Recent COI (e-cig related research)

R.Polosa is Professor of Internal Medicine entirely supported by the University of Cataura (Italy) and Scientific advisor for LIAF (Italian acronym for Italian Anti Smoking League)

Research grant

- ***Pharma industry*** (Pfizer, GSK, Novartis)
- ***E-Cig industry*** (Arbi Group Srl)

Consultancy role

- ***Governmental Authorities*** (Cancer Research UK; Italian Ministry of Health's Technical Committee on e-cigarette; Food and Drug Administration, USA; French National Program of Clinical Research (PHRC) of the French Ministry of Health)
- ***Pharma industry*** (Global Health Alliance for treatment of tobacco dependence)
- ***E-Cig industry*** (Arbi Group Srl; ECITA - Electronic Cigarette Industry Trade Association)

Lectures fees

- ***Governmental Authorities*** (Cancer Research UK; UK All Party Parliamentary Group; Russian "National Research and Study Institute For Public Health”)
- ***Pharma industry*** (Pfizer, Novartis)
- ***E-Cig industry*** (SFATA - Smoke-Free Alternatives Trade Association; FIVAPE; FIESEL; REAL FARMA)

E-Cigarettes use and harm reversal: emerging evidence in health and disease

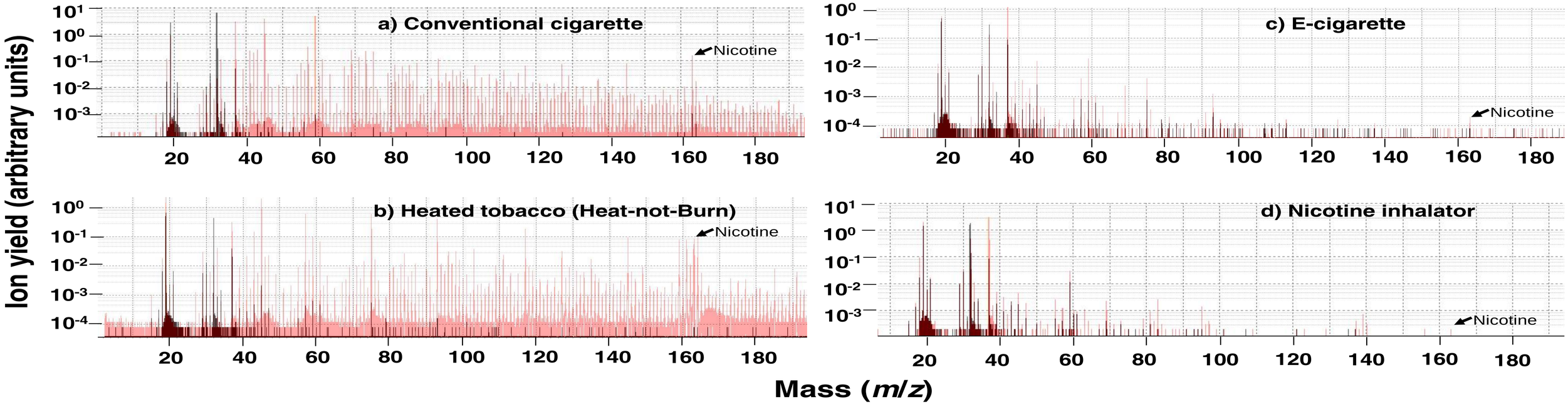
Prof. Riccardo Polosa
Institute of Internal Medicine
University of Catania
ITALY

CORESTA SSPT 2015 – Smoke Science & Product Technology | 4-8 October 2015 | Jeju, KOREA

Representative PTR-MS mass spectra of VOCs released in a single exhaled breath

O'Connell G. et al

SRNT-USA 26/02/2015

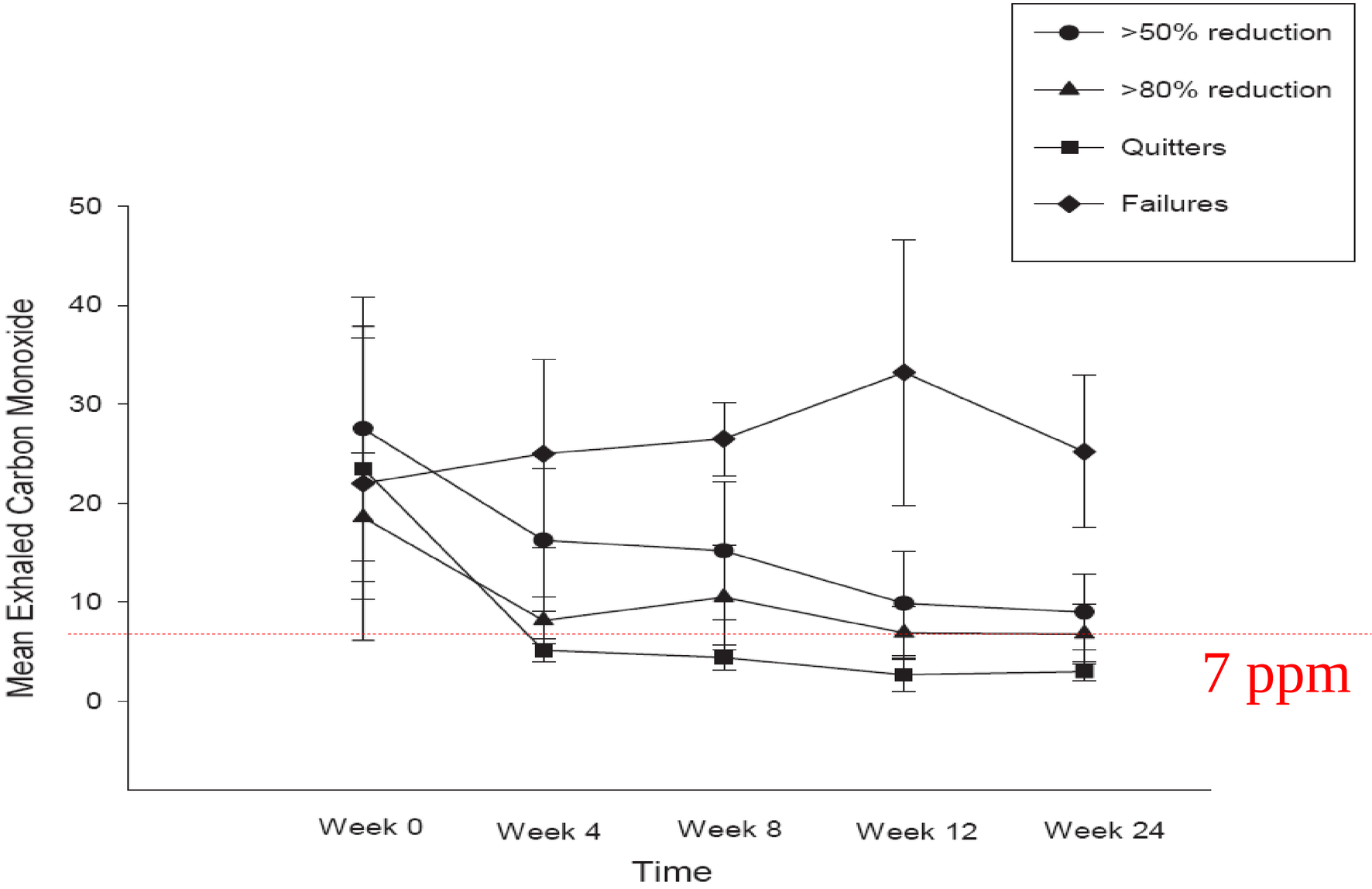


Black peaks, VOCs released in exhaled breath (background control)
Red peaks, VOCs released in exhaled breath following product use.
Specific compound (ion trace) at m/z 163 is nicotine and is labelled with arrowhead.

BoE

Exhaled CO in ECIG users

R. Polosa et al. BMC Public Health 2011

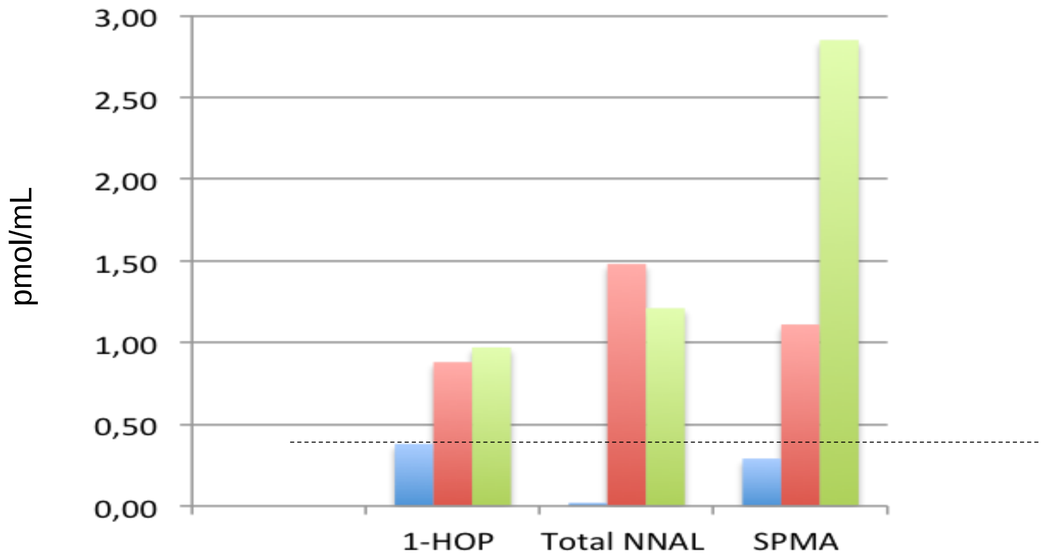


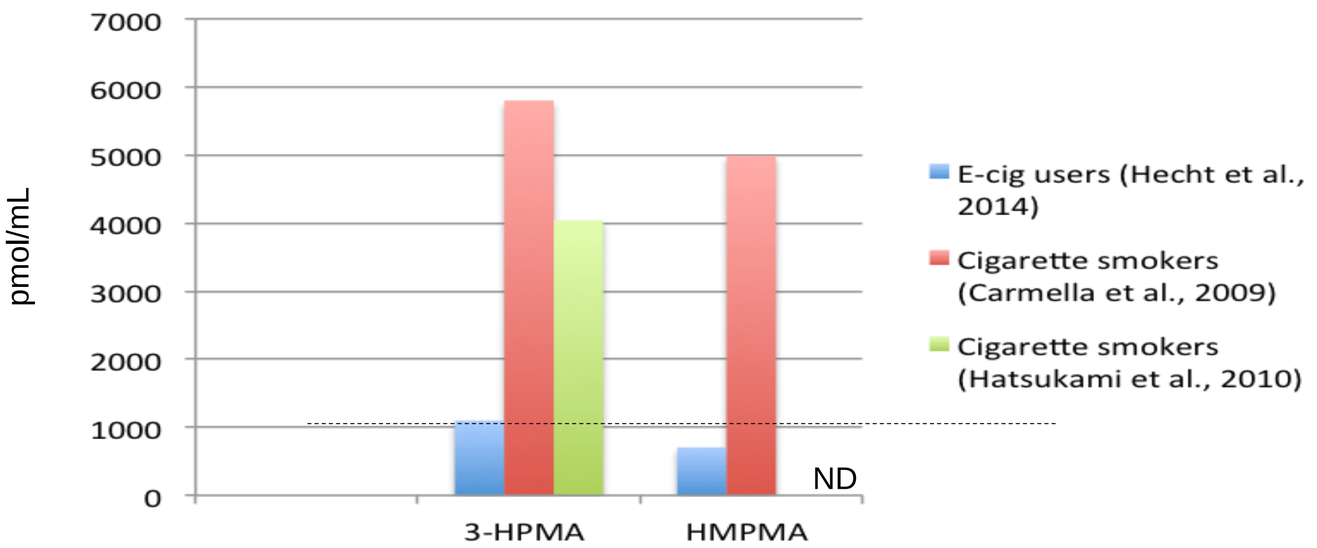
BoE

ECs have a more favorable toxicity profile than tobacco cigarettes

Carcinogen metabolites levels in the urine of EC users and cigarette smokers

(adjusted for age and sex)

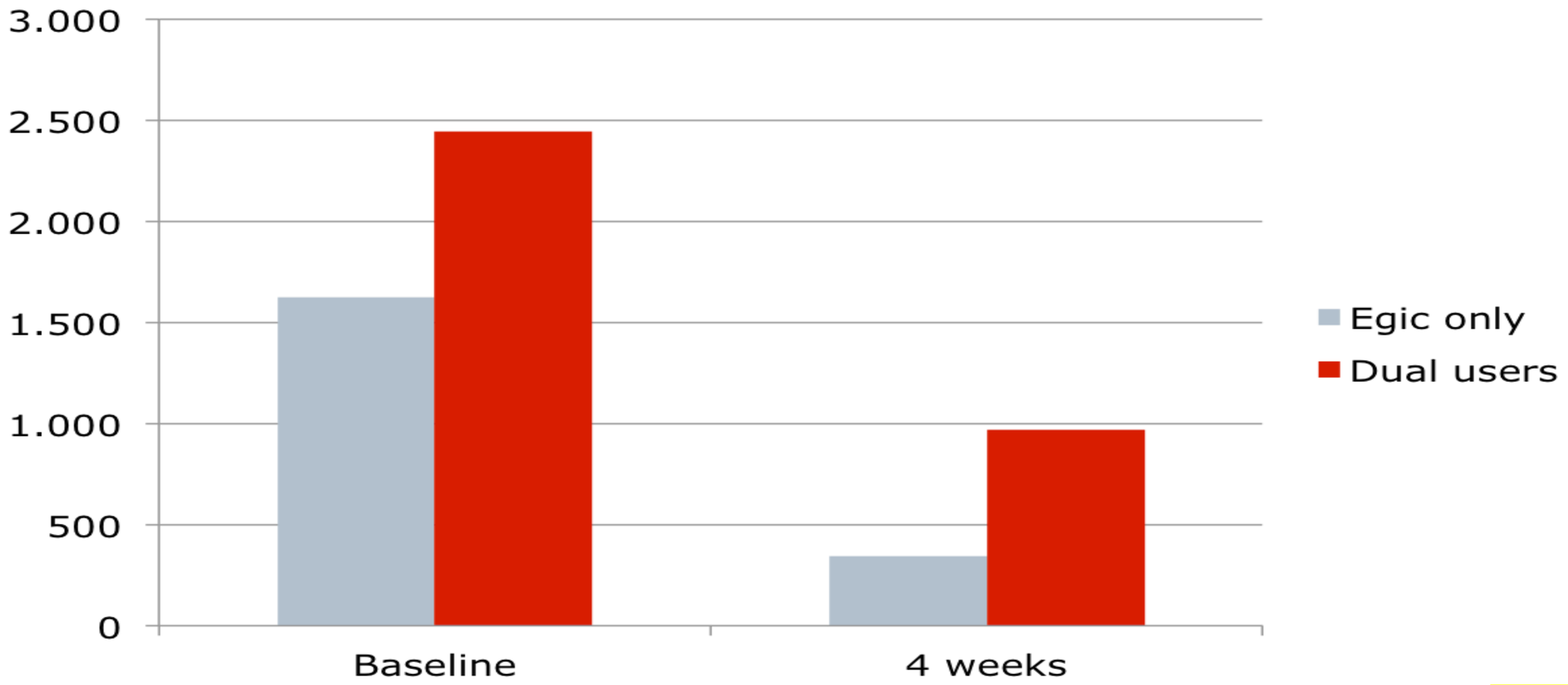




BoE

Hect SS, et al. Nicotine Tob Res 2015

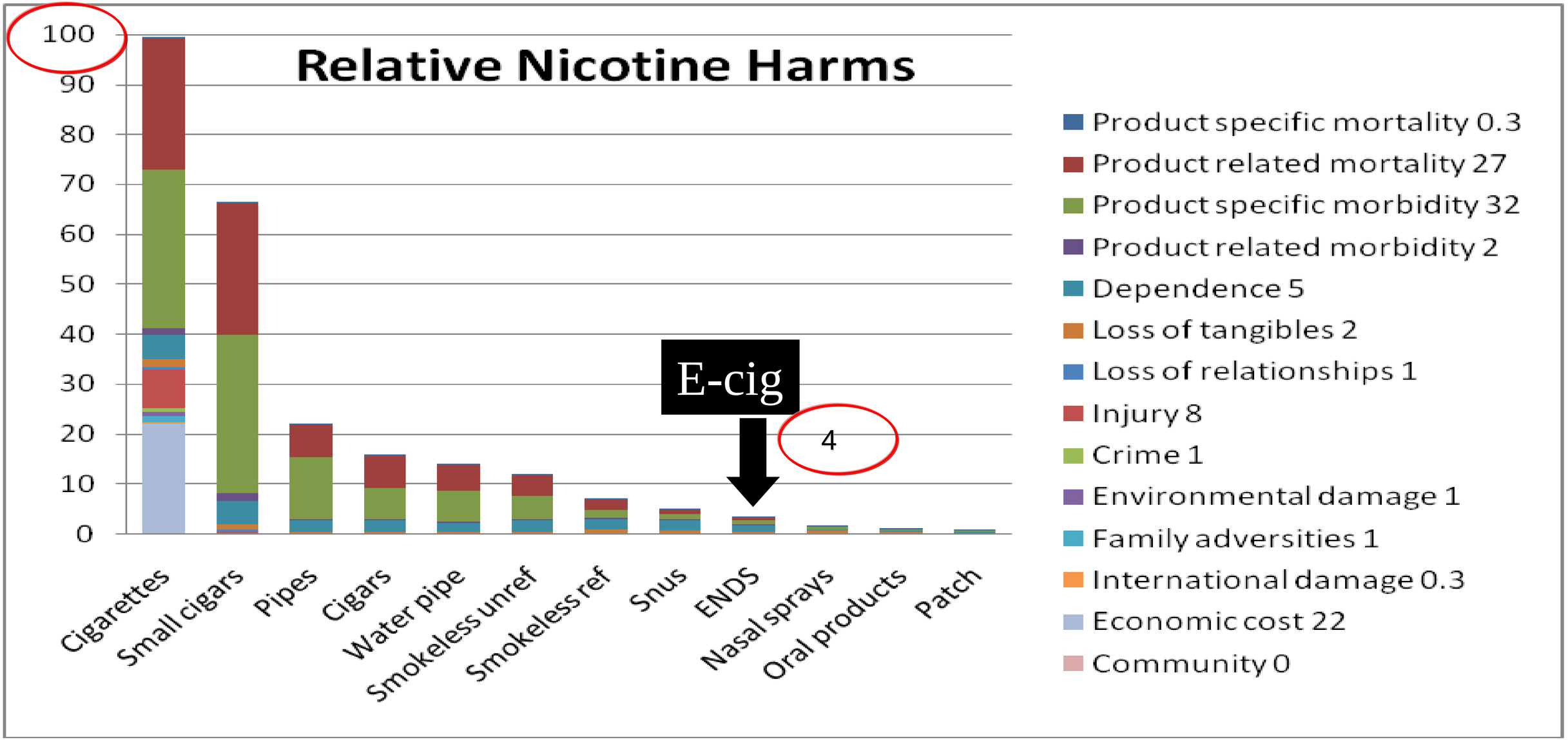
Change in 3-HPMA (ng/mg creatinine) at baseline and after 4 wks of EC use



BoE

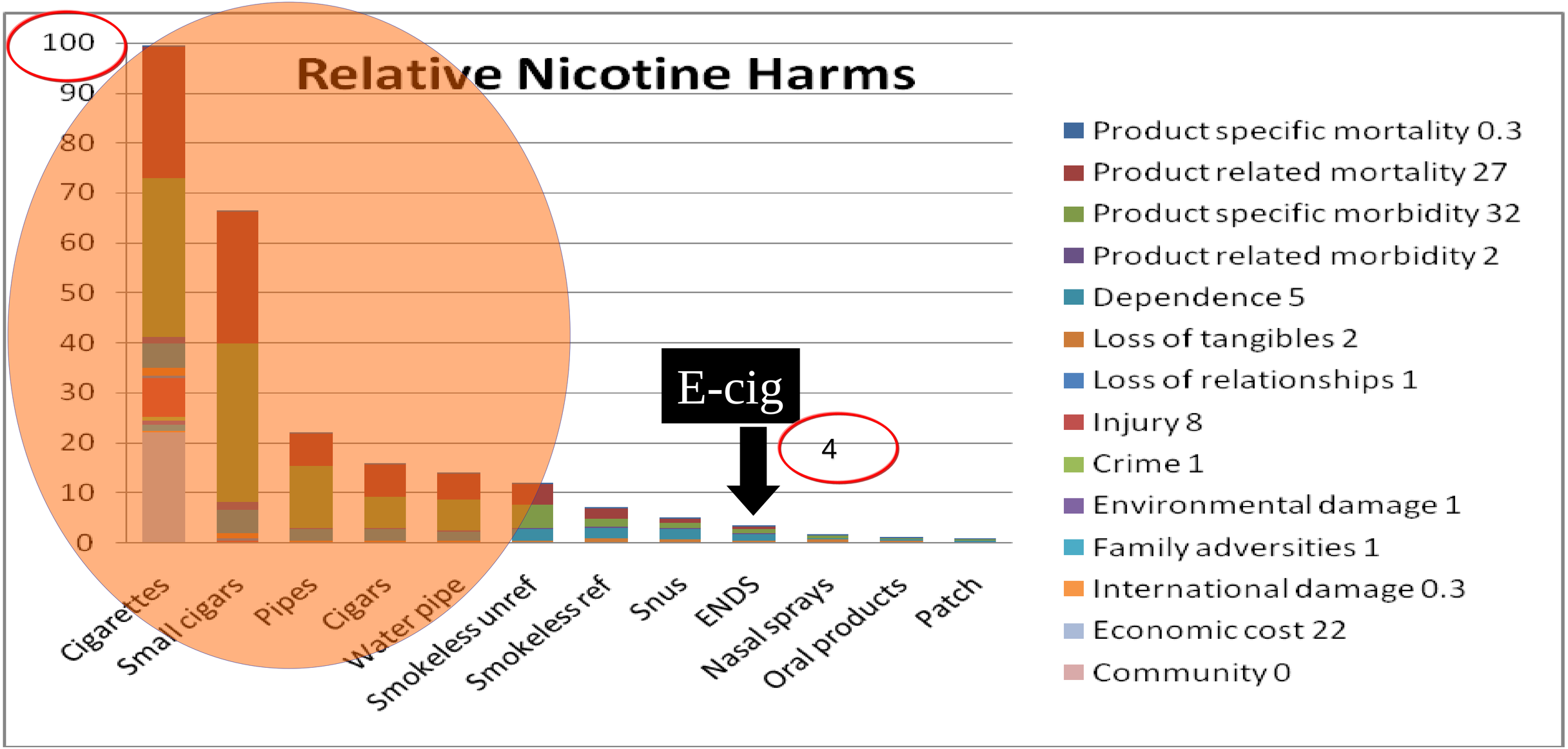
McRobbie et al. Cancer Prev Res; 8(9) September 2015

Nicotine containing products: risk estimates



DJ Nutt, LD Phillips, D Balfour, HV Curran, M Dockrell, J Foulds, K Fagerstrom, K Letlape, A Milton, R Polosa, J Ramsey, D Sweanor. Estimating the harms of nicotine-containing products using the MCDA approach. Eur J Addiction 2014

Nicotine containing products: risk estimates



DJ Nutt, LD Phillips, D Balfour, HV Curran, M Dockrell, J Foulds, K Fagerstrom, K Letlape, A Milton, R Polosa, J Ramsey, D Sweanor. Estimating the harms of nicotine-containing products using the MCDA approach. Eur J Addiction 2014

The Demise of the Traditional Cigarette is Long Past Due.

Traditional Cigarettes have been essentially the same since 1881 when James Bonsack invented the cigarette-making machine. Cigarettes may have changed over the years, but they have not progressed much.

NOT ADAPTABLE

Source: An 1892 Duke of Durham box of machine-rolled cigarettes, healthliteracy.worlded.org

"Change Is Inevitable, but Progress Is Not"

Vaping is an Idea Whose Time Has Come.

Vaping is an idea whose time has come. I'm not surprised that the vaping phenomenon is here, but I am surprised that it took so long to get here. The adaptability of vaping technology will allow it not only to survive, but to thrive.

EXTREMELY ADAPTABLE

3D Printed Mod

Source: facebook.com/vapedroid

Source: supersmokerbluetooth.com

Gamucci Launches New Scientific Products Division to Lead e-Cig Industry in Innovation and Quality

Gamucci Electronic Cigarettes are sold in 55 countries worldwide

Do significant reductions in BoEs lead to significant changes in BoBEs?

Overall changes in biomarkers in RTP and control groups

Shepperd et al. 2015, Reg Tox Pharma 72:273-291 ; Haswell et al. 2014, Biomarkers 19:356-367

RTP Smokers

Biomarker	Change at the EOS (%)	Biomarker	Change at the EOS (%)
HMPMA‡†	-75%	4 - ABP‡†	-17%
NNN‡†¶	-66%	2 - AN‡†	-10%
CEMA‡†	-59%	8-iso-PGF2 type VI	-6%
NAB‡†	-44%	o-tol	-4%
NNAL‡†	-40%	WBCs	0%
3 - HPMA‡†	-34%	8-iso-PGF2 type III	3%
3 - ABP‡†	-32%	Phenanthrene ('total')	19%
MHBMA‡†	-31%	Nicotine Equivalents‡†	26%
1 - OHP‡†	-30%	Saliva Cotinine‡†	28%
NAT‡†	-28%	Naphthalene ('total')	55%
ECO‡†	-19%	sICAM-1‡†¶	60%
DTBX	-19%	Fluorene ('total')	81%

‡ Denotes % changes with Baseline vs. EOS values statistically significant as determined by evaluation of the simple effects in the statistical models that include only the smoking groups with CPD as a covariate

† Denotes % changes with Baseline vs. EOS values statistically significant as determined by evaluation of the simple effects in the statistical models that include only the smoking groups without CPD as a covariate.

¶ Denotes statistical significance derived from analysis excluding extreme values

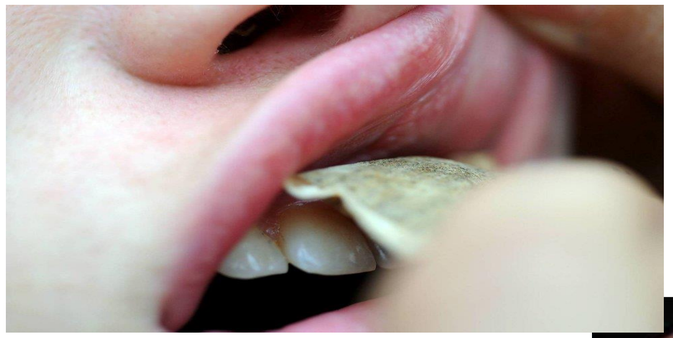
ECs: from risk reduction to harm reversal

1. Impossibility to provide long term evidence for THR for many years

2. Direct evidence for harm reversal in health and disease can be generated (focus on biomarkers used as proxy for risk prediction in respiratory, cardiovascular and metabolic disease)

3. These emerging evidence-based findings should be communicated (to improve counseling between physicians and their patients using or intending to use THR products)

XXI Century
Current THR approaches



NCP that
are enjoyable

NCP that are
NOT enjoyable

XXI Century
Current THR approaches

Polosa *et al. Harm Reduction Journal* 2013, **10**:19
http://www.harmreductionjournal.com/content/10/1/19

HARM REDUCTION JOURNAL

REVIEW Open Access

A fresh look at tobacco harm reduction: the case for the electronic cigarette

Riccardo Polosa[1,2*], Brad Rodu[3], Pasquale Caponnetto[1], Marilena Maglia[1] and Cirino Raciti[1]

NCP that
are enjoyable

ECs: from risk reduction to harm reversal

Direct evidence for harm reversal in health (i.e. early changes can be detectable in ‘healthy’ smokers switching to vaping)

Direct evidence for harm reversal in disease (i.e. early changes can be detectable in EC users with preexisting disease)

Exploring ECs harm reversal potential

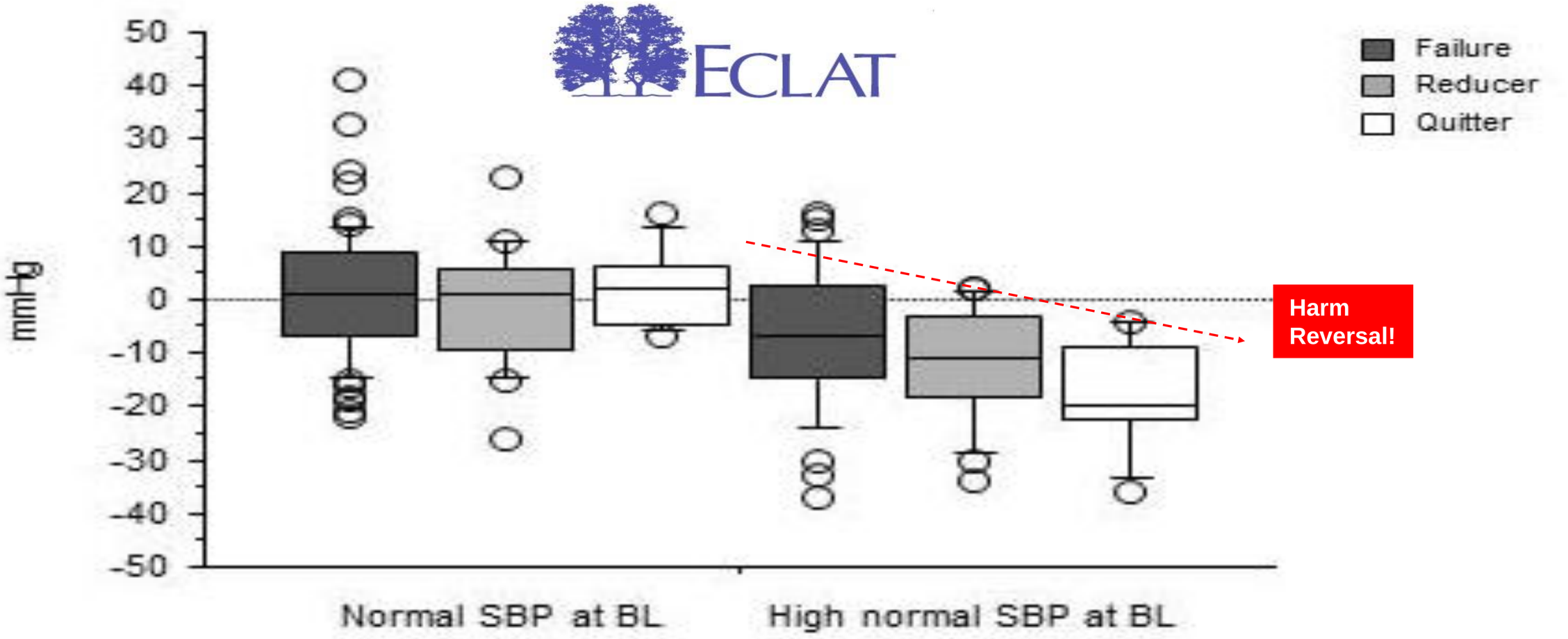
(e.g. reduction in biomarkers used as proxy for risk prediction in CVD)

STUDY ASSESSMENTS

Procedure		BL Visit	Wk2	Wk4	Wk6	Wk8	Wk10	Wk12	Wk24	Wk52
		Visit 1	**Visit 2**	**Visit 3**	**Visit 4**	**Visit 5**	**Visit 6**	**Visit 7**	**Visit 8**	**Visit 9**
Informed consent		X								
SMOKE CHART	Sociodemografic factors	X								
	Medical history	X								
	Drug history	X								
	Physical examination	X						X	X	X
	Vital signs – HR & BP	X	X	X	X	X	X	X	X	X
	Weight - Kg	X						X	X	X
	Smoking Hx	X								
	BDI and BAI	X								
	FTND	X								
	eCO	X	X	X				X	X	X
GN-SBQ		X								
NO and spirometry		X		X				X	X	X
Saliva collection for cotinine								X		
Give Study Diary		X	X	X						
Collect Study Diary			X	X				X		
Craving/VAS		X	X	X				X	X	X
MNWS (past 2 weeks)		X	X	X	X	X	X	X	X	X
MNWS (past 24 hrs)		X	X	X	X	X	X	X	X	X
Adverse events		X	X	X	X	X	X	X	X	X
E-cig training and dispense of E-cig kit		X								
Dispense study cartridges		X	X	X	X	X	X			
Cartridges use record			X	X	X	X	X	X		
Smokers' preference								X	X	X

Long-term effect of reduced smoking on BP in smokers switching to ECs

SBP changes at Week 52 from baseline



BLOOD PRESSURE CONTROL IN E-CIG USERS

K. Farsalinos et al. Int. J. Environ. Res. Public Health 2014

Side effects/accidents	Total (n = 19,353)	Current smokers (n = 3682)	Former smokers (n = 15,671)	Statistic	*p* value
		Dual users	Single users		
Hypertension (N = 2162)					
Worse	19 (0.8)	6 (1.5)	13 (0.7)		
Stable	944 (39.9)	194 (49.7)	750 (38.0)	$\chi^2 = 33.8$	<0.001
Improved	1149 (49.9)	139 (35.6)	1040 (52.7)		

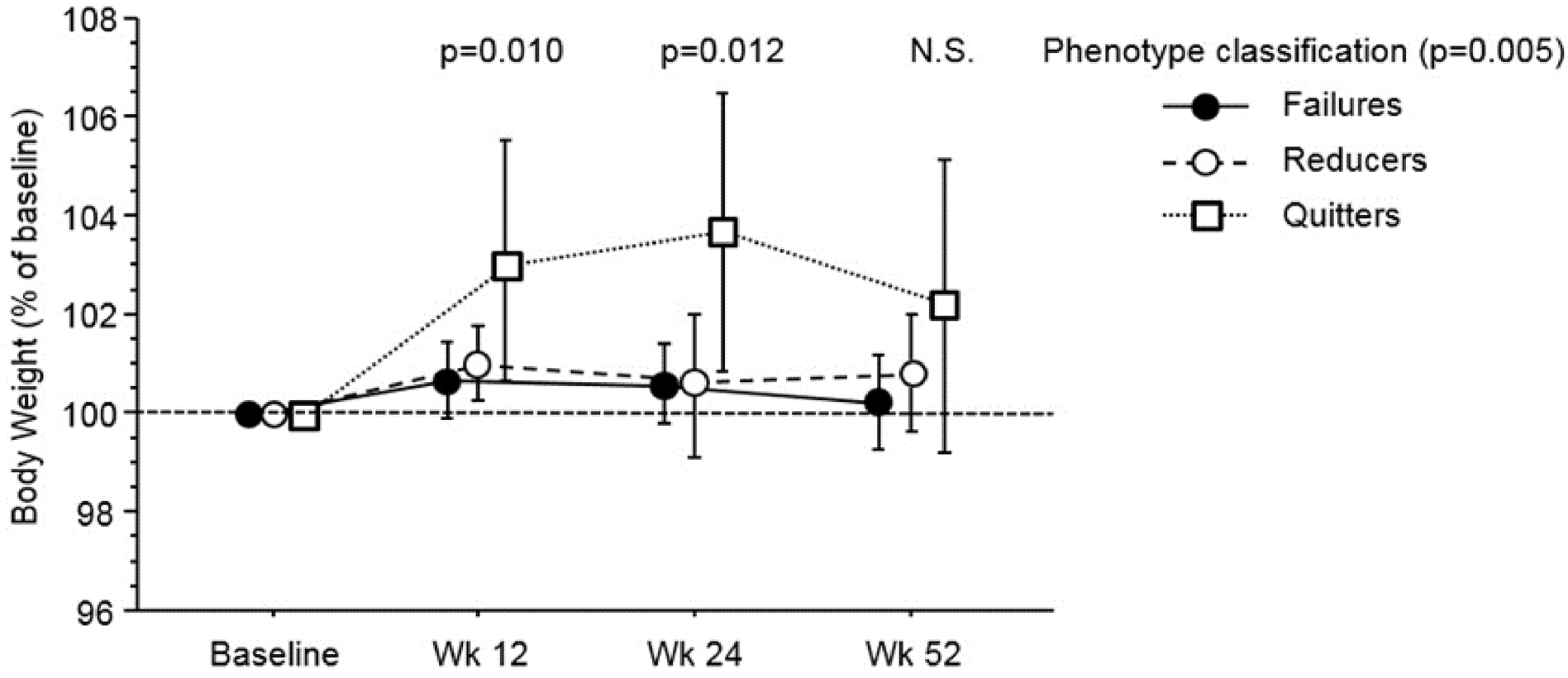
Exploring ECs harm reversal potential

(e.g. reduction in biomarkers used as proxy for risk prediction in CVD and metabolic diseases)

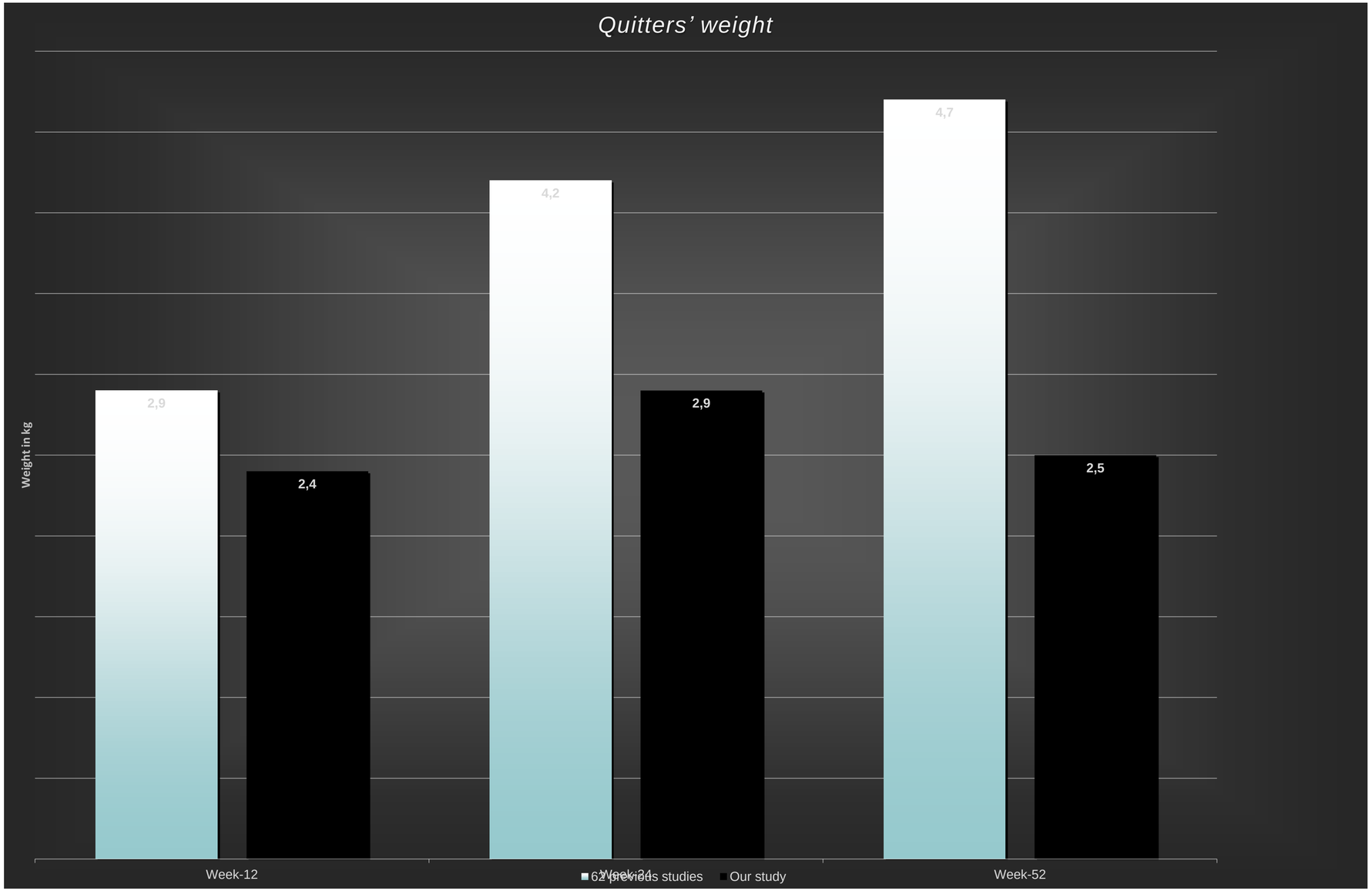
STUDY ASSESSMENTS

Procedure		BL Visit	Wk2	Wk4	Wk6	Wk8	Wk10	Wk12	Wk24	Wk52
		Visit 1	**Visit 2**	**Visit 3**	**Visit 4**	**Visit 5**	**Visit 6**	**Visit 7**	**Visit 8**	**Visit 9**
Informed consent		X								
SMOKE CHART	Sociodemografic factors	X								
	Medical history	X								
	Drug history	X								
	Physical examination	X						X	X	X
	Vital signs – HR & BP	X	X	X	X	X	X	X	X	X
	Weight - Kg	X						X	X	X
	Smoking Hx	X								
	BDI and BAI									
	FTND									
	eCO								X	X
GN-SBQ										
NO and spirometry									X	X
Saliva collection for cotinine										
Give Study Diary										
Collect Study Diary										
Craving/VAS									X	X
MNWS (past 2 weeks)									X	X
MNWS (past 24 hrs)									X	X
Adverse events									X	X
E-cig training and dispense of E-cig kit										
Dispense study cartridges		X	X	X	X	X	X			
Cartridges use record			X	X	X	X	X	X		
Smokers' preference								X	X	X

Effect of smoking abstinence/reduction on weight changes in smokers switching to ECs



Post Cessation Weight Gain in Quitters: Cochrane vs ECLAT



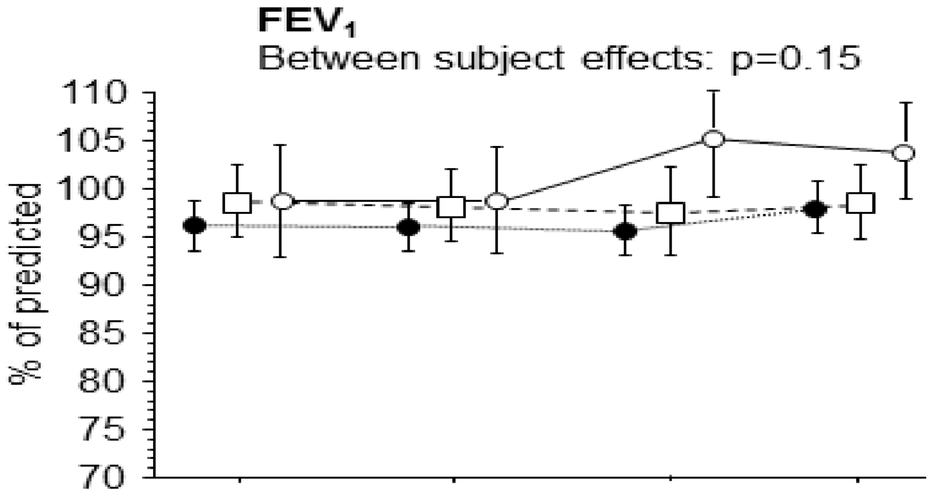
Exploring ECs harm reversal potential

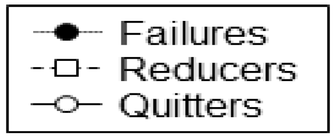
(e.g. reduction in biomarkers used as proxy for risk prediction in COAD)

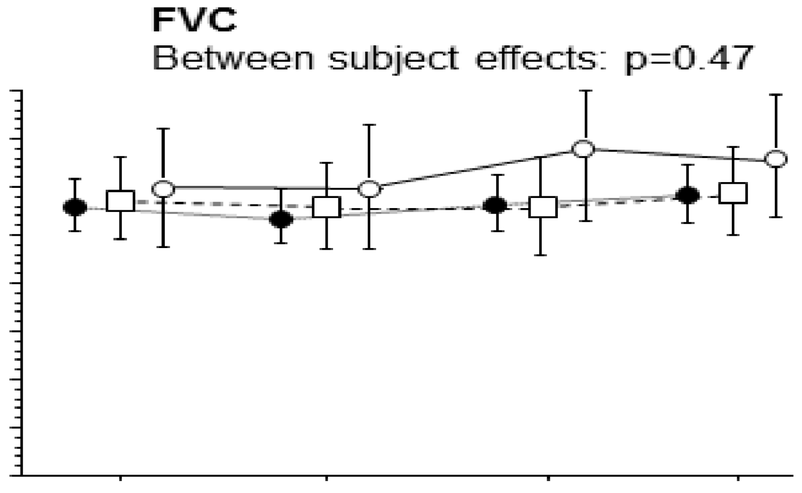
STUDY ASSESSMENTS

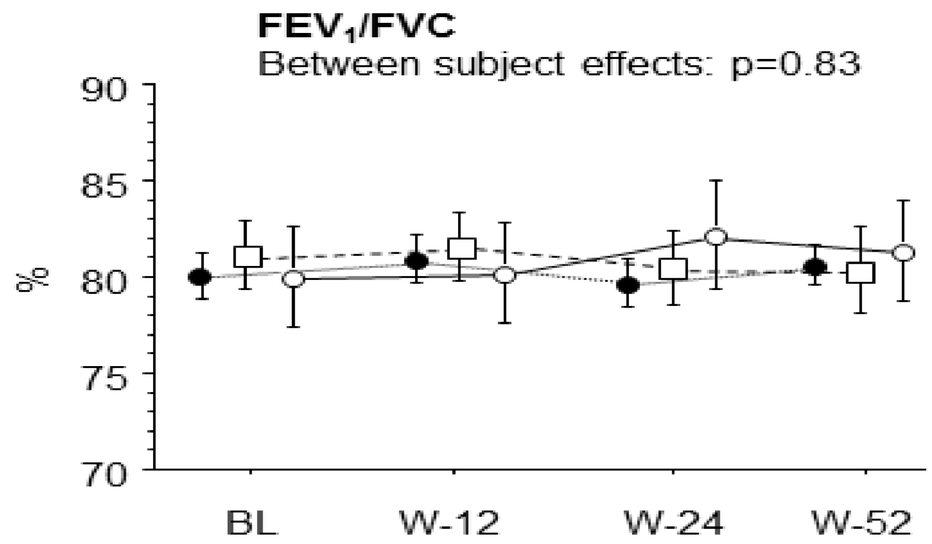
Procedure		BL Visit	Wk2	Wk4	Wk6	Wk8	Wk10	Wk12	Wk24	Wk52
		Visit 1	**Visit 2**	**Visit 3**	**Visit 4**	**Visit 5**	**Visit 6**	**Visit 7**	**Visit 8**	**Visit 9**
Informed consent		X								
SMOKE CHART	Sociodemografic factors	X								
	Medical history	X								
	Drug history	X								
	Physical examination	X							X	X
	Vital signs – HR & BP	X							X	X
	Weight - Kg	X							X	X
	Smoking Hx	X								
	BDI and BAI	X								
	FTND	X								
	eCO	X							X	X
GN-SBQ		X								
NO and spirometry		X		X		X		X	X	X
Saliva collection for cotinine					X			X		
Give Study Diary		X	X	X	X	X	X			
Collect Study Diary			X	X	X	X	X	X		
Craving/VAS		X	X	X	X	X	X	X	X	X
MNWS (past 2 weeks)		X	X	X	X	X	X	X	X	X
MNWS (past 24 hrs)		X	X	X	X	X	X	X	X	X
Adverse events		X	X	X	X	X	X	X	X	X
E-cig training and dispense of E-cig kit		X								
Dispense study cartridges		X	X	X	X	X	X			
Cartridges use record			X	X	X	X	X	X		
Smokers' preference								X	X	X

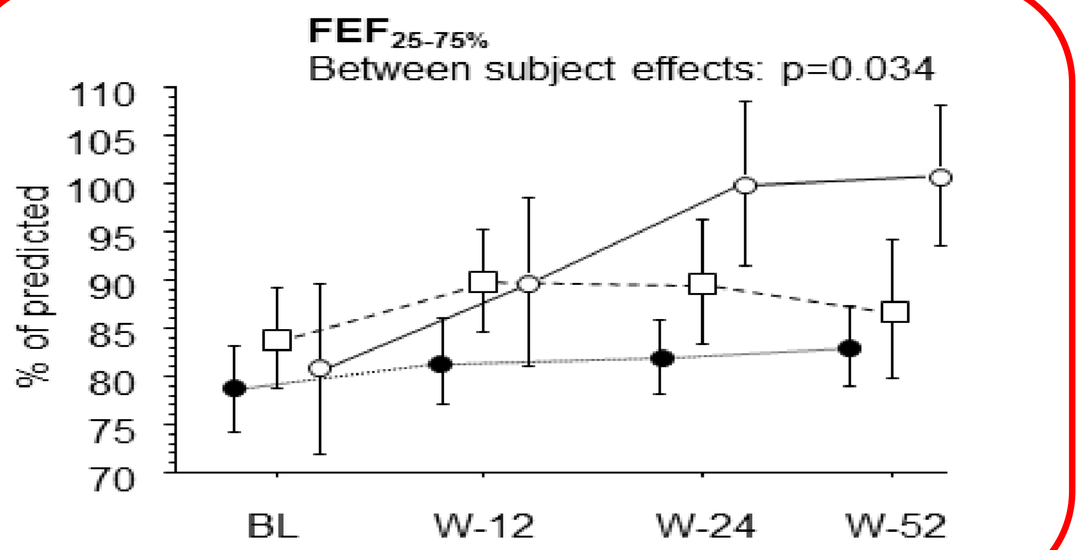
Chronic effect of abstinence/reduction on spirometry in smokers switching to ECs











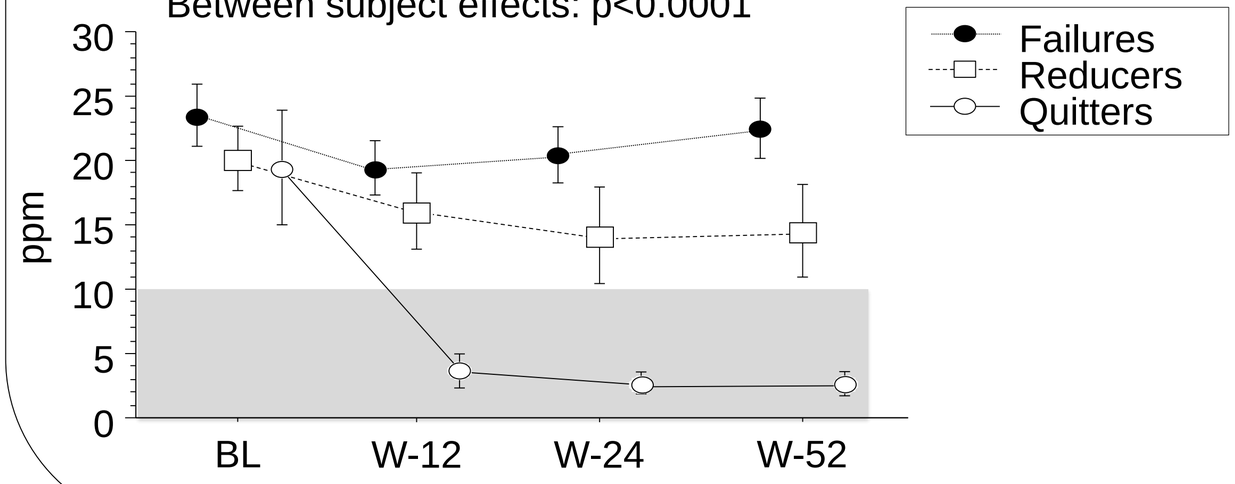
Chronic effect of abstinence/reduction on eCO and FeNO in smokers switching to ECs

CHANGES IN BREATHOMICS FROM A 1-YEAR RANDOMIZED SMOKING CESSATION TRIAL OF ECs

Davide Campagna, Fabio Cibella, Pasquale Caponnetto, et al.

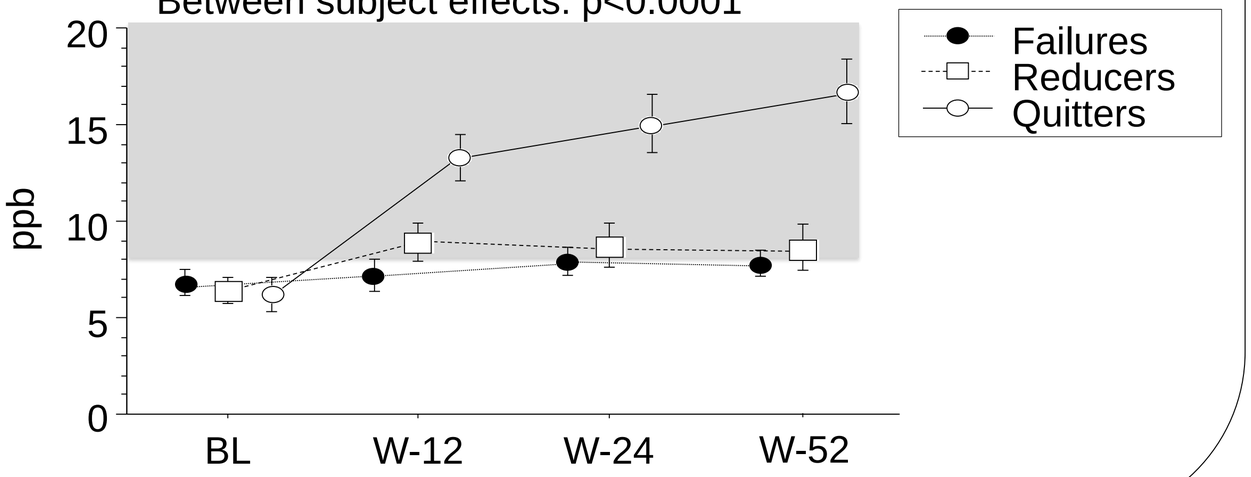
eCO

Between subject effects: p<0.0001



FeNO

Between subject effects: p<0.0001



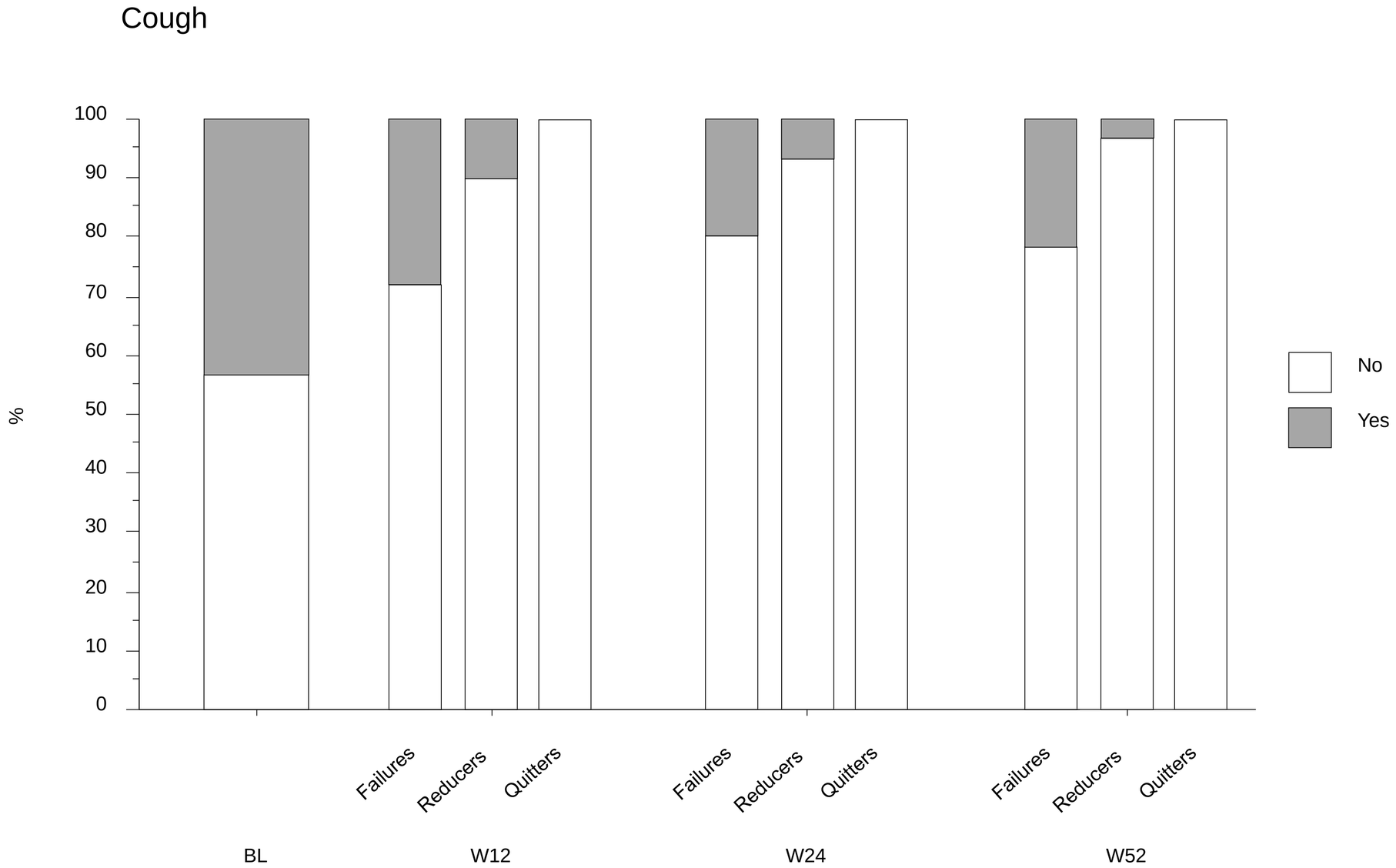
Exploring ECs harm reversal potential

(e.g. reduction in respir symptoms as proxy for risk prediction in COAD)

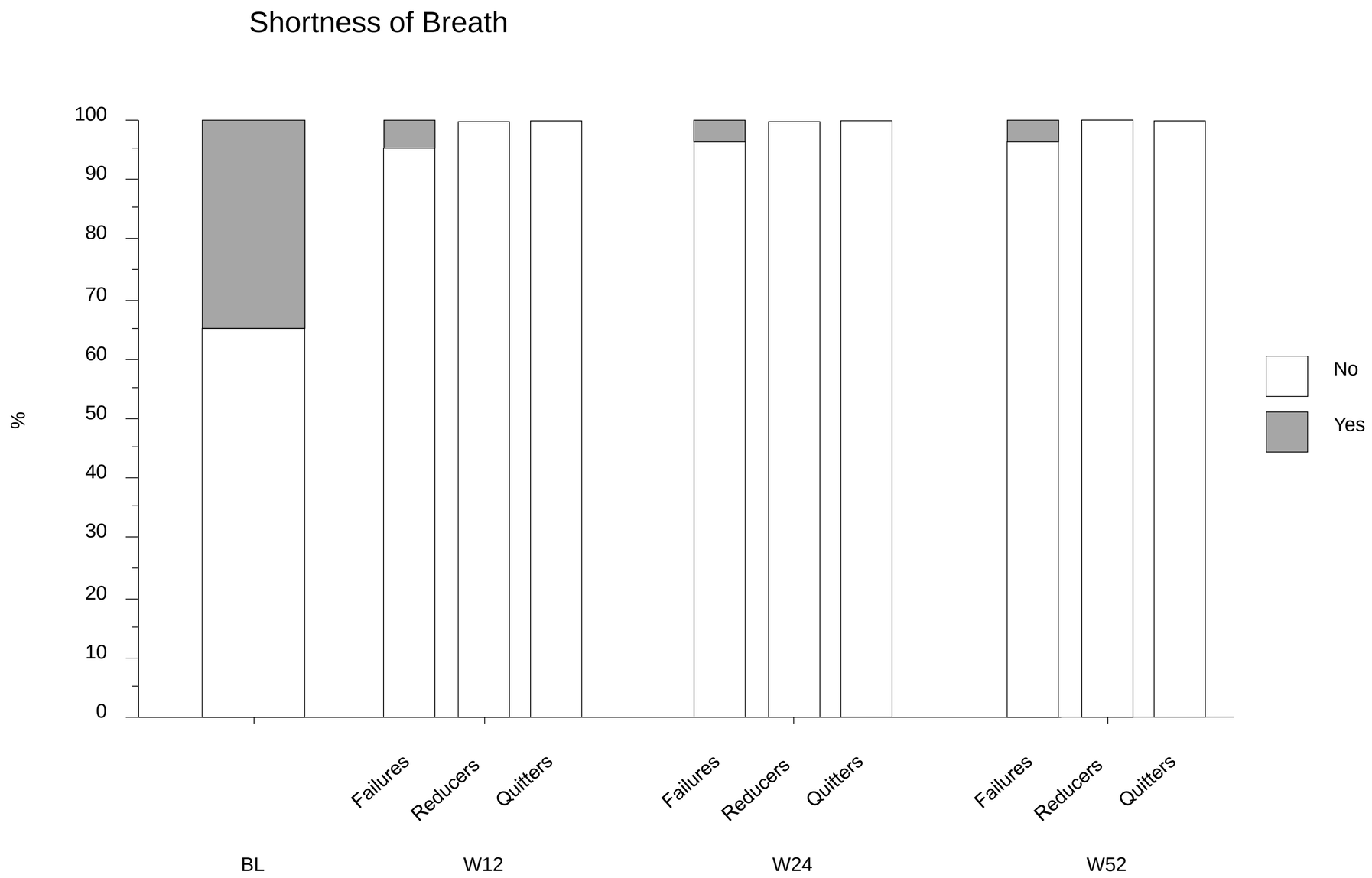
STUDY ASSESSMENTS

Procedure		BL Visit	Wk2	Wk4	Wk6	Wk8	Wk10	Wk12	Wk24	Wk52
		Visit 1	**Visit 2**	**Visit 3**	**Visit 4**	**Visit 5**	**Visit 6**	**Visit 7**	**Visit 8**	**Visit 9**
Informed consent		X								
SMOKE CHART	Sociodemografic factors	X								
	Medical history	X								
	Drug history	X								
	Physical examination	X						X	X	X
	Vital signs – HR & BP	X	X	X	X	X	X	X	X	X
	Weight - Kg	X						X	X	X
	Smoking Hx	X								
	BDI and BAI	X								
	FTND	X								
	eCO	X	X	X	X	X	X	X	X	X
GN-SBQ		X								
NO and spirometry		X		X		X		X	X	X
Saliva collection for cotinine					X			X		
Give Study Diary		X	X	X	X	X	X			
Collect Study Diary			X	X	X	X	X	X		
Craving/VAS		X	X	X	X	X	X	X	X	X
MNWS (past 2 weeks)		X	X	X	X	X	X	X	X	X
MNWS (past 24 hrs)		X	X	X	X	X	X	X	X	X
Adverse events		X	X	X	X	X	X	X	X	X
E-cig training and dispense of E-cig kit		X								
Dispense study cartridges		X	X	X	X	X	X			
Cartridges use record			X	X	X	X	X	X		
Smokers' preference								X	X	X

Effect of abstinence/reduction on cough in smokers switching to ECs



Effect of abstinence/reduction on SOB in smokers switching to ECs



ECs: from risk reduction to harm reversal

Direct evidence for harm reversal in health (i.e. early changes can be detectable in ‘healthy’ smokers switching to vaping)

Direct evidence for harm reversal in disease (i.e. early changes can be detectable in EC users with preexisting disease)

Int. J. Environ. Res. Public Health **2014**, *11*, 4965-4977; doi:10.3390/ijerph110504965

OPEN ACCESS

International Journal of
Environmental Research and Public Health
ISSN 1660-4601
www.mdpi.com/journal/ijerph

Article

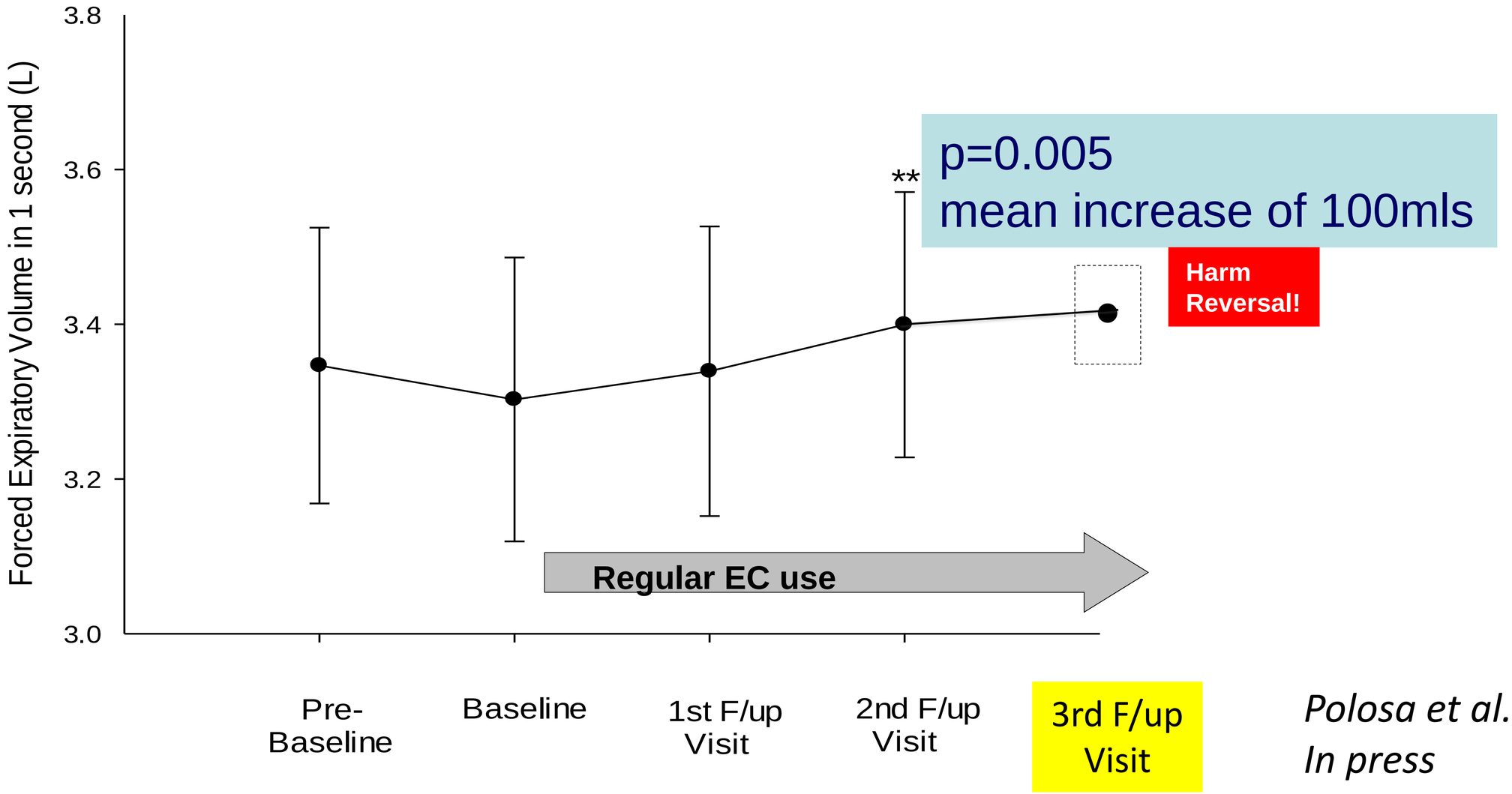
Effect of Smoking Abstinence and Reduction in Asthmatic Smokers Switching to Electronic Cigarettes: Evidence for Harm Reversal

Riccardo Polosa [1,2,3,*], Jaymin Morjaria [4], Pasquale Caponnetto [1,2], Massimo Caruso [1,3], Simona Strano [1,3], Eliana Battaglia [1,3] and Cristina Russo [1,2,3]

- ECs are effective and safe in RCTs of healthy smokers
- No data about EC use in smokers with pre-existing disease
- We investigated subjective and objective asthma outcomes as well as safety in smoking asthmatics who switched to EC

FEV1

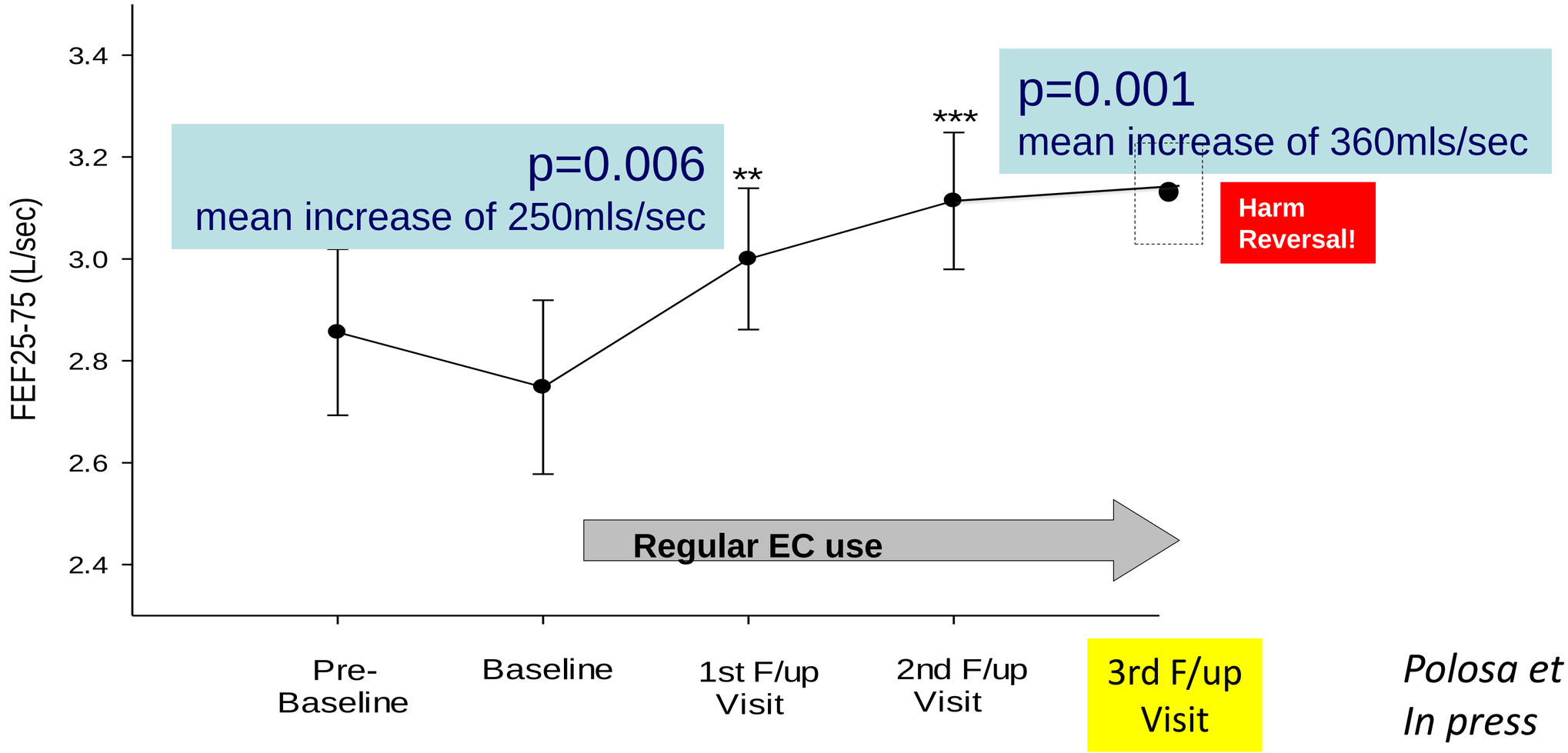
Improvement from baseline to 24 months



Polosa et al.
In press

FEF25-75

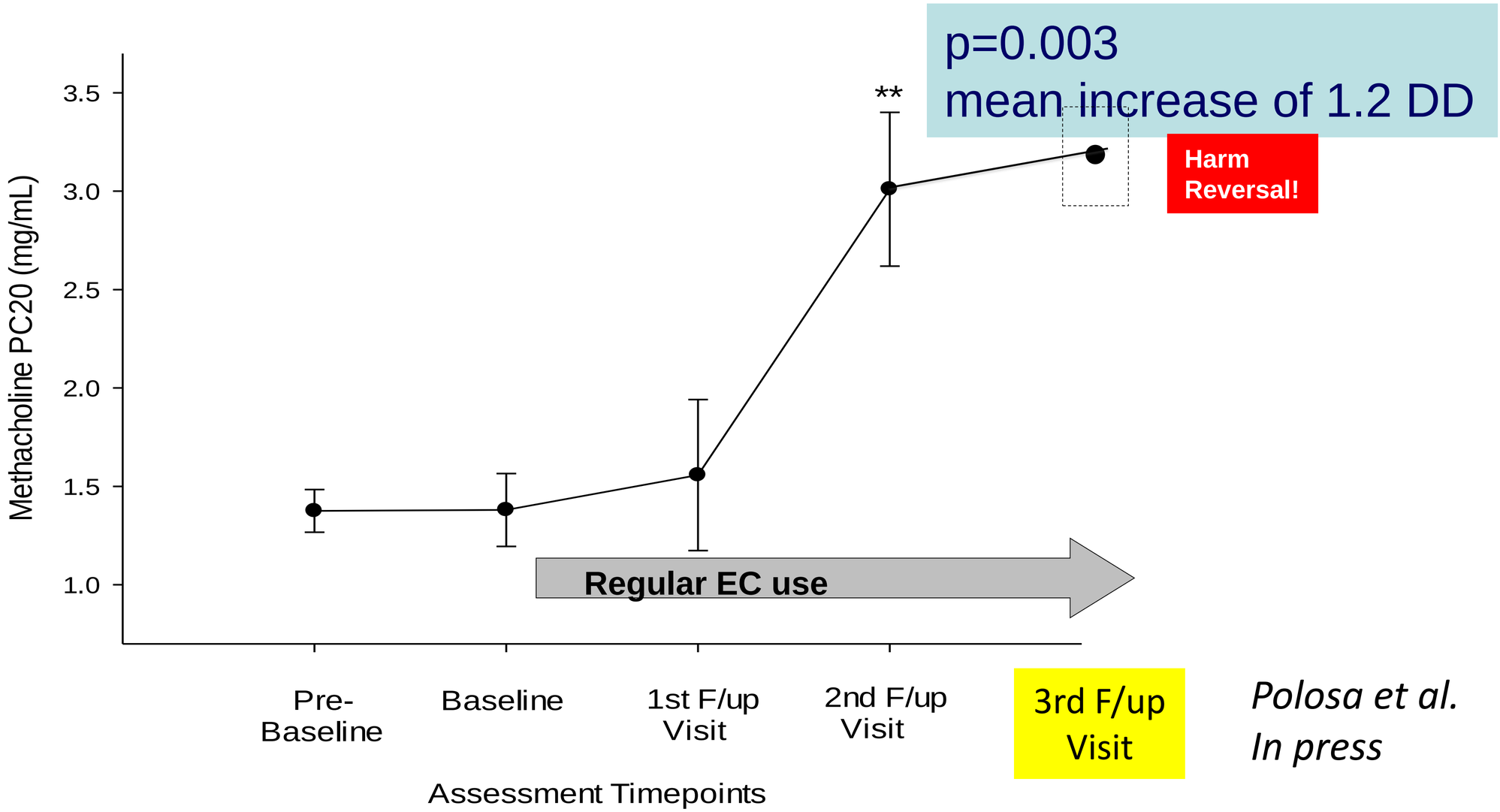
Improvement from baseline to 24 months



Polosa et al.
In press

Methacholine PC20

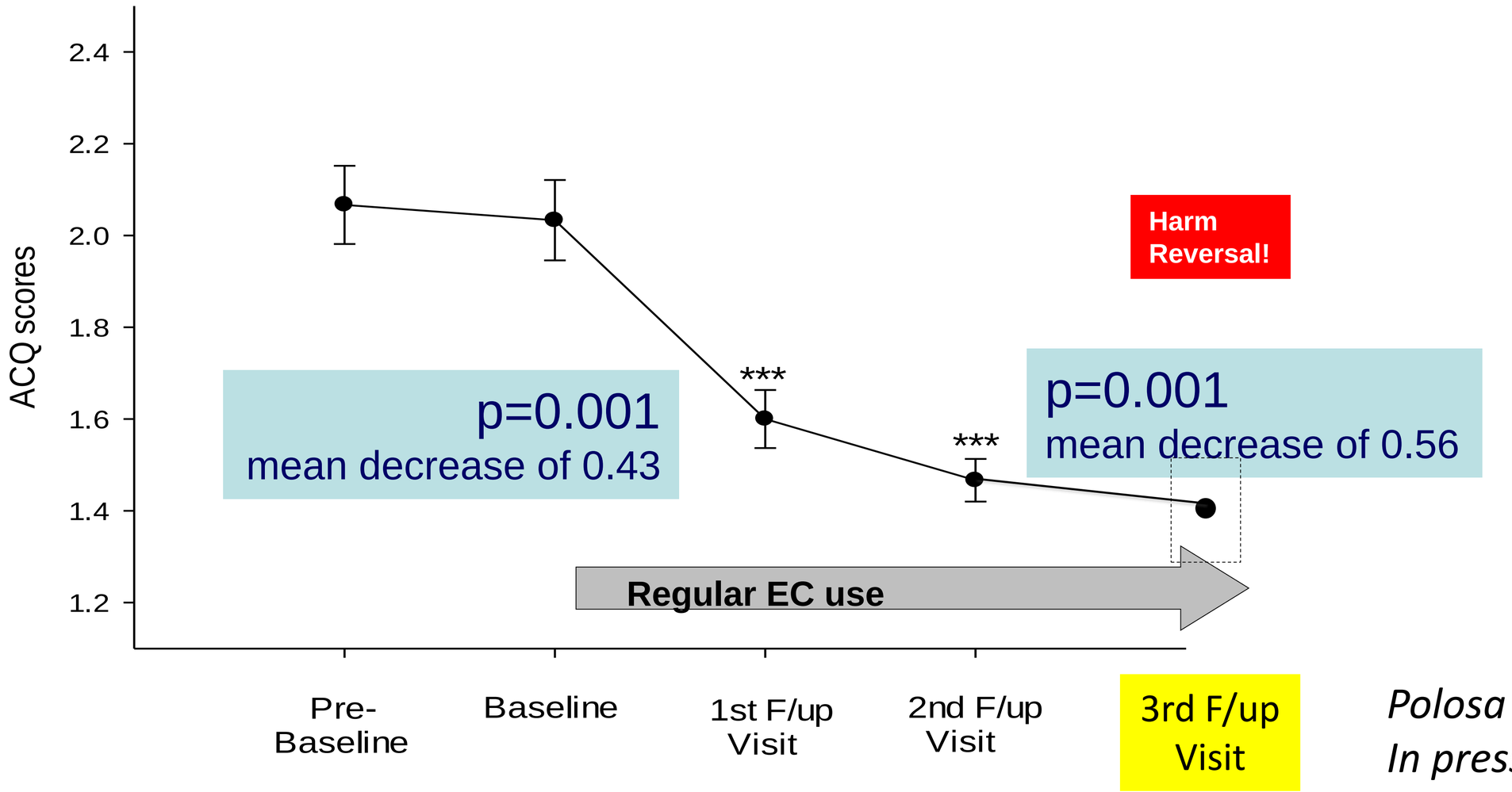
Improvement from baseline to 24 months



Polosa et al.
In press

Juniper's ACQ

Improvement from baseline to 24 months



Polosa et al.
In press

RESPIRATORY SYMPTOMS IN E-CIG USERS

K. Farsalinos et al. Int. J. Environ. Res. Public Health 2014

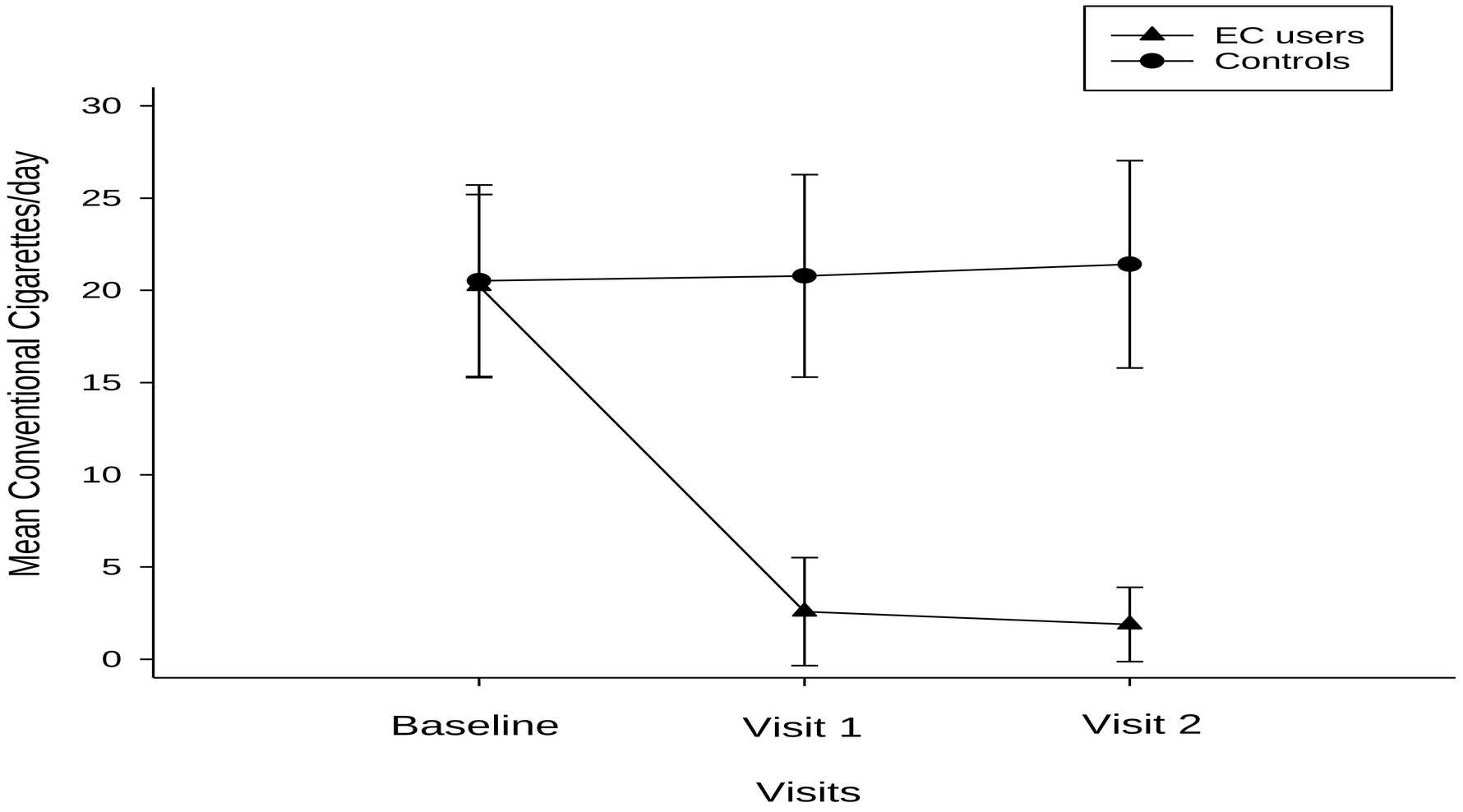
Side effects/accidents	Total (n = 19,353)	Current smokers (n = 3682)	Former smokers (n = 15,671)	Statistic	*p* value
		Dual users	Single users		
Asthma (N = 1173)					
Worse	14 (1.1)	5 (2.2)	9 (0.8)		
Stable	303 (23.2)	78 (34.4)	225 (20.8)	$\chi^2 = 27.3$	<0.001
Improved	856 (65.4)	116 (51.1)	742 (68.6)		
COPD (N = 1062)					
Worse	10 (0.8)	4 (1.7)	6 (0.6)		
Stable	151 (12.7)	39 (17.0)	112 (11.7)	$\chi^2 = 9.5$	0.009
Improved	901 (75.7)	158 (68.7)	743 (77.4)		

BLOOD PRESSURE CONTROL IN SMOKERS WITH ARTERIAL HYPERTENSION WHO SWITCHED TO ELECTRONIC CIGARETTES

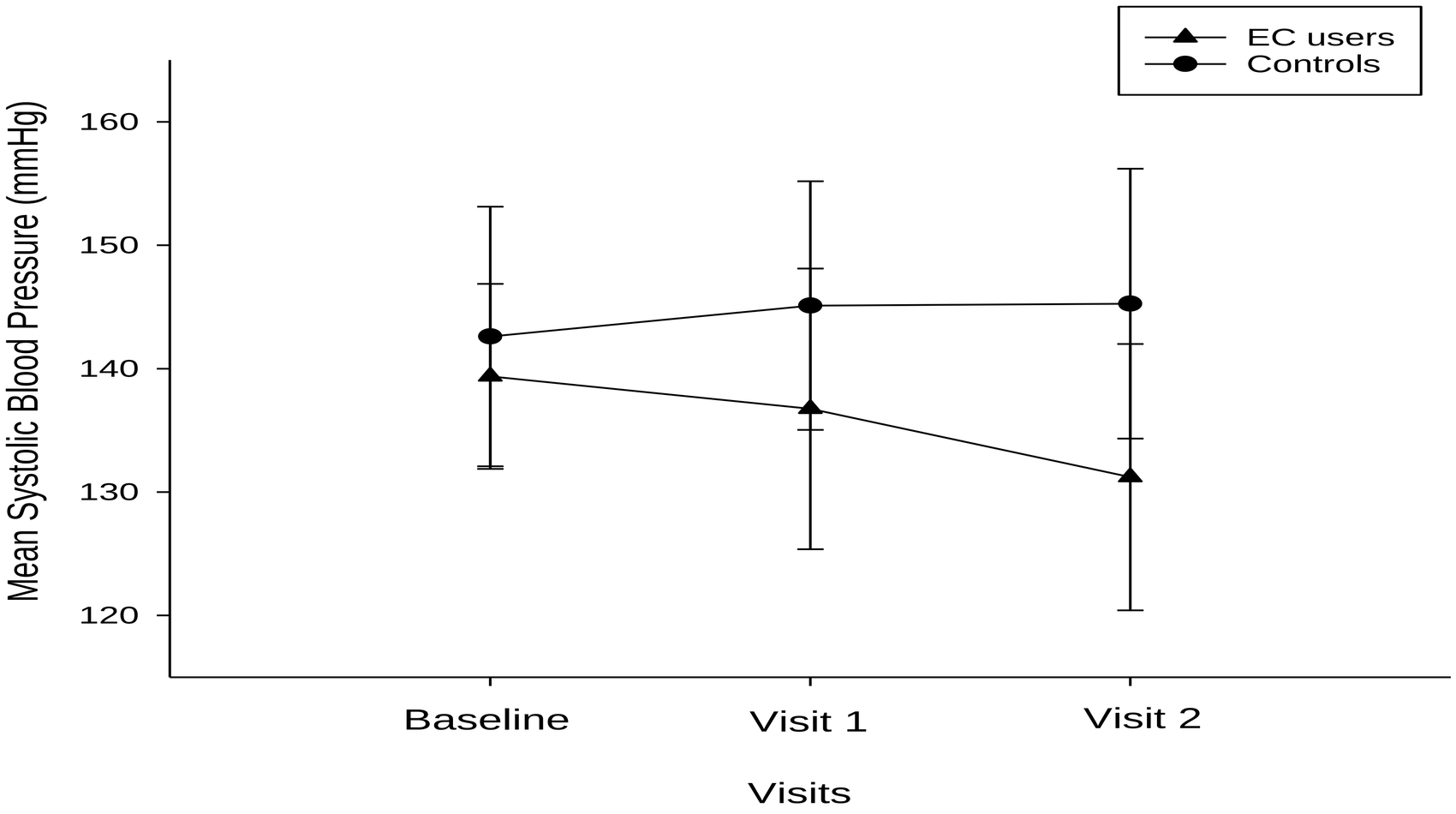
Riccardo Polosa et al. (submitted for publication)

- ECs are effective and safe in RCTs of healthy smokers
- No data about EC use in smokers with pre-existing disease
- We investigated changes in blood pressure and BP control in smoking hypertensive patients who switched to EC

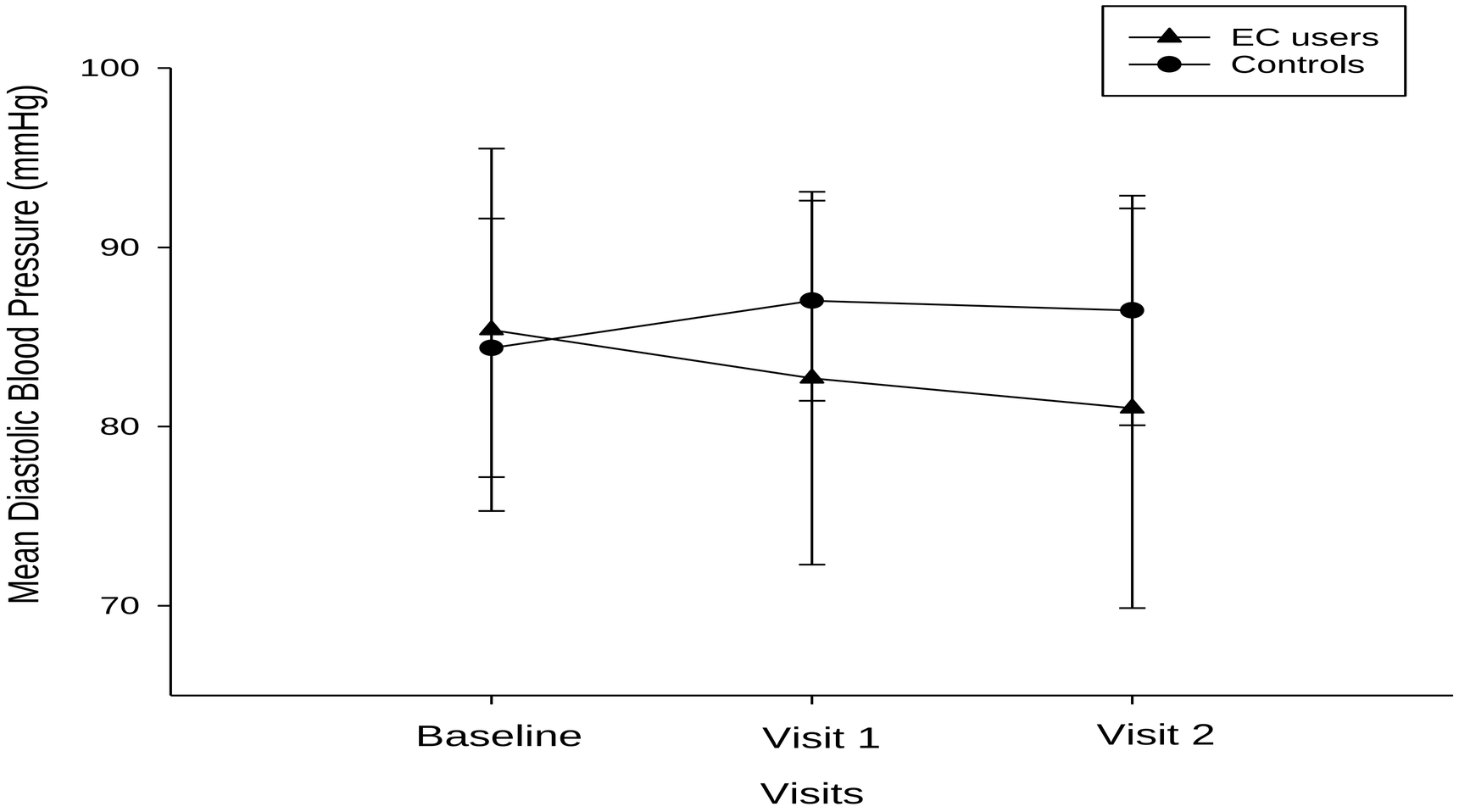
Changes in daily smoking from baseline



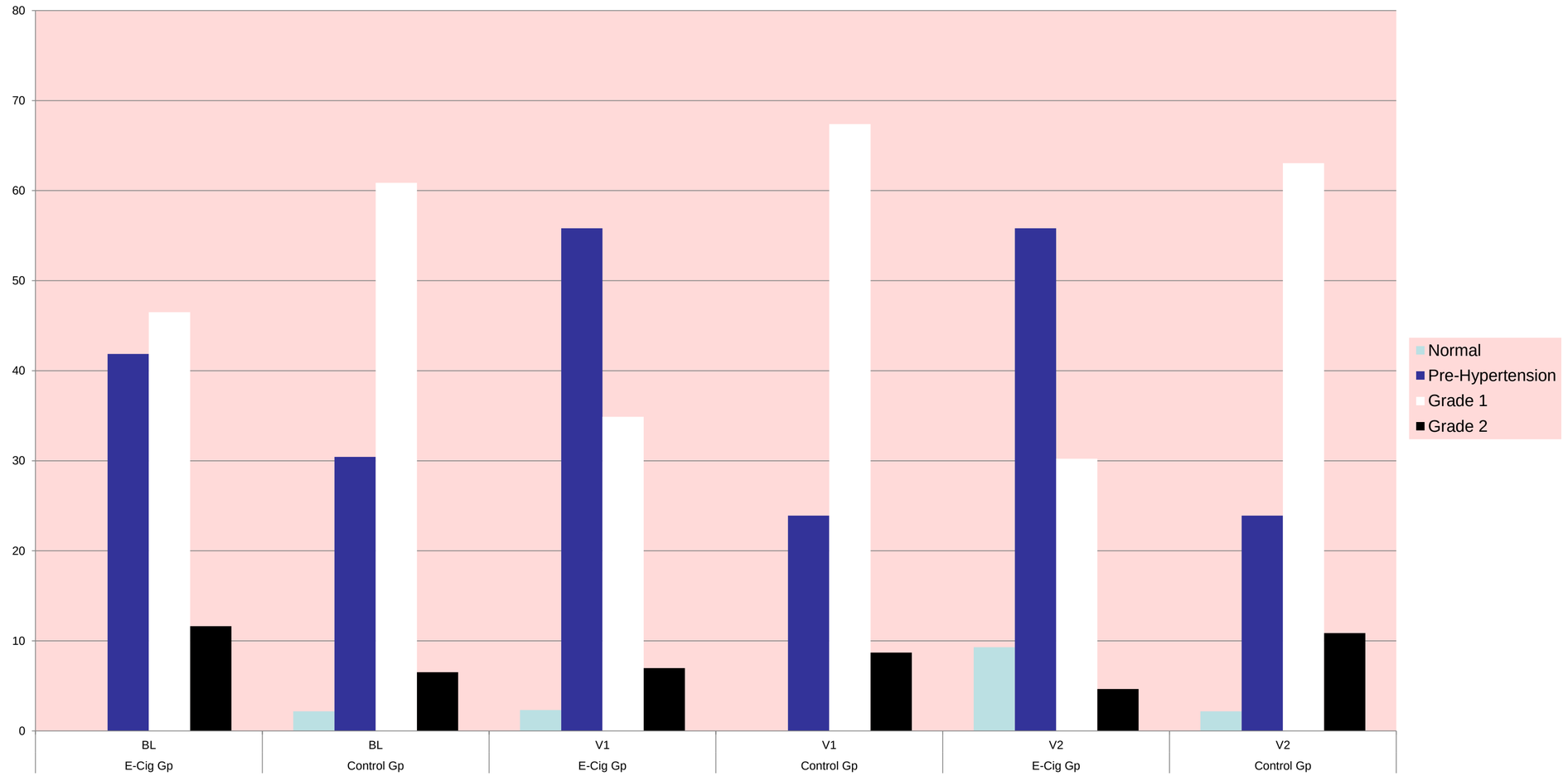
Changes in SBP from baseline



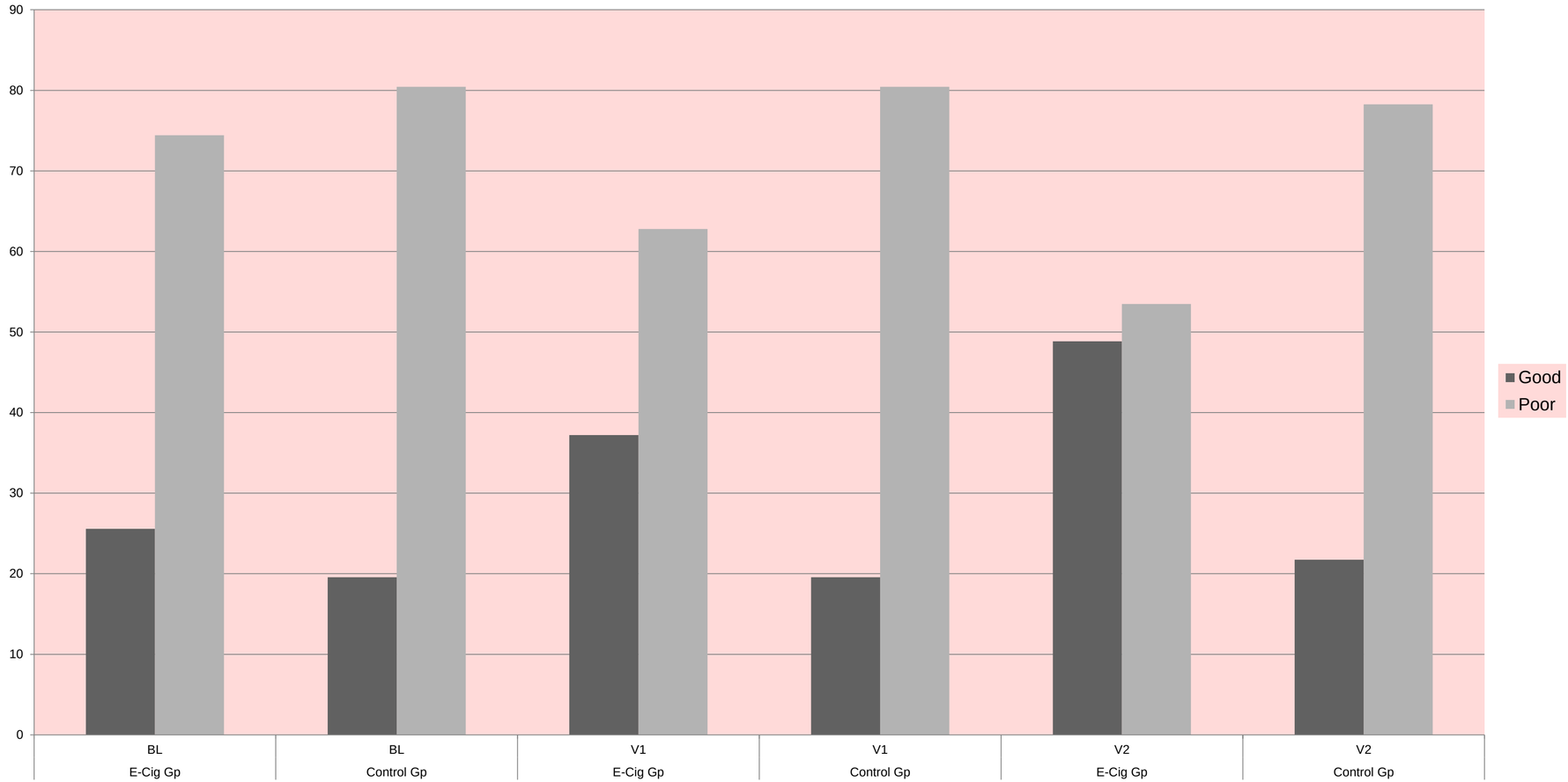
Changes in DBP from baseline



Proportion of BP grading throughout the study



Proportion of good and poor BP control throughout the study



Take Home Message

- EC use improves lung function, respiratory symptoms, subjective asthma outcomes;
- EC use improves BP and BP control in hypertensive patients;
- Improvements were reported also in dual users;
- EC use limits post cessation weight gain when abstaining from smoking;
- Exposure to e-vapour in vulnerable populations (i.e. asthma, hypertension) does not trigger acute symptoms;
- ECs are a safe alternative to cigarettes in smokers with chronic diseases.

Acknowledgments