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**Balancing Resource Relief
and Critical Health Needs
through Reduced-Risk
Product Transition**

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Balancing Resource Relief and Critical Health Needs through Reduced-Risk Product Transition

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Abstract: This paper explores regional disparities in avoidable mortalities and hospital discharges, influenced by factors associated with high-risk behaviors such as excessive alcohol consumption, smoking, and inadequate physical activity levels. We gathered data from various official sources (ISTAT and Eurostat) and conducted a comprehensive panel data regression analysis to investigate the intricate relationships between these variables. The study found that a higher prevalence of smokers is associated with increased avoidable mortality and hospital discharges. Specifically, a 1% decrease in the percentage of smokers led to an average reduction of 12.76 hospital discharges per 10,000 inhabitants. This reduction translated to an estimated total saving of approximately 331 million Euros across all regions in 2020. Similarly, excessive wine consumption was linked to higher rates of preventable mortality and hospital discharges. A one unit drop in the number of heavy drinkers per 1,000 inhabitants would result in a saving of about 60 million Euros. Furthermore, the variable indicating the prevalence of individuals aged 3 and above who never engage in sports was positively correlated with adverse health outcomes. A 1% decrease in the number of individuals in this category would lead to a saving of approximately 223 million Euros. In parallel, we analyzed pathologies associated with smoking, which include lung cancer, respiratory ailments, and cerebrovascular diseases. Moreover, we explored the potential benefits of transitioning from high-risk to reduced-risk products, aiming at alleviating the strain on the healthcare system while reallocating resources to address critical health needs. The results suggest that if 50 percent of smokers transitioned to reduced-risk products such as e-cigarettes and heat-not-burn tobacco, the NHS could potentially save 722 million Euros in terms of smoking-related illnesses. Among the healthcare systems examined, Lombardy stands to gain the most from this transition, with an estimated annual saving of approximately 140 million Euros. The findings indicate that there is potential for further savings in the National Health Service (Servizio Sanitario Nazionale, NHS) by advocating for a reduction in high-risk behaviors.

Keywords: Smoking; excessive alcohol consumption, inadequate physical activity, health expenditure, avoidable mortality, hospital discharges, Reduced-risk products, regional variations

JEL Codes: I11, I13, I14, I15, I19

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Abstract

This paper explores regional disparities in avoidable mortalities and hospital discharges, influenced by factors associated with high-risk behaviors such as excessive alcohol consumption, smoking, and inadequate physical activity levels. We gathered data from various official sources (ISTAT and Eurostat) and conducted a comprehensive panel data regression analysis to investigate the intricate relationships between these variables. The study found that a higher prevalence of smokers is associated with increased avoidable mortality and hospital discharges. Specifically, a 1% decrease in the percentage of smokers led to an average reduction of 12.76 hospital discharges per 10,000 inhabitants. This reduction translated to an estimated total saving of approximately 331 million Euros across all regions in 2020. Similarly, excessive wine consumption was linked to higher rates of preventable mortality and hospital discharges. A one unit drop in the number of heavy drinkers per 1,000 inhabitants would result in a saving of about 60 million Euros. Furthermore, the variable indicating the prevalence of individuals aged 3 and above who never engage in sports was positively correlated with adverse health outcomes. A 1% decrease in the number of individuals in this category would lead to a saving of approximately 223 million Euros. In parallel, we analyzed pathologies associated with smoking, which include lung cancer, respiratory ailments, and cerebrovascular diseases. Moreover, we explored the potential benefits of transitioning from high-risk to reduced-risk products, aiming at alleviating the strain on the healthcare system while reallocating resources to address critical health needs. The results suggest that if 50 percent of smokers transitioned to reduced-risk products such as e-cigarettes and heat-not-burn tobacco, the NHS could potentially save 722 million Euros in terms of smoking-related illnesses. Among the healthcare systems examined, Lombardy stands to gain the most from this transition, with an estimated annual saving of approximately 140 million Euros. The findings indicate that there is potential for further savings in the National Health Service (Servizio Sanitario Nazionale, NHS) by advocating for a reduction in high-risk behaviors.

Keywords: Smoking; excessive alcohol consumption; inadequate physical activity; health expenditure; avoidable mortality; hospital discharges; Reduced-risk products; regional variations.

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1 Introduction

In scenarios where a government struggles with substantial public debt and intense pressure to reduce it, numerous challenges emerge in financing public spending. One prominent example is the case of the Italian government, which annually submits its budget for parliamentary

approval. This is particularly arduous given Italy's high debt-to-GDP ratio, standing at around 145%, and a fiscal burden approaching 50%. In practical terms, this implies that the government faces constraints on both raising taxes and increasing public expenditure to maintain vital public infrastructures and services, raising doubts about the financial sustainability of the NHS. What is even more concerning is that the intended efficiency-improving reductions in healthcare spending have, paradoxically, turned out to be across-the-board cuts, jeopardising the overall health of the population.

This paper argues in favor of an alternative approach aimed at enhancing public health and saving healthcare resources: promoting a shift from consuming high-risk products to low-risk alternatives. For instance, a recent study carried out in England has put forth the idea that promoting a shift from conventional tobacco smoking to reduced-risk alternatives like vaping and heat-not-burn tobacco could lead to potential annual savings of roughly half a billion pounds (Moscone, 2023). This is substantiated by empirical evidence demonstrating that these reduced-risk products (RRPs) serve as effective tools for smoking cessation or risk mitigation in terms of diseases. One important contribution of this paper is to estimate the prospective cost savings that such a shift could generate within the Italian NHS.

Nonetheless, it's essential to consider other high-risk behaviours, such as excessive wine consumption, which can result in various health and social consequences, including liver damage, heart issues, elevated blood pressure, and an elevated risk of specific types of cancer (The Lancet, 2023). Another important contribution of this paper is to show the associations between excessive wine consumption and both preventable deaths and hospital admissions, emphasizing the importance of promoting moderate and responsible consumption levels of alcohol. An analogous analysis is undertaken to encourage a reduction in preventable mortality, including accidents and injuries (The Lancet, 2019). Certainly, there are other high-risk products, such as excessive sugar and salt intake, that warrant thorough analysis to identify opportunities for reallocating health resources. However, analysing these topics falls out of the scope of this paper.

The remainder of the paper is structured as follows. Section 2 describes data sources and methods, Section 3 comments on estimation results and discusses the geographical distribution of needs and supply when switching to RRPs, and Section 4 concludes.

2 Data and methods

We gathered data on avoidable mortality broken down by region for the years 2002 to 2019 from the Equitable and Sustainable Well-Being (BES) survey conducted by the Italian Office of National Statistics (Istat). Avoidable mortality includes the death of individuals aged between 0 and 74, where the cause of death could have been treated or prevented through healthcare, prevention, and medical interventions. This index is computed as the number of deaths per 10,000 inhabitants. Various authors, including Nolte and McKee (2003) and Tobias and Yeh (2009), have examined and analyzed this variable. The primary diseases behind preventable deaths are lung cancer, ischemic heart diseases, as well as alcohol-related disorders and poisonings. We have gathered the (latest) figure on the average daily cost for an inpatient bed hospitalisation in 2010 from the World Health Organization and updated it by using the consumer price index for Italy to account for inflation until 2021.

Additionally, we gathered data on the percentage of individuals aged 14 and above who are smokers, that is the smoking prevalence, the percentage of individuals aged 3 and above who

do not engage in regular physical activity, and the percentage of individuals aged 11 and above who consume more than half a liter of wine daily, all per 100 residents. These variables were sourced from the “Multipurpose survey on households: aspects of daily life” available from Istat. We also collected regional data on hospital discharges, total and broken down by pathology, and average length of stay total and by pathology for each region and year in the sample from Eurostat. Finally, we acquired data on the annual unemployment rate at the regional level from the “Statistics on income and living conditions survey” also available from Istat. Table 1 provides definitions of the variables under examination along with some summary statistics.

In our analysis, we also investigate the impact on mortality and hospital admissions when individuals who smoke transition from traditional cigarettes to RRP. Although there is limited research on how the decreased exposure to harmful substances translates into a reduced risk of smoke-related diseases and subsequent hospitalization among RRP users, several studies suggest a significant average reduction of over 90% in exposure to chemicals known to be major contributors to health risks. Notably, in 2020, the U.S. Food and Drug Administration endorsed heat-not-burn tobacco as a Modified Risk Tobacco Product, supported by empirical evidence indicating a risk reduction ranging between 70% and 97% in the development of smoking-related diseases (US Food and Drug Administration, 2020; Forster et al, 2018; Mallock et al, 2018). Therefore, in this paper, we will make the (conservative) assumption that transitioning from traditional cigarettes to RRP for a cigarette smoker leads to a 70% reduction in the risk of developing a smoking-related disease. This estimation of a 70% risk reduction for RRP is grounded in the fact that the harmful components present in cigarette smoke, including carcinogens, are either absent in RRP or, if present, occur at levels much lower than 5% of those found in cigarette smoke.

Table 1: Definition of variables and descriptive statistics

Variable	Average	Median	Min	Max	N
Deaths of persons aged 0-74, due to causes identified as treatable or preventable per 10,000 inhabitants	19.7	19.5	13.9	29.3	320
Hospital discharges per 10,000 inhabitants	1,357	1,320	641	2,276	400
Hospital discharges for malignant neoplasm of, trachea, bronchus and lung per 10,000 inhabitants	7.7	7.6	2.1	14.6	420
Hospital discharges for pneumonia or other acute lower respiratory diseases per 10,000 inhabitants	43.6	45.6	10.3	85.4	420
Hospital discharges for cerebrovascular diseases per 10,000 inhabitants	42.9	41.6	24.3	77.2	420
Prevalence persons aged 14+ per smoking habits: smokers per 100 inhabitants	20.9	20.8	15.4	28.0	360

Prevalence persons aged 11+ wine consumption: >0.5 liter of wine a day per 1,000 inhabitants	29.4	27.0	7.0	61.0	280
Number of accidents w/ injuries per 1,000 inhabitants	33.9	29.5	13.6	68.1	360
Prevalence persons aged 3+ practicing sports: never per 100 inhabitants	39.1	38.6	12.8	61.8	360
Unemployment rate (percentage of unemployed persons in relation to the corresponding labour force)	9.9	8.6	2.6	25.7	408

3 Empirical Results

We employ a panel data regression model incorporating regional fixed effects to address variations in regional healthcare systems and disparities in health demands and supply. In fact, in the past decade, the Italian NHS has undergone substantial institutional changes, progressively transferring the responsibilities for funding and overseeing healthcare services from the central system to the regions. This shift has led to significant disparities in healthcare provision among different regions in Italy (Moscone et al., 2012).

We initially present two regression models, as detailed in Table 2, providing an overview of the associations between avoidable mortality and high-risk consumption, as well as the correlation between hospital discharges per 10,000 inhabitants and high-risk consumption. The regressions have also been adjusted for unemployment rates which are a proxy for the general standard of living in each region that potentially also affects avoidable mortality and total discharges. Results show that all explanatory variables exhibit statistical significance. As expected, the prevalence of smokers tends to increase avoidable mortality and hospital discharges. Specifically, a 1 unit reduction in the percentage of smokers, holding other variables fixed, leads to an average reduction of 12.76 in hospital discharges per 10,000 inhabitants. If we multiply this coefficient by the average length of stay of (total) discharges for each region and then by the average daily cost for an inpatient bed hospitalization, we obtain an estimate of around 331 million Euros for the total savings of such reduction across all regions in 2020. As for excessive wine consumption, the higher consumption of this risky substance leads to an increase in rates of preventable mortality and discharges. Using similar calculations adopted in the case of the smoke variable, if we were to observe a one unit drop in the number of heavy drinkers per 1,000 inhabitants, we would observe a saving of approximately 60 million Euros. Additionally, the variables ‘Number of accidents w/ injuries.’ And ‘Prevalence persons aged 3+ never practicing sports’ are both positively correlated with the outcome variables. Using similar calculations as before, a 1 unit reduction in the number of accidents per 1,000 inhabitants and a 1% contraction in the number of individuals never practicing sports would lead to a saving of 106 and 223 million Euros, respectively.

Table 2: Regression results on factors affecting avoidable mortality and total discharges

	(1)	(2)
	Avoidable mortality	Total hospital discharges
Prevalence persons aged 14+ per smoking habits: smokers	0.130*** (0.019)	12.756*** (4.451)
Prevalence persons aged 11+ wine consumption: >0.5 liter of wine a day	0.026*** (0.004)	2.303*** (0.946)
Number of accidents w/ injuries	0.049*** (0.009)	4.093*** (2.069)
Prevalence persons aged 3+ never practicing sports	0.039*** (0.011)	8.574*** (2.423)
Observations	270	280
R^2	0.794	0.622
Adjusted R^2	0.774	0.586

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

We observe that the total discharges variable is quite a broad measure of healthcare resources including a wide range of diseases that could be influenced by large number of factors. By concentrating on particular pathologies, we can reduce unobserved heterogeneity and look at the effect of risk factors under specific scenarios. In the rest of the paper, we focus on smoke-related pathologies and explore potential cost savings for the NHS should traditional smokers transition to RRP products. To initiate this exercise, we first present regression outcomes focusing only on smoking-related diseases and smoking as high-risk factor in Table 3. The dependent variables are the discharge rates per 10,000 inhabitants for specific smoking-related pathologies, encompassing lung cancer, respiratory, and cerebrovascular diseases. The key explanatory variable is the smoking prevalence. As before, we control for the unemployment rate.

Table 3: Regression results on factors affecting pathology-specific discharges

	(1)	(2)	(3)
	Neoplasm respiratory system	Acute lower respiratory disease	Cerebrovascular disease
Prevalence persons aged 14+ per smoking habits: smokers	0.292*** (0.033)	1.958*** (0.266)	0.721*** (0.114)
Observations	351	351	351
R^2	0.367	0.308	0.265

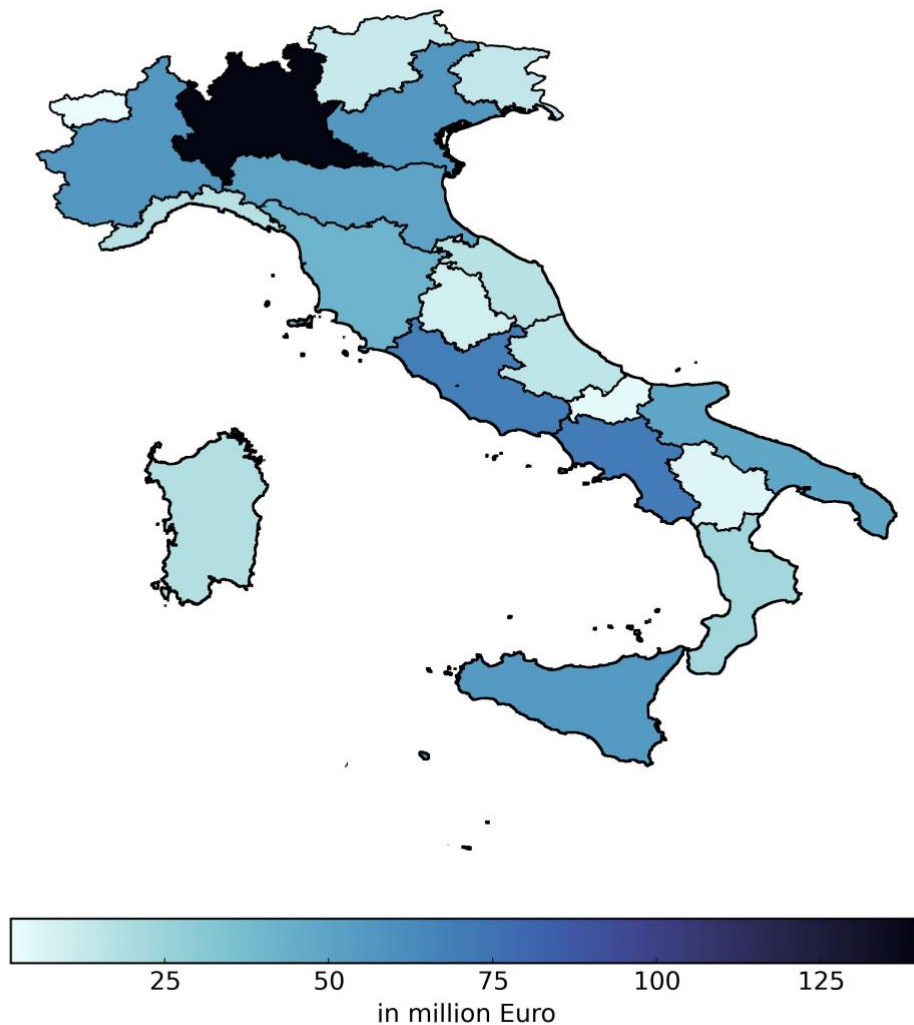
Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Again, by exploiting details on the average length of hospital stays and the frequency of hospital discharges by pathology, we can estimate the total daily cost of hospital care for each specific pathology. Moreover, using the coefficients obtained from the regression analysis, we can assess potential savings by region under certain scenarios. For instance, assuming a 50 percent shift from traditional cigarette to RRP products, we project savings of 722 million Euro covering the three specified pathologies. Map 1 illustrates the regional distribution of total savings in Italy. Unsurprisingly, due to the size of the population, the healthcare system of the Lombardy region, the most populated region in Italy, is likely to benefit the most from the transition towards RRP, with estimated savings of approximately 140 million euros. This is about 20 percent of the total savings for Italy. Following closely with savings of around 70 million euros each year, or roughly 10 percent, are Campania and Lazio. In Veneto and Sicilia, the estimated annual savings are approximately 56 million Euros. Valle d'Aosta ranks lowest in terms of savings with about 1.6 million Euro or even less than 0.5 percent of total savings.

Similarly, this reasoning can be carried out for other pathologies linked to the consumption of high-risk products, such as excessive drinking or artificial trans fats. However, it is much more challenging to quantify these effects as there is no extensive literature on risk-reducing for these products.

Figure 1: Potential regional savings in 50 per cent of smokers switch to reduced-risk products
Potential regional savings if 50 percent of smokers switch to reduced-risk products



4 Concluding remarks and limitations

In conclusion, this paper delves into regional disparities in preventable deaths and hospital discharges, driven by factors linked to risky consumption behaviors such as excessive alcohol consumption, smoking, and insufficient physical activity levels. We compiled data from various authoritative sources, including ISTAT and Eurostat, and conducted an extensive panel data analysis to explore the intricate relationships among these variables. Simultaneously, we explored health issues associated with smoking, including lung cancer, respiratory conditions, and cerebrovascular diseases. Moreover, we investigated the potential advantages of transitioning from high-risk to reduced-risk products, with the goal of reducing the strain on the healthcare system and reallocating resources to address pressing health priorities. The results suggest that advocating for a reduction in high-risk behaviors could yield further cost savings for the healthcare system. However, risky behaviors will continue to exist, like it or not. It is paramount, then, to improve the health outcomes resulting from those risky behaviors.

Furthermore, estimates resulting from this empirical analysis offer a limited and likely conservative assessment of the potential savings associated with advocating a transition from high-risk to reduced-risk products. It is important to note that the calculated savings, attributed to the reduced smoking of conventional tobacco products, do not factor in the augmented productivity resulting from fewer missed workdays. This consideration should encompass not only hospital stays, but also activities related to diagnosis, therapy, and rehabilitation (Sgambato et al., 2011).

While the author identifies a statistically significant association between risk factors and the outcome variables, it is important to exercise caution, as this study does not fall under the category of causal inference. It is certainly plausible that omitted variable issues may have biased the estimated coefficients.

The analysis conducted so far aims to serve as a scientific foundation and a starting point for reflection, heralding further developments in a discourse often dominated by rhetoric rather than empirical evidence. This is especially pertinent in the context of countries like Italy, which grapple with the challenge of allocating resources for their annual budget submissions for parliamentary approval. This task is particularly demanding considering Italy's high debt-to-GDP ratio, mounting fiscal burdens, and the rising cost of living.

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