Looking for a city's DNA? Try its ATMs

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A depiction of the double helical structure of DNA. Its four coding units (A, T, C, G) are color-coded in pink, orange, purple and yellow. Credit: NHGRI

Automated teller machine keypads in New York City have plenty of microbes but they're mostly from normal human skin, household

surfaces or traces of food, according to a study published this week in *mSphere*, an open access journal from the American Society for Microbiology.

"Our results suggest that ATM keypads integrate microbes from different sources, including the human microbiome, foods, and potentially novel environmental organisms adapted to air or surfaces," said senior study author Jane M. Carlton, PhD, director of the Center for Genomics and Systems Biology, and professor of biology, at New York University. "DNA obtained from ATM keypads may therefore provide a record of both human behavior and environmental sources of microbes."

During the study - part of a larger effort to study microbes across New York City—the investigators in June and July 2014 took swabs of keypads from 66 ATM machines in eight neighborhoods over three New York boroughs: Manhattan, Queens and Brooklyn. Four of the machines were located outdoors. Then, in the lab, they studied samples with 16S amplicon sequencing, used to identify and compare bacteria; and 18S amplicon sequencing, used to identify parasites, fungi and protists (other microscopic organisms).The most abundant bacteria found across most samples were normal human skin microbes from the *Actinobacteria*, *Bacteroides*, *Firmicutes*, and *Proteobacteria* families. Overall, the bacteria samples had low diversity and showed no obvious clustering by geography. In the 18S sequencing, investigators found some fungi and low levels of protists.

The most common identified sources of microbes on the keypads were household surfaces such as televisions, restrooms, kitchens and pillows. Researchers found microbes from bony fish and mollusks, and from chicken on some neighborhood ATMs, suggesting that residual DNA from a meal may remain on a person's hands and be transferred to the ATM keypad upon use.

ATM keypads located in laundromats and stores had the highest number of biomarkers, with the most prominent being Lactobacillales (lactic acid bacteria), which is usually found in decomposing plants or milk products. In samples from Manhattan, researchers observed the biomarker Xeromyces bisporus, a foodborne mold associated with spoiled baked goods. "It seems plausible that this fungus may have been transferred from people who have recently handled baked goods, particularly in a commuter-heavy area such as Midtown Manhattan where there are many nearby convenience stores and cafés selling this type of food product to business workers," Carlton said.

Researchers found no significant difference in the keypads from ATMs located outdoors versus indoors.

Since each ATM keypad in New York City is most likely utilized by hundreds of people each day (and may come into contact with air, water, and microbes from different urban surfaces), the microbial communities obtained in this study may represent an "average" community that is effectively pooled from vastly different sources, said study coauthor Maria Gloria Dominguez-Bello, PhD, an associate professor in New York University School of Medicine's Human Microbiome Program.

The relative lack of diversity among locations could result from periodic cleaning of the machines, which would wipe out some of the microbes, as well as usage of ATMs by tourists, commuters from other locations, etc., the researchers said. Next, they'll study microbes in the city's cats, dogs, mice, pigeons and cockroaches.

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