

# Moon may hold frozen water in more places than suspected

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CAPE CANAVERAL, FLA.

The moon's shadowed, frigid nooks and crannies may hold frozen water in more places and in larger quantities than previously suspected, good news for

astronauts at future lunar bases who could tap into these resources for drinking and making rocket fuel, scientists reported Monday.

While previous observations have indicated millions of tons of ice in the permanently shadowed craters of the moon's

poles, a pair of studies in the journal *Nature Astronomy* take the availability of lunar surface water to a new level.

More than 15,400 square miles of lunar terrain have the capability to trap water in the form of ice, according to a team led by the University of Colorado's Paul Hayne. That's 20% more area than previous estimates, he said.

These ice-rich areas are near the moon's north and south poles. Temperatures are so low in these so-called cold traps — minus 261 degrees Fahrenheit — that they could hold onto the water for millions or even billions of years.

"We believe this will

help expand the possible landing sites for future lunar missions seeking water, opening up real estate previously considered 'off limits' for being bone dry," Hayne said in an email to *The Associated Press*.

Using data from NASA's Lunar Reconnaissance Orbiter, the researchers identified cold traps as small as a few yards across and as wide as 18 miles and more, and used computer models to get all the way down to micrometers in size.

"Since the little ones are too small to see from orbit, despite being vastly more numerous, we can't yet identify ice inside them," Hayne said. "Once

we're on the surface, we will do that experiment."

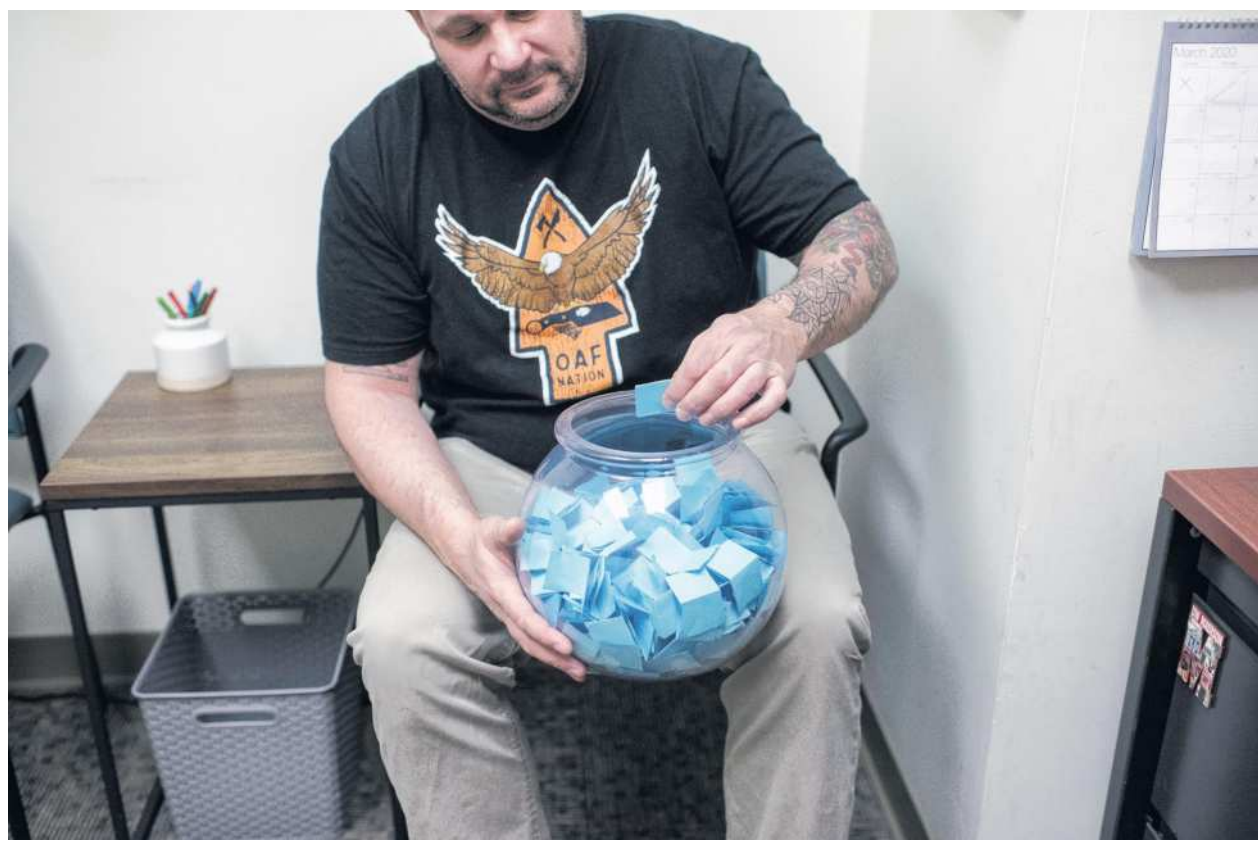
For a second study, scientists used NASA's airborne infrared observatory *Sofia* to conclusively identify water molecules on the sunlit portions of the moon, just outside the polar regions. Most of these molecules are likely stored in the voids between moon dust and other particles or locked inside glassy volcanic material.

Scientists believe all this water on the moon came from comets, asteroids, interplanetary dust, the solar wind or even lunar volcanic eruptions. They'll have a better idea of the sources "if we can get down on the surface and

analyze samples of the ice," Hayne said.

The lead researcher, Casey Honniball, a post-doctoral fellow at NASA's Goddard Space Flight Center, said at a news conference that she wanted to make it clear the *Sofia* study had not found puddles on the moon. Rather, the identified hydrogen and oxygen molecules are so far apart, they are neither in liquid or solid form, she noted.

NASA is under White House direction to put astronauts back on the moon by 2024. The space agency wants its new Artemis moon-landing program to be sustainable, unlike the Apollo program a half-century ago.



HANNAH YOON NYT

Stephen Goldschmidt draws a slip of paper from a bowl as part of his contingency management treatment at the Philadelphia Veterans Affairs Medical Center on March 4. Some slips offer encouraging messages; others, monetary rewards.

# This addiction treatment works, but it's underused

BY ABBY GOODNOUGH  
*The New York Times*

PHILADELPHIA

Steven Kelty had been addicted to crack cocaine for 32 years when he tried a different kind of treatment last year, one so basic that he was skeptical.

He would come to a clinic twice a week to provide a urine sample, and if it was free of drugs, he would get to draw a slip of paper out of a fishbowl. Half contained encouraging messages — typically, "Good job!" — but the other half were vouchers for prizes worth between \$1 and \$100.

"I've been to a lot of rehabs, and there were no incentives except for the idea of being clean after you finished," said Kelty, 61, of Winfield, Pennsylvania. "Some of us need something to motivate us — even if it's a small thing — to live a better life."

The treatment is called contingency management, because the rewards are contingent on staying abstinent. A number of clinical trials have found it highly effective in getting people addicted to stimulants like cocaine and methamphetamine to stay in treatment and stop using. But outside the research arena and the Department of Veterans Affairs, where Kelty is a patient, it is nearly impossible to find programs that



MADDIE MCGARVEY NYT

Jodi Waxler-Malloy at her home in Toledo, Ohio, on March 9. Waxler-Malloy tried contingency management for a few months last year.

offer such treatment — even as overdose deaths involving meth, in particular, have soared. There were more than 16,500 such deaths last year, according to preliminary data, more than twice as many as in 2016.

Early data suggests that overdoses have increased even more during the coronavirus pandemic, which has forced most treatment programs to move online.

Researchers say that one of the biggest obstacles to contingency management is a moral objection to the idea of rewarding someone for staying off drugs. That is one reason publicly funded programs like Medicaid, which provides

health coverage for the poor, do not cover the treatment.

Some treatment providers are also wary of giving prizes that they say patients could sell or trade for drugs. Greg Delaney, a pastor and the outreach coordinator at Woodhaven, a residential treatment center in Ohio, said, "Until you're at the point where you can say, 'I can make a good decision with this \$50,' it's counterproductive."

Two medications used to treat opioid addiction, methadone and buprenorphine, have been viewed with similar suspicion because they are opioids themselves, even though research shows they substantially reduce

the risk of death and help people stay in treatment. But the federal government has started aggressively promoting such treatment for opioid addiction, and has heavily invested in expanding access to it.

There are no medicines proven to suppress the cravings that come with addiction to meth and cocaine. Instead, there are a raft of behavioral interventions, some of which have little evidence of effectiveness.

"The most common treatment is to do whatever the hell you feel like," said Michael McDonell, an associate professor at Washington State University who has conducted a number of studies on

contingency management. "We had two statewide meetings about meth recently, and at one, a colleague said, 'Why aren't we just doing contingency management? Why would we spend all this money on interventions that won't work?'"

The fact that no public or private insurer will pay for contingency management, except in a few pilot programs, is a major challenge to expanding it; the biggest obstacle is that offering motivational rewards to patients has been interpreted as violating the federal anti-kickback statute. A group of treatment experts recently asked the Department of Health and Human Services to waive the statute for two years as it pertains to contingency management, but the agency refused, saying programs that provide rewards need to be evaluated on a case-by-case basis.

Congress recently told states that they could start spending federal "opioid response" grants on treatment for stimulant addiction, but the agency that distributes the grants allows only \$75 per patient, per year, for contingency management.

"The biggest question is, How do we get the payers on board with this?," said Eric Gastfriend, the chief executive of DynamiCare Health, a technology company in Boston. The company has worked with BrightView and other treatment programs to provide contingency management through a phone app that patients can use to share saliva test results with providers in real time, via video. For rewards, patients can earn up to \$600 over the course of a year through DynamiCare, on a debit card that blocks cash withdrawals and purchases at liquor stores and bars based on merchant category codes.

"I was hesitant to try it — like, hey, is this legal?" said Dr. Shawn Ryan, the chief medical officer and president of BrightView Health, an addiction treatment provider with locations throughout Ohio, which started using contingency management last year. But the results have been striking, he said, adding, "I'm talking about significant improvements in attendance to therapy sessions, significant reductions in drug and alcohol use."

Federal officials say that they want to expand access to contingency management for stimulant addiction, but that finding an effective medication for it would be better.

"If we were paying for it, that would help," Dr. Nora Volkow, the director

of the National Institute on Drug Abuse, said of contingency management for meth addiction. "But we badly need medications to help strengthen the response to behavioral interventions. This is a highly, highly addictive drug."

One patient at BrightView Health, Jodi Waxler-Malloy, 47, of Toledo, Ohio, tried contingency management treatment after participating in more than a dozen treatment programs for cocaine, heroin and meth addiction since her early 20s.

BrightView restarted her on buprenorphine for her heroin addiction and set her up with the DynamiCare app and debit card as an incentive to stay off meth. DynamiCare would add between \$1 and \$25 to her debit card whenever she went to BrightView for a doctor appointment or therapy, though she never knew the amount ahead of time.

"Nothing's for free, so at first I said, 'Yeah, yeah,'" Waxler-Malloy said. "But the next day, I looked at the app on my phone and they'd given me \$25 for detoxing. Wow, really? I went back the next day and I got \$5 more."

Waxler-Malloy said the monetary rewards helped her get through the first month of sobriety in particular, a period when her housing was precarious, her cravings were intense and she needed to save whatever money she earned waitressing for rent at a sober living house that she was waiting to move into.

"It was enough to buy cigarettes or grab something to eat," she said. "Maybe I was going to the appointments and meetings for the wrong reason at that time, but it helped me in the long run — helped me meet people, have a support group."

Contingency management has been used the most by the Department of Veterans Affairs, where 110 clinics and hospitals have employed it since 2011 to help more than 5,100 veterans stay off drugs.

One problem with contingency management, evidence suggests, is that people have less success staying abstinent after the treatment ends. For that reason, Richard Rawson, a researcher at the University of Vermont who has studied meth addiction for decades, believes it should be used indefinitely, just as medications for opioid addiction often are.

"Unfortunately, addiction is a chronic brain disease and treatments need to be designed to accommodate this reality," he said.