Manuscript under review.
Risk of Cirrhosis


25% lower

1925

25% lower

1945

13% lower

Flemming JA et al. Manuscript under review.
Risk of Cirrhosis

Flemming JA et al. Manuscript under review.
Risk of Cirrhosis

- 1925: 25% lower
- 1945: 13% lower
- 1951: 25% lower
- 1966: 30% higher
- 1980: 63% higher
- 1990: 142% higher

Risk of Cirrhosis - Males

Flemming JA et al. Manuscript under review.
Risk of Cirrhosis - Males

1925

1945

1951

1966

1980

1990

19% lower

Risk of Cirrhosis - Males

1925

1945

1951

1966

1980

1990

13% lower

Flemming JA et al. Manuscript under review.
Risk of Cirrhosis - Males

- 1925: 19% lower
- 1945: 13% lower
- 1951: 15% higher
- 1966: 15% higher
- 1980: 37% higher
- 1990:

Flemming JA et al. Manuscript under review.
Risk of Cirrhosis - Males


19% lower 13% lower 15% higher 37% higher 112% higher

Flemming JA et al. Manuscript under review.

Risk of Cirrhosis - Females


19% lower 13% lower 15% higher 37% higher 112% higher

Flemming JA et al. Manuscript under review.
Risk of Cirrhosis - Females

Flemming JA et al. Manuscript under review.

Risk of Cirrhosis - Females

Flemming JA et al. Manuscript under review.
Risk of Cirrhosis - Females

1925
1945
1951
1966
1980
1990

34% lower
15% lower
52% higher
52% higher
111% higher

Flemming JA et al. Manuscript under review.
Risk of Cirrhosis - Females

34% lower 15% lower 52% higher 111% higher 196% higher

Cause of increased incidence?


‘Generation X’ and ‘Millenial Birth Cohorts’
- All under the age of 50 at diagnosis
- ? NAFLD
  - First described in 1980
  - NAFLD most common CLD in children
- ? Increase in HCV in young PWID
- ? Alcohol consumption

Flemming JA et al. Manuscript under review.
Summary

- HCV incidence is on the decline except in younger age groups and women and will continue to be complicated by advanced liver disease into the next decade
- Acute HBV incidence is declining
- Primary liver cancers are on the rise
- Epidemiology of fatty liver in Canada not well characterized
- The face of cirrhosis appears to be changing
  - Younger birth cohorts
  - Increase in female sex

Thank You
Questions?