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According to Macquarie University researchers, **bees might become bio monitors**, examining their neighborhoods to see how far **antimicrobial resistance** (AMR) has spread.

According to the **World Health Organization** (WHO), at least 700,000 people die each year as a result of drug-resistant illnesses, with AMR expected to kill 10 million people by 2050. However, we have few methods to monitor its proliferation in the environment.

The study, published in Environmental Science and Technology, used honey bees as a "**crowdsourced**" environmental proxy since they forage and interact with pollutants in soil, dust, air, water, and pollen.

"**Bees interact with human environments**, so they are a really good indicator of pollution that may present a risk of harm to humans," says first author Kara Fry, an Adjunct Research Fellow at Macquarie University's School of Natural Sciences as well as a Senior Research and Development Officer at the Environment Protection Authority Victoria (EPA).

"Bees only live for about four weeks, so whatever you're seeing in a bee is something that's in the environment right now."

Fry and lead author Professor Mark Taylor, the EPA Victoria Chief Environmental Scientist, studied 18 colonies from citizen-scientist beekeepers across a variety of land-use types around Greater Sydney.

She took eight bees from each hive and examined what was in their digestive tracts. She was specifically hunting for genetic elements known as Class 1 integrons, which are important drivers of antibiotic resistance. **She also searched for hazardous metals like lead**.

"Class 1 integrons have spread into other natural systems as humans have released their bacteria into the environment." They can now be found on every continent, including Antarctica. "**You can find them in a wide range of settings**," Fry explains.

The study discovered that **more than 80% of the bees tested positive for one or more antimicrobial resistance targets across all hives**, shocking the researchers by demonstrating that AMR is common regardless of land-use context.

Fry and her colleagues anticipated finding more integrons in more densely inhabited areas. Instead, they discovered them all over the place, with higher proportions near bodies of water like dams and lakes.

"**We suspect that the presence of local water bodies that collect run-off is a critical source of AMR contamination**," explains Fry. "Everything from the catchment drains down into that system."

"As expected, our study data revealed that residential and industrial areas were heavily impacted by environmental lead, with higher concentrations in more densely populated areas." AMR, on the other hand, was significantly more prevalent throughout the entire metropolitan area."

While the ability to monitor pollutants and know where their concentrations are highest may be an essential tool in determining where to execute clean-ups, the discovery of how ubiquitous AMR also serves as a wake-up call for people to change their behavior.

"**The misuse and overuse of antimicrobial products are the primary drivers of AMR**." "The message from this research is to use antibiotics only when necessary and as directed, and to dispose of them properly by returning unused medications to your pharmacy," Fry says.

"**We should also look at the products we use in our homes and avoid those with added antimicrobial agents**."

The researchers are currently looking at how bees may detect other environmental toxins, as well as whether certain bird species can be employed in biomonitoring.