Madame Chair and Committee Members

My name is Meshaila Sinnis and I am the co-owner of The End Vapor Shop. We have 2 locations one in New Glasgow and another in Truro. Our business serves thousands of customers with their choice of electronic cigarette products. We were Atlantic Canada's first electronic cigarette brick and mortar location. I am proud of our business, and the products we sell. Our industry has set voluntary standards, and as such we do not sell to anyone under the legal smoking age.

I want to take a few minutes to talk about the inaccurate comments, and statements I heard on October 28th, on the second reading of Bill 60.

1. The statement that electronic cigarettes with fruit flavours are attractive to children is not only misleading, it's false. Fruit flavours are designed for adults, the same adults that choose fruit flavoured liquor, coffee, and other products. Adults enjoy fruit flavours in a variety of products. Becoming and adult does not mean we lose our sense of taste. By suggesting that our business, and industry makes fruit flavours to entice children is unsupported, by science, and is fear mongering at best. It's misleading, and is a slam against the industry I support.

2. Electronic cigarettes are not a tobacco product. E-liquid does not contain tobacco, does not create smoke, and does not create lethal tars. It's false to claim electronic cigarettes are a tobacco product, when no part of the product is a tobacco product. To claim something that its not, is not ethical, and is not in my view legal to do. Regardless of the fact that nicotine comes from tobacco it does not make it a tobacco product. Examples of this are Nicotine gums are not marketed as a tobacco product.- They are a drug designed to assist smokers quit smoking.

3. Canadian Tobacco firms and parents, have no plans for marketing electronic cigarettes in Canada. The allegations, that our industry is connected to the tobacco industry are totally false.

We heard on Oct 28th, three MLAS spoke in favour of Bill 60. What were so evident are the personal slants that were proposed. We heard repeatedly from those MLAS, that our industry is not supportive of regulations. We heard statements that our products could be a gate way to smoking, we also heard that "We should have seen this coming" These statements are concerning for many reasons.

As a vendor I agree with sensible, regulations that protect children, and clearly support the message that electronic cigarettes are an adult product. I agree with restrictions on advertising, and manufacturing standards. But I cannot accept slamming of this industry on fears, and misleading statements from officials, the same officials that admitted they have received " a mountain of emails, and phone calls" then turn around and ignore every single one of them. It's clear by the statements on Oct 28th, you're not interested in working with our industry, or sitting down at a table to discuss concerns. We have yet to have a round table discussion. What we have is Bill 60, which in effect will destroy my business, as consumers will simply purchase from other vendors in other provinces.

Removing access to the very product that has reduced harm is going to reverse the gain we have made over the past few years of smokers switching since the electronic cigarette was introduced. Those very same consumers who will just turn back to cigarettes, I understand this topic brings emotion, but fear based emotion is lethal. And in this case will have lethal consequences for my consumers.

Today we know the current smoking death rate has remained constant for decades Here we have a product that could reverse death, disease and disability in a just a few decades, if we supported it. I find it mind boggling to say the least when we know NRT have been a total failure for public Health. In the 1970's every public health unit wanted to find a safer product for smokers and in 2014 we have it. We know that smokers smoke for the nicotine, they die from the tar. Quite or Die is the only mantra public health wants to hear. You're refusing to accept the facts that electronic cigarettes that have fruit flavours are what consumers want. NRT is a failure due to price, taste, and delivery method. Over 98% of users fail on this product. Electronic cigarettes do one thing; they change the delivery method on nicotine. They are not an approved quit smoking product.

I will also point out that nicotine gums, sprays now come in your so called "kiddy flavours" such as "fruit explosion" and "fruit winterchill" you might be shocked to know this product is OTC, and has no age restrictions. Your constant analogy of kiddy flavours makes no sense when the number one NRT comes in those same flavours. Why are you not attacking that product? Menthol products are not popular in tobacco nor in electronic cigarettes. The majority of my consumers will not tolerate this flavour.

In closing, the facts are clear, electronic cigarettes can and do reduce harm, and save lives, restricting flavours will just drive this market underground, and makes no sense when many other adult deigned products like NRT, liquor, and even condoms come fruit flavoured. There is not one family that has not had to deal with the lethal consequences of tobacco use. The bottom line is electronic cigarettes are not a tobacco product, are not associated with death, or disease. We agree that nicotine is a lifetime of addiction, - correct regulations can protect youth from this product, like we do for liquor and adult products. Including electronic cigarette in educational programs to show youth how addictive this product is would be a far better avenue to protect youth so they don't ever start, then proposing a ban on flavours which will do nothing but move those consumers underground.

We cannot wait for decades for science, to act on a life saving product. We understand the science surrounding this product is in the beginning stage, but what we know so far is most would recognize the product is at least 90% safer if not more. Waiting decades now, stalling progress will result in the next 25 years in over a million deaths. The fruit flavour issue is what makes this product a success. Removing access to this element will result with lethal consequence for consumers. Unless you're willing to have liquor sold behind cupboards, stripped of flavour and remove all NRT that contain fruit, this concept makes no sense. I urge you to vote no to bill 60, voting yes will mean more death, and more disease for the very same population your trying to protect.

Please allow me to introduce medical journal (1) titled *'Impact of Flavor Variability on Electronic Cigarette Use Experience: An Internet Survey'*

4616 participants were tested. This journal concludes that E-juice flavorings play a major role in the overall experience of dedicated users and support the hypothesis that they are important contributors in reducing or eliminating smoking consumption.

Please allow me to introduce medical journal (2) titled '*Characteristics, Perceived Side Effects and Benefits of Electronic Cigarette Use: A worldwide Survey of More than 19,000 consumers'*

19,414 participants were surveyed.The journal concludes that Ecigs are used as long-term substitutes to smoking. They can be effective even in subjects who are highly dependent on smoking and are heavy smokers.

Also take note, Dr. Konstantinos Farsalinos a renowned cardiologist and researchers for Onassis Cardiac Surgery Center headed these journals.

Please allow me to introduce Ingredients list (A). Here you will find A list of the ingredients in Electronic Cigarettes in comparison to Tobacco Cigarettes. The highlighted ingredients in the traditional cigarettes are added flavor. Will you be considering the push to ban them as well? We don't have time to read through this but I could only hope you will and realize how horrific some of these ingredients are and perhaps it may enlighten you as to why I will not allow the ecigarette to be lumped with tobacco.

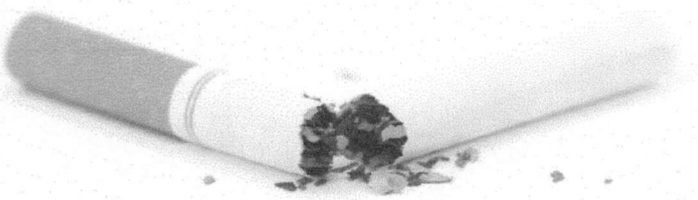
I have added studies 3 and 4. I put these in here so you could take a moment and understand that what is in the vapor isn't harmful to it's bystanders. Although I will not argue the indoor vaping ban, it doesn't hurt to see the studies that conclude.

Last but not least. This bill that unfortunately I could not have submitted on my behalf as my MLA for my area was unable to return my phone calls or commit to an appointment with me after several attempts.
Allow me to take 2 minutes to explain to you the importance.

SINNIS

INGREDIENTS

CIGARETTE



Flavours are highlighted

Acetanisole
Acetic acid
Acetoin
Acetophenone
6-Acetoxydihydrotheaspirane
2-Acetyl-3-Ethylpyrazine
2-Acetyl-5-Methylfuran
Acetylpyrazine
2-Acetylpyridine
3-Acetylpyridine
2-Acetylthiazole
Aconitic Acid
dl-Alanine
Alfalfa Extract
Allspice Extract, Oleoresin, and Oil
Allyl Hexanoate
Allyl Ionone
Almond Bitter Oil
Ambergris Tincture
Ammonia
Ammonium Bicarbonate
Ammonium Hydroxide
Diammonium phosphate
Ammonium sulfide
Amyl Alcohol
Amyl Butyrate
Amyl Formate
Amyl Octanoate
alpha-Amylcinnamaldehyde
Amyris Oil
trans-Anethole
Angelica Root Extract, Oil and Seed Oil
Anise
Anise Star, Extract and Oils
Anisyl Acetate
Anisyl Alcohol
Anisyl Formate
Anisyl Phenylacetate
Apple Juice Concentrate, Extract, and Skins

E-CIGARETTE

Propylene Glycol
Vegetable Glycerin (food grade)
Natural & Artifical flavoring (food grade)
Nicotine

Apricot Extract and Juice Concentrate
L-Arginine
Asafetida Fluid Extract And Oil
Ascorbic Acid
L-Asparagine Monohydrate
L-Aspartic Acid
Balsam of Peru and Oil
Basil Oil
Bay leaf, Oil and Sweet Oil
Beeswax White
Beet Juice Concentrate
Benzaldehyde
Benzaldehyde Glyceryl Acetal
Benzoic acid, Benzoin
Benzoin Resin
Benzophenone
Benzyl Alcohol
Benzyl Benzoate
Benzyl Butyrate
Benzyl Cinnamate
Benzyl Propionate
Benzyl salicylate
Bergamot Oil
Bisabolene
Black Currant Buds Absolute
Borneol
Bornyl Acetate
Buchu Leaf Oil
1,3-Butanediol
2,3-Butanedione
1-Butanol
2-Butanone
4(2-Butenylidene)-3,5,5-Trimethyl-2-Cyclohexen-1-One
Butter, Butter Esters, and Butter Oil
Butyl acetate
Butyl butyrate
Butyl butyryl lactate
Butyl isovalerate
Butyl phenylacetate
Butyl ndecylenate
3-Butylidenephthalide
Butyric Acid
Cadinene
Caffeine
Calcium Carbonate
Camphene
Cananga Oil
Capsicum Oleoresin
Caramel color
Caraway Oil
Carbon Dioxide
Cardamom Oleoresin, Extract, Seed Oil, and Powder
Carob Bean and Extract
beta-Carotene
Carrot Oil
Carvacrol
4-Carvomenthenol
L-Carvone
beta-Caryophyllene
beta-Caryophyllene Oxide

Cascarilla Oil and Bark Extract
Cassia Bark Oil
Cassie Absolute and Oil
Castoreum Extract, Tincture and Absolute
Cedar Leaf Oil
Cedarwood Oil Terpenes and Virginiana
Cedrol
Celery Seed Extract, Solid, Oil, And Oleoresin
Cellulose Fiber
Chamomile Flower Oil And Extract
Chicory Extract
Chocolate
Cinnamaldehyde
Cinnamic Acid
Cinnamon Leaf Oil, Bark Oil, and Extract
Cinnamyl Acetate
Cinnamyl Alcohol
Cinnamyl Cinnamate
Cinnamyl Isovalerate
Cinnamyl Propionate
Citral
Citric Acid
Citronella Oil
dl-Citronellol
Citronellyl Butyrate
Citronellyl Isobutyrate
Civet Absolute
Clary Oil
Clover Tops, Red Solid Extract
Cocoa
Cocoa Shells, Extract, Distillate And Powder
Coconut Oil
Coffee
Cognac White and Green Oil
Copaiba Oil
Coriander Extract and Oil
Corn Oil
Corn Silk
Costus Root Oil
Cubeb Oil
Cuminaldehyde
para-Cymene
L-Cysteine
Dandelion Root Solid Extract
Davana Oil
2-trans,4-trans-Decadienal
delta-Decalactone
gamma-Decalactone
Decanal
Decanoic acid
1-Decanol
2-Decenal
Dehydromenthofurolactone
Diethyl Malonate
Diethyl Sebacate
2,3-Diethylpyrazine
Dihydro Anethole
5,7-Dihydro-2-Methylthieno(3,4-D) Pyrimidine
Dill Seed Oil and Extract
meta-Dimethoxybenzene

para-Dimethoxybenzene
2,6-Dimethoxyphenol
Dimethyl Succinate
3,4-Dimethyl-1,2-Cyclopentanedione
3,5-Dimethyl-1,2-Cyclopentanedione
3,7-Dimethyl-1,3,6-Octatriene
4,5-Dimethyl-3-Hydroxy-2,5-Dihydrofuran-2-One
6,10-Dimethyl-5,9-Undecadien-2-One
3,7-Dimethyl-6-Octenoic Acid
2,4 Dimethylacetophenone
alpha,para-Dimethylbenzyl Alcohol
alpha,alpha-Dimethylphenethyl Acetate
alpha,alpha Dimethylphenethyl Butyrate
2,3-Dimethylpyrazine
2,5-Dimethylpyrazine
2,6-Dimethylpyrazine
Dimethyltetrahydrobenzofuranone
delta-Dodecalactone
gamma-Dodecalactone
para-Ethoxybenzaldehyde
Ethyl 10-Undecenoate
Ethyl 2-Methylbutyrate
Ethyl acetate
Ethyl acetoacetate
Ethyl alcohol
Ethyl benzoate
Ethyl butyrate
Ethyl cinnamate
Ethyl decanoate
Ethyl fenchol
Ethyl furoate
Ethyl heptanoate
Ethyl hexanoate
Ethyl isovalerate
Ethyl lactate
Ethyl laurate
Ethyl levulinate
Ethyl maltol
Ethyl methylphenylglycidate
Ethyl myristate
Ethyl nonanoate
Ethyl octadecanoate
Ethyl octanoate
Ethyl oleate
Ethyl palmitate
Ethyl phenylacetate
Ethyl propionate
Ethyl salicylate
Ethyl trans-2-butenoate
Ethyl valerate
Ethyl vanillin
2-Ethyl (or Methyl)-(3,5 and 6)-Methoxypyrazine
2-Ethyl-1-Hexanol,3-Ethyl-2-Hydroxy-2-Cyclopenten-1-One
2-Ethyl-3,(5 or 6)-Dimethylpyrazine
5-Ethyl-3-Hydroxy-4-Methyl-2(5H)-Furanone
2-Ethyl-3-Methylpyrazine
3-Ethylpyridine
4-Ethylbenzaldehyde
4-Ethylguaiacol
4-Ethylphenol (para-Ethylphenol)

Eucalyptol
Farnesol
D-Fenchone
Fennel Sweet Oil
Fenugreek, Extract, Resin, and Absolute
fig Juice Concentrate
Food Starch Modified
Furfuryl Mercaptan
4-(2-Furyl)-3-Buten-2-One
Galbanum Oil
Genet Absolute
Gentian Root Extract
Geraniol
Geranium Rose Oil
Geranyl Acetate
Geranyl Butyrate
Geranyl Formate
Geranyl Isovalerate
Geranyl Phenylacetate
Ginger Oil and Oleoresin
L-Glutamic Acid
L-Glutamine
Glycerol
Glycyrrhizin Ammoniated
Grape Juice Concentrate
Guaiac Wood Oil
Guaiacol
Guar Gum
2,4-Heptadienal
gamma-Heptalactone
Heptanoic Acid
2-Heptanone
3-Hepten-2-One
2-Hepten-4-One
4-Heptenal
trans-2-Heptenal
Heptyl acetate
omega-6-Hexadecenlactone
gamma-Hexalactone
Hexanal
Hexanoic acid
2-Hexen-1-Ol
3-Hexen-1-Ol
cis-3-Hexen-1-Yl Acetate
2-Hexenal
3-Hexenoic Acid
trans-2-Hexenoic Acid
cis-3-Hexenyl Formate
Hexyl 2-Methylbutyrate
Hexyl Acetate
Hexyl Alcohol
Hexyl Phenylacetate
L-Histidine
Honey
Hops Oil
Hydrolyzed Milk Solids
Hydrolyzed Plant Proteins
5-Hydroxy-2,4-Decadienoic Acid delta- Lactone
4-Hydroxy-2,5-Dimethyl-3(2H)-Furanone
2-Hydroxy-3,5,5-Trimethyl-2-Cyclohexen-1-One

4-Hydroxy -3-Pentenoic Acid Lactone
2-Hydroxy-4-Methylbenzaldehyde
4-Hydroxybutanoic Acid Lactone
Hydroxycitronellal
6-Hydroxydihydrotheaspirane
4-(para-Hydroxyphenyl)-2-Butanone
Hyssop Oil
Immortelle Absolute and Extract
alpha-Ionone
beta-Ionone
alpha-Irone
Isoamyl Acetate
Isoamyl Benzoate
Isoamyl Butyrate
Isoamyl Cinnamate
Isoamyl Formate, Isoamyl Hexanoate
Isoamyl Isovalerate
Isoamyl Octanoate
Isoamyl Phenylacetate
Isobornyl Acetate
Isobutyl Acetate
Isobutyl Alcohol
Isobutyl Cinnamate
Isobutyl Phenylacetate
Isobutyl Salicylate
2-Isobutyl-3-Methoxypyrazine
alpha-Isobutylphenethyl Alcohol
Isobutyraldehyde
Isobutyric Acid
d,l-Isoleucine
alpha-Isomethylionone
2-Isopropylphenol
Isovaleric Acid
Jasmine Absolute, Concrete and Oil
Kola Nut Extract
Labdanum Absolute and Oleoresin
Lactic Acid
Lauric Acid
Lauric Aldehyde
Lavandin Oil
Lavender oil
Lemon Oil and Extract
Lemongrass Oil
L-Leucine
Levulinic acid
Liquorice root, fluid, extract and powder
Lime Oil
Linalool
Linalool Oxide
Linalyl acetate
Linden Flowers
Lovage Oil And Extract
L-Lysine
Mace Powder, Extract and Oil
Magnesium Carbonate
Malic Acid
Malt and Malt Extract
Maltodextrin
Maltol
Maltyl Isobutyrate

Mandarin Oil
Maple Syrup and Concentrate
Mate Leaf, Absolute and Oil
para-Mentha-8-Thiol-3-One
Menthol
Menthone
Menthyl Acetate
dl-Methionine
Methoprene
2-Methoxy-4-Methylphenol
2-Methoxy-4-Vinylphenol
para-Methoxybenzaldehyde
1-(para-Methoxyphenyl)-1-Penten-3-One
4-(para-Methoxyphenyl)-2-Butanone
1-(para-Methoxyphenyl)-2-Propanone
Methoxypyrazine
Methyl 2-Furoate
Methyl 2-Octynoate
Methyl 2-Pyrrolyl Ketone
Methyl Anisate
Methyl anthranilate
Methyl Benzoate
Methyl Cinnamate
Methyl Dihydrojasmonate
Methyl Ester of Rosin, Partially Hydrogenated
Methyl Isovalerate
Methyl Linoleate (48%)
Methyl Linolenate (52%) Mixture
Methyl Naphthyl Ketone
Methyl Nicotinate
Methyl phenylacetate
Methyl Salicylate
Methyl Sulfide
3-Methyl-1-Cyclopentadecanone
4-Methyl-1-Phenyl-2-Pentanone
5-Methyl-2-Phenyl-2-Hexenal
5-Methyl-2-Thiophenecarboxaldehyde
6-Methyl-3,-5-Heptadien-2-One
2-Methyl-3-(para-Isopropylphenyl) Propionaldehyde
5-Methyl-3-Hexen-2-One
1-Methyl-3-Methoxy-4-Isopropylbenzene
4-Methyl-3-Pentene-2-One
2-Methyl-4-Phenylbutyraldehyde
6-Methyl-5-Hepten-2-One
4-Methyl-5-Thiazoleethanol
4-Methyl-5-Vinylthiazole
Methyl-alpha-Ionone
Methyl-trans-2-Butenoic Acid
4-Methylacetophenone
para-Methylanisole
alpha-Methylbenzyl Acetate
alpha-Methylbenzyl Alcohol
2-Methylbutyraldehyde
3-Methylbutyraldehyde
2-Methylbutyric Acid
alpha-Methylcinnamaldehyde
Methylcyclopentenolone
2-Methylheptanoic Acid
2-Methylhexanoic Acid
3-Methylpentanoic Acid

4-Methylpentanoic Acid
2-Methylpyrazine
5-Methylquinoxaline
2-Methyltetrahydrofuran-3-one
(Methylthio)Methylpyrazine (Mixture Of Isomers)
3-Methylthiopropionaldehyde
Methyl 3-Methylthiopropionate
2-Methylvaleric Acid
Mimosa Absolute and Extract
Molasses Extract and Tincture
Mountain Maple Solid Extract
Mullein Flowers
Myristaldehyde
Myristic acid
Myrrh Oil
beta-Napthyl Ethyl Ether
Nerol
Neroli Bigarde Oil
Nerolidol
Nona-2-trans,6-cis-dienal
2,6-Nonadien-1-ol
gamma-Nonalactone
Nonanal
Nonanoic Acid
Nonanone
trans-2-Nonen-1-ol
2-Nonenal
Nonyl Acetate
Nutmeg Powder and Oil
Nicotine
Oak chips extract and oil
Oakmoss absolute
9,12-Octadecadienoic acid (48%) and 9,12,15-Octadecatrienoic acid (52%)
delta-Octalactone
gamma-Octalactone
Octanal
Octanoic acid
1-Octanol
2-Octanone
3-Octen-2-one
1-Octen-3-ol
1-Octen-3-yl acetate
2-Octenal
Octyl isobutyrate
Oleic acid
Olibanum oil
Opoponax oil and gum
Orange blossom water, absolute, and leaf absolute
Orange oil and extract
Origanum oil
Orris concrete oil and root extract
Palmarosa Oil
Palmitic acid
Parsley Seed Oil
Patchouli Oil
omega-Pentadecalactone
2,3-Pentanedione
2-Pentanone
4-Pentenoic Acid

2-Pentylpyridine
Pepper Oil, Black And White
Peppermint Oil
Peruvian (Bois De Rose) Oil
Petitgrain Absolute, Mandarin Oil and Terpeneless Oil
alpha-Phellandrene
2-Phenenthyl Acetate
Phenethyl alcohol
Phenethyl Butyrate
Phenethyl Cinnamate
Phenethyl Isobutyrate
Phenethyl Isovalerate
Phenethyl Phenylacetate
Phenethyl Salicylate
1-Phenyl-1-Propanol
3-Phenyl-1-Propanol
2-Phenyl-2-Butenal
4-Phenyl-3-Buten-2-Ol
4-Phenyl-3-Buten-2-One
Phenylacetaldehyde
Phenylacetic Acid
L-Phenylalanine
3-Phenylpropionaldehyde
3-Phenylpropionic Acid
3-Phenylpropyl Acetate
3-Phenylpropyl Cinnamate
2-(3-Phenylpropyl)Tetrahydrofuran
Phosphoric Acid
Pimenta Leaf Oil
Pine Needle Oil, Pine Oil, Scotch
Pineapple Juice Concentrate
alpha-Pinene, beta-Pinene
D-Piperitone
Piperonal
Pipsissewa Leaf Extract
Plum Juice
Potassium Sorbate
L-Proline
Propenylguaethol
Propionic Acid
Propyl Acetate
Propyl para-Hydroxybenzoate
Propylene Glycol
3-Propylidenephthalide
Prune Juice and Concentrate
Pyridine
Pyroligneous Acid And Extract
Pyrrole
Pyruvic Acid
Raisin Juice Concentrate
Rhodinol
Rose Absolute and Oil
Rosemary Oil
Rum
Rum Ether
Rye Extract
Sage, Sage oil, and Sage oleoresin
Salicylaldehyde
Sandalwood oil, yellow
Sclareolide

Skatole
Smoke flavor
Snakeroot oil
Sodium acetate
Sodium benzoate
Sodium bicarbonate
Sodium carbonate
Sodium chloride
Sodium citrate
Sodium hydroxide
Solanone
Spearmint oil
Styrax extract, gum and oil
Sucrose octaacetate
Sugar alcohols
Sugars
Tagetes Oil
Tannic Acid
Tartaric Acid
Tea Leaf and Absolute
alpha-Terpineol
Terpinolene
Terpinyl Acetate
5,6,7,8-Tetrahydroquinoxaline
1,5,5,9-Tetramethyl-13-Oxatricyclo(8.3.0.0(4,9))Tridecane
2,3,4,5, and 3,4,5,6-Tetramethylethyl-Cyclohexanone
2,3,5,6-Tetramethylpyrazine
Thiamine Hydrochloride
Thiazole
L-Threonine
Thyme Oil, White and Red
Thymol
Tobacco Extracts
Tocopherols (mixed)
Tolu balsam Gum and Extract
Tolualdehydes
para-Tolyl 3-Methylbutyrate
para-Tolyl Acetaldehyde
para-Tolyl Acetate
para-Tolyl Isobutyrate
para-Tolyl Phenylacetate
Triacetin
2-Tridecanone
2-Tridecenal
Triethyl Citrate
3,5,5-Trimethyl-1-Hexanol
para,alpha,alpha-Trimethylbenzyl Alcohol
4-(2,6,6-Trimethylcyclohex-1-Enyl)But-2-En-4-One
2,6,6-Trimethylcyclohex-2-Ene-1,4-Dione
2,6,6-Trimethylcyclohexa-1,3-Dienyl Methan
4-(2,6,6-Trimethylcyclohexa-1,3-Dienyl)But-2-En-4-One
2,2,6-Trimethylcyclohexanone
2,3,5-Trimethylpyrazine
L-Tyrosine
delta-Undecalactone
gamma-Undecalactone
Undecanal
2-Undecanone
10-Undecenal
Urea

Valencene Valeraldehyde Valerian Root Extract, Oil and Powder Valeric acid gamma-Valerolactone Valine Vanilla Extract And Oleoresin Vanillin Veratraldehyde Vetiver Oil Vinegar Violet Leaf Absolute Walnut Hull Extract Water Wheat Extract And Flour Wild Cherry Bark Extract Wine and Wine Cherry Xanthan Gum 3,4-Xylenol Yeast	

SINNIS

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Article

Impact of Flavour Variability on Electronic Cigarette Use Experience: An Internet Survey

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Abstract: *Background:* A major characteristic of the electronic cigarette (EC) market is the availability of a large number of different flavours. This has been criticised by the public health authorities, some of whom believe that diverse flavours will attract young users and that ECs are a gateway to smoking. At the same time, several reports in the news media mention that the main purpose of flavour marketing is to attract youngsters. The importance of flavourings and their patterns of use by EC consumers have not been adequately evaluated, therefore, the purpose of this survey was to examine and understand the impact of flavourings in the EC experience of dedicated users. *Methods:* A questionnaire was prepared and uploaded in an online survey tool. EC users were asked to participate irrespective of their current smoking status. Participants were divided according to their smoking status at the time of participation in two subgroups: former smokers and current smokers. *Results:* In total, 4,618 participants were included in the analysis, with 4,515 reporting current smoking status. The vast majority (91.1%) were former smokers, while current smokers had reduced smoking consumption from 20 to 4 cigarettes per day. Both subgroups had a median smoking history of 22 years and had been using ECs for 12 months. On average they were using three different types of liquid flavours on a regular basis, with former smokers switching between flavours more frequently compared to current smokers; 69.2% of the former subgroup reported doing so on a daily basis or within the day. Fruit flavours were more popular at the time of participation, while tobacco flavours were more popular at initiation of EC use. On a scale from 1 (not at all important) to 5 (extremely important) participants answered that variability of flavours was "very important" (score = 4) in their effort to reduce or quit smoking. The majority reported that restricting variability will make ECs less enjoyable and more boring, while 48.5% mentioned that it would increase craving for cigarettes and 39.7% said that it would have been less likely for them to reduce or quit smoking. The number of flavours used was independently associated with smoking cessation. *Conclusions:* The results of this survey of dedicated users indicate that flavours are marketed in order to satisfy vapers' demand. They appear to contribute to both perceived pleasure and the effort to reduce cigarette consumption or quit smoking. Due to the fact that adoption of ECs by youngsters is currently minimal, it seems that implementing regulatory restrictions to flavours could cause harm to current vapers while no public health benefits would be observed in youngsters. Therefore, flavours variability should be maintained; any potential future risk for youngsters being attracted to ECs can be sufficiently minimized by strictly prohibiting EC sales in this population group.

Keywords: electronic cigarette; flavours; smoking; tobacco; nicotine; smoking cessation; public health

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1. Introduction

Cigarette smoking is considered the single most preventable cause of disease, affecting several systems in the human body and causing premature death [1]. The World Health Organisation predicts more than 1 billion deaths within the 21st century related to tobacco cigarettes [2]. Although there is overwhelming evidence for the benefits of smoking cessation [3], it is a very difficult addiction to break. Currently available nicotine replacement therapy have low long-term success rate, which may be attributed solely to psychological support [4], while oral medications are more effective [5] but are hindered by reports of adverse neuropsychiatric effects [6]. In this context, the tobacco harm reduction strategy has been developed, with a goal of providing nicotine through alternative methods in order to reduce the amount of harmful substances obtained by the user [7].

Electronic cigarettes (ECs) have been marketed in recent years as alternative to smoking products. They consist mainly of a battery and an atomiser where liquid is stored and gets evaporated by energy supplied to an electrical resistance. The liquid contains mainly propylene glycol and glycerol, with the option to include nicotine. A major characteristic of the EC liquid market is the availability of a variety of flavourings. Besides tobacco-like flavours, the consumer can choose flavours consisting of fruits, sweets, drinks and beverages and many more. The availability of so many flavours has been criticized by authorities such as the Food and Drug Administration (FDA), stating that there is a potential to attract youngsters [8]. Such a concern was probably raised by the experience with tobacco products, with studies showing that flavoured cigarettes were more appealing to young users [9]. A recent survey of electronic cigarette users found that almost half of participants were using non-tobacco flavours [10]. However, no survey was specifically designed to detect the impact of flavourings on EC experience by users. Therefore, the purpose of this survey was to evaluate the patterns of flavourings use and determine their popularity in a sample of dedicated adult EC users.

2. Methods

A questionnaire was prepared by the research team in two languages (English and Greek) and was uploaded in an online survey tool (www.surveymonkey.com). A brief presentation of the survey was uploaded in the website of a non-profit EC advocates group (www.ecigarette-research.com) together with informed consents in English and Greek. If the participant agreed with the informed consent, he was redirected to the questionnaire in the respective language by pressing the "I agree" button. The survey was available online for 15 days. The protocol was approved by the ethics committee of our institution.

EC users of any age, irrespective of current or previous smoking status, were asked to participate to the survey. The survey was communicated in internet social media and several EC users' forums and advocate groups worldwide. The IP address of the participants was recorded in order to remove double entries. There was an option for participants to report their email address for participation in future projects; unwillingness to report the email address was not a criterion for exclusion from the survey. Information about age, gender, country of residence and education level was requested. Past and present smoking status was asked and, based on the latter, participants were divided into two groups for the analysis: former smokers who had completely quit smoking and smokers who were still smoking after initiation of EC use. The questionnaire included questions about the type of flavours used regularly by the participants, whether the variety of flavourings was important in reducing or completely substituting smoking and defining the reasons for using multiple flavours. To assess difficulty in finding flavours of their preference at EC use initiation, the following question was asked: "Was it difficult to find the flavourings of your preference at initiation of EC use?". The answers were scored as: 1, "not at all difficult"; 2, "slightly difficult"; 3, "difficult"; 4, "very difficult"; and 5, "extremely difficult". To examine the importance of flavours variability in reducing or quitting smoking, the following question was asked: "Was the variability of flavourings important in your effort to reduce or completely substitute smoking?". The answer was scored as: 1, "not at all important"; 2, "slightly important"; 3, "important"; 4, "very important"; and 5, "extremely important".

3. Statistical Analysis

Participants were categorised into current smokers and former-smokers according to their reported status at the time of participation to the survey. Results are reported for the whole sample and for each of the subgroups. The sample size varied by variable because of missing data. In some questions, responders were allowed to choose more than one option; in these cases, each answer is presented separately and the sum of responses may exceed 100%. Kolmogorov-Smirnoff tests were performed to assess normality of distribution of variables. Continuous variables are reported as median (interquartile range [IQR]). Categorical variables are reported as number (percentage). Mann Whitney U test was used to compare continuous variables between current and former smokers, while cross tabulations with χ^2 test were used for categorical variables. Finally, a stepwise binary logistic regression analysis was performed, with smoking status (former *vs.* current smoker) as the independent variable and age, gender, education level, smoking duration, number of flavourings used regularly, and EC consumption (ml liquid or number of prefilled cartomisers) as covariates. A two-tailed P value of <0.05 was considered statistically significant, and all analyses were performed with commercially available statistical software (SPSS v. 18, Chicago, IL, USA).

4. Results

4.1. Baseline Characteristics

After excluding double entries, 4,618 participants were included to the analysis, with 4,515 reporting current smoking status (current *vs.* former smokers). The baseline characteristics of the study group and subgroups are displayed in Table 1. More than 90% were former smokers. The mean age was 40 years, with male predominance. No difference between former and current smokers was observed in age, while more males were former smokers. The vast majority were from America and Europe, with a small proportion residing in Asia and Australia. More than half of participants were educated to the level of university/college. Smoking duration was similar between subgroups. Interestingly, former smokers reported higher daily cigarette consumption before initiation of EC use, although the difference was not statistically significant. Current smokers reported a substantial reduction in cigarette consumption, from 20 to 4 cigarettes per day. The median duration of EC use was 12 months, with higher consumption (ml liquid or number of cartridges) reported by former smokers. Higher nicotine concentration liquids were used by current smokers ($P = 0.005$). In total, 140 participants (3.0%) reported using non-nicotine liquids, 2.8% of former and 1% of current smokers ($\chi^2 = 4.5$, $P = 0.033$); 21 users of non-nicotine liquids did not mention their current smoking status. Finally, more current smokers were using first (cigarette-like) and second generation (eGo-type) devices while more former smokers were using third generation devices (also called "Mods", variable voltage or wattage devices).

4.2. Perceptions in Relation to Flavours

Responses to questions related to flavours are displayed in Table 2. At the time of participation, most commonly used flavours were fruits, followed by sweets and tobacco. Significant differences were observed between subgroups. Characteristically, more current smokers were using tobacco flavours compared to former smokers, while more of the latter were using fruit and sweet flavours. On a regular basis, participants reported using 3 (IQR: 2–4) different types of flavours. At initiation of EC use, most popular flavours were tobacco followed by fruit and sweet flavours. The median score for difficulty to find the flavours of their preference at EC initiation was 2 (IQR: 1–3), with no difference between subgroups. Most participants (68.3%) were switching between flavours on a daily basis or within the day, with former smokers switching more frequently. More than half of the study sample mentioned that they like the variety of flavours and that the taste gets blunt from long-term use of the same flavour. The average score for importance of flavours variability in reducing or quitting smoking was 4 ("very important"). Finally, the majority of participants stated that restricting variability of flavours would make the EC experience less enjoyable while almost half of them answered that it would increase craving for tobacco cigarettes and would make reducing or completely substituting smoking less likely.

Table 1. Baseline characteristics of the study population and subgroups.

Characteristic	Total	Former Smokers	Current Smokers	Statistic	P
Participants, n (%)	4,618	4,117 (91.2)	398 (8.8)		
English translation	4,386 (95.0)	3,915 (95.1)	369 (92.7)		
Greek translation	232 (5.0)	202 (4.9)	29 (7.3)		
Region of residence, n (%)					
America	2,220 (48.5)	2,007 (48.7)	157 (39.4)		
Asia	76 (1.7)	58 (1.4)	16 (4.0)		
Australia	80 (1.7)	75 (1.8)	4 (1.0)		
Europe	2,197 (48.0)	1,939 (47.1)	217 (54.5)		
Education, n (%)					
High school or less	1,037 (22.7)	917 (22.3)	98 (24.6)		
Technical Education	1,099 (24.1)	993 (24.1)	86 (21.6)		
University/College	2,425 (53.2)	2,170 (52.7)	206 (51.8)		
Age (years)	40 (32–49)	40 (32–49)	40 (32–49)	U = 754,278	0.624
Gender (male)	3,229 (71.8)	2,922 (72.7)	246 (62.5)	$\chi^2 = 18.0$	<0.001
Smoking duration (years)	22 (15–30)	22 (15–30)	22 (14–30)	U = 816,534	0.924
Cigarette consumption before EC use (/d)	24 (20–30)	25 (20–30)	20 (19–30)	U = 768,398	0.189
Cigarettes consumption after EC use (/d)			4 (2–6)		
EC use duration (months)	12 (6–23)	12 (6–23)	12 (5–23)	U = 790,219	0.373
EC consumption (ml or cartridges/d)	4 (3–5)	4 (3–5)	3 (2–5)	U = 677,862	<0.001
Nicotine levels in EC (mg/ml)	12 (6–18)	12 (6–18)	12 (8–18)	U = 722,563	0.005
EC devices used, n (%)					
Cigarette-like	84 (1.8)	61 (1.5)	20 (5.0)	$\chi^2 = 25.9$	<0.001
eGo-type	1,123 (24.7)	966 (23.5)	133 (33.4)	$\chi^2 = 19.5$	<0.001
"Mods" [a]	3,348 (73.5)	3,047 (74.0)	237 (59.5)	$\chi^2 = 38.3$	<0.001

Notes: Values presented as median (interquartile range) or number (percentage). Abbreviations: EC, electronic cigarette. [a] New generation devices, usually hand-made or with the ability to manually set the voltage or wattage delivery.

Table 2. Patterns of flavourings use in the study population and subgroups.

Characteristic	Total	Former Smokers	Current Smokers	Statistic	P
		Flavours used now, n (%) [a]			
Tobacco	1,984 (43.9)	1,773 (43.1)	211 (53.0)	$\chi^2 = 14.6$	<0.001
Mint/menthol	1,468 (31.8)	1,339 (32.5)	129 (32.4)	$\chi^2 = 0.0$	0.964
Sweet	2,836 (61.4)	2,629 (63.9)	207 (52.0)	$\chi^2 = 21.8$	<0.001
Nuts	691 (15.0)	643 (15.6)	48 (12.1)	$\chi^2 = 3.5$	0.060
Fruits	3,203 (69.4)	2,953 (71.7)	250 (62.8)	$\chi^2 = 14.0$	<0.001
Drinks/beverages	1,699 (36.8)	1,562 (37.9)	137 (34.4)	$\chi^2 = 1.9$	0.167
Other	1,028 (22.3)	946 (23.0)	82 (20.6)	$\chi^2 = 1.2$	0.281

Table 2. *Cont.*

Flavours used at EC initiation, n (%) [a]					
Tobacco	3,118 (69.1)	2,846 (69.1)	272 (68.3)	$\chi^2 = 0.1$	0.746
Mint/menthol	1,086 (24.1)	1,004 (24.4)	82 (20.6)	$\chi^2 = 2.8$	0.092
Sweet	1,347 (29.8)	1,251 (30.4)	96 (24.1)	$\chi^2 = 6.8$	0.009
Nuts	203 (4.5)	186 (4.5)	17 (4.3)	$\chi^2 = 0.1$	0.821
Fruits	1,743 (38.6)	1,606 (39.0)	137 (34.4)	$\chi^2 = 3.2$	0.073
Drinks/beverages	808 (17.9)	748 (16.8)	60 (15.1)	$\chi^2 = 2.4$	0.124
Other	302 (6.7)	282 (6.8)	20 (5.0)	$\chi^2 = 1.9$	0.164
Switching between flavours, n (%)					
Daily/within the day	3,083 (68.3)	2,851 (69.2)	232 (58.3)	$\chi^2 = 20.1$	<0.001
Weekly	718 (15.9)	636 (15.4)	82 (20.6)	$\chi^2 = 7.2$	0.007
Less than weekly	465 (10.3)	412 (10.0)	53 (13.3)	$\chi^2 = 4.3$	0.038
At EC initiation, was it difficult to find the flavours of your preference? [b]	2 (1–3)	2 (1–3)	2 (1–3)	U = 760,068	0.054
Why do you feel the need to choose different flavours? n (%) [a]					
Like variety of choices	3,300 (73.1)	3,041 (73.9)	259 (65.1)	$\chi^2 = 14.3$	<0.001
They get "blunt" from long-term use	2,325 (51.5)	2,131 (51.8)	194 (48.7)	$\chi^2 = 1.3$	0.250
Other reasons	342 (7.6)	318 (7.7)	24 (6)	$\chi^2 = 1.5$	0.223
Was flavours variability important in reducing/quitting smoking? [b]	4 (3–5)	4 (3–5)	4 (3–5)	U = 731,547	0.455
How would your experience with EC change if flavours variability was limited? n (%) [a]					
Less enjoyable	3,111 (68.9)	2,886 (70.1)	225 (56.5)	$\chi^2 = 31.2$	<0.001
More boring	2,063 (45.7)	1,901 (46.2)	236 (40.7)	$\chi^2 = 4.4$	0.036
Increase craving for cigarettes	2,188 (48.5)	1,982 (48.1)	206 (51.8)	$\chi^2 = 1.9$	0.168
Less likely to reduce or quit smoking	1,793 (39.7)	1,617 (39.3)	176 (44.2)	$\chi^2 = 3.7$	0.054
No difference	285 (6.3)	253 (6.1)	32 (8.0)	$\chi^2 = 2.2$	0.138

Notes: Values presented as median (interquartile range) or number (percentage). Abbreviations: EC, electronic cigarette. [a] Participants were allowed to choose more than one answers. [b] Score reported (see text for details).

Binary logistic regression analysis showed that male gender (B = 0.373, *P* = 0.001), EC consumption (B = 0.046, *P* = 0.044) and number of flavours regularly used (B = 0.089, *P* = 0.038) were associated with complete smoking abstinence in this population of dedicated long-term vapers, while age, education level and smoking duration were not associated with smoking abstinence.

5. Discussion

This is the first survey that specifically focused on the issue of flavours and their impact in EC use. A substantial number of dedicated EC consumers participated; they reported that flavours play an important role in their EC use experience and in reducing cigarette consumption and craving, while the number of flavours regularly used was independently associated with complete smoking abstinence in this population.

The availability of a variety of flavours has been a controversial issue since the initial appearance of ECs to the market. Most companies offer a variety of flavours, from those resembling tobacco to a large number commonly used in the food industry. Public health authorities have raised concerns about this issue, and several statements have been released suggesting flavours could attract youngsters [8,11,12]. Such concerns are probably rooted back to the marketing of the tobacco industry for flavoured tobacco cigarettes. Internal industry documents and published surveys indicated that flavoured tobacco products are more appealing to youngsters and may be a gateway to maintaining smoking as a long term habit, while use by adults was quite low [13–16]. This is the main reason why the FDA decided to implement a ban on characteristic flavours in tobacco cigarettes [17]. It was expected that such concerns would be raised for ECs, although current vapers are overwhelmingly adults. Anecdotal evidence from EC consumers' internet forums and results from surveys [10] have shown that different flavours are very popular among dedicated users. The results of this survey confirm previous observations by finding that dedicated users switch between flavours frequently and the variability of flavours plays an important role both in reducing cigarette craving and in perceived pleasure. Moreover, the number of flavours used was associated with smoking cessation. Therefore, flavours variability is needed to support the demand by current vapers, who are in their vast majority adults. This survey also indicated that there is a switch in flavours preference of EC consumers; tobacco is the preferred flavour when initiating EC use, probably because smokers are used to this flavour and feel the need to use something that resembles their experience from smoking. However, different choices are made as time of use progresses. This may be a way to distract them from the tobacco flavour in order to reduce smoking craving; alternatively, it could indicate that they just don't need the tobacco flavour any more, but feel the desire to experiment with new flavours. In some cases, tobacco flavour may even become unpleasant, especially in those who have completely quit smoking. The improvement in olfactory and gustatory senses in these people can lead to both more pleasure perceived from different flavours and an aversion to tobacco flavour (in a similar way that it is unpleasant for a non-smoker); the latter has been reported in EC consumers' forums (http://www.e-cigarette-forum.com/forum/polls/209041-do-you-vape-tobacco-flavors.html). Such a phenomenon may contribute to lower relapse to smoking and may prevent the EC from being a gateway to smoking; however, this should be specifically studied before making any conclusions. Finally, the issue of taste buds "tolerance", which is anecdotally mentioned by vapers, was reported by almost half of the sample as a reason to switch between flavours, although it is most probably a type of olfactory rather than gustatory tolerance.

Besides information on the use of flavourings, this survey provides information on other issues related to EC use. A small minority of participants were using first generation cigarette-like devices. This has been observed in other surveys [10]. There was a higher prevalence of third-generation devices used in the subgroup of former smokers compared to current smokers. Such devices have the ability to provide higher energy to the atomiser, thus producing more vapour and delivering more pleasure to the user [18,19]. Until now, two randomised studies evaluating the efficacy of EC use in smoking cessation have used first-generation cigarette-like devices [20,21]. It is possible that newer generation devices may be more effective in substituting smoking, and this should be evaluated in future studies. Additionally, former smokers were using lower nicotine-concentration liquids compared to current smokers. It has been observed from previous studies that EC users who have completely substituted smoking try to gradually reduce their nicotine use [18]. Despite that, only 2.8% of former smokers were using 0-nicotine liquids at the time of survey participation, indicating that nicotine is important in smoking abstinence and that EC consumers remain long-term nicotine users. However, the possibility that several vapers may quit EC use shortly after switching to non-nicotine liquids cannot be excluded; such users would not participate to this survey, therefore overestimating the significance of nicotine on EC use. Finally, we observed a male predominance in participation to this survey, which is in line with previous studies [10,18]. In this survey, males were more likely to have completely quit smoking. Further studies are needed to explore this phenomenon and define whether females are less successful in smoking cessation with EC use, are less motivated long-term users or use ECs in the short term as smoking substitutes.

There are some limitations applicable to this study. The survey was announced and promoted in popular EC websites. Therefore, it is expected that dedicated users with positive experience with ECs would mainly participate, and the high proportion of former smokers confirms this. However, it is important to evaluate the patterns of use in smokers who have successfully quit smoking, since this can provide health officials with information on how to educate smokers into using ECs, especially during the initial period of use. Although a significant proportion stated that flavours play a major role in reducing or quitting smoking, this study was not designed to evaluate whether variability of flavours may promote smoking cessation in the general population; moreover our sample is not representative of the general population of smokers, who are generally less educated compared to the population evaluated here [22]. This should be evaluated in a randomised study. Finally, although the fact that flavours are important for existing EC users provides sufficient explanation for their current marketing, it does not exclude the possibility that they may also attract youngsters. However, currently available evidence indicates that regular use of ECs by non-smoking adults or youngsters is very limited [23–25]; thus, any restriction of flavours for the reason of protecting youngsters is currently not substantiated by evidence and no public health benefit would be derived. On the contrary, such a measure could have a negative impact and cause harm in current vapers, who are reporting that they enjoy flavours and that restrictions would make smoking reduction or cessation more difficult and would increase cigarette craving. Therefore, it would be more realistic and valuable to promote restrictions to the use of ECs by youngsters and to properly inform the public that ECs should be used only by smokers as a method to reduce cigarette consumption or completely substitute smoking.

6. Conclusions

The results of this survey indicate that EC liquid flavourings play a major role in the overall experience of dedicated users and support the hypothesis that they are important contributors in reducing or eliminating smoking consumption. This should be considered by the health authorities; based on the current minimal adoption of ECs by youngsters, it is reasonable to support that any proposed regulation should ensure that flavourings are available to EC consumers while at the same time restrictions to the use by youngsters (especially non-smokers) should be imposed in order to avoid future penetration of EC use to this population.

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Conflicts of Interest

The authors declare no conflict of interest.

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SINNIS

A Comparison of Electronic Cigarette Emissions With Those of Human Breath, Outdoor Air, and Tobacco Smoke

John Madden
Ecigarette Reviewed
February 20th, 2014

Abstract

Background Local lawmakers across the United States have been amending their cities' smoke-free air acts to include e-cigarettes, ensuring the devices are regulated the same as tobacco cigarettes. While e-cig vapor has generally been found to be far safer than tobacco smoke with exposure to bystanders posing no apparent concern, the purpose of this paper is to compare existing data on its contaminants with those in other forms of air people may be exposed on a daily basis.

Methods Existing data on e-cigarettes was pulled from peer-reviewed studies analyzing both mainstream vapor using smoking machines and secondhand vapor generated by volunteer vapers in a cramped experimental chamber. That data was compared with particulate matter of three Los Angeles elementary schools, human breath emissions and cigarette smoke, also pulled from existing papers and studies. Threshold Limit Value (TLV) ratios were then calculated for each data point to show how each measured up to the most stringent workplace exposure standards.

Results The research used for the purpose of this paper found that electronic cigarettes contain levels of volatile organic compounds comparable to those found in human breath emissions, as many are naturally produced by the body. Most contaminants found in secondhand vapor and human breath were at levels <1% of TLV. However, isoprene was found both secondhand e-cig vapor and in human breath at levels in between 7-10% of TLV, although it wasn't detected in mainstream e-cig vapor. In n terms of trace elements (metals) found in e-cigs, levels were comparable those detected in outdoor air of a major US city. It should be noted that, outside of the reports on tobacco cigarettes used, the other three sources studied have contaminant levels well within what TLVs allow for.

Conclusions Several VOCs found in secondhand e-cig vapor are also found in human breath at similar levels. This shows that occurrence in e-cigarette vapor may be primarily a direct result of natural production by the human body. Due to variances in methods used to measure the air in each reference, comparisons can only be considered preliminary until a more uniform study is conducted. However, while passive vaping can be expected from electronic cigarette use, it may be no more injurious to human health than inhaling outdoor air or human breath emissions that occur naturally in public spaces. Further study is warranted to compare secondhand breath analysis with e-cig vapor in a crowded room using identical measurement methods. Hopefully this paper raises public awareness that e-cigarette vapor is relatively comparable to existing air in public places, especially in terms of safety.

Keywords: e-cigarettes, smoke-free air law, passive vaping, human breath, outdoor air

Background

The use of electronic cigarettes in public places has been a popular debate topic among city councils. Ordinances and amendments have passed in New York and Chicago have already voted to regulate e-cigarette usage the same way they treat tobacco smoking, meaning vaping, or use of e-cigs, is prohibited anywhere smoking isn't allowed in public places. Los Angeles city council has announced a plan to amend its own smoke-free law to include e-cigarettes, on the basis their vapor contains toxins and carcinogens. Recent studies have also found levels of lead, chromium, nickel, and nicotine in the second-hand vapor of e-cigs. Prohibiting electronic cigarette use wherever smoking is banned, Feuer contends, is necessary in order to protect bystanders from involuntary inhalation of the vapor they emit.

While recent studies on electronic cigarettes have indeed found trace elements and compounds in passive e-cig vapor, none have been detected at levels that warrant any concern to public health (Burstyn, 2014). Dr. Igor Burstyn's recent study analyzed over 9,000 observations of electronic cigarette vapor content reported in various peer reviewed and grey literature studies and concluded secondhand exposure poses no concern to bystanders. However, lawmakers seem to exclude these results from their proposals. Furthermore, they seem unaware that a high percentage of the constituents of secondhand e-cig vapor already exist in smoke-free air and can even be attributed to natural production by the human body.

The purpose of this review is to compare the results from Dr. Burstyn's analysis of e-cigarette vapor constituents with those of peer reviewed studies on other forms of air humans are exposed to on a daily basis. It is hypothesized that e-cigarette vapor, aside from its appearance, is not much more different or dangerous than the air one might already be exposed to from living in a city or eating at a crowded restaurant. If many of the same elements found in e-cigarette vapor are already present at similar levels in smoke-free air, the argument that they contaminant air in public spaces should not be used.

Materials and Methods

Literature search

In addition to having open access to a provisional PDF of Dr. Burstyn's analysis of e-cig vapor on Biomed Central (2014), references for human breath emissions, outdoor air quality and secondhand smoke were searched online and through Google Scholar. Keywords searched included "human breath emissions", "human breath vocs", "formaldehyde human breath", "los angeles vocs", new york vocs" "chicago vocs" "la air quality", "los angeles air quality", "secondhand smoke emissions", "secondhand smoke particulates", "secondhand smoke vocs", "cigarette vocs", and "environmental tobacco smoke", all with and without the search term "pdf" added. Several articles were researched but few met the criteria, explained below, in relation to the purpose of this paper. To fill in a few gaps and ensure more compatible cross-references, a few other previously researched articles on electronic cigarettes were used. In order to meet criteria for the purpose of this paper, articles needed to quantify data on either VOC emissions or inorganic compounds and metals contained in the air studied. One study was purchased through ScienceDirect (Charles, Batterman & Jia, 2007) and data from two others was accessed through reports on third-party websites. For example, formaldehyde content of secondhand e-cig vapor was not reported in the Burstyn study (2014), but it was detected by Schripp, Markewitz, Uhde, & Salthammer (2013). However the Schripp et al. paper was not purchased because the data on formaldehyde levels detected in e-cig vapor was reported by Tobacco Truth (Rodu, 2013). Likewise, data for formaldehyde emissions was reported by Moser et al. (2005) and accessed through a press release (MHARR, 2008).

Regulatory and Recommended Limit Calculations

All relevant data was imported manually into a spreadsheet, with a separate tab for each group of results. The spreadsheet included seven tabs for data entry and one tab for charts. For the study on outdoor air at three LA elementary schools (Resurrection, Central LA, the average of all three was used for volatile organic compounds. Since total suspended particulate matter for trace elements was only measured at one school (Resurrection) just those results were used.

After entering in previously reported VOC and inorganic compound results, all data was converted into either PPM or mg/m^3 if it wasn't reported as such. The lowest regulatory or recommended exposure limit for each was searched on either the OSHA (accessed Jan 30, 2014) or, in the case of Isoprene, the AIHA 2011 WEELs (accesed Jan 30, 2014) website. Lowest, or most stringent, exposure limits reported for each article in either PPM or mg/m^3.

For the Burstyn (2014) study, exposure limit ratios had already been calculated but ratios for all other groups of study results, except mainstream and sidestream cigarette smoke, were calculated in the spreadsheet for the purpose of this paper.

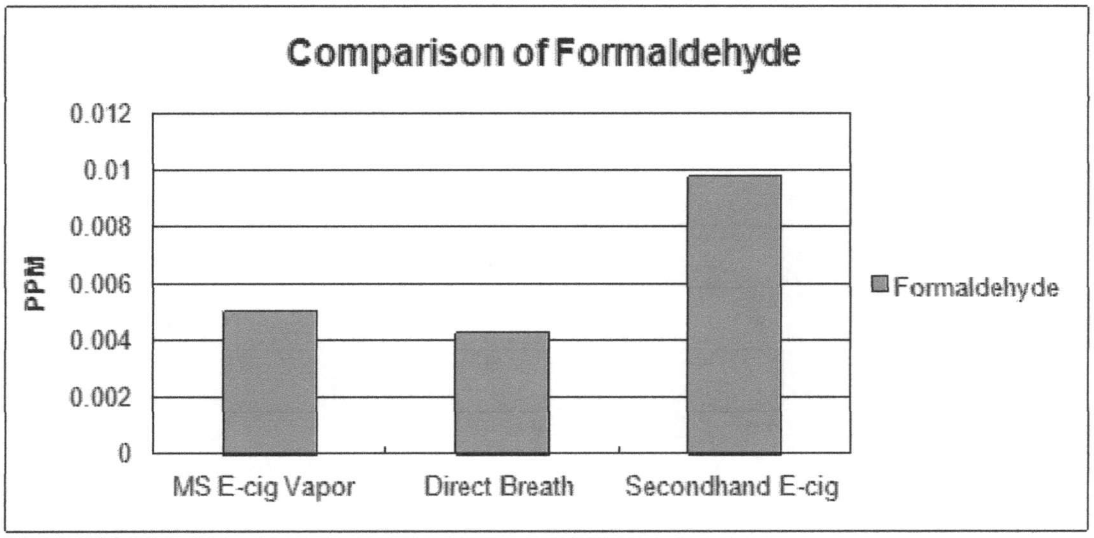
Comparison and Charts

Any relevant and comparable data was pulled into a separate tab on the spreadsheet to create charts. For elements and compounds with multiple results, the average was used for comparisons. The only problem with the comparisons was that the way human breath was measured made results directly incomparable to secondhand/passive vapor. Hence no charts were made comparing human breath solely with passive vapor. However, it could be used to show that breath combined with mainstream e-cig vapor could produce similar results to the those of passive vapor.

Results and discussion

Volatile organic compounds were found in all three sources compared. The results for formaldehyde provided an interesting comparison, as levels detected in mainstream e-cig vapor nearly matched those of human breath. Even those these results were detected in different studies, when added together they are comparable with formaldehyde levels found in secondhand vapor.

Fig. 1a



Acetone, while detected at levels below exposure limits for both mainstream e-cig vapor and human breath, was significantly higher in the latter. Results for passive vaping were actually below those of human breath.

Fig. 1b

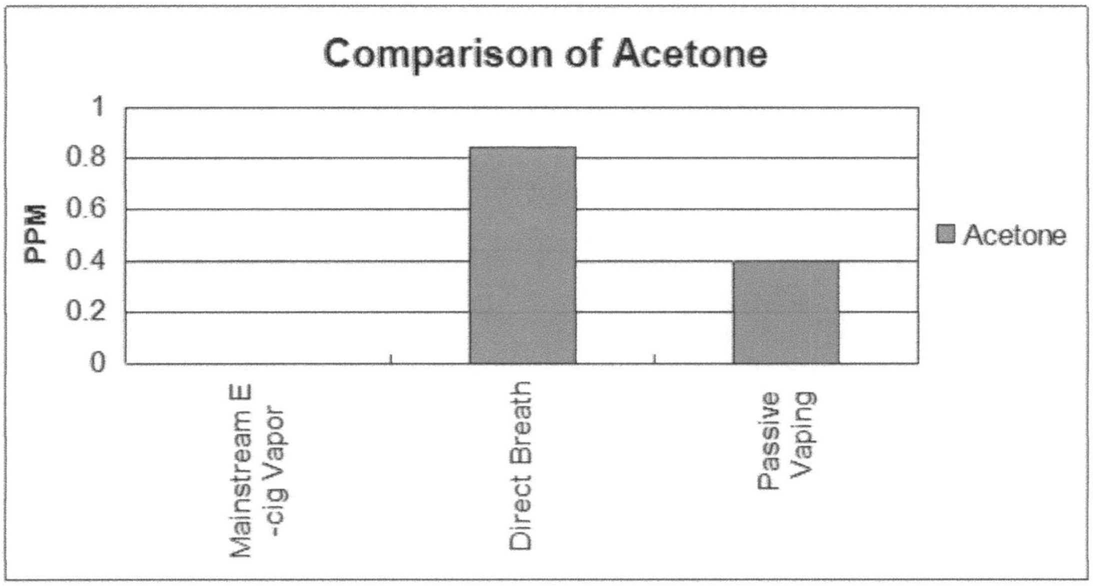
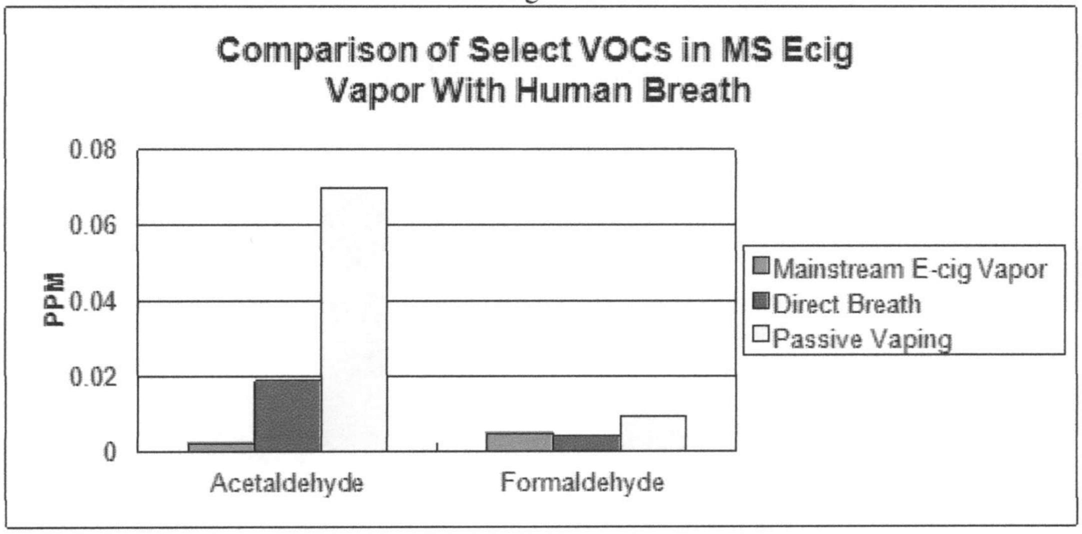


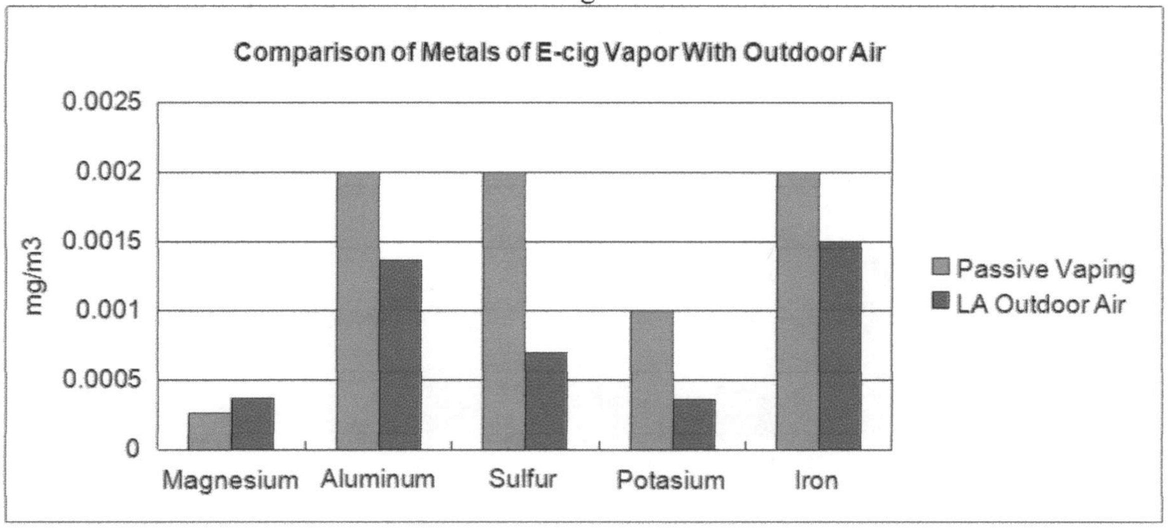
Fig. 1c



Acetaldehyde was also detected higher levels in direct human breath than in mainstream vapor. However, it was detected at significantly higher levels in passive vaping than in human breath. But in terms of exposure limits, all were well under 1%.

Figure 2 below shows comparisons of trace elements found in e-cig vapor with the same detected in Los Angeles outdoor air at Resurrection Catholic School in Boyle Heights. All trace elements found in both sources were at levels below .002mg/m^3 and well within exposure limits.

Fig 2


Comparison of Metals of E-cig Vapor With Outdoor Air
0.0025
0.002
0.0015
0.001
0.0005
0
mg/m3
Magnesium
Aluminum
Sulfur
Potasium
Iron
Passive Vaping
LA Outdoor Air

Tables

Volatile Organic Compounds

Table 1a: MS Exposure predictions based on analysis of e-cigarette aerosols generated by smoking machines

Compound	Estimated concentration in personal breathing zone: PPM	Estimated concentration in personal breathing zone: mg/m³	Most Stringent Limit (PPM)	Most Stringent Limit (mg/m³)	Ratio of most stringent TLV (%): Calculated directly	Ratio of most stringent TLV (%): Safety factor 10
Acetaldehyde	0.005		25		0.02	0.2
	0.003		25		0.01	0.1
	0.001		25		0.004	0.04
	0.00004		25		0.0001	0.001
	0.0002		25		0.001	0.01
	0.001		25		0.004	0.04
	0.008		25		0.03	0.3
Acetone	0.002		250		0.0003	0.003
	0.0004		250		0.0001	0.001
Acrolein	0.001		0.1		1	13
	0.002		0.1		2	20
	0.006		0.1		6	60
Butanal	0.0002		25		0.001	0.01
Crotonaldehyde		0.0004		0.86	0.01	0.1
Formaldehyde	0.002		0.3		0.6	6
	0.008		0.3		3	30
	0.006		0.3		2	20
	0.00024		0.3		<0.1	<1
	0.0003		0.3		0.1	1
	0.01		0.3		4	40
	0.009		0.3		3	30
Glyoxal		0.002		0.1	2	20
		0.006		0.1	6	60
o-Methylbenzaldehyde		0.001		0.5	0.05	0.5
p,m-Xylene		0.00003		434	0.001	0.01
Propanal	0.002		20		0.01	0.1
	0.0006		20		0.002	0.02
	0.0005		20		0.02	0.2
Toluene	0.0001		10		0.003	0.03
Valeraldehyde		0.0001		175	0.0001	0.001

Resource: http://www.biomedcentral.com/content/pdf/1471-2458-14-18.pdf

Table 1b: Environmental Exposure predictions for volatile organic compounds based on analysis of aerosols generated by volunteer vapers

Compound	Estimated concentration in personal breathing zone (PPM)	Most Stringent Limit (PPM)	Ratio of most stringent Exposure Limit (%) Calculated directly	Ratio of most stringent Exposure Limit (%) Safety factor 10	Ref.
2-butanone (MEK)	0.04	200	0.02	0.2	[1]
	0.002	200	0.007	0.07	
2-furaldehyde	0.01	2	0.7	7	
Acetaldehyde	0.07	25	0.3	3	
Acetic acid	0.3	10	3	30	
Acetone	0.4	250	0.2	2	
Acrolein	<0.001	0.1	<0.7	<7	
Benzene	0.02	0.5	3	30	
Butyl hydroxyl toluene	0.00004	1	0.002	0.02	
Isoprene*	0.1	2	7	70	
Limonene	0.009	30	0.03	0.3	
	0.00002	30	0.000001	0.00001	
m,p-Xyelen	0.01	100	0.01	0.1	
Phenol	0.01	5	0.3	3	
Propanal	0.004	20	0.01	0.1	
Toluene	0.01	10	0.07	0.7	
Formaldehyde	0.00978	0.3	3.26	32.6	[2]
Alkaloids					
Nicotine	0.0005	0.075	0.66	6.6	[3]

1. http://www.biomedcentral.com/content/pdf/1471-2458-14-18.pdf
2. http://onlinelibrary.wiley.com/doi/10.1111/j.1600-0668.2012.00792.x/abstract
3. http://ntr.oxfordjournals.org/content/early/2013/12/10/ntr.ntt203.short

* Limit 2 ppm per 8 hrs established by AIHA WEELs

Tables 1a and 1b show the results from Dr. Igor Burstyn's (2014) study on electronic cigarette vapor. The first table shows levels of mainstream volatile organic compounds detected by smoke machines while the second shows levels of VOCs detected in passive vapor generated by volunteer vapers. Formaldehyde wasn't reported for passive vaping by Burstyn but it had been previously measured by Schripp et al. (2012) at 12 ug/m^3, or .00978 ppm. Table 1b also shows measurement of nicotine detected in passive vapor in the Czogala et al. (2013) study.

Table 2: Concentrations of VOCs in Exhaled Human Breath

	Weighted Average		Most Stringent Limit[2]	Ratio of most stringent Limit		
Compound	ppm	mg/m3	ppm	Percentage	Safety Factor 10	Ref
Acetaldehyde	0.019	0.035	25	0.076	0.76	[1]
Acetone	0.84	2.30	250	0.336	3.36	
Butanone	0.016	0.047	200	0.008	0.08	
1-Butene	0.063	0.14	250	0.0252	0.252	
Dimethyl Sulfide	0.012	0.03	10	0.12	1.2	
Ethanol	0.77	1.40	1,000	0.077	0.77	
Ethyl Acetate	0.017	0.062	400	0.00425	0.0425	
Ethylene	0.023	0.026	200	0.0115	0.115	
Formaldehyde	0.0043	0.00528	0.3	1.43	14.33	[2]
Furan	0.014	0.039	None	n/a	n/a	[1]
Hexanal	0.011	0.045	None	n/a	n/a	
Isoprene*	0.21	0.59	2	10.5	105	
Isopropanol	0.15	0.37	200	0.075	0.75	
Methanol	0.33	0.43	200	0.165	1.65	
Methyl Ethyl Ketone	0.01	0.029	200	0.005	0.05	
Pentane	0.012	0.035	120	0.01	0.1	
1-Pentene	0.021	0.06	None	n/a	n/a	
n-Propanol	0.13	0.32	100	0.13	1.3	

1. http://www.tandfonline.com/doi/pdf/10.1080/10473289.1999.10463831
2. http://www.businesswire.com/news/home/20080404005660/en/

* Limit 2 ppm per 8 hrs established by AIHA WEELs

Table 2 shows the concentrations of volatile organic compounds detected in the Fenske & Paulson (1999) study. Formaldehyde levels were taken from a 2005 Moser et al. study and reported in a MHARR press release (2008). Isoprene levels detected from direct breath readings are actually pushing exposure safety, however when calculated for various enclosed public spaces (p. 596) they fall safely within limits.

Table 3: Concentrations of VOCs in Outdoor Air at Three LA Measuring Sites

Compound	Average found in air of 3 LA measuring sites (PPM)	Most Stringent Limit[1] (PPM)	Ratio of Most Stringent Limit	
			Percent	Safety Factor 10
Toluene	0.00124	10	0.0124	0.124
m+p-xylenes	0.00064	100	0.00064	0.0064
Benzene	0.00042	0.5	0.084	0.84
Methylene Chloride	0.00056	25	0.00224	0.0224
2-butanone	0.00065	200	0.000325	0.00325
o-xylene	0.00022	100	0.00022	0.0022
Ethylbenzene	0.00018	20	0.0009	0.009
1,3-butadiene	0.00008	1	0.008	0.08
Acetone	0.00684	250	0.002736	0.02736
Formaldehyde	0.0032	0.3	1.067	10.667
Acetaldehyde	0.0014	25	0.0056	0.056

Reference: http://www.aqmd.gov/tao/AQ-Reports/Resurrection_Catholic_School_Study.pdf

Table 3 reflects averages of volatile organic compounds captured using a gas chromatograph-mass spectrometer at three Los Angeles testing sites (Resurrection, Rubidoux and Central LA). All are well within recommended and regulatory limits.

Table 6 below contains the levels (in micrograms per cubic meter) of VOCs found in environmental tobacco smoke (ETS) from an IARC Monographs study (2004) and Schripp (2013). These make up just a small fraction of the contaminants found in secondhand cigarette smoke. Nicotine, an alkaloid, is shown at the bottom of the table.

Table 6: VOC Levels of ETS

VOC	Cigarette Emissions (µg/m3)	PPM	PPB	Most Stringent Limit (PPM)	Ratio of Most Stringent Limit: Percentage	Ratio of Most Stringent Limit: Safety Factor 10
Formaldehyde	143	0.117	117	0.3		
Benzene	30	0.00939	9.39	0.5	1.878	18.78
Toluene	54.5	0.01446	14.46	10	0.14	1.45
1,3-Butadiene	40	0.01808	18.08	1	1.81	18.08
Acetaldehyde	268	0.149	149	25	0.60	5.96
Isoprene	657	0.236	236	2		
Styrene	10	0.00235	2.35	20	0.01	0.12
Catechol	1.24	0.00028	0.28	5	0.01	0.06
3-Ethenyl pyridine	37.1	0.00863	8.63	Not listed	n/a	n/a
Ethylbenzene	8.5	0.00196	1.96	20	0.01	0.10
Pyridine	23.8	0.00736	7.36	1	0.74	7.36
Limonene	29.1	0.00522	5.22	30	0.02	0.17
Phenol	16.7	0.00434	4.34	5	0.09	0.87
m, p-xylene	28	0.00415	4.15	100	0.004	0.04
Acetone	64	0.02694	26.9	250	0.01	0.11
2-Butanone	19	0.00644	6.44	200	0.003	0.03
2-Furaldehyde	21	0.00534	5.34	2	0.27	2.67
Propanal	12	0.00488	4.88	20	0.02	0.24
Acetic Acid	68	0.02769	27.69	10	0.28	2.77
Alkalines						
Nicotine	90.8	0.01368	13.68	0.075	18.24	182.40

Inorganic Compounds

Table 4: Exposure predictions based on analysis of aerosols generated by smoking machines: Inorganic Compounds

Element quantified	Assumed compound containing the element for comparison with TLV	Estimated concentration in personal breathing zone (mg/m3)	Most Stringent Limit (mg/m^3)	Ratio of most stringent TLV (%)	
				Calculated directly	Safety factor 10
Aluminum	Respirable Al metal & insoluble compounds	0.002	10	0.2	2
Barium	Ba & insoluble compounds	0.00005	0.5	0.01	0.1
Boron	Boron oxide	0.02	10	0.1	1
Cadmium	Respirable Cd & compounds	0.00002	0.002	1	10
Chromium	Insoluble Cr (IV) compounds	3.00E-05	0.0002	0.3	3
Copper	Cu fume	0.0008	0.1	0.4	4
Iron	Soluble iron salts, as Fe	0.002	1	0.02	0.2
Lead	Inorganic compounds as Pb	7.00E-05	0.00015	0.1	1
		0.000025	0.00015	0.05	0.5
Magnesium	Inhalable magnesium oxide	0.00026	10	0.003	0.03
Manganese	Inorganic compounds, as Mn	8.00E-06	0.02	0.04	0.4
Nickel	Inhalable soluble inorganic compounds, as Ni	2.00E-05	0.015	0.02	0.2
		0.00005	0.015	0.05	0.5
Potassium	KOH	0.001	2	0.1	1
Tin	Organic compounds, as Sn	0.0001	0.1	0.1	1
Zinc	Zinc chloride fume	0.0004	1	0.04	0.4
Zirconium	Zr and compounds	3.00E-05	5	0.001	0.01
Sulfur	SO_2	0.002	0.25	0.3	3

Reference: http://www.biomedcentral.com/content/pdf/1471-2458-14-18.pdf

Table 4a shows the levels of inorganic compounds and metals from mainstream e-cig vapor detected in Burstyn's (2014) study. Again, all are well within exposure limits.

Table 5: Average Levels of Trace Elements in TSP at Resurrection Catholic School

Compound	Average found in TSP of Ressurection school (mg/m3)	Most Stringent Limit (mg/m3)	Ratio of Most Stringent Limit	
			Percent	Safety Factor 10
Magnesium	0.00037	10	0.0037	0.037
Aluminum	0.00136	10	0.0136	0.136
Silicon	0.00184	5	0.0368	0.368
Sulfur	0.00069	0.25	0.276	2.76
Potasium	0.00036	2	0.018	0.18
Calcium	0.00102	2	0.051	0.51
Iron	0.0015	1	0.15	1.5
Hexavalent Chromium	0.00000011	0.0002	0.055	0.55

Table 5 shows levels of trace elements detected in air at Resurrection Catholic School in the Boyle Heights area of Los Angeles. Five of these elements were comparable to levels of inorganic compounds detected in mainstream e-cig vapor. Levels of trace elements were not reported for human breath.

Fig 3

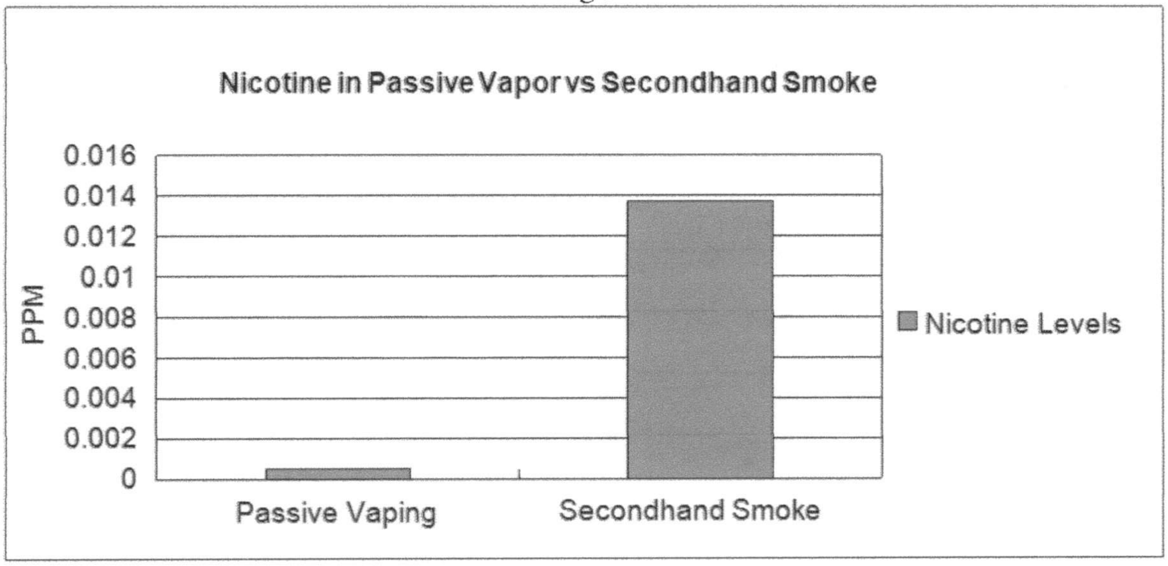


Figure 3 compares the levels of nicotine contained in passive vapor with those of secondhand smoke. Nicotine levels in ETS are ten times are 20 times more than they are in secondhand vapor. Further research is needed to assess nicotine levels of passive vaping from e-liquids with variety of nicotine strengths and from using different types of devices. However, the nicotine detected in secondhand vapor for the purpose of this study is significantly less than that of environmental tobacco smoke.

Conclusion

Prior to conducting research, it was hypothesized that volatile organic compounds of city outdoor air would be comparable to those of e-cigarette vapor, due to automobile, factory and other emission waste. However, results showed that it was the levels of metals detected in outdoor air that were actually more comparable to those of e-cig vapor. VOCs were still detected in the air of three measuring stations in Los Angeles, just not at significant levels in relation to this study.

On the contrary, VOCs detected on human breath were not only comparable to those of e-cigarette vapor, they provide a primary source for many of the chemicals found in the latter. In both indoor and outdoor public spaces, electronic cigarettes will not be the only source of air contamination. The human body emits many of the same volatile organic compounds, while outdoor air can contain many of the same trace elements found in e-cigarette vapor.

In terms of nicotine, secondhand smoke contains significantly more nicotine than passive vapor. In fact, while passive vapor has levels of nicotine well within both required and recommended exposure limits, those of ETS exceed these limits when calculating for a safety factor of 10. So while passive vapor has considerable differences with ETS, or secondhand smoke, it shares many similarities with air contaminants from sources that already exist in public places. It would be wise to consider this when drafting ordinances that single out e-cigarettes on the basis that they contain "harmful chemicals".

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Link to summary of this paper:

http://ecigarettereviewed.com/contaminants-in-e-cig-vapor-found-in-human-breath-and-outdoor-air

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