



Smoking for the poor and vaping for the rich? Distributional concerns for novel nicotine delivery systems



Vincenzo Carrieri^{a,b,c,*}, Andrew M. Jones^{d,e,f}

^a Università di Salerno, Fisciano (SA), Italy

^b HEDG, University of York, York, UK

^c RWI Research Network, Essen, Germany

^d Department of Economics and Related Studies, University of York, York, UK

^e Monash University, Clayton, VIC, Australia

^f University of Bergen, Bergen, Norway

HIGHLIGHTS

- We compare income-related inequalities in smoking vs smoking and NDS.
- We estimate the source of income-related inequalities in the use of NDS.
- Pro-poor inequalities in smoking are greater than when smoking and NDS are combined.
- Significant pro-rich inequalities in use of e-cig and other NDS are found.
- A higher take-up of NDS among richer, younger and better-educated smokers is found.

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ABSTRACT

We compare income-related inequalities in the use of traditional smoking and of novel nicotine delivery systems (NDS), such as e-cigarettes and other smokeless products, and we apply a regression-based decomposition method for rank-dependent inequality measures to estimate the source of inequalities in the use of NDS. Using data from the 2013 wave of the Health Survey for England, we find that pro-poor inequality is greater for traditional smoking than for smoking and the smokeless products combined. Significant pro-rich inequalities are found in e-cig and other NDS consumption due to higher take-up among richer, younger and better-educated smokers. These patterns might lead to a long-run equilibrium with both higher average health and higher socioeconomic health inequalities.

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1. Introduction

Electronic cigarettes (e-cigs) and other novel nicotine delivery systems (NDS) represent one of the most important innovations in the tobacco market. E-cigs are battery-operated devices that aim to simulate combustible cigarettes, while other NDS encompasses alternative methods to administer nicotine to the brain without the harms of combustion (i.e. chewing gum, nicotine patches). E-cigs

are the newest and the most used nicotine delivery system. They do not contain tobacco but operate by heating nicotine and other chemicals into a vapour that is inhaled.¹ Since their introduction to the market in 2004, global usage of e-cigarettes has risen exponentially (Cobb et al., 2010; Rom et al., 2014).²

The reasons for increasing prevalence are that these new methods are perceived as healthier, cheaper, and more socially

¹ Inhaling from e-cigarettes is commonly called *vaping*.

² In the UK, there are an estimated 2.6 million e-cigs users (ASH, 2016), while, in 2014, 12.6% of adults had ever tried an e-cig at least one time in the USA (Schoenborn and Gindi, 2015). The e-cigs market is estimated to be worth £91.3 million a year (Chittock, 2014). It increased by 340% in 2013 to reach £193 million, and is expected to be worth £340 million by 2015 (Clarke, 2014).

* Correspondence to: Dipartimento di Scienze Economiche e Statistiche, Università degli Studi di Salerno, Via Giovanni Paolo II, 84084 Fisciano (SA), Italy.

E-mail addresses: vcarrieri@unisa.it (V. Carrieri), andrew.jones@york.ac.uk (A.M. Jones).

acceptable than conventional cigarettes (Rom et al., 2014). However, the primary objective of users is essentially that of quitting smoking (Pepper and Brewer, 2013). Both the health benefits and the ability to help quitting smoking are the two most explored issues in the empirical literature. Despite some side effects and some debate on their effectiveness to aid quitting,³ e-cigs are generally evaluated as much safer than smoking and a valid aid for quitting (Public Health England, 2015). As a consequence, in 2015, the UK's Royal College of Physicians recommended that e-cigs should be offered to smokers and that “with the right checks and measures, vaping could improve the lives of millions of people” (Public Health England, 2015).

The distributional consequences of these new smokeless products, and, in particular, whether their take-up varies systematically across socio-economic groups remains to be clarified. This is relevant in order to properly assess the desirability of any health promotion activity (as e-cigs and other NDS might be considered) and to identify welfare-improving interventions. Importantly, Contoyannis and Forster (1999a,b) show that when responsiveness to health promotion policies varies across socio-economic groups, i.e. a higher take-up rate among the better off, a striking conflict between efficiency and equity may arise: average population health and inequalities in health may both increase.

This paper fills this gap using fresh data on e-cig and other NDS consumption from the latest wave of the Health Survey for England (2013). Our analysis follows three steps. First, we analyse whether e-cig and other NDS re-shape the income-related inequalities in smoking, comparing the level of inequalities in traditional smoking with the inequalities in smoking and NDS combined. Secondly, we estimate the level of income-related inequalities in NDS take-up. Finally, we investigate the sources of income-related inequalities in NDS take-up rate using a regression-based decomposition method for rank-dependent inequality measures, and assessing the contribution of income, education and demographics to inequality.

The paper is organized as follows: the next section presents the data and the methods; Section 3 presents the results; and the final section discusses the implication of our findings and concludes.

2. Data and empirical methodology

We use a sample of 10,980 individuals (including 1697 current smokers) from the latest wave (2013) of the Health Survey for England (HSE), which contains information on traditional smoking, the use of e-cigs and other nicotine delivery systems (NDS) along with information on demographics and socio-economic variables.

The main variables we use ask individuals to report whether they currently or ever used e-cigs or other NDS, and to report their current smoking status (never/ex-regular smoker/ex-occasional smoker/current smoker). From these we define two dummy variables: the first to indicate current smokers the second to indicate current smokers combined with users of NDS.

With the aim of estimating and comparing income-related inequalities in traditional smoking vs. both traditional smoking and use of the new smokeless products, we use the Erreygers (2009) index for both outcomes. The Erreygers index is a rank-dependent

Table 1

Estimates of income-related inequalities: Traditional vs. new methods.

	Traditional smoking	All methods	E-cig and other NDS
Take-up rate	15.45%	20.39%	53.8%
EI	−0.063***	−0.054***	0.074**
Std. Error	0.008	0.008	0.028
Observations	10,980	10,980	1697

** Indicate significance at 5%.

*** Indicate significance at 1%.

inequality measure for bounded dependent variables that can be conveniently calculated as follows⁴:

$$EI(S_i) = \frac{8}{b-a} \text{cov}(S_i, R_i) \quad (1)$$

where b and a are the upper and lower bounds of the dependent variable (1 and 0 in our case), S_i indicates the individual take-up of nicotine products (traditional smoking or both traditional smoking and NDS) while R_i is a monotonically increasing function of income measuring the individual's relative position in the income distribution, bounded between 0 (poorest) and 1 (richest). The Erreygers index varies from $\mu - 1$ to $1 + \mu$, where μ is the mean of variable whose inequality is being investigated. Positive (negative) values of the index indicate that levels of S are more concentrated among those with higher (lower) rank in the income distribution. This is generally termed pro-rich (pro-poor) inequality. As a measure income, we use equivalised household income including total income of a household from all sources, after tax and other deductions, divided by the number of household members converted into equivalised adults.

To measure income-related inequalities in the use of new smokeless products, we calculate the EI defined in (1) using e-cig and other NDS take-up as dependent variable. As e-cigs and other NDS are used as smoking cessation methods, we restrict the attention to the subsample of current smokers (1697 observations). We consider current (instead of ex-) smokers, in order to evaluate potential consequences of these methods on the expected long-run smoking (and health) gradient across income. Lastly, for the purpose of investigating the main sources of inequality in the new smokeless products, take-up of e-cig and other NDS (NDS_i) is modelled as follows:

$$NDS_i = \alpha + \beta_{inc} x_i^{inc} + \beta_{edu} x_i^{edu} + \beta_{dem} x_i^{dem} + \varepsilon_i \quad (2)$$

where x_i^{inc} , x_i^{edu} , x_i^{dem} represent income and the set of education and demographic variables, while β_{inc} , β_{edu} , β_{dem} the corresponding coefficients, and ε_i is the error term. The set of demographic variables include six age group variables (11–18, 18–34, 35–44, 45–64, 65–74, 75+), for each gender, while the set of education variables include one dummy for each of the following categories: degree or national vocational qualification (NVQ) 4 or 5; higher education below degree; NVQ 3 or General Certificate of Education (GCE) Advanced Level; NVQ 2 or GCE Ordinary Level; NVQ 1 or Certificate of Secondary Education (CSE); Other qualifications from outside England; no qualification. Omitted categories in our analysis are males, aged 11–18 and with no qualification.

³ E-cigs have been found as effective, though not more, than nicotine patches for short-term cigarette cessation (Dockrell et al., 2013; Etter and Bullen, 2011; Bullen et al., 2013), and cartridge analyses find fewer toxins than are found in traditional cigarettes (Goniewicz et al., 2014). However, in a randomized trial 29% of e-cig users continued e-cigs at 6-months compared to only 8% of patch users (Bullen et al., 2013), suggesting e-cig use might persist after other cessation methods. In addition, cartridges have been found to contain hazards, such as cytotoxic heavy metal and silicate particles (Williams and Talbot, 2011).

⁴ We use the Erreygers index because it is the only rank-dependent inequality measure for bounded variables satisfying two desirable properties: the *mirror condition* – the invariance of the inequality index to the coding of the dependent variable as 0 or 1 – and the *quasi-absoluteness*. The mirror condition is also respected by the Wagstaff index (Wagstaff, 2005), but the Erreygers index is an absolute rather than a relative measure of inequality. An advantage of this property in our context is that our estimates of inequality are suitable for a comparison between countries characterized by a different average use of NDS.

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