

Table 1 Study Characteristics: Acute Autonomic Effects of TC's Vs EC's

Author & Year	Study Design	Sample Size	Acute Exposure	Exposure Device (Device Type)	Nicotine Concentration	Duration Of Exposure	Nicotine/Cotinine Levels	Autonomic CV Outcomes	CVO Primary Outcomes	Conflict of Interest
Biondi-Zoccai et al, 2019 [5]	Randomized crossover study	N = 20 TC smokers	20 TC smokers 20 ECN vapers	Marlboro Gold EVC Blu-Pro	Marlboro Gold = .60mg per TC ECN Blu-Pro = 16 mg nicotine cartridge equivalent to .58mg in 9 puffs	TC - 1 cigarette ECN - 9 puffs	Serum Cotinine levels	SBP DBP	Not Primary Endpoint	No
Farsalinos et al, 2014 [15]	Randomized controlled trial	N = 76 TC smokers and ECN users	36 TC (not-crossover study) 40 ECN (not-crossover)	TC - commercially available ECN eGo-T battery Nobacco with an eGo-C atomizer, 2nd gen	TC = 1 mg ECN= 11 mg/ml nicotine cartridge	TC - 1 cigarette ECN - used for 7 mins	Not measured	SBP DBP HR	Not reported	Yes
Franzen et al, 2018 [16]	Randomized double-blind crossover study	N = 15 TC smokers	15 TC 15 ECN 15 EC0	TC - Philip Morris cig. ECN - DIPSE eGo-T battery CE4, 3rd gen EC0 - DIPSE eGo-T battery CE4, 3rd gen	TC = not reported ECN = 24 mg/mL nicotine cartridge EC0 = 0 mg/ml nicotine cartridge	TC - 1 cigarette ECN - one puff every 30 seconds for 10 (4sec) puffs, EC0 - one puff every 30 seconds for 10 (4sec) puffs	Not measured	Central SBP Central DBP Peripheral SBP Peripheral DBP HR	Not reported	No
Ikonomidis et al, 2018 [25]	Randomized crossover study	N = 70 TC smokers	N = 70 TC N = 35 ECN N = 35 EC0	TC - did not say brand, conventional cigarette ECN - eGo Epsilon BDC 1100, Nobacco TM EC0 - eGo Epsilon BDC 1100, Nobacco TM	TC = not reported ECN = 12 mg/mL nicotine cartridge EC0 = 0 mg/ml nicotine cartridge	TC - 1 cigarette ECN - 7 mins EC0 - 7 mins	Not measured	Central SBP Central DBP Peripheral SBP Peripheral DBP HR	Not reported	No

Kerr et al, 2019 [26]	Randomized non-blinded crossover study	N = 20 TC smokers	N = 20 TC N = 20 ECN	TC - commercially available ECN - SmokeMax Groove Trading Ltd, 1300mAh variable voltage rechargeable battery, a tank and an atomizer, 2nd gen	TC = approximately 0.5mg of nicotine ECN = 17.27 mg/ml nicotine cartridge	TC - 1 cigarette ECN - 15 puffs, approximately equivalent to .5mg	Not measured	SBP DBP HR	Not reported	No
Vlachopoulos et al, 2016 [47]	Crossover clinical study	N = 24 TC smokers	N = 24 TC N = 24 ECN N = 24 sham	TC - not reported ECN - not reported sham - not reported	TC = not reported ENC = not reported Sham = not reported	TC - 5 min EC - 5 min EC - 30 min sham - nothing for 60 min	Not measured	SBP DBP HR	Not reported	No
Vansickel et al, 2010 [44]	Randomized crossover study	N = 32 TC smokers	N = 32 TC N = 32 Hydro - ECN N = 32 NPRO - ECN N = 32 Sham	TC - participants used their own commercially available TC ECN – Hydro ECN - NPRO Sham - unlit TC	TC - not reported ECN - Hydro 18 mg cartridge ECN - NPRO 16 mg cartridge Sham - unlit TC	TC - 1 cigarette ECN - Hydro 10 puffs ECN - NPRO 10 puffs Sham - unlit TC	Plasma Nicotine	HR	Not reported	No
Yan et al, 2015 [52]	Randomized single-blinded, 6 period crossover trial	N = 23 TC smokers	N = 23 Product A N = 23 Product B N = 23 Product C N = 23 Product D N = 23 Product E N = 24 Product F	Product A - non-commercial ECN rechargeable cartomizer Product B - non-commercial ECN rechargeable cartomizer Product C - non-commercial ECN Magnificent Menthol rechargeable cartomizer Product D - commercially	Product A - 2.4% nicotine, 75% Gly Product B - 2.4% nicotine, 50% Gly, 20% PG Product C- 2.4%, 75% Gly Product D - 1.6% nicotine, 75% Gly Product E - 1.6% nicotine, 50% Gly, 20% PG	Product A - 50 puffs (5 sec puffs at 30 sec intervals) Product B - 50 puffs (5 sec puffs at 30 sec intervals) Product C - 50 puffs (5 sec puffs at 30 sec intervals) Product D - 50 puffs (5 sec puffs at 30 sec intervals)	Plasma Nicotine	SBP DBP HR	Not reported	Yes

				available rechargeable cartomizer Blu E-cig	Product F- not reported	Product E - 50 puffs (5 sec puffs at 30 sec intervals)				
				Product E - Classic Tobacco ECN rechargeable cartomizer		Product F - 1 entire TC				
				Product F - Marlboro Gold King Size						

Abbreviations:
CV = cardiovascular
CVO = cardiovascular outcome
DBP=diastolic blood pressure
EC - electronic cigarette
ECN - electronic cigarette with nicotine
ECO - electronic cigarette without nicotine
Gly - Glycerin
HR - heart rate
PG - Propylene Glycol
SBP = systolic blood pressure
TC - tobacco cigarette

Table 2 Study Characteristics: Acute Autonomic Cardiovascular Effects of ECs with Nicotine vs ECs without Nicotine

Author & Year	Study Design	Sample Size	Acute Exposure	Exposure Device (Device Type)	Nicotine Concentration	Duration Of Exposure	Nicotine/Cotinine Levels	Autonomic CV Outcomes	CVO Primary Outcomes	Conflict of Interest
Franzen et al, 2018 [16]	Randomized double-blind crossover study	N = 15 TC smokers	N = 15 TC N = 15 ECN N = 15 EC0	TC - Philip Morris ECN - DIPSE eGo-T battery CE4, 3rd gen EC0 - DIPSE eGo-T battery CE4, 3rd gen	TC = not reported ECN = 24 mg/mL nicotine cartridge EC0 = 0 mg/ml nicotine cartridge	TC - 1 cigarette ECN - one puff every 30 seconds for 10 puffs (4 sec inhalations) EC0 - one puff every 30 seconds for 10 puffs, (4 sec inhalations)	Not measured	Central SBP Central DBP Peripheral SBP Peripheral DBP HR	Not reported	No
Antoniewicz et al, 2019 [2]	Randomized double-blind crossover study	N = 17 Occasional TC smokers	N = 17 ECN N = 17 EC0	ECN - eVic-VT, Shenzhen Joy-Etech, 3rd gen EC0 - eVic-VT, Shenzhen Joy-Etech, 3rd gen	ECN = 19 mg/ml EC0 = 0 mg/ml	ECN = 30 puffs for 30 mins EC0 = 30 puffs for 30 mins	Baseline plasma cotinine only	SBP DBP HR	Not reported	No
Chaumont et al, 2018 [8]	Randomized single-blind crossover study	N = 25 TC Smokers	N = 25 ECN N = 25 EC0 N = 25 Sham EC	ECN - last-generation high-power EC with commercially available parts in U.S (Smoke©, Shenzen, China) EC0 - last-generation high-power EC with commercially available parts in U.S (Smoke©, Shenzen, China) Sham EC - last-generation high-power EC with commercially available parts in U.S (Smoke©, Shenzen, China) while turned off	ECN = 3 mg/ml EC0 = 0 mg/ml Sham EC = turned off	ECN = 25 puffs (4sec inhalations at 30sec intervals) EC0 = 25 puffs (4sec inhalations at 30sec intervals) Sham = 25 puffs (4sec inhalations at 30sec intervals)	Plasma nicotine	SBP DBP HR	No, secondary outcome	No

Cossio et al, 2019 [9]	Single-blind randomized study	N = 16 Nicotine naïve participants	N = 16 ECN N = 16 EC0 N = 16 Cigarette like pipe	ECN - Combination of a battery Cirrus 3, White Cloud Cigarette and cartridge EC0 - Combination of a battery Cirrus 3 and cartridge Cigarette like pipe - Harmless Cigarette Quit Smoking Aid	ECN - 5.4% nicotine EC0 - 0% nicotine Harmless Cigarette Quit Smoking Aid - 0% nicotine	ECN - 6 mins, 18 puffs (4 sec inhalations) EC0 - 6 mins, 18 puffs (4 sec inhalations) Harmless Cigarette Quit Smoking Aid - 6 mins, 18 puffs (4 sec inhalations)	Not measured	SBP DBP	Not reported	No
Moheimani et al, 2017 [34]	Open label, randomized crossover study	N = 33 Nicotine naïve participants	N = 33 ECN N = 33 EC0 N = 33 Sham	N = 15 used EC - Greensmoke cigalike device w and w/o nicotine N = 18 used EC - eGo-One by Joyetech, 2nd gen pen-like device w and w/o nicotine N = 33 used sham EC w/o e-liquid	ECN = 1.2% nicotine EC0 = 0% nicotine Sham = no e-liquid	First 6 participants - 10 mins, with a puff every 30 sec with 3 sec inhalations Last 27 participants - 30 mins, 60 puffs every 30 sec with 3 sec inhalations	Plasma nicotine Plasma cotinine	SBP DBP HRV HR	Not reported	No

Table 2 Study Characteristics: Acute Autonomic Cardiovascular Effects of ECs with Nicotine vs ECs without Nicotine

Abbreviations:

CV = cardiovascular

CVO = cardiovascular outcome

DBP=diastolic blood pressure

EC - electronic cigarette

ECN - electronic cigarette with nicotine

EC0 - electronic cigarette without nicotine

HR - heart rate

SBP = systolic blood pressure

TC - tobacco cigarette

Table 3 Study Characteristics: Chronic Autonomic Cardiovascular Effects of Electronic Cigarettes

Author & Year	Study Design	Sample Size	Exposure	Exposure Device (Device Type)	Nicotine Concentration	Duration Of Exposure	Nicotine/Cotinine Levels	Autonomic CV Outcomes	CVO Primary Outcomes	Conflict of Interest
D'Ruiz et al, 2017 [11]	5 day randomized open-label controlled trial while participants were clinically confined	N = 105 TC smokers	N = 15 Tobacco Rechargeable N = 15 Cherry Rechargeable N = 15 Cherry Disposable N = 15 TC + Tobacco Rechargeable N = 15 TC + Cherry Rechargeable N = 15 TC + Cherry Disposable N = 15 Nicotine Cessation	Tobacco Rechargeable blu EC Cherry Rechargeable blu EC Cherry Disposable blu EC Commercially available TC + Tobacco Rechargeable blu EC Commercially available TC + Cherry Rechargeable blu EC Commercially available TC + Cherry Disposable blu EC Nicotine Cessation	Tobacco Rechargeable blu EC = 86mg of nicotine in 5 days Cherry Rechargeable blu EC = 99mg of nicotine in 5 days Cherry Disposable blue EC = 99mg of nicotine in 5 days Commercially available TC + Tobacco Rechargeable blu EC = 107mg of nicotine in 5 days Commercially available TC + Cherry Rechargeable blu EC = 80mg of nicotine in 5 days Commercially available TC + Cherry Disposable blu EC = 89mg of nicotine in 5 days	Puff behavior and use topography were not reported. EC's were weighed before and after use.	Not reported	SBP DBP HR	Not reported	Yes
Ikonomidis et al, 2018 [25]	1-month randomized crossover clinical trial	N = 70 TC smokers	N = 70 all TC smokers switched to ECN N = 20 TC smoker controls	TC - did not say brand, conventional cigarette ECN - eGo Epsilon BDC 1100, Nobacco TM	TC = not reported ECN = 12 mg/mL nicotine cartridge EC0 = 0 mg/ml	TC - 1 conventional cigarette ECN - 7 mins EC0 - 7 mins	Not measured	Central SBP Central DBP Peripheral SBP Peripheral DBP HR	Not reported	No

				EC0 - eGo Epsilon BDC 1100, Nobacco TM	nicotine cartridge					
Farsalinos et al, 2016 [14]	Post hoc analysis of 12- month prospective randomized controlled trial	N = 300 TC smokers	N = 100 - ECN N = 100 - ECN N = 100 - EC0	Rechargeable Categorica EC model 401	N = 100 - EC 2.4% nicotine N = 100 - EC 2.4% nicotine + EC 1.8% nicotine N = 100 - EC 0% nicotine	ad libitum (but up to a maximum of four cartridges per day	Not measured	SBP DBP HR	Not primary or secondary outcome	Yes
Moheimani et al, 2017 [35]	Cross sectional case control study	N = 42 (23 EC vapers and 19 nicotine naïve)	N/A	Participant chosen commercially available EC	N= 21 own EC brand	Not reported	Plasma nicotine and cotinine	HRV HR BP	HRV Primary outcome	No
Polosa et al, 2017 [38]	3.5 yr Prospective observational study	N = total 21 (9 EC vapers and 12 nicotine naïve)	N/A	Assortment of refillable EGO style products and more advanced refillable devices including Provari, Innokin, Joyetech eVIC, Avatar Puff	6 of the 9 EC users used EC with nicotine 3 of the 9 EC users used EC without nicotine	ad libitum daily use	Not measured	SBP DBP HR	Not reported	Yes
Veldheer et al, 2019 [45]	3mo Randomized controlled trial	N = 263 TC smokers	N = 72 Cigarette substitute users N = 191 ECN users in one of 3 EC study arms	EC - 3.3-4.1 V, 1100 mAh rechargeable battery and a 1.5 Ohm, dual-coil, 510-style cartomizer (SmokTech, Shenzhen, China). Cigarette substitute - QuitSmart, Inc., NC. Plastic tube that resembles a cigarette	Cig-Sub arm 1 = 0mg/ml of nicotine EC arm 2 = 0mg/ml of nicotine EC arm 3 = 8mg/ml of nicotine EC arm 4 = 36mg/ml of nicotine	Puff behavior and use topography were not reported, although investigators said participants were asked to track number of puffs.	Not measured	SBP DBP HR	Not reported	No

George et al, 2019 [18]	Prospective randomized trial	N = 145 TC smokers	N = 40 TC Smokers N = 37 ECN users N = 37 EC0 users	TC – commercially available EC - Vapourlites Starter Kit EC0 - Vapourlites Starter Kit	TC – commercially available EC - Vapourlites Starter Kit with XR5 16 mg nicotine cartomizer EC0 - Vapourlites Starter Kit with 0 mg nicotine cartomizer	Puff behavior and use topography were not reported, although investigators said participants were asked to track number of puffs.	Not Measured	SBP DBP HR	Secondary outcomes	No
Polosa et al, 2016 [39]	Retrospective study	N = 89 TC smokers	N/A	N/A	N/A	N/A	N/A	SBP DBP	Primary Outcome	No

Abbreviations:

CV = cardiovascular

CVO = cardiovascular outcome

DBP=diastolic blood pressure

EC - electronic cigarette

ECN - electronic cigarette with nicotine

EC0 - electronic cigarette without nicotine

HR - heart rate

SBP = systolic blood pressure

TC - tobacco cigarette