Smoke and Mirrors

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PURA DIAGNOSTICS

State of Play

- In the US about 37% of high school seniors reported vaping in 2018, up from 28% in 2017.
- In the UK there has been a 10% increase in use in the same period (2.9 million to 3.2 million users)
- In the US the drive is to acquire more users, i.e. make vaping a life style choice
- In the UK the aim is to convert smokers to vapers without increasing over user

Introduction

- At present ~23 people have died and over 1000's have been hospitalised from vaping in the US. Some states have recommended that everyone stop vaping until they find the cause of death.
  - ? Contaminant, Possibilities include chemical irritation, or allergic or immune reactions to various chemicals or other substances in the inhaled vapours
  - Chemicals present in formulation or made during heating/vaporisation?

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Epidemiology

- Current evidence
  - Fatty substances in Lung Macrophages. Lung scans from patients with vaping illness look like a serious viral or bacterial pneumonia, but those tests come back negative – Lipoid pneumonia
  - Histologists have identified what also looks like lung damage similar to chemical damage e.g. mustard gas

Introduction to Biomarkers

- Direct or indirect measurement of smoke/vaping products or by-products in body matrices that provide an objective indication of the extent of smoke/vape intake over a defined period.

- Examples:
  - Nicotine
    - short half-life
    - can only be measured in blood or urine
  - Total nicotine metabolites
   - uncertain accuracy
  - Thiocyanate
    - Long half-life

The Ideal

- Cheap (i.e. easy to measure)
  - Point of Care or Back to Lab
  - Turn around time
- Sensitive (covers the analytical range)
- Specific (e.g. only found in smoking/vaping)
- Long or short dwell time
- Well documented (published studies)
- No interferences

Common Biomarkers

- Expired-air carbon monoxide
  - ✓ cheap
  - ✓ easy
  - ✓ immediate results
  - ✖ limited to day of testing
  - ✖ cannot pick up occasional smoking or vapers
  - ✖ not specific
- Cotinine
  - ✓ Sensitive & Specific
  - ✖ limited to the past few days
  - ✖ cannot be used in people using NRT

Nicotine Metabolism
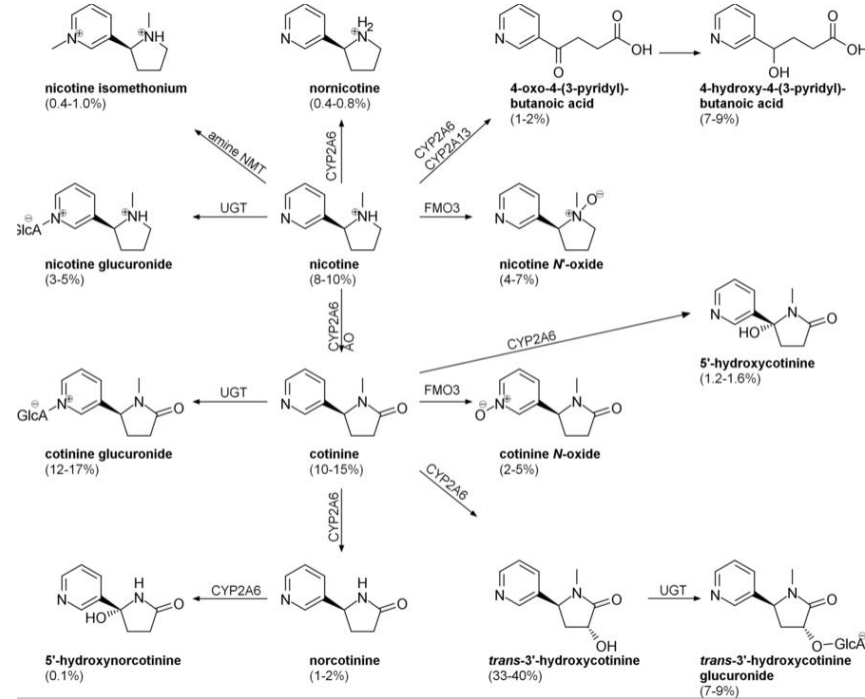
Biomarker Pathway

- Expired-air CO (half life ~2-6 hrs)
  - 10ppm is common but non-smokers very rarely have levels higher than 5ppm and light smokers may have <10ppm
  - Must also take account of pollution
- Cotinine (Urine – elimination half life ~16 hrs)
  - Present for up to 4 days in urine – levels ~1,000 to 8,000 ng/mL urine
  - Different sub-populations may require different thresholds to take account of levels of passive exposure

- Possible New Pathway:
  - Perform a CO measurement with a vitalograph CO type monitor
    - Consider lowering the cut off for smokers to 5-6ppm rather than the 10ppm which was historically used.
  - Combine this with a cotinine measurement (NPT with back to lab if required)
- Results
  - Neg CO and Neg Cotinine – none smoker/Vaper
  - Pos CO and Pos Cotinine – Possible Smoker*
  - Neg CO and Pos Cotinine – Possible Vaper
    - * Cannot differentiate between someone who smokes and vapes.
  - If Cotinine Pos - Perform BTL Cotinine/Anabasine confirmation (with cutoff)