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## The Harsh Truth Behind the Vaping Epidemic

Dr. Doghramji:

Since 2015 JUUL vaping devices have swept away a young demographic with its sweet flavors and easy to use capability and the numbers behind this trend are worrisome. According to a recent study, 60% of high schoolers and 54% of middle schoolers use JUUL as their nicotine vaping product but why are so many kids getting hooked on JUUL even amid the nationwide health scare surrounding these vaping devices?

Welcome to Clinician's Round Table on ReachMD. I'm Dr. Paul Doghramji and here with me to talk about a recent study that may help answer that question is Dr. David Peyton, a Professor of Chemistry at Portland State University. Thanks for joining us today Dr. Peyton.

Dr. Peyton:

I'm glad to be here. Thank you for inviting me.

Dr. Doghramji:

So Dr. Peyton, vaping is obviously a hot topic right now that's getting a lot of coverage, so can you catch us up to speed on what we currently know about it?

Dr. Peyton:

Well, we have a fair amount of knowledge about the range of devices. They can be fairly complex things the hobbyist would want to use all the way to very, very simple devices as exemplified by the JUUL pods which anyone can just take out of the package and use almost immediately. There's a lot we also do not know. The manufacturers do not provide a whole lot of detail about say the flavorings that they're putting in them, although they do say approximately how much nicotine is in each of them, which is important to know. We also know that as you heat up the liquids that deliver the nicotine in the devices that the liquid nature can change. You can have chemical reactions so that you degrade a small fraction of the e-liquid and because the solvents are indeed the bulk of the e-liquids, the propylene glycol and glycerol that make up the solutions can change to other molecules and so we're getting a better view of what those are and trying to figure out the toxicology so we can say how dangerous are those. But the bottom line that I'm making right now is that what you put into a device is not necessarily what you inhale that comes out of that device.

Dr. Doghramji:

I see and can you tell us a little bit about vitamin E acetate and why the CDC recently coined it as an official quote on quote "scapegoat" for the vaping crisis?

Dr. Peyton:

Yeah. So vaping is a term that is used both for nicotine delivery devices and for cannabis delivery devices - concentrated cannabis oil. And it turns out that vitamin E acetate is an additive for specifically the cannabis systems. I've never heard of it being used for an exclusively nicotine system. This is an additive that's put in to cut the concentration of the cannabis in those devices and that can make it a higher profit margin for the people who are selling it. Now the vitamin E acetate is very viscous so it mimics the physical properties of the cannabinoids. Now, when those are inhaled, it acts, apparently, like an oil in the lungs which can be quite toxic and that has been found, this vitamin E acetate, in a huge number of patients who are suffering with the lung disease that's associated with vaping. So, this vitamin E acetate problem seems to be associated primarily, if not exclusively, with cannabis users.

Dr. Doghramji:

I see. Very interesting. So, alright, now that we have some background on what we know about vaping, let's dive into the details of the study you and your team conducted. What exactly did you investigate and what were some of the key findings?

Dr. Peyton:

What we investigated was the formation of what's called a nicotine salt in e-liquids and this is the formulation that's been brought to market by JUUL and other electronic cigarette manufacturers but, first of all, JUUL. And what the nicotine salt product does versus just the the bare nicotine otherwise known as the freebase nicotine, is the nicotine salt formulation makes the nicotine less volatile, less likely to go into the gas phase as you're vaping. And the way you form this is by adding acid to the e-liquid formulation. So, JUUL adds benzoic acid. And what this allows them to do is increase the concentration of nicotine in the e-liquids to actually a quite high level without making it harsh. If you just added freebase nicotine without this acid then at that high nicotine concentration, it would be very difficult for a novice user to tolerate or, in fact, many advanced users to tolerate. So, by making the salt, they can increase the concentration up to nearly 60 mg/mL of nicotine. Now, this is interesting because it made the percent freebase concentration between 10 and 20%, which almost exactly matches the freebase concentration in the most popular cigarette worldwide which are the Marlboros. And so, in terms of nicotine dosing, or at least nicotine availability in terms of the concentration of the nicotine, and how the nicotine feels, the nicotine impacts, which is related to that 10 to 20% freebase concentration, this makes the JUUL almost a perfect mimic for this most popular cigarette.

Dr. Doghramji:

Well, now I think there's a common misconception especially among young people that these JUUL devices are safer or less addictive than the cigarettes but your study seems to definitively disprove that rather. Is that correct?

Dr. Peyton:

Well, what our study shows is that it very likely has a very similar addictive quality to what standard cigarettes have, the Marlboros and those like the Marlboros. As far as safety goes, we don't actually address that in this study. That's a lot of other molecules that are not nicotine, so I would not say that this study talks about safety. But, as far as addictiveness, yeah, our study sort of predicts that the JUUL would be very, very addictive and that certainly is what the people doing sociology type measurements on high school kids using JUUL indicates.

Dr. Doghramji:

Alright. So then can you comment on how JUUL devices are similar to cigarettes and how they are different?

Dr. Peyton:

Well, they're similar in terms of the amount of nicotine they deliver and the harshness or lack of harshness of that nicotine. That's what JUUL has really hit upon, the high concentration of nicotine while not being harsh. And again, this mimics some of the most popular, biggest selling cigarettes worldwide and they're the biggest selling, most popular for a reason. They drive accessibility and addictiveness.

Dr. Doghramji:

So, for those just tuning in, this is Clinician's Round Table on ReachMD. I'm Dr. Paul Doghramji and today I'm speaking with Dr. David Peyton about the vaping epidemic and the latest research surrounding it. So, Dr. Peyton, now that we've covered the fascinating results that your team did recently, I'd like to look at this vaping issue as a whole. So, what would you like physicians to know so that they can better inform and care for their patients who do vape?

Dr. Peyton:

Well, first of all, that not all vaping devices for nicotine are the same. Some of them deliver low concentrations of nicotine with high freebase content and those can be perceived during the initial vaping process as very similar to something like a JUUL or the other mimics of JUUL, which are the nicotine salt, which deliver a very high concentration of nicotine without being harsh and you can see how that could be a real potential driver of addiction and fairly quickly during use. It also happens, of course, that JUUL devices are sleek. They're very user accessible in terms of you don't have to fiddle with them very much. You can charge them in your computer port, USB powered system. You can hide them pretty readily and they don't produce a huge cloud of vapor during the vaping. So, it's easy for people to sort of hide their use. But, just because they don't produce a high cloud of vapor, does not mean that they're not addictive.

Dr. Doghramji:

Well, now the CDC along with the FDA, they're telling physicians to report cases of e-cigarette use. Do you think this will help the crisis our nation is currently facing or are other interventions needed?

Dr. Peyton:

That is I think a difficult question. I think it's going to be useful if we can get better data to know what the overall usage patterns are. If one is looking at what is driving initial usage of course there's a lot of discussion with the current regulations having just come out or at least recommendations, for eliminating flavors in pod systems. I would be concerned that a lot of users of those pod systems will

probably turn to the tank systems where flavors are still being, going to be allowed and, if anything, I would like to see recommendations for people getting off of the salt formulations and, moving them more towards the freebase formulations where the concentration of nicotine is inherently lower and then people could potentially go to lower and lower nicotine concentrations and then eliminate vaping from their usage which is always going to be the healthier alternative.

Dr. Doghramji:

Well, unfortunately, we're almost out of time today, Dr. Peyton, but before we close, I know the jury may not be out on this just yet, but can you tell us if there'll be any long-term side effects on our younger patients who have been hooked on vaping?

Dr. Peyton:

Well, clearly, if they continue with high nicotine concentrations, there are more and more studies coming out showing, they're going to be cardiological events in a certain fraction of the population, cardiovascular, and lung-related issues, um, but then there's also degradation of the e-liquid solvents, the propylene glycol and glycerol that make up that liquid and what the long-term effects of carbonyl compounds like formaldehyde, which are generated and acrolein and several others, unfortunately, we're probably going to be, as a society, having to monitor that in the population for decades to come in order to see what exactly is going to come up. But there almost certainly will be effects coming up from that. I do not mean to be alarmist saying that these are less dangerous than cigarettes is something I'm somewhat comfortable in asserting. How much less dangerous, we don't know yet.

Dr. Doghramji:

Very interesting to know. And David, I'd like to thank you for joining me to talk about this widely discussed topic and for giving us insights into this recent study on vaping. It was great having you on the program today.

Dr. Peyton:

Well, thanks so much for having me.

Dr. Doghramji:

I'm Dr. Paul Doghramji and you've been listening to Clinician's Round Table on ReachMD. To access this episode and others in this series, visit [ReachMD.com/CliniciansRoundTable](https://ReachMD.com/CliniciansRoundTable) where you can be part of the knowledge. Thanks for listening.