

# SOLUTIONS IN SEWAGE? :

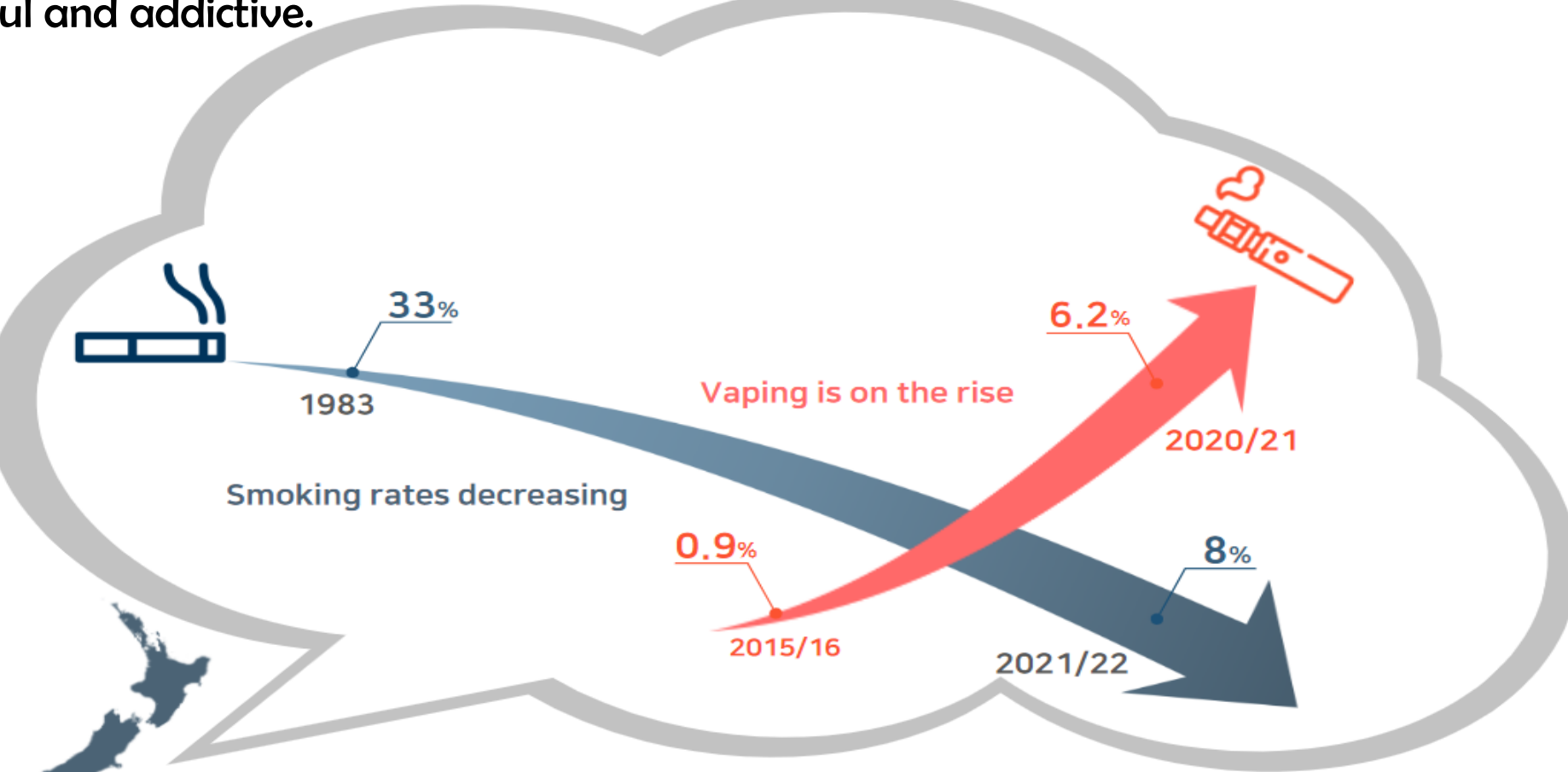
## Wastewater Analysis to Understand Cigarette Smoking and Vaping in NZ

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### Cigarette smoking vs Vaping

Cigarettes (combustible tobacco) kills > 8 million people each year, and it is a major risk factor for various serious illnesses<sup>1</sup>.

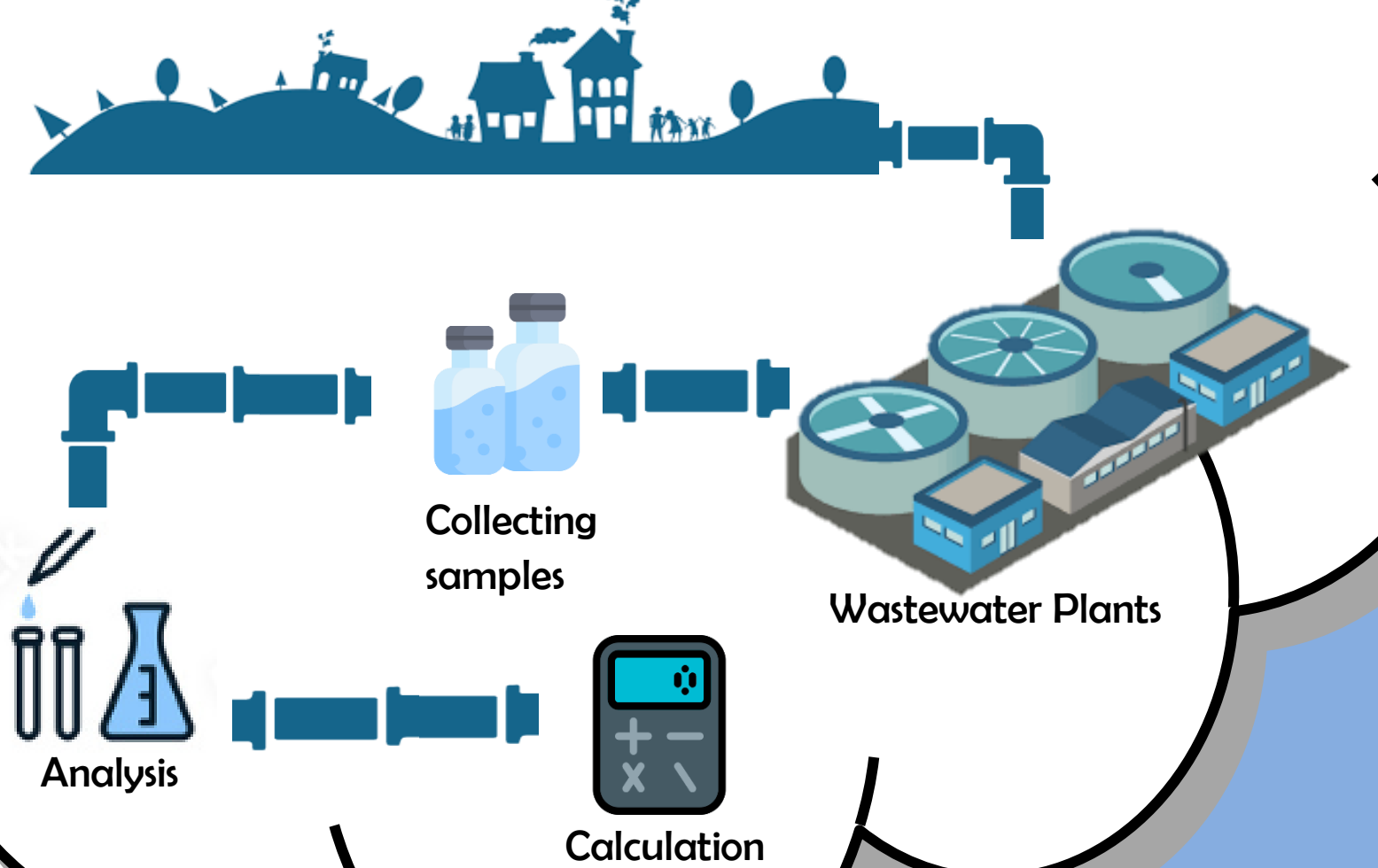
Vaping or e-cigarettes are a device that delivers nicotine with flavouring and other chemicals to the lungs by heating a liquid to create vapour. It is smokeless, but vaping is still harmful and addictive.



Over the ~ 6 years since vaping came to NZ, opposite trends in cigarette smoking and vaping<sup>2</sup> indicate that many cigarette smokers have switched to vaping. However, youth vaping levels in particular are growing at an alarming rate indicating they are rapidly taking up this harmful habit.

### How we measure the consumption?

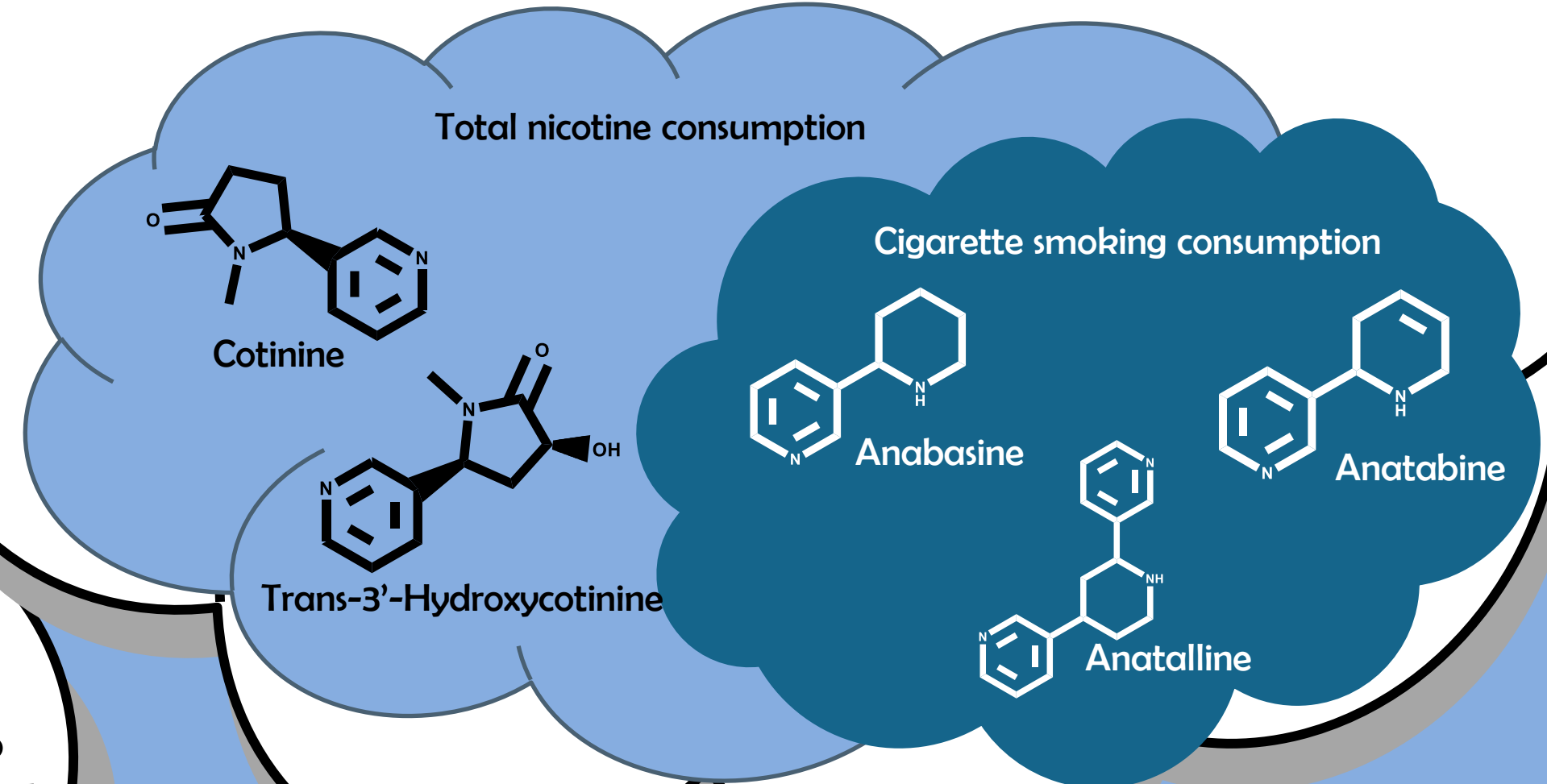
Wastewater samples from the population are collected at wastewater treatment plants, then analysed for specific target metabolites<sup>3</sup> that tell us how much people smoke cigarettes and vape.



### Target metabolites

Two main nicotine metabolites and three tobacco-specific metabolites will be analysed in wastewater<sup>4</sup>.

The total nicotine consumption will be calculated from both cigarette smoking and vaping. We can identify separate rates for vaping and cigarette smoking by separating cigarette smoking consumption from the total nicotine consumption.



### Aims of this research

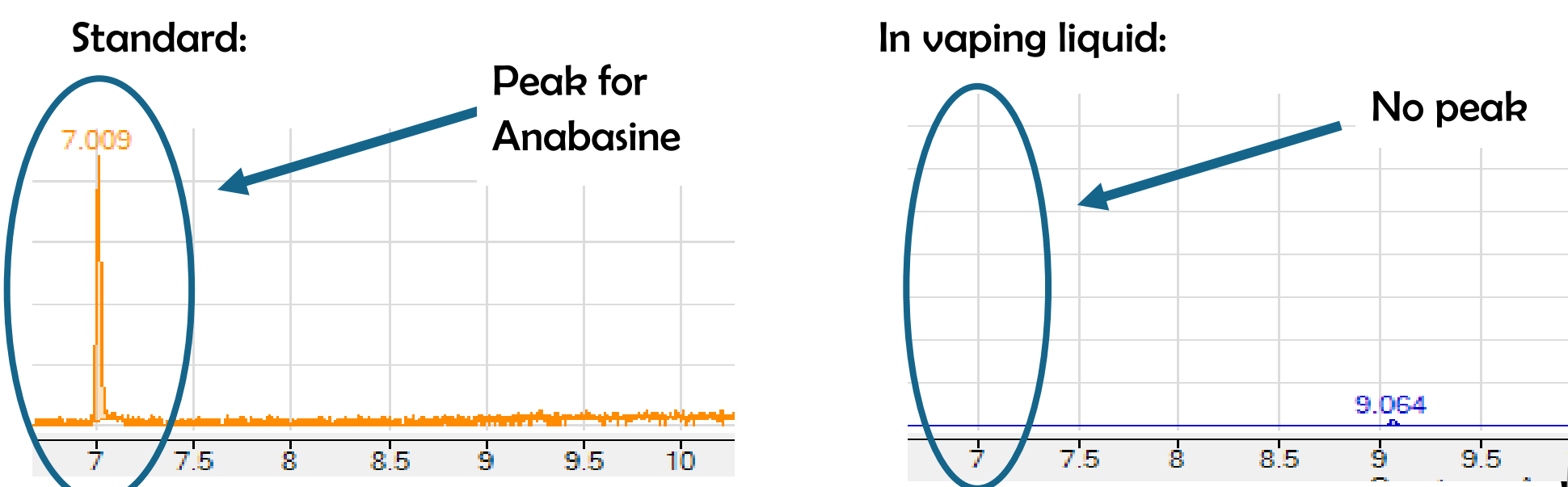
**Overall aim: Analyse smoking and vaping habits in New Zealand**

To do this, we will:

1. Confirm that there are no cigarette smoking target metabolites in NZ vaping liquids to ensure we can separately analyse for cigarette and vaping rates.
2. Develop an analytical methods to analyse target metabolites to measure cigarette smoking and vaping in NZ.
3. Analyse wastewater samples from around NZ to understand and identify smoking and vaping trends & factors that influence these.

### Vaping liquid analysis (Goal 1)

Using GC-MS (Gas-Chromatography-Mass Spectrometry), we have developed a method to analyse smoking specific metabolites (anabasine, anatabine, and anataballine) in vaping liquids.

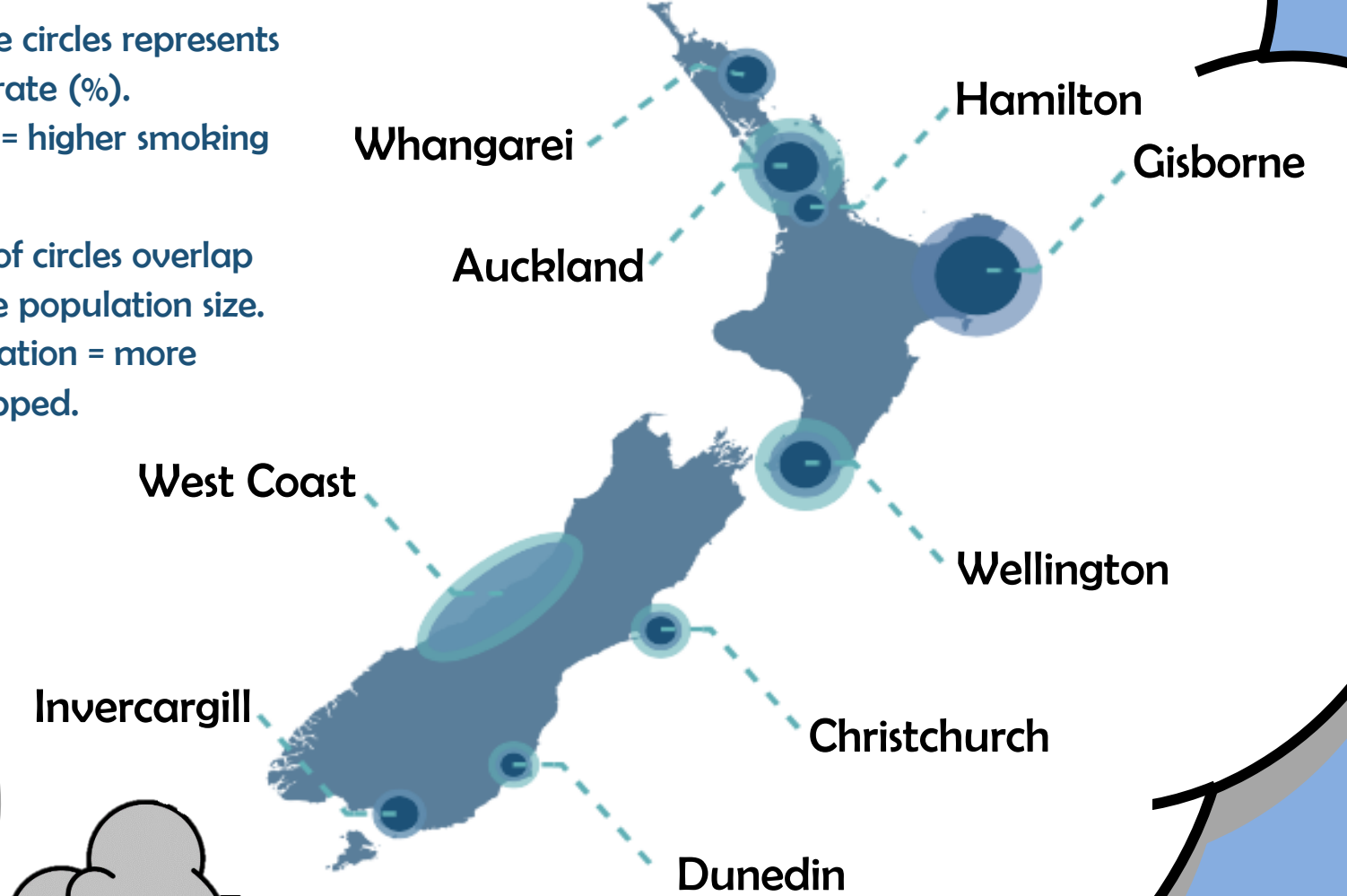


Analysing the vaping liquids, we have found no presence of these cigarette metabolites in vaping liquids, meaning they can be used in the analysis to measure cigarette smoking only.

### Wastewater Sampling

We are collecting wastewater from 9 locations in NZ from May 2023 to Oct 2023. The locations were specifically chosen based on the population demographics, the age of the population, and reported smoking prevalence.

The size of the circles represents the smoking rate (%).  
Bigger circles = higher smoking rate.  
The number of circles overlap represents the population size.  
Larger population = more circles overlapped.



### Progress

- Finalise vaping liquid analysis to confirm target metabolites
- Complete wastewater sample collection and method development to analyse target metabolites
- Analyse data to understand cigarette smoking and vaping trends and influences in NZ

### What this research can do for us?

- Provide real time and updated smoking rates in NZ
- Identify factors that affect the NZ smoking and vaping trends especially among young people
- Provide more reliable information on NZ health policies
- Inform the public and the government about nicotine consumption in NZ

### Acknowledgements

Thanks to:



### References

1) World Health Organization. Tobacco. 2) Ministry of Health-Manatū Hauora. New Zealand Health Survey Annual Data Explorer. Ministry of Health NZ. 3) Wastewater Analysis to Monitor Use of Caffeine and Nicotine and Evaluation of Their Metabolites as Biomarkers for Population Size Assessment. <https://doi.org/10.1016/j.watres.2015.02.002>. 4) Novel Wastewater-Based Epidemiology Approach Based on Liquid Chromatography-Tandem Mass Spectrometry for Assessing Population Exposure to Tobacco-Specific Toxicants and Carcinogens. <https://doi.org/10.1021/acs.analchem.7b02052>.