

NEBULISED TOBRAMYCIN

Nebuliser Residue & Antibiotic Resistance

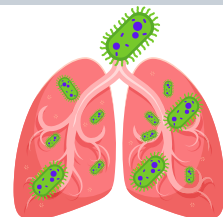


Findings from a collaborative project between Cystic Fibrosis Otago and Otago University



NEBULISED ANTIBIOTICS

People with cystic fibrosis (PWCF) use antibiotics inhaled through a nebuliser to prevent & treat bacterial lung infections. In New Zealand, nebulised tobramycin is recommended for treating or managing infection with *Pseudomonas aeruginosa*, a major cause of lung infection in PWCF.



Members of the Otago CF community have questioned the disconnect between:

Manufacturer advice for cleaning nebulisers



'Rinse & clean to remove residue after use'

and

National advice for disposing of antibiotics



'Never pour down drains or put in household rubbish'

ANTIBIOTIC RESISTANCE

Bacteria are very good at adapting to their environment & changing in ways that decrease or eliminate the effectiveness of antibiotics. This **ANTIBIOTIC RESISTANCE** is a serious & growing health problem.



1. There are lots of bacteria. A few are resistant to the antibiotic.



2. The antibiotic kills bacteria but the resistant strain remains.



3. The antibiotic resistant bacteria now have plenty of room to multiply.



4. Some resistant bacteria can pass their resistance on to other bacteria.

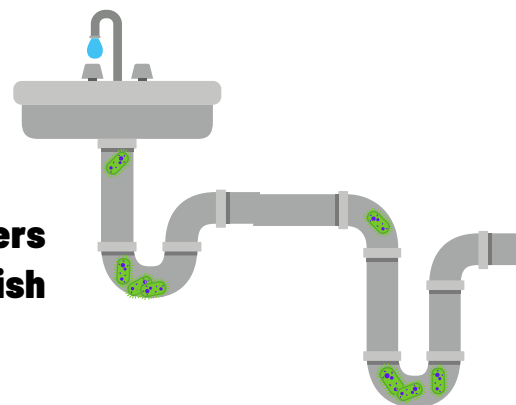
Exposing bacteria to antibiotics creates opportunity for resistance to develop.

To keep antibiotics working, exposing bacteria to antibiotics unnecessarily should be avoided.

RESEARCH QUESTIONS

Pseudomonas bacteria thrive in moist environments and are widely present in drains and soil. This led members of the Otago CF community to pose the question:

'Could rinsing residual tobramycin solution from nebulisers down household sinks, or pouring it into household rubbish bins, contribute to tobramycin-resistant *Pseudomonas*?'



Members of CFNZ (Otago) & scientists at Otago University teamed up to explore:

1. **a. What types of nebulisers and nebulised antibiotics are being used by PWCF?**
b. What methods are being used by PWCF, or their carers, to dispose of residual antibiotic solution after treatment with nebulised antibiotics?



2. **How much antibiotic remains in nebulisers after treatment with nebulised antibiotics?**



3. **a. How might disposing of nebulised antibiotic residue down household drains impact on antibiotic resistance?**
b. What can we do to minimise possible risk to ourselves & the environment?

RESEARCH FINDINGS

1



A telephone survey of 9 PWCF in Otago, & a web-based survey completed by 20 PWCF throughout the rest of NZ found:



- Tobramycin (TOBI)** was the antibiotic most commonly nebulised by PWCF
 - PARI e-flow Rapid and PARI Boy SX** were the two types of nebulisers used by PWCF
- Antibiotic residue was disposed of down household sinks** when nebulisers were rinsed and cleaned. This included:



Draining directly into the sink



Rinsing under tap water into the sink



Rinsing in a container of water (sometimes with dish detergent), which is then poured down the sink

2

The amount of tobramycin in wash water from rinsed nebulisers was measured using Liquid Chromatography Mass Spectrometry (LC-MS).



Three types of nebuliser were tested following inhaled antibiotic treatment (300mg tobramycin) by a PWCF.



For all types of nebuliser, approx **40% of the 300mg dose remained in the nebuliser**

Tobramycin dose



300mg

Tobramycin residue in nebuliser



120mg (40% of dose)

Nebuliser types tested:

PARI e-flow Rapid

PARI Boy SX

PARI Boy Classic*

*PARI Boy Classic is a new nebuliser model replacing the PARI Boy SX



WHAT DOES THIS MEAN ?

This study suggests 40% of a standard tobramycin dose may be rinsed down household drains following nebulised antibiotic treatment for *Pseudomonas* infection in PWCF.

3

An online hui with members of the CF community and Otago University scientists was held to discuss these findings, and to share ideas for practical and safe disposal of antibiotic residue from nebulisers.

*'A PWCF with chronic *Pseudomonas* infection is typically prescribed inhaled tobramycin 300mg twice a day for 28 days, continuing month on-month off. Could pouring 40% of this amount down household drains lead to tobramycin-resistant *Pseudomonas* in those drains?'*



'If 40% of the prescribed dose remains in the nebuliser, does this mean the PWCF isn't receiving as much tobramycin as they should?'

Yes, this is a possibility. How much risk this would pose to individuals with CF is not clear and needs further investigation.

'Can we take the rinse water to a pharmacy for safe disposal?'



No. The 300mg tobramycin dose has been calculated from studies using nebulisers. It allows for the fact that, for various reasons, not all of this dose will reach the lungs.

This is not a service currently offered by pharmacies.

Could the rinse water be poured through some kind of home-based filter system to remove the antibiotic?'

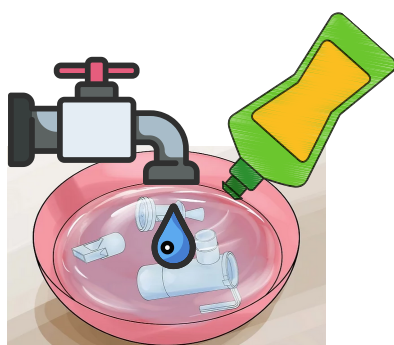


A convenient and low-cost adsorption system that could be used at home is a very interesting possibility that requires further research.

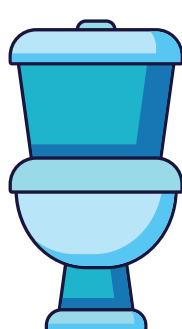


NEXT STEPS

This study has raised a number of questions that require further investigation. At this point, the following strategies around nebuliser hygiene* are advisable.



Wash nebuliser components in warm water and dish washing liquid in a dedicated plastic, glass or metal bowl.



Dispose of nebuliser wash-water down the toilet, closing the lid before flushing.



Clean toilets/drains with bleach - this may help kill any *Pseudomonas* bacteria that are present.

*Bell J, Alexander L, Carson J, et al. Nebuliser hygiene in cystic fibrosis: evidence-based recommendations. *Breathe* 2020; 16: 190328.