Theme 6 : How to determine probability of occupational causality in COPD:

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SMT Disclosure

- Patients seen at request of Ont WSIB
- Grant Support previously from Ont WSIB

Clinical issues to consider

- Definition: epidemiologic vs case definition
- Causes and range of specific risk populations – specific occupations or VGDF?
- Confounding factors/ risk factors: smoking, atopy, others
- Clinical diagnosis, overlap syndromes

COPD is not a single disease: can co-exist or overlap

- Asthma – may result in a component of irreversible airflow limitation (ACOS)
- Chronic bronchiolitis – e.g. from nitrogen oxides, sulphur dioxide or from popcorn butter flavoring (smoking-related airway disease usually starts in bronchioles)
- Bronchiectasis

Clinical studies of COPD usually aim to exclude these other airway diseases

Risk Factors for COPD

Genes

Exposure to particles

- Tobacco smoke
- Occupational dusts, organic and inorganic
- Indoor air pollution from heating and cooking with biomass in poorly ventilated dwellings
- Outdoor air pollution

Lung growth and development

Gender

Age

Respiratory infections

Socioeconomic status

Asthma/Bronchial hyperreactivity

Chronic Bronchitis

Occupational COPD

- COPD caused in whole or in part by occupational exposures

The leading risk factor for COPD is smoking

- Smoking accounts for 80% of all COPD
- Smoking is falling, but has been more common in at risk working populations, especially in older workers
- Therefore estimates of COPD related to work must consider smoking as a confounder as well as a possible co-factor

American Thoracic Society Documents

American Thoracic Society Statement: Occupational Contribution to the Burden of Airway Disease

THIS OFFICIAL STATEMENT OF THE AMERICAN THORACIC SOCIETY WAS APPROVED BY THE ATS BOARD OF DIRECTORS JUNE 2002.

‘ ……a value of 15% is a reasonable estimate of the occupational contribution to the population of the burden of COPD. ’

COPD 2007 estimate

Blanc & Torén, Int J Tuberc Lung Dis (IJTLD) 2007; 11:122-33

- 6 studies including > 18,000 subjects;
  1 mortality study >300,000 subjects
- PAR% for occupational exposure:
  Range = 0-37%, Median = 15%
- PAR% Among non-smokers (5 estimates)
  Range =27-53%, Median = 31%

Chronic obstructive pulmonary disease among residents of an historically industrialised area

Darby et al; Thorax, 2012

Cigarettes /VGDF Exposure	Subject n (1183)	Probability COPD	Excess Prob.	Adjusted OR
Never/No	530	0.02	0	1.0 (REF)
Never/Yes	302	0.08	0.06	5.6 (2.6-12)
Low/No	248	0.07	0.05	4.0 (1.8-8.9)
Low/Yes	279	0.18	0.16	15.7 (7.6-32)
High/No	186	0.15	0.13	10.4 (4.9-22)
High/Yes	338	0.31	0.29	32 (16-64)

Low = 20 Pack-years or less; High=>20 Pack-years;
VGDF=Vapors, Gas, Dust, or Fumes by Job Exposure Matrix

UK Biobank study (De Matteis, OEM 2016)

- Q in >500,000 adults 2006-10,
- 397,282 had at least 1 of 3 attempts acceptable spirometry, COPD defined by LLN
- 228,614 with spirometry and a coded current job
- 57% never smoked
- ~11% previous asthma diagnosis
- Stratified analyses – prevalence ratios cases vs healthy but overall findings similar by group

	PR		
	ALL	NS	NA
Seafarers	2.64	3.9	3.1
Coal mine operatives	2.3	na	3.17
Industrial cleaners	1.96	1.0	1.96
Roofers	1.86	1.99	1.53
Packers, canners fillers	1.60	1.67	1.42
Domestics, cleaners	1.43	1.38	1.46
Floorers and wall tilers	1.41	1.46	1.56

Also chemical workers, postal workers, school assistants…

Many other occupations with increased risk airflow obstruction

(Hnizdo et al, AJIM '04)

- - NHANES III data, population aged 30-75
- Defined obstruction as FEV1/FVC <75% and FEV1 <80% predicted
- Most frequent associated industries: armed forces; rubber, plastics, and leather manufacturing; utilities; textile mill manufacturing; health care; food products manufacturing; sales; construction; and agriculture

Examples of higher risk occupations for chronic obstructive airways diseases (excluding asthma)

Occupations	Exposures
• Hog/poultry farmers	• Organic dust, gases
• Cotton workers (byssinosis) and other textile workers	• Dust, endotoxin
• Welders	• Nitrogen oxides, ozone
• Flavoring workers (popcorn workers's lung)	• Diacetyl
• Aluminum pot-workers	• Al fluorides
• Miners	• Silica dust
• WTC dust,	• High pH Calcium oxide dust
• Deployed military workers in Asia	• Gases from burn pits, dusts

Implications of epi studies

- The occupational contribution to COPD from VGDF is especially high among non-smokers,
- but greatest risks of COPD are among smokers with occupational exposures to VGDF and is more than additive
- Risk also increased with alpha-on antitryptase deficiency- do other COPD risk factors similarly increase occupational risks?

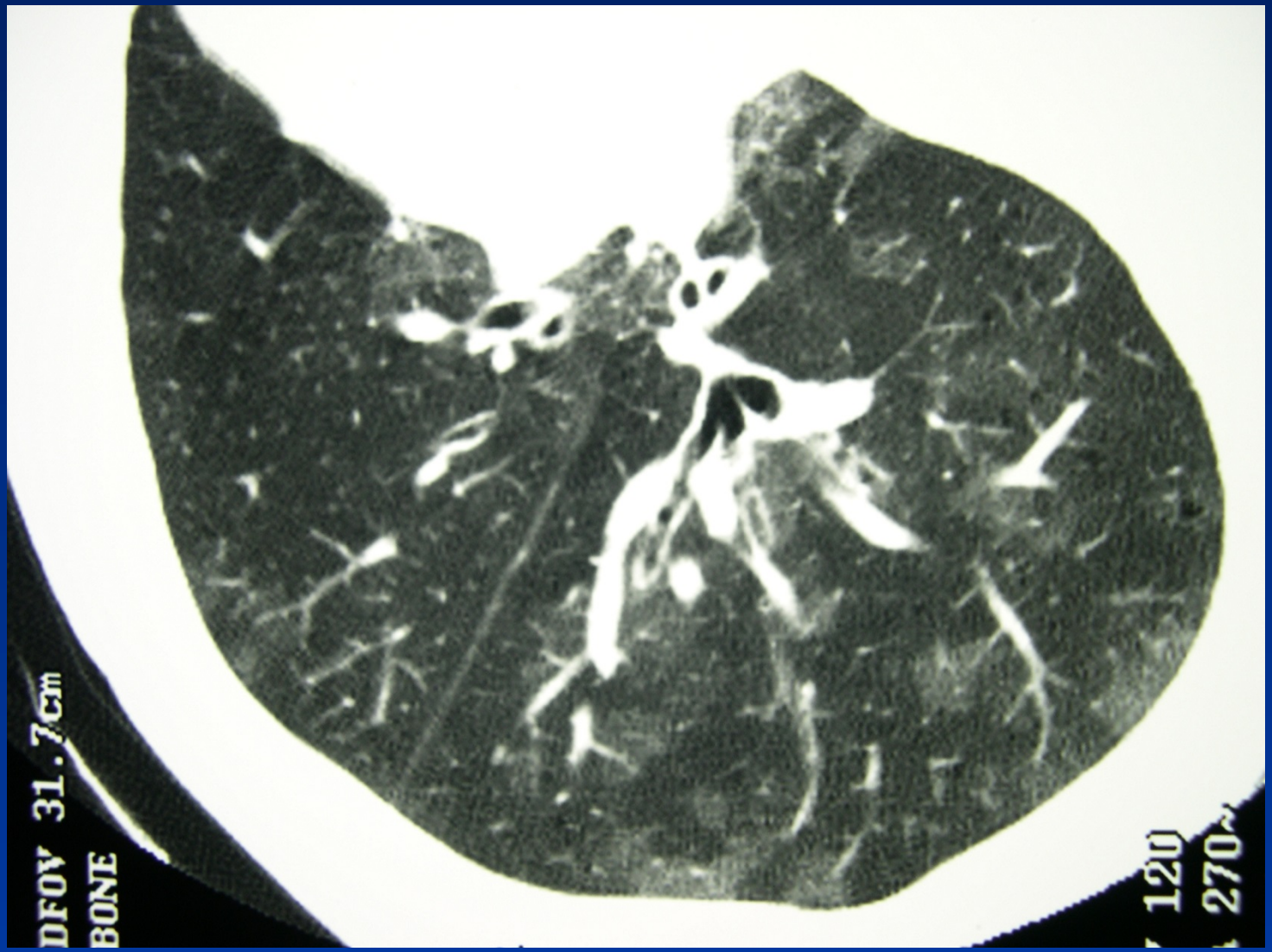
Case example

- Mr MB, age 55
- Smoked 2-3 per day x20y, quit 2004
- Worked x 23 years with TTC as a welder in tunnels, exposed to dusts, including asbestos and welding and diesel fumes (included stainless steel welding and manganese), mostly arc welding
- Progressive SOBOE x2y, now climbing 10 steps
- Cough and clear sputum at work

Case contd

- FEV1 47%, FEV1/VC 40%, FEV1 ↑ 14% (>200ml) post-bd
- Moderate hyperinflation, severe gas trapping, normal DLCO
- Allergy skin tests all negative, including Ni, Chromium salts
- Serial PEFRs 320-360, higher range after prn b-d
- CT chest mosaic attenuation, bronchial wall thickening, mucus plugs – no Asb changes

CT - mosaic attenuation, bronchiolitis (exp image)



Case continued

- Δ Occ COPD with asthmatic component (ACOS) and likely component of bronchiolitis
- Changed work to outdoor delivery for TTC
- Combination LABA, LAMA, ICS + SABA
- Follow-up FEV1 58%, FEV1/FVC 46%, no further b.d response
- Symptomatically improved with outdoor work
- WSIB claim accepted for occ COPD

Other diagnostic issues: medical surveillance

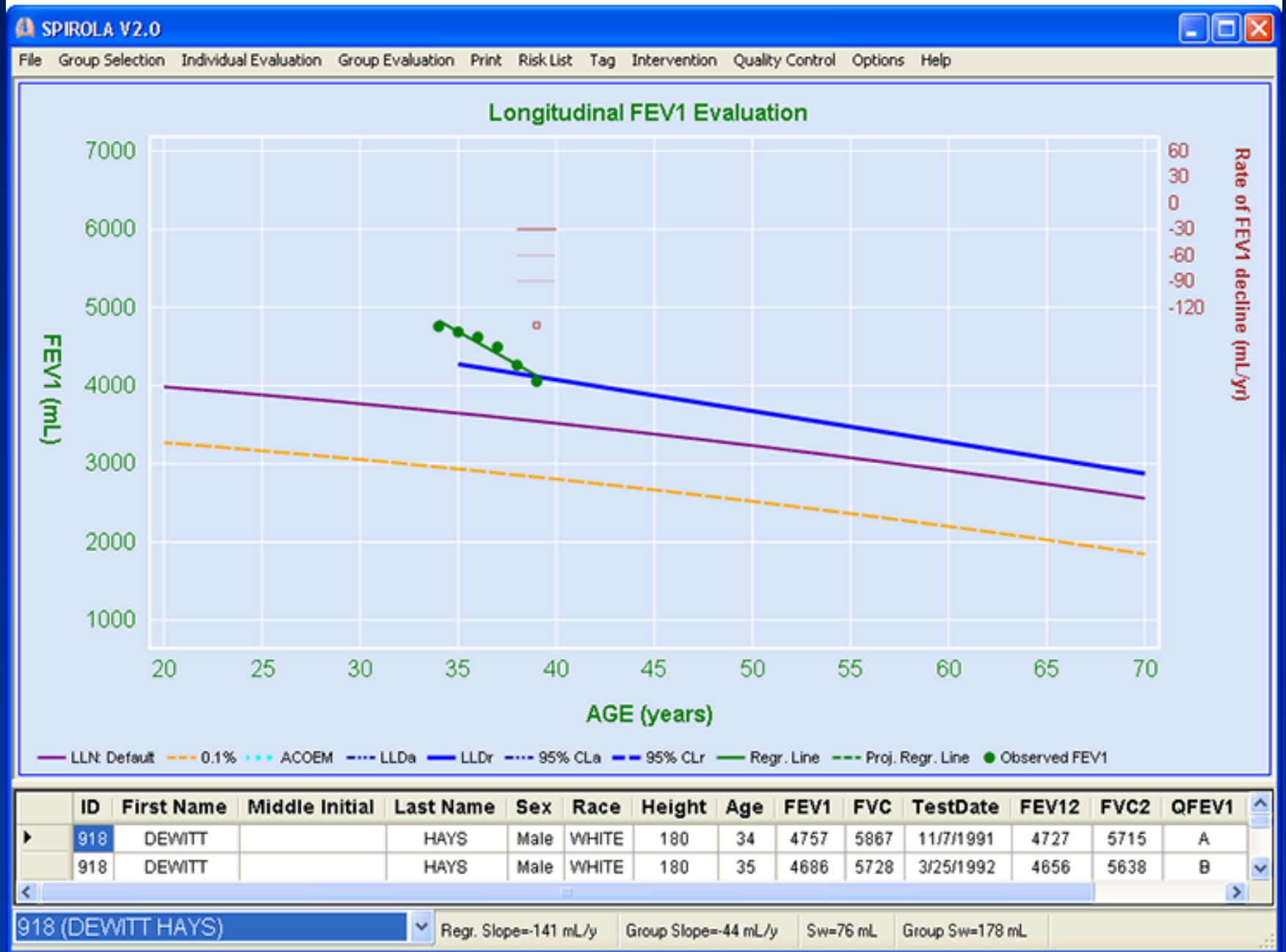
- ? How common
- Has been performed for flavoring workers, miners, and some other higher-risk settings
- Spirometry needs: quality tests, preferably with pre-placement baseline values and longitudinal comparisons (ATS 2014 Statement)
- Need to recognize that baseline values in workers are often “supernormal” and a fall to “normal” values may be a significant change

Spirola program, CDC NIOSH

www.cdc.gov/niosh/topics/spirometry/spirola.html

Percent predicted values for FEV1 and FVC, and the FEV1/FVC ratio plotted against age

Longitudinal FEV1 values (green dots) plotted against age and evaluated against the limit of longitudinal decline (blue line) and the cross-sectional limits: lower limit of normal (purple line) and 0.1th percentile (orange line)



ID	First Name	Middle Initial	Last Name	Sex	Race	Height	Age	FEV1	FVC	TestDate	FEV12	FVC2	QFEV1
918	DEWITT		HAYS	Male	WHITE	180	34	4757	5867	11/7/1991	4727	5715	A
918	DEWITT		HAYS	Male	WHITE	180	35	4686	5728	3/25/1992	4656	5638	B

André…..